Indira Gandhi National Open University
School of Interdisciplinary and
Trans-disciplinary Studies

MPYE – 013

Philosophy of Technology

Block 1

REALITY: CHAOS THEORY AND NANOTECHNOLOGY

Expert Committee

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Director, School of
Social Work
IGNOU

Prof. Renu Bharadwaj
School of Humanities
IGNOU

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Panthanmackel,
Senior Consultant,
IGNOU

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Mandya - Mysore

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Jnana-deepa
Vidyapeeth
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Pune

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IGNOU Study Centre
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IIT, Chennai.

Dr. Joseph Martis
St. Joseph's College
Jeppu, Mangalore – 2

Dr. Jaswinder Kaur
Dhillon
147, Kabir park
Opp. GND University
Amristar – 143 002

Prof. Y.S. Gowramma
Principal,
College of Fine Arts,
Manasagangotri
Mysore – 570 001

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CBCI Centre
New Delhi

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Aligarh Muslim
University
Aligarh

Dr. Bhuvaneswari
Lavanya Flats
Gangai Amman Koil
St.
Thiruvanmiyur
Chennai – 600 041

Dr. Alok Nag
Vishwa Jyoti Gurukul
Varanasi

Block Preparation

Units 1&2	Jeff Shawn Dharmaram Vidyakshetram Bangalore.
Unit 3	Dr. P.Kesava Kumar Dept of Philosophy Pondicherry University.
Unit 4	Dr. Kuruvilla Panikattu Jnana-Deepa Vidyapeeth Ramwadi, Pune.

Content Editor
Dr. V. John Peter
St. Joseph's Philosophical College,
Kotagiri, Tamil Nadu.

Format Editor
Prof. Gracious Thomas
IGNOU, New Delhi.

Programme Coordinator
Prof. Gracious Thomas
IGNOU, New Delhi.

BLOCK INTRODUCTION

Philosophical roots of the concept of chaos are very deep with references dating back to 2500 BCE in Asian, Egyptian and Mayan Cultures. Initially, human attempt was to tame chaos and bring harmony. The Greeks infused scientific attitude into the mythical idea of immense and creative chaos. Aristotelian holistic vision of the universe was replaced in the reductionist onslaught and was replaced my deterministic mechanistic vision of the universe. Newtonian mechanics gave the stamp of approval of to this rigorous deterministic vision of the universe. Newtonian mechanics treated the whole world as a machine in which each and every part could be brought under control. Chaos theory has brought in a 'new paradigm' both in scientific and social arena in the contemporary world. Unlike the mechanistic vision, chaos theory focus on a context which is in a state of becoming in an open environment that receives and exchanges data or information and are sensitive to the changes happening around.

Unit 1 traces the significant philosophical developments in the evolution of the concept of chaos till the time of Newton. Both Newtonian and quantum mechanics are characterised by their affiliation to extreme determinism and indeterminism respectively. Chaos theory, without rejecting any of the theories and without proposing any new laws, brings in an alternative by bringing in the deterministic and indeterministic aspects. Chaos theory has shown that chaos in non-linear dynamical systems is not random but it has got a hidden order that helps us in making short term predictions as well as long term trends. Thus the alternative which chaos theory opens up reconciling the extremes gives an organic, holistic and ecological view of the world instead of the mechanistic or random vision.

Unit 2 is to give a general introduction to the concept of fractals that can represent and analyse the roughness of reality. It goes into the scientific intricacies, the philosophical and scientific significance associated with fractals are emphasized. It enables the students to have a basic understanding of fractals and how fractals represents the roughness of reality. It not only analyses the practical applications of fractals but also creatively ponder on the philosophical implications.

Unit 3 brings home to us the latest Nano technology which is an innovative development in science and technology. It has a convergence with many disciplines. It has revolutionary implications for society. It has even a potential to challenge the existing notions of reality. This unit provides the basic ideas and applications of nano technology. Further it explores the social ethical implications of this kind of technological developments in contemporary world situation.

The **Unit 4** on 'nature of nature' appreciates the evolving nature of humans. What is unique about contemporary nature? How does culture and nature differ today? Has technology transformed our culture and our nature beyond recognition? The unit makes us realize that our nature is engineered or our nature has become part of our culture and to appreciate the radical changes taking place in our self-understanding ("singularity"). The unit also explains the complex relationship to the triads of nature, nurture and culture. Because of the technology available to contemporary humans, we have developed our culture so much that it radically alters our nature.

COURSE INTRODUCTION

Our world-view truly shapes our understanding of ourselves and the world. For instance, the static world view of the ancients was radically altered by Newton's model of the world as a machine. Such an understanding brought about by the scientific discoveries of Newton changed our understanding of humans, world and God also. In the last century two of the greatest scientific theories have been the theory of relativity ("the most creative theory") and the theory of quantum mechanics ("the most successful theory"). Big Bang Theory, which is intimately connected to these two theories explain the origin of the universe. The very nature of time, space at the macro-world and micro-world that these two theories provide are quite different from the classical view of nature.

Block 1 speaks of understanding reality through Chaos Theology and Nanotechnology. the theory of chaos tells us that there is a very close connection between apparent order and chaos. Nanotechnology, which is the science of building machines at a subatomic level, we have a lot to learn. The theory of chaos and nanotechnology, propose to us a world quite different from the classical, Newtonian or even Einsteinian worlds. These two theories through different insights into the nature of reality. The fractal nature of reality tells us that roughness in the world (not the idealisations of the world) is what really counts. It changes the way we understand the world..

The **block 2**, moves from reality to life. Quantum mechanics shattered our way of understanding the world. Biotechnology, most probably, will shatter the way we approach life, something much more intimate to us. Already there are talks about "artificial life" and "artificial cells." Though they still remain at the theoretical realm, they will have quite significant repercussions on our own lives and on our understanding of life. The danger posed by such technologisation is the commodification of life. The opportunity provided by such technologies is the human ability to enhance life.

Block 3 brings in the latest neurological findings that will surely throw further light on our self-understanding, consciousness, self-identity and all those aspects that make our human life so unique. Advances in brain studies, it is hoped, will provide solace to many sick people, prevent many neurological sickness and further help us to understand ourselves. Though we are just beginning in the process of understanding our brain, it is hoped, that technological advances will improve and enhance our own self-understanding. Closely connected with our self-understanding is our understanding of God. We do not believe that God is an illusion created by God. But we can rightly claim that it is the brain that enables us to experience God.

Block 4 deals with highly developed technologies that try to address the perennial quest of humans to overcome death and attain physical immortality. Physical immortality is difficult, in a way, to talk about at length because it can be approached from so many different angles. The question of whether death is inevitable and with much advanced technology could humanity overcome it, is critically looked at from the philosophical point of view.

UNIT 1: INTRODUCTION TO THE THEORY OF CHAOS

Contents

1.0 OBJECTIVES

This primary objective of this unit is to introduce the chaos theory by analysing it from the scientific and philosophical perspectives. In chaos theory you will find a perfect blending of, once considered irreconcilable extremes of linearity and non-linearity, determinism and indeterminism which were the characteristic features of Newtonian mechanics and quantum mechanics respectively. The developments in scientific fields do not remain aloof from the real life settings instead they trickle down to various fields, including philosophy leading to the formation and transformation of human thought pattern. This can very well be seen in mechanistic deterministic vision of the universe that assured future to be present before us like past on one hand and the indeterministic vision that led to submission to randomness and chance on the other. Chaos theory brings in an alternative to these extremes views in both scientific and philosophical realm. The essential scientific features of chaos theory are discussed without going into the complex equations. The philosophical analysis of chaos theory will showcase the paradigm shift that chaos theory has initiated.
Thus by the end of this Unit, you should be able to:

- have a basic understanding of the chaos theory and its concepts.
- analyse the chaos theory as an alternative to Newtonian and quantum mechanics.
- understand how chaos theory initiates a paradigm shift
- reflect on the relevance of chaos theory in the contemporary world.

1.1 INTRODUCTION

The word chaos in everyday life would mean a totally disorganized random state. The term chaos used in chaos theory must be taken as a term of art and does not go along with the ordinary connotations. To be more specific, the noun chaos and the adjective chaotic are used to describe the time and behaviour of a system when the behaviour of the system is aperiodic. The word ‘chaos’ first entered physics in the physicist James Clerk Maxwell’s phrase, ‘state of molecular chaos’ in the nineteenth century.

The sudden and dramatic changes in non-linear dynamic systems may give rise to complex chaotic behaviour. Underlying this aperiodic and apparent random behaviour, there is a determined order waiting to be revealed. The chaos that is being discussed here is deterministic chaos. Associating determinism with chaos may sound paradoxical but it is not the kind of determinism outlined by Newtonian laws but it depicts the uncertainty consistent with determinism. This is due to sensitive dependence on initial condition which results in the amplification of small scale uncertainties over a period of time resulting in unpredictability in long term behaviour even though the behaviour is predictable in the short term.

After Newtonian mechanics, relativity and quantum theory, the scientists have pinned their hopes on chaos theory as they believe in its potential to make significant contribution cutting across scientific disciplines. As chaos theory brought together thinkers from fields that had been widely separated, it is a science of the global nature of systems. The new alternative which chaos theory has opened incorporates both linearity in Newtonian mechanics and non-linearity in quantum mechanics. Chaos theory has not looked back since it made its first appearance in the scientific arena; the juggernaut still rolls on with lot of promises and surprises in store.

1.2 CHAOS IN HISTORY

Down the lanes of history, the concept of chaos can be looked at from both philosophical and scientific perspectives. Chaos was relatively a new entrant in the scientific field. Chaos began making appearance a century ago when scientists started bringing in the concepts of spontaneous change, irregularity and disorder, constructing a new epistemology which had the potential to call in to question the classical laws of physics. The philosophical roots of chaos are very deep with references dating back to 2500 BCE in the Asian, Egyptian, and Mayan cultures.

The focal point of human attempt during these times was to tame chaos and put it in an order to bring about harmony. Around the globe, people of various cultures and civilizations developed diverse techniques to master chaos and bring about an order. There were calendars to predict seasons, astronomical rules to judge the position of planets, markings in the river bank to note the rise and fall of water level in river Nile and the like. All these were done to infuse order to the chaotic world and were adorned with attractive myths. Beginning with myth and belief in magical powers, human beings moved forward into scientific thought process keeping in mind the intense desire to bring about order and harmony, or, in other words, to have a deterministic vision in order to have predictability. It was pure chaos that ruled in the age of early human history. Slowly, but steadily, the underlying rules in nature were brought in, the natural science as well as mathematics developed hand in hand.

In the Greek tradition, the concept of chaos made its first appearance in Hesiod's *Theogony*, dated back to 800 BCE. The mythical idea of chaos as immense and creative with an uneasy tension between chaos and order was injected upon with scientific attitude by the Greeks and also was subject to religious interpretations. With the arrival of Galileo, Kepler, Descartes and Newton on the scene, linearity and non-linearity or the order and chaos which once co-existed were separated. The reductionist science called the shots and sidelined the concept of chaos. Francis Bacon and Descartes were instrumental in reducing the four causes of Aristotle into two namely material cause and efficient cause. The formal cause and final cause were skipped to philosophy of religion. Thus Aristotelian holistic and organic vision of the universe was overthrown and was replaced by mechanical vision of universe. The laws and concepts of Newton gave a strong deterministic assurance to the whole world. Stating that the non-linear system as imperfect, only the linear systems were studied and the scientists even thought that non-linearity could be incorporated into linearity.

1.3 NEWTONIAN DETERMINISM AND QUANTUM INDETERMINISM

The scientific community and the world at large believed that on April 29, 1686, the day when Sir Issac Newton presented his research – *Principia Mathematica* to Royal Society of London, would mark the death of chaos and herald the birth of determinism and predictability. Newton for the first time provided a unified quantitative explanation for a wide range of physical phenomena with his laws of motion, law of universal gravitation, the concepts of absolute space and absolute time together with mathematical techniques of calculus. Thus he placed the stamp of approval on the rigorous deterministic philosophical vision of Descartes and Bacon. Determinism, predictability and reversibility were the characteristics of Newtonian mechanics.

In the Newtonian deterministic vision, the whole world was conceived to be a gigantic machine. When each part of the machine namely, mechanics, heat waves, sound, light, magnetism, electricity- were all brought under control, the wild excitement resulted in extreme deterministic views like Laplace Demon. It stated that there would be nothing in the world which would be uncertain and the future would be present before our eyes like past.

The Newtonian world view trickled down to various fields. Just like physicists reduce the property of gases to motion of their atoms or molecules, John Locke reduced the patterns observed in society to the behavior of individuals and stated that there were natural laws governing human societies as we had laws in the physical universe. He also stated that the function of government was not to impose laws but to discover and enforce the natural laws inherent to mankind which became the corner stone of the value systems of the enlightenment and influenced the development of modern economic and political thought. Science and Philosophy which were once wedded to each other were separated by the influence of Newtonian Physics. Man was considered to be the master of the gigantic machine called universe which was given to him to exploit and this led to the plundering of nature. Yet another consequence of Newtonian mechanics was that the present became a sum of the past events or a passage to determine future events resulting in the oblivion of the present. Chaotic or the non-linear phenomena were considered to be imperfections that could be appropriated to linearity and thus, linearity ruled the stage.

The Newtonian vision of a clock work universe with linearity, determinism and predictability remained at the helm of scientific affairs for years. Contrary to the expectation of the time, new theories came up. As Illya Prigogine says, "Classical science, the mythical science of a simply passive world, belongs to the past, was killed not by philosophical criticism or empirical resignation but by the internal development of science itself." As the time unfolded, relativity eliminated the Newtonian illusion of absolute space and time and Einstein said that everyone would have his or her own personal timings. Quantum theory eliminated the Newtonian dream of a controllable measurement process. The matrix and wave mechanics represented reality through mathematical symbols and manipulated them to get results. Three important philosophical principles associated with quantum mechanics were complimentality, uncertainty and probability. Complimentality suggests that particle and wave are complimentary while uncertainty explains that there is a certain amount of uncertainty when we are precisely measuring speed and position, time and energy. The probability determines the result. Thus uncertainty and probability together described nature as indeterministic.

Check Your Progress I

Note: Use the space provided for your answers.s.

1) Trace the significant developments in the evolution of the concept of chaos till the time of Newton.

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2) What are the philosophical consequences of deterministic Newtonian mechanics?

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1.4 SCIENTIFIC ANALYSIS OF CHAOS THEORY

Torn up between the extremes of rigorous deterministic Newtonian mechanics and indeterministic quantum mechanics, Chaos theory shows the way out. Chaos theory has shown that chaos in non-linear dynamical systems is not random but it has got a hidden order that helps us in making short term predictions as well as long term trends. Thus, the alternative which Chaos theory opens up reconciling both determinism and indeterminism, yields meaningful and scientific output. The shift from mechanical worldview can be characterized by words like organic, holistic and ecological. Philosophically, the Aristotelian holistic vision of blending the abstract (mathematical), tangible (imaginative) and the metaphysical into a single whole is making a grand come back. Joseph Ford of Georgia Institute of Technology, terms chaos as, "Dynamics freed at last from the shackles of order and predictability … systems liberated to randomly explore their every dynamical possibility … exciting variety, richness of choice, of cornucopia of opportunity."

Henri Poincare had outlined the central features of deterministic Chaos Theory a century ago in his book *Science and Method*, "a very small cause which escapes our notice, determines a considerable effect that we cannot fail to see, and then we say the effect is due to chance." It was not well acknowledged during that time because of the emphasis on linearity and outright rejection on non-linearity. Edward Lorenz, a meteorologist at the Massachusetts Institute of Technology, presented a paper titled, "Predictability: Does the flap of a butterfly's wing in Brazil set off a Tornado in Texas?" and is credited with the renewed interest in Chaos theory. He coined the term Butterfly Effect. He came across this interesting concept while working on the problem of weather prediction in 1961. While trying to make weather prediction possible, Lorenz entered 0.506 instead of 0.506127 in his computer in order to save space, thinking that the shortened rounded off number which was once part in a thousand would make no effect. This very small difference made a great diversion in the outcome. This effect came to be known as the butterfly effect. Scientifically it is called sensitive dependence on initial condition.

Chaotic Systems are deterministic, non-linear, sensitive to initial conditions and bounded. Determinism in Chaos would mean that chaos does not arise from same lawless behaviour governed by chance but it is the stochastic behaviour occurring in deterministic systems or the lawless behaviour governed entirely by law. In linearity the output is directly or inversely proportional to the input but for a non-linear system, a small change in parameter can lead to sudden and dramatic changes in both qualitative and quantitative behaviour of the system. It will exhibit bifurcations and also have multiple basins of attractions. Boundedness in the chaotic dynamics would mean that even though chaotic systems have sensitive dependence to initial condition, the trajectories confine themselves to a bound region, which will have maximum and minimum parameter values beyond which they won't wander, unless perturbed.

Chaotic Systems are not random, or periodic. Random events have equal probability of being in any state they can be in, from one moment to the next, independent of the previous state. In the midst of the apparent random behaviour in a chaotic system, there is an underlying structure revealed in the phase space that sometimes allows us to make prediction about its long-term trend and very short term behaviour. Edward Lorenz called this 'orderly disorder' in normal space. The state space or phase space is the mathematical space where each point represents a possible state of the system and helps us to study the geometric properties of the trajectories of the target system without knowing the exact solutions to the dynamical equations. Chaotic systems usually possess strange attractors, often with fractal dimensions. They are called strange attractors because, unlike fixed point, limit cycle and torus attractor; they don't exhibit properties like seemingly random behaviour, sensitivity to initial conditions and mixing in finite time. Fractal image contain infinite detail when we zoom in. The advantage of fractal image is that the extraordinary detail present in fractal images can be generated by very simple recipes. The attractors not only provide the standard statistical observation but also the 'directional' information which show how the system tends to change from its current state. This helps us make predictions about long term trend and short term behaviour. The properties of attractors are key sign posts at the junction where Chaos theory matures past mere metaphor and offers opportunities for practical applications.

When chaotic, complex non linear system is perturbed, the system loses its stability. The farther the system moves from equilibrium the more unstable it gets. The system then makes changes so as to regain the lost equilibrium. These changes are linear, gradual, segmental, predictable, moderate and incremental. But when this doesn't work, the continued perturbation will result in bifurcation, the diverging point, where the possibilities are many. One fork is chosen where the bifurcation occurs at a certain point which leads to second order change, characterized as turbulent, chaotic, non-linear, sudden, dramatic, transformative and unpredictable.

The importance of bifurcation lies in its universality. The ratio of the successive spacing tends to a number $\delta = 4.6692$ as $n \to \infty$. What is again a pleasant surprise is that this number is universal for most single hump maps. There is yet another universal number associated with the pitchfork bifurcation. The spacing gets smaller and smaller and the ratio converges to a universal number $\alpha = 2.5029$, rather rapidly. Feigenbaum discovered that both δ and α are universal numbers for a period doubling cascades. Experiments conducted by scientists over the years confirmed Feigenbaum's discovery regarding the universality of bifurcation was not confined to turbulent fluids alone, but in all kinds of physical systems like electronic, optical and even biological.

Chaos was once considered unreliable, uncontrollable and therefore unusable, but scientists have turned the situation topsy-turvy by making chaos manageable, exploitable and even invaluable. Three basic methods of chaos control are- Ott Gregboi and Yorke (OGY) method, Pyrages method and Bradley's method. The Lyapunov exponent, discovered by the Russian mathematician Aleksandr M. Lyapunov, is useful for evaluating a model's sensitivity to perturbation which is indeed the root of unpredictability of chaos. Glenn E. James states the important consequences of chaos control in his book *Chaos Theory: The Essentials for Military Application*, "no model was needed, minimal computation was required, parameter adjustments were quite small, different periodic behaviours were stabilized for the same system and control was possible even with feedback based on imprecise measurements."

The ability to control chaos in the dynamical systems would mean that chaos theory can be put to work in a wide variety of fields. From laser technology to management leadership, chaos theory has proved to be of great value. Some of the applications of chaos theory in mechanical systems include laser, encryption, chaotic circuit, engine systems and also in space and satellite mission. In natural systems the applications can be seen in fisheries, ecology and in living systems it ranges from economy, management leadership and military systems. Thus chaos theory in action has set the ball rolling not only with an array of scientific discoveries from mechanical, living and complex systems, but also with far reaching philosophical implications.

Check Your Progress II

Note: Use the space provided for your answers.s.

1) Explain chaos theory as an alternative to Newtonian and quantum mechanics?

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2) What is the significance of strange attractor in chaotic dynamics?

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1.5 PHILOSOPHY OF CHAOS THEORY

Chaos theory has brought in a paradigm shift in the philosophical deliberations especially in philosophy of science where the benchmark had been the classical mechanistic paradigm. Differing methodologically and epistemologically from the classical science, chaos theory can be considered as an anti-establishment and holistic science.

Mark Stone analyses the term determinism and makes a fourfold division outlining the various senses in which the term determinism is used in order to understand better the determinism associated with chaos theory. The fourfold division are differential dynamics, unique evolution, value determinateness and total predictability. The determinism which is associated with chaos theory is differential dynamics. Differential dynamics would state that the system is deterministic if the way it changes in time can be specified by a set of differential equations. The complex behaviour in a dynamical system must arise not from the fact that system is an approximation of a huge number of complicated interacting subsystems but from the internal mathematical structure. The deterministic approach towards chaos theory takes to the study of apparently disorderedly behaviour is thus in contrast to a statistical approach which focuses on the evolution of average values at many places in the system, or averages over many systems.

The unique evolution holds that the complete instantaneous description of a deterministic system fixes the past and future with no alternatives. As this forms the core of Laplacian vision of determinism, John Earman calls this the 'Laplacian determinism.' The third level of determinism namely value determinateness would mean that for deterministic systems the accuracy of a state description is infinitely refinable, even though any given state description will contain some error or in other words, physical quantities have exact values. Total predictability is the idea that the universe is predictable, in principle, by an all-powerful intelligence or computational scheme, given complete information of instantaneous conditions and the complete set of physical laws. Karl Popper calls this scientific determinism.

Determinism associated with chaos theory is used in the sense of differential dynamics and not in the sense of unique evolution, value determinateness or total predictability. The non-linearity in chaos theory, thwarts any attempt to fix the past and future, infinitely refine physical values and the dream of total predictability. The existence of chaotic systems leads us to the conclusion that the world is not totally predictable and any definition of determinism that includes total predictability in determinism is false.

The deterministic chaos theory with the presence of differential equation helps in the short term predictions. Even though long term predictions are ruled out in the non linear chaotic system, that doesn't mean it is completely indeterministic. The presence of strange attractor and the fractal nature of this strange attractor help in predicting the long term trend. Thus, chaos theory shows an alternative to the scientific world torn apart by rigorous determinism of the Newtonian mechanism and indeterminism of quantum mechanics.

While the popular literature hails chaos theory as a revolution, an analysis based on Thomas Kuhn's perspective in the philosophy of science gives a different picture. He states three characteristics of a revolution: "1) Rejection of once accepted scientific theory by the new one. 2) Shift in problems available for scientific scrutiny 3. Transformation of world within which scientific work is done." Apart from the first criteria, the second and third fits in with regard to chaos theory.

Focusing on the second criteria that call for interesting problems and successful solution to bestow the status of revolution, Katherine Hayles makes a convincing case. She brings before the study of physicist Bernardo Huberman that shows the chaotic model of eye moments in schizophrenics. Thus second characteristic fits the bill to classify chaos theory as a revolution. As chaos theory has brought about a change in scientific imagination, the third criteria too doesn't contradict chaos theory.

But chaos theory loses out in the first criteria which state the 'rejection of one time honoured scientific theory in favour of another incompatible with it.' Chaos theory so far has not displaced any theories. The chaotic behaviour occurs in Newtonian systems too. Chaos theory involves no fundamental theoretical change, while a Kuhnian revolution involves 'reconstruction of the field from new fundamentals, a reconstruction that changes some of the fields' most elementary theoretical generalizations.' So chaos theory cannot be called a revolution in the Kuhnian sense as it doesn't fit into the characteristic spelt out by Thomas Kuhn.

The focus of chaos theory is on qualitative understanding rather than quantitative information. Stephen H. Kellert defines chaos theory as "the qualitative study of unstable aperiodic behaviour in deterministic non linear dynamical systems." In qualitative understanding, rather than giving a fixed accurate solution, the emphasis is on giving general information and the great classification, which is obtained by dwelling to questions pertaining to periodicity and stability of orbits, the symmetric and asymptotic properties of behaviour, and the structure of the set of solutions. Thus chaos theory with its focus on qualitative understanding is a welcome change from the rigorous deterministic quantitative analysis of Newtonian mechanics. Thus, chaos theory initiates a paradigm shift.

Chaos theory can best suit Thomas Kuhn's analysis of scientific paradigms. According to Kuhn "a paradigm is not a theory as such, but a frame work of thought – a conceptual scheme – around which the data of experiment and observation are organized." The basic paradigm shift occurs from time to time in the history of ideas. So with this it's not only the scientific theories that change but also the scientist's conception of the world too undergoes a change. In the Kuhnian scientific understanding emphasis is not on the structure of the scientific theory but "theories are cohesive systematic bodies of knowledge defined mainly by the roles they play in normal science practice within a dominant paradigm."

The strict model-target approach too undergoes a change with the arrival of chaos theory. Following a strategy called piecemeal improvement there are two basic approaches to model a target system, invoking faithful model assumption in philosophical literature. In the first basic approach the model is kept fixed and initial data is successively refined so as to converge it to target systems behaviour. The second approach involves keeping the initial data fixed and making successive refinement in the model. As the principle of linear superposition no longer holds in non-linear models, the two approaches mentioned above are met with serious difficulties when applied to non-linear models. This is because a small change in the data quality of a small refinement in the model can result in huge divergence in system behaviour unlike linear systems. This non-linear approach from the perspective of chaos theory shows that in any non-linear system there can be mismatch between models and targets. Going behind the strict model oriented approaches that bank on rigorous deterministic predictability, without leaving space for creative response has all possibility to backfire.

1.6. RELEVANCE OF CHAOS THEORY

Chaos theory with its popular appeal, far reaching implications and wide range of applications has brought in a 'new paradigm' both in scientific and social arena. Chaos theory has neither created nor destroyed any laws it but it has brought to the forefront the once ignored disorder, instability, diversity, disequilibrium, non-linearity and temporality concepts which once suffered under the excessive emphasis of non-linearity, determinism, predictability and reversibility. Taking strong exception to the mechanistic vision that emphasis on fixed framework structures, chaos theory focus on a context which is in a state of becoming in an open environment that receives and exchanges data or information and are sensitive to the changes happening around.

Chaos theory as a metaphor has proved its usefulness in diverse fields. But irrational application of this metaphor will seriously question the credibility of the theory. Ian Stewart would point to the dangerous use of the metaphor of chaos in the wrong places with absolutely wrong interpretations. Chaos theory is fast getting misinterpreted as that which glorifies randomness and there is every possibility that it might end up in false conception like the popular interpretation of Einstein's theory of relativity, where relativity was taken by the popular interpreters as everything is relative, whereas Einstein meant relative to the speed of light. There are scientists argue that chaos is merely a subcomponent of non-linear dynamics which indeed is part of complex systems and so it can't be called a discipline in its own right.

The new generation in the globalized world is characterised by its reliance on randomness and chance and blind oppositions to dogmas of religions, structures, cultures, value systems and above all established systems. Chaos theory, by revealing the hidden order in the apparent disorder and by reconciling the extremes can turn out to be a powerful antidote in this regard.

Chaos theory also gives warning signals with the fact that the sensitive dependence on initial conditions which over the course of time result in bifurcations that can cause serious consequences. A recent example to such a phenomenon is the 2011 revolution in Egypt. It all began when a 26 year old woman wrote in the social networking site called facebook, 'People, I am going to Tahrir Square.' The message soon snowballed into a movement that ousted Egyptian president Hosni Mubarak. This would also mean that, even an uprising in a country or a war between two nations over the course of time may lead to a nuclear war between nations creating irrevocable harm to human beings.

Unveiling the mysteries of universe, sending out warning signals, providing breathing space in a world torn between extremes and seriously questioning the established theories, chaos theory has opened up innumerable possibilities of research. Chaos theory has heralded the dawn of a new era where the 'deterministic chaos' will have a greater say in the affairs of the world. Cutting across disciplines, chaos theory has the potential to permeate diverse streams and render intelligible the diverse phenomena, initiating a 'paradigm shift'.

Check Your Progress III

Note: Use the space provided for your answers.s.

1) According to Mark Stone, what kind of determinism is associated with chaos theory?
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2) What is the relevance of chaos theory in the contemporary world?
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1.7 LET US SUM UP

In this unit we have tried to give a general introduction to the dynamics of deterministic chaos theory. Beginning with the evolution of the concept of chaos in world history revealing the diverse way in which chaos and order was perceived. The scientific and philosophical implications of the extremes of Newtonian mechanics and quantum theory are discussed followed by chaos theory, which is presented as an alternative that brings together the opposing poles without making any rejection or addition of laws. Finally we conclude the unit by showing the significance of chaos theory as having the potential to initiate a paradigm shift in the state of affairs of the contemporary world.

1.8 KEY WORDS

Attractor and Strange Attractor: Attractors are the set of points in the dynamical system that attracts the orbits and to which the system settles down after its transient dynamics die out. Strange Attractor is complicated, bounded orbits of trajectories of a chaotic system, exhibiting fractal nature, allowing us to make short term predictions and long term trends.

Linearity and Non-linearity: In linearity the output is directly or inversely proportional to input. Non-linearity means that the output of a system is not directly or inversely proportional to its input. A small change in parameter can lead to sudden and dramatic changes in qualitative and quantitative behaviour of the system and give rise to complex behaviour called chaos.

Bifurcation: The tendency of a non-linear system exhibiting the drastic appearance of a qualitatively different solution when one controlling parameter is varied.

Fractals: A fractal is a rough geometric shape that can be split into parts, each of which is exactly, approximately or statistically a reduced-size copy of the whole, a property called self-similarity.

1.9 FURTHER READINGS AND REFERENCES

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UNIT 2 FRACTALS AND ROUGHNESS OF REALITY

Contents

2.0 OBJECTIVES

This unit is conceived to give a general introduction to the concept of fractals that can represent and analyse the roughness of reality. Rather than going into the scientific intricacies, the philosophical and scientific significance associated with fractals are emphasized. In comparison with Euclidean geometry, which remained unchallenged for centuries, we shall see how fractal geometry comes in as a worthy alternative. We shall also analyse how Benoit Mandelbrot, the father of fractal geometry, successfully represented the irregular and rough texture of nature with fractal dimensions while the Euclidean geometry unsuccessfully tried to fit in the complexities of nature into predefined shapes. A discussion on fractals like Koch curve, Mandelbrot set and others will give a basic understanding on some of the famous fractals. The significance of fractals can be seen in their practical application in myriad fields initiating a tectonic shift in scientific and philosophical outlook. Thus by the end of this Unit you should be able to:

- have a basic understanding of fractals
- contrast Euclidean geometry and Fractal Geometry
- understand how fractals represents the roughness of reality
- analyse the practical applications of fractals
- creatively ponder on the philosophical implications of fractals

2.1 INTRODUCTION

The fractal Geometry better represents the complexity of nature which was once bracketed off by the Euclidean Geometry and also reveals the micro-macro relationship. Rather than singularly approaching and analysing nature from the perspective of Platonic perfection, the introduction of fractals has initiated a paradigm shift that very well incorporates and analyses the irregularity and roughness of the nature.

Benoit Mandelbrot was the man behind the discovery of fractal dimension. The fractal dimension was initially called the Hausdorff-Besicovitch dimensions after the mathematicians Felix

Hausdorff and A.S. Besicovitch who invented and developed it. The concept of fractal dimension was considered by mathematicians to be an abstract mathematical idea. They used to go behind the fractal dimensions purely for their own entertainment. So the fractal dimension which was once ignored by most mathematicians was given a fresh lease of life by Mandelbrot. Thus today, these fractal dimensions finds application in real life as it helps in analyzing the complexity of fractal shapes, describing a wide range of natural phenomena.

Mandelbrot wrote in his book, *The Fractal Geometry of Nature*, "clouds are not spheres, mountains are not cones; coastlines are not circles, and bark is not smooth, nor does lightning travel in straight line." He moved beyond the Euclidean geometry where space has three dimension, a plane has two, a line has one and a point has zero dimension to the fractional dimensions. Mandelbrot evolved a new type of mathematics, capable of describing and analyzing the structured irregularity of the natural world, and coined a new name for the geometric forms involved: fractals. Fractional dimension became a way of measuring qualities that otherwise have no clear definition: the degree of roughness or brokenness or irregularities of the object. Fractals are ubiquitous in nature; they are seen in clouds and coastlines, ferns and trees. The human circulatory system is a series of self similar fractal from 'aorta to capillary.'

Mandelbrot made a claim which the world stood up and listened. The claim was that the degree of irregularity remains constant over different scales. Surprisingly, often, the claim turns out to be true. Over and over again, the world displays a regular irregularity. Rather than applying Euclidean geometry which bypassed the irregular structures, the fractal geometry made sure that the irregularities of the nature were incorporated. Above all it finds order in the apparent disorder which is seen in the nature. It is a movement inspired from nature rather than dominating nature with our own set of rules.

2.2 FROM EUCLIDEAN TO FRACTAL GEOMETRY

Euclid collected, studied the works of his predecessors on geometry and systematically presented in his book *Elements* which contains treatises on maths and geometry. Until the arrival Non-Euclidean Geometry in the second half of nineteenth century, Euclidean Geometry stood unchallenged. Geometric statements in Greece were derived by logic alone from self evident geometric assumptions called axioms. Euclid chose five axioms and from them he formed the body of theorems known as Euclidean geometry. The Euclidean postulates can be given in modern terms as: 1. A line joining two points is a straight line. 2. This line can be extended indefinitely. 3. Given any straight line, a circle can be drawn having the segment as radius and one point as the centre. 4. All right angles are congruent. 5. If two lines are drawn which intersect a third in such a way that the sum of the inner angles on one side is less than two right angles then two lines inevitably must intersect each other on that side if extended far enough. As the fifth postulate stands as basis for the uniqueness of parallel lines, it is called the parallel postulate.

The classical Euclidean geometry is predominantly influenced by the Platonic philosophy. The Platonic philosophy gave utmost importance to the world of forms or ideas which were considered as eternal and absolute. The temporal and changing world which we live in was considered only to be the shadow of the unperceived real world that is permanent and unchanging. As a necessary after effect of Platonic philosophy, irregularities or complexity of nature was not taken up into Euclidean geometry. Thus we have the shapes of classical geometry restricted to lines and planes, circles and spheres, triangles and cones. Whatever be the irregular features that were present in the reality, they were all powerfully abstracted into these perfect shapes.

The absoluteness of Euclidean geometry was challenged by mathematicians like Janos Bolayi, Nikolai Lobachevski, and Karl Friedrich Gauss in the nineteenth century. The Non Euclidean geometry came up with the realization that the Euclid's parallel postulate was independent of the other four axioms and could never be derived from them. They also understood that a consistent system of geometry can be built if one add the negation of the parallel postulate to other axioms. The two main types of non Euclidean geometry are hyperbolic geometry and elliptical geometry, having negative and positive curvature respectively. The properties of the Non-Euclidean geometry such as curvature were far beyond the every day human experience which Einstein could apply to his theory of relativity.

The strong influence which Euclidean geometry wielded can be well understood from Immanuel Kant who claimed that people could think about space only in Euclidean terms. The arrival of non Euclidean geometry showed that there are other conceivable descriptions of space. Non Euclidean geometry was the first step forward from the rigid notion of viewing the reality from a linear outlook with excessive emphasis on perfection and leaving out imperfect and irregular feature. The arrival of fractal geometry brought in the once ignored realm of complexity found in nature.

2.3 FRACTAL GEOMETRY AND THE THEORY OF ROUGHNESS

Euclid was preoccupied by the vision of unrealistically ordered universe, and could not provide a geometry that could picture the roughness and irregularity of the world Galileo stated that the Great book of Nature is written in the language of mathematics with characters being circles, triangles, and other such shapes.. With Fractal geometry, Mandelbrot was knitting together a theory of roughness. This changed the notion that pure mathematics was incompatible in representing the irregularity of the substances in the world through the fractal geometry of nature.

Emphasizing the roughness of the universe, Mandelbrot states that everything in the world is rough except for the circles. Geometry and physics have ignored the roughness of reality as they were too complicated. Beyond the regular geometrical structures like circle, cone, sphere, straight line and the like, Mandelbrot wanted to show that the odd shapes that is found in the nature carry meaning. He heralded the arrival of a new geometry which provided a language to describe the nature with its imperfections and irregularities.

The fractal geometry measures the degree of roughness or brokenness or irregularity of an object. The term fractal was coined by Mandelbrot in 1975 from the Latin term *fractus* which describes a broken stone – broken up and irregular. According to Mandelbrot, "Fractals are geometrical shapes that, contrary to those of Euclid, are not regular at all. First, they are irregular all over. Secondly, they have the same degree of irregularity on all scales. A fractal object looks the same when examined from far away or nearby – it is self similar." Fractal geometry is called the geometry of nature because unlike the classical or Euclidean geometry it helps us model things that we see in every day life.

Self similarity, a hall mark of fractals, means the object is similar to a part of itself exactly or in an approximate way. Many examples of fractals can be seen in nature like ferns, cauliflower and many other plants where the branch and twig are very like the whole. There are three types of self similarity namely exact self similarity, quasi self similarity and statistical self similarity. Objects displaying the exact self similarity appear identical at different scales. In quasi self similarity, the fractal would be approximately self similar across scales. Statistical self similarity means a numerical or statistical measure of the fractal is preserved across scales.

Yet another feature of fractal geometry is the fractional or non integer dimension. In 1967, Mandelbrot wrote a seminal paper titled, "How long is the coast of Britain? Statistical self-similarity and fractional dimensionality," in *Science* magazine. Though it seemed to be simple question, the answer would depend on the way we measure the coastline. If we measure it with a meter stick, the answer will be approximate as it would be overlooking the little nooks and crannies. If measured with a smaller scale then we would get a greater length for the coastline as it would go into smaller spaces of the coastline and count them. Thus the length of the coastline would depend on the one's choice of measuring stick. This problem according to Mandelbrot can be solved only by moving away from the ordinary three dimensions to fractal dimensions.

Going beyond the classical Euclidean geometry that works with objects existing in integer dimension, Mandelbrot moved to the non integer dimension. Non integer dimension helps in measuring the qualities of an object which exhibits roughness or brokenness or irregularity. He specified the ways of calculating the fractal dimension of real objects and stated that irregularity remains constant over different scales. The fractal used to model coastlines have the dimension between 1 and 2, while those used to model mountain surfaces have dimension between 2 and 3. The fractal dimension of earth's surface as indicated by NASA photos is 2.1 while that of Mars is 2.4.

Even though the term fractal has been coined recently by Mandelbrot; mathematicians knew well about the complex fractal structures for a century or more. For pure mathematicians these fractal sets that they derived from complex numbers were a means of entertainment. During those times geometry was considered inferior to pure mathematics. Mathematicians remained aloof from the real world confining themselves to the world of numbers. With the arrival of Mandelbrot, mathematics again combined hands with reality. Thus, fractal sets which were once the object of bizarre fancies of mathematicians were found to be useful for describing diverse natural phenomena.

Check Your Progress I

Note: Use the space provided for your answers.

1) Why was Euclidean geometry unable to represent the roughness of reality?
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2) Explain the fractional dimension and self similarity associated with fractal geometry.
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2.4 SOME FAMOUS FRACTALS

In order to model the fractal shapes found in nature, geometric figures that exhibit precise self-similarity are constructed. Iteration is the method by which mathematical fractals are constructed. It means continuously repeating a certain mathematical operation. There are three types of iterations namely generator iteration, Iterated Function System (IFS) Iteration and Formula Iteration. In generator iteration, certain geometric shapes are repeatedly substituted by other shapes to create a fractal. Iterated Function System iteration applies geometric transformation repeatedly in order to create a fractal. In the formula iteration a certain mathematical formula or several formulas are repeated to create a fractal.

Koch Curve

Koch curve or the Snow flake curve is one of the simplest fractal shapes generated by iteration. It was discovered by Swedish Mathematician Helge von Koch in 1906. The process starts with a line segment. It is divided into three equal parts and the central section is replaced by two sides of an equilateral triangle. This process is repeated for the four segments repeated after the first iteration and the process is repeated to get the Koch curve.

The Cantor Set

Cantor set is named after the nineteenth-century mathematician George Cantor. The generation of this set involves iteration of a single operation on a line of unit length. The middle third from each line segment of the previous set is removed with each iteration. With the increasing iterations the number of separate line segments tends to infinity while the length of each segment approaches zero. Magnification reveals self similarity as the structure is essentially distinguishable from the whole.

The Sierpinski Triangle

Named after the polish mathematician Waclaw Sierpinski, Sierpiniski triangle is made by making infinite removals. Each triangle is divided into four smaller, upside down triangles. Then we remove the centre of the four triangles. Iterating this process, an infinite number of times the total area of the set tends to infinity as the size of each new triangle goes to zero. Upon zooming into the completed Sierpinski triangle to any depth would reveal the exact replica of the entire Sierpinski triangle. It provides one of the basic examples of a self similar set.

The Mandelbrot Set

The Mandelbrot set, one of the famous fractals in existence, is the modern development of a theory developed independently in 1918 by Gaston Julia and Plerru Fatou. This set is named after Benoit Mandelbrot. It is born out of the quadratic equation $z = z^2+c$, where z and c are complex umbers. Mandelbrot set is the set of all complex c such that iterating $z = z^2+c$ does not diverge. One of the interesting features of Mandelbrot set is that it retains its highly complicated structure even while zooming at higher levels of magnification.

The Julia Set

The Julia set was discovered by Gaston Julia and Pierre Fatou. The Julia shares a very close relation with Mandelbrot set. It is the difference in function iteration that separates Julia set and Mandelbrot set. The Mandelbrot set iterates $z = z^2+c$ with z always starting at 0 and varying the c value. The Julia set iterates $z = z^2+c$ c for a fixed c value and varying z values. While the Julia set is in the dynamical space or the z plane, the Mandelbrot set is in the parameter space, or c plane.

Check Your Progress II

Note: Use the space provided for your answers.

1) What is iteration used for and what are its different types?

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2) How is a Mandelbrot set created?

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2.5 PRACTICAL APPLICATIONS OF FRACTALS

The fractal concept and the fractal objects find immense use in diverse fields. From image compression to finance, artists and scientists are experiencing the value of fractals. Fractal Geometry is used to describe many complex phenomena. From physics to astrophysics, biology to chemistry and even in market fluctuations fractals have found various applications.

Yet another important application of fractals is in the non linear dynamics, especially with regard to chaos theory. Both chaos theory and fractals appeared unrelated in the nineteen seventies during their infancy even though they are mathematical cousins. The predictability in a chaotic system is ruled out due to sensitive dependence on initial condition and makes one wonder about the scope of finding any order in the system. Here fractal structure of the strange attractor comes to the rescue. Fractals help us decode the language of chaos and present us with a meaningful picture. The strange attractors of chaotic systems are often fractal. This does not mean that all fractals are examples of chaos. Chaos naturally produces fractals. As nearby trajectories expand they must eventually fold over close to one another for the motion to remain finite. This is repeated again and again, generating folds within folds, up to infinity. The beautiful microscopic structure of chaotic attractors results from this process. The advantage of fractal image is that the extraordinary detail present in fractal images can be generated by very simple recipes. The fractal intricacy of an attractor gives the best solution to the modelling problems that involves a structure with infinite intricacy and having the characteristic of chaos.

Mandelbrot was involved in the study of financial prices during the early and toward the end of his career. He stated that the price fluctuations, as assumed by economists are not smooth but often discontinuous and irregular and the most important ones are concentrated in time in such a way that the wealth acquired in stock markets is confined to a very small number of favourable periods. Great attention is received for Mandelbrot's notions of fractals and multi-fractal forms of economic concentration. His study of the financial markets in 1963 resulted in a paper titled, "The Variation of Certain Speculative Prices." and in 2004 he co-authored a book with journalist Richard Hudson titled *The (Mis) Behaviour of Markets: A Fractal View of Risk, Ruin, and Reward*.

Fractals aid in modelling self similar natural forms. It helps in mimicking the large scale real world objects. Fractals comes in handy for an environmentalist who want to estimate the effect of a disaster like a large scale oil spill or the doctor who needs to calculate the surface area covered by bronchial tubes within a human lung. In both the cases fractals are used to an approximate the structure of a real object for the better understanding and implementation.

Fractals create amazing visual effects which has been successfully tried and tested in many films like Star Wars and Star Trek. They not only have the aesthetic value but also trick the mind. The Fractal images are aesthetically and economically far better alternative to the outdoor costly and elaborate shooting sets.

Fractals are used in architecture. According to Mandelbrot, "some cultures have a very strong fractal aspect; Persian, Indian and Mughal architecture often show the contours of small domes within large ones." Identifying the fractal structure of a building helps one to adjust the structure so as to improve the strength and integrity.

Fractals also find use in psychology and counselling. Theoretical biologists have began finding fractal organization that control structures all through the body a decade after Mandelbrot published his physiological speculations. Geologists have found that the distribution of earth quakes fitted into a mathematical pattern which is fractal. The fractal patters also helps in making weather predictions.

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2.6 SIGNIFICANCE OF FRACTALS

Fractals have stimulated new and deeper investigations in diverse fields. It unravels a new regime of nature which is subjected to mathematical modelling. The formless and irregular patterns receive a new meaning with fractals. Fractals convincingly explain and explore the innumerable complex natural phenomena which were conveniently bypassed for the want of scientific explanation.

Fractal geometry was successful in representing the reality with its irregularities and imperfections which classical and Euclidean geometry could not do. The idea of fractal dimension was a worthy replacement for the Euclidean measurements that failed to capture the essence of irregular shapes. Thus, rather than bracketing out the roughness of the reality as an imperfection, fractals helps in incorporating them with others thus resulting in a holistic understanding of the reality.

It is impossible to quantitatively measure the individual details of a fractal. We have a shift from quantity to quality. The fractal dimension gives the numerical measure of the degree of roughness of a fractal. The understanding of fractals displaces the general notion that the 'complexity of structure is a result of complicated interwoven processes.' This would mean acknowledging the greater significance of simple process, which could result in complex patterns. The fractal patterns arising out of the iteration of simple equations underline this fact.

The fractal dimension has reignited the interest in mathematics by creating a renewed interest both for teaching and studying. Fractals are extremely useful in teaching mathematics in combination with physics and some aspects of art. Mandelbrot finds the tremendous interest seen in fractal geometry outside the mathematics community as a healthy development. This would impart mathematical literacy to the otherwise highly educated people. As Ian Stewart states, "So today, fractals appear in science in two different ways. They may occur as the primary object, a descriptive tool for studying irregular process and forms. Or they may be a mathematical deduction from an underlying chaotic dynamic."

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Check Your Progress III

Note: Use the space provided for your answers.

1) How is chaos theory and fractals related?

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2) Explain how fractals have stimulated new and deeper investigations in diverse fields.

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2.7 LET US SUM UP

In this unit we have initiated a discussion on the concept of fractals. In comparison to Euclidean geometry that strived for Platonic perfection and lost out in representing the roughness of reality, fractal geometry is presented as means to picture the roughness of reality in the best possible way. We have seen how Benoit Mandelbrot related the fractals, which once remained an exclusive property of mathematicians in successfully explaining the complexity of nature. Some of the famous fractals and the way in which they were modelled also have been discussed in brief. After the discussion on the practical application of fractals, we conclude by outlining the far reaching significance fractals have in store for mankind.

2.8 KEY WORDS

Benoit B. Mandelbrot: The mathematician who coined the term Fractal. It was Mandelbrot that the fractal sets which were once the object of bizarre fancies of mathematicians were found to be useful for describing diverse natural phenomena.

Fractals: A fractal is a rough geometric shape that can be split into parts, each of which is exactly, approximately or statistically a reduced-size copy of the whole, a property called self-similarity.

Fractal Dimension: Fractal dimension is the fractional or non integer dimension which helps in measuring the qualities of an object which exhibits roughness, brokenness or irregularity in a better way.

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UNIT 3 NANOTECHNOLOGY: BASIC IDEAS AND APPLICATIONS

Contents

3.1 OBJECTIVES

Nano technology is an innovative development in science and technology. It has a convergence with many disciplines. It has revolutionary implications for society. It has even a potential to challenge the existing notions of reality. This unit provides the basic ideas and applications of nano technology. Further it explores the social ethical implications of this kind of technological developments in contemporary world situation.

3.2 INTRODUCTION

Nanotechnology involves working with matter at the atomic or molecular scale. Nano technology is a technology of rearranging and processing of atoms and molecules to fabricate materials to nano specifications such as a nanometre. Materials and devices designed and made at the molecular level would be quite different from those of daily use today. It is argued that the new products would be far superior in terms of strength, toughness, speed and efficiency. The products are considered cleaner, stronger, lighter and more precise. Nano technology is set to bring about a fundamental change in several areas- materials science, electronics, biology, medicine- and is expected to profoundly change the pattern and standard of life of people. The goal of research in nanotechnology is to discover and understand these unique properties and ultimately find a way to put these characteristics to use.

Nano science is a convergence of physics, chemistry, materials science and biology, which deals with the manipulation and characterization of matter on length scales between the molecular and the micron size. Nanotechnology is an emerging engineering discipline that applies methods from nano science to create products. Nanotechnology is an emerging range of technologies in which medicine and engineering meet physics and chemistry. Nanotechnology involves 'research and technology development at the atomic, molecular, or macromolecular levels, in the length scale of approximately 1 to 100 nm range, to provide a fundamental understanding of phenomena and materials at the nanoscale and to create and use structures, devices, and systems that have novel properties and functions because of their small and/or intermediate size'. Materials of molecular and macromolecular scales have new and often unexpected properties. Nano technology poses a challenge to manipulate atoms individually and place them precisely where they are needed with predefined features.

3.3 NANO TECHNOLOGY: DEFINITION

There is no common agreement on the definition of nanotechnology. Many scholars and research agencies defined it differently. The current dictionary definition of Nanotechnology is 'the design, characterization, production and application of materials, devices and systems by controlling shape and size at nanoscale.' (E.Abad. et al., *Nano Dictionary*. Basel: Collegium Basilea, 2005) The Royal Society (2004) defines *Nanoscience* as the study of phenomena and manipulation of materials at atomic, molecular and macromolecular scales, where properties differ significantly from those at a larger scale. *Nanotechnologies* are design, characterization, production and application of structures, devices and systems by controlling shape and size at nanometer scale. US National Nanotechnology Initiative (NNI), one of the largest founders of nanotechnology research in the world uses the definition: nanotechnology is the understanding and control of matter at the dimensions between approximately 1 and 100 nanometers, where unique phenomena enable novel applications. Encompassing nanoscale science, engineering, and technology, nanotechnology involves imaging, measuring, modeling, and manipulating matter at this length scale. (NNI, 2008). US Foresight Institute came with a definition, "nanotechnology is a group of emerging technologies in which the structure of matter is controlled at the nanometer scale to produce novel materials and devices that have useful and unique properties."

3.4 HISTORICAL DEVELOPMENT OF NANO TECHNOLOGY

Though the term Nanotechnology was coined in 1974 by a Japanese scientist Norio Taniguchi, it has nothing to do with the present day usage. The prefix of nanotechnology derives from the unit of length, the nanometer, and in their broadest definitions these terms refer to the science and technology that derives from being able to assemble, manipulate, observe and control matter on length scales from one nanometer up to 100 nanometers or so. One nanometer is a billionth of a meter or one thousandth of a micrometer, sometimes called a micron, which in turn is one thousandth of a millimeter. It is abbreviated to 1 nm. Molecules, viruses and atoms are objects that range from less than 1nm to about 100 nm. For instance, a human hair is roughly 20,000 nm in diameter. A bacterial cell might be up to a few thousand nanometers in size. They are too small to see with the eye, or even with the microscopes that use visible light. New technologies are facilitating to visualize even these small particles. The technologies like the scanning tunneling microscope and the atomic force microscope are not only for seeing but also manipulating things at this small scale.

Prior to invention of scanning tunneling microscope, the atomic structure of matter was quantitatively revealed by x-ray diffraction. The information they contain are not direct real space representation of matter. With them you cannot pinpoint the position in space of a given atom, molecule or cluster. With the development of Scanning Tunnelling microscope, not only could the individual atoms and molecules be imaged; they could also be individually manipulated. Through the inventions of scanning tunneling microscopy (STM), scanning force microscopy (SFM) in second half of twentieth century, images are obtained not by gathering reflected or refracted waves from a sample, as happens in conventional microscopies such as light or electron microscopy. Instead, a very fine tip is scanned across the surface of the sample, interacting with it in one of a number of possible ways. The picture is built up electronically by recording the changing interaction with the surface as the tip is scanned across it. New techniques – including scanning force microscopy – are capable of interrogating the properties of single molecules. It is the information about the properties of a single molecule provided by these techniques will be essential in the design of nano scale devices.

Today, nano technology has emerged as an important interdisciplinary subject with internalizing the recent developments in various fields. The nano technology has wider applications and products produced by nano technology have serious implications too for contemporary world-economically, ethically and politically. The world of nano technology is broadly divided into two major application areas- wet and dry areas. The wet area includes the biological domain, where nano structures may function within biological cells. The dry area includes hydrophobic architectures and strategies that govern improvement of materials including computer chips. Dry nano technology applications have preceded the biological use. Initially, biology and electronics are likely to be the major areas of application. Nano technology is also expected to provide a new tool to read the genetic code. The discoveries that have been made so far in the science of nano scale, offer new possibilities for a multitude of industries.

3.5 NANO TECHNOLOGY: NEW TECHNOLOGICAL REVOLUTION

Nanotechnology is being heralded as a new technological revolution. It is so profound that it will touch all aspects of economy and society. Through the developments in nano technology, energy will be clean and abundant, the environment will have been repaired to a pristine state, and any kind of material artefact can be made for almost no cost. Space travel will be cheap and easy, disease will be a thing of the past, and we can all expect to live for more years.

Current applications for nanotechnology are dominated by tools for scientists, and by new materials that are structured on the nanoscale. Such materials are used in cosmetics, health and medicine and in a variety of manufactured goods. The electronics and information technology industries are also a prominent driver for these new technologies. Carbon nanotubes have potential applications in electronics, improved materials, and drug delivery. Today we have already been witnessing a few commercial applications of nanotechnology such as improved hard-disks for computers, sunscreens, and improvements to telecommunications. Much of the potential for the translation of nanoscience into useful and viable products is likely to be realised within the next decade or two. As the knowledge and tools improve, it is likely that at least some of the possible applications will become commonplace in our everyday lives. For instance, new lithographic techniques to make nanoscale components for computers are highly likely to replace current methods and materials. Levels of public expectation that nanotechnology may bring about significant improvements in the length and the quality of life are high. In the field of bio technology and medicine, the public expectation on this new technology is high. The biggest economic driving force for nanotechnology now comes from information technology. Nanotechnology has the potential for smaller and faster computers with larger memories than current processes of making transistors and other components permit. In the long term, entirely new applications may emerge.

Technological optimists look forward to a world transformed for the better by nanotechnology. For them it will cheapen the production of all goods and services, permit the development of new products and self-assembly modes of production, and allow the further miniaturisation of control systems. At the same, there is strong criticism on the implication of nano technology in our society on different accounts. However, it is too early to predict its implications.

3.6. APPLICATIONS OF NANO TECHNOLOGY

Nanotechnology applications in development can be broadly divided into several thematic areas: the development of the tools that enable the research and ultimately the technology; applications relating to new or improved materials; applications within the sphere of electronics and IT; advances in health and medicine; improvements in cosmetic products and advances in food technology; developments in products for military and security use, and space exploration; and products and processes to improve the environment. Nano technology has tremendous development in the fields of material science, electronics, biomedical science, biotechnology, military and the environment. The computing and electro communications industries are driving large investments with the aim of maintaining the relentless technological advances that the structure of those industries seems to demand. In Biomedical science, the driving force for innovation is as much political as economic, as spending on medical research seems to be one of the most popular and widely supported forms of public spending in western economies.

Material science

The science of metals, ceramics, colloids and polymers, has always concerned itself with controlling the structure of materials on the nanoscale. Here, nanoscale science and technology will largely facilitate incremental advances on existing materials and technologies. The improved control over nanoscale structure, and better understanding of relationships between structure and properties, will continue the long-run trend towards materials that are stronger and tougher for their weight. Some specific areas in which Nano science technology is contributing to materials science now include: new forms of carbon; nanocomposites; quantum dots and wires; and nanostructured materials produced by self-assembly. The cosmetics and paints industries are perhaps perceived as being the most developed in incorporating nanoparticles into their products, for example, the shampoos, skin creams, and sunscreens already being used by consumers.

Medical

The medical area of nanoscience application is projected as one of the most potentially valuable, with many projected benefits to humanity. With the advent of new materials, and the synergy of nanotechnologies and biotechnologies, it could be possible to create artificial organs and implants that are more akin to the original, through cell growth on artificial scaffolds or biosynthetic coatings that increase biocompatibility and reduce rejection. These could include retinal, cochlear and neural implants, repair of damaged nerve cells, and replacements of damaged skin, tissue or bone. The diagnostics and drug delivery is likely to benefit from the development of nanotechnology. With nanoparticles it is possible that drugs may be given better solubility, leading to better absorption.

Cosmetics
Cosmetics and personal products companies have been extremely active in using nanotechnology to improve their existing products and to develop new ones. Cosmetics companies were among the first to get products that were labelled as being nano-enhanced to market. Shampoos and skin creams, containing nanoparticles with the ability to deliver the desired ingredient to where it is needed.

Military
In the field of military, improved materials, lighter but with tough, heat resistant properties, are being used in the design and construction of spacecraft and satellites, and this process will gain from nanotechnology. There is also the possibility of nanotechnology facilitating improvements in civilian security equipment. The Institute of Nanotechnology suggests fingerprinting will become cheaper, quicker and more effective using DNA techniques involving nanotechnology, and there is also the possibility that nano-based sensors could be used as electronic detectors (‘sniffer dogs’) for improved airport security. Quantum dots, fluorescent nanoparticles which glow when exposed to ultraviolet light, may be used as tags and labels to prevent theft and counterfeiting, and to trace the course of drugs within the body.

Biotechnology
In the field of biotechnology researchers are looking to nanotechnology as the basis of new implants that will replace lost hearing or vision, as new ways of delivering 'smart drugs' to parts of the human body, and as ways of carrying 'body repair' cells to areas where tissue has been damaged. As researchers master this new field, revolutionary concepts such as replacement arteries, nanofibre bone reinforcements, powerful microscopes the size of a pen, and new diagnostic technologies are becoming more and more probable.

Green Technology
Nanotechnology can be used to prevent, monitor and alleviate a wide range of environmental problems, while significantly reducing cost and improving performance. Current and future applications of nanotechnology will allow us to:

- Develop new "green" processing technologies that minimize the amount of undesired by-products;
- Detect and remove the finest contaminants from air, water, and soil, which would enhance the ability of governments to respond to terrorist threats and ensure the safety of water supplies;
- Attain sustainable development by reducing the use of raw materials;
- Design cars that are lighter and more resistant to denting and scratching, resulting in fuel savings and increased longer-lasting vehicles;
- Extend the shelf life of food and beverages by creating barriers against water vapor and oxygen;
- Save energy through "smart" insulation and construction materials

Hi-Tech

Nanotechnology provides unprecedented control of light and power. Light emission and/or absorption are crucial for optical communications, display technologies, information storage, solar energy collection, genome sequencing, and even targeted drug delivery. The integration of organic/inorganic/mechanical properties can result in self-intelligent systems and self-correcting systems with internal control. Miniaturization is a critical concern for microelectronics, computing and telecommunications industries. Optical routers, large-scale displays, and ultra-dense molecular memory are only some of the short-term applications. A cool flat-panel screen will replace your bulky television set at an affordable price, thanks to carbon nanotechnology. This technology will produce better displays at a lower cost, for home theatres, office equipment, portable computing tools, and many other applications. Based on a fusion of biology and photonics, there are also potential applications in non-invasive cancer therapies, laser tissue welding, drug delivery, and diagnostics.

Check Your Progress I

Note: Use the space provided for your answers.

1) Define nanotechnology?

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2) Discuss the applications of nanotechnology?

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3.7 DISCOURSE ON NANO TECHNOLOGY

The debate on nanotechnology is founded on a range of conceptions of what this emerging technology encompasses, and judgments on what it may mean for society. The scientific community too divided on the potential and future of nano technology. Some of them attributed radical departure from science and technology and visualized revolutionary implications of nano technology. Some of the scientists are skeptical about the potential of nano technology and even critical about the ongoing research and propaganda about nano technology.

The term nano technology was popularized by a book written by K. Eric Drexler, nanotechnology visionary in a book of 'future history' called *Engines of Creation*. Drexler used the word to describe his vision of a world where molecular manufacturing would allow people to manufacture *anything* they might need – from automobiles to pieces of beef – simply by feeding waste material into a box that would use nano scale assemblers to re-configure it into the necessary form. Jamie Dinkelacker, in his paper *Transitions to Tomorrow* (2002), Nanotechnology heralds a new industrial era, a 'Molecular Epoch' that involves major social changes. The advances in science have been achieving near total control over the structure of matter. He viewed that the era of nano technology promises "novel materials and capabilities, leading to novel living patterns, new ways of socializing, and yielding fresh approaches to cooperation and competition. He speculates that nanotechnology offers the potential for global material abundance, and it is the loss of scarcity that has the "potential for dramatic social change. Especially, the molecular nano technology has the ability to "programme matter with molecular precision". In *'Why the Future Doesn't Need Us'*(2000), Bill Joy, chief scientist of Sun Microsystems, also adopts the radical conception of nanotechnology, where the "replicating and evolving processes that have been confined to the natural world are about to become realms of human endeavor". Joy accepts that nanotechnology, coupled with advances in genetics and robotics, is highly revolutionary and transformative.

George M Whitesides, an experimental surface chemist and pioneer of new nanotechnology techniques, in his article *The Once and Future Nanomachine* (2001), is much more skeptical about the radical view of nano technology. He contends that nanotechnology could learn much from biology. Rather projecting the magnitude of nano technology and the nano machines, he appraises the developments in biology and chemistry, on which nano technology is based. Whitesides seems reluctant to believe that new forms of sophisticated nanoscale machines are feasible, particularly not from scaling down macro-machines. Instead, "biology and chemistry, not a mechanical engineering textbook" may hold solutions for nanotechnology. Whitesides is skeptical that the Drexlerian vision of molecular manufacturing is possible, though he does not explicitly rule it out.

Richard E Smalley, chemist and the Nobel Prize winner for the discovery of fullerenes in 1996, in *Of Chemistry, Love and Nanobots* (2001) too is skeptical as Whitesides. For Smalley, chemistry is the most effective method of molecular manipulation, as atoms perform a "complex dance involving motion in multiple dimensions" in chemical reactions. He argues that nanobots or assemblers "are simply not possible in our world", due to constraints imposed by the limitations of the scale. In his view, the need to control all the atoms surrounding the reaction site would require so many manipulators that there would not be room, while the atoms forming the nanobot would themselves bond with the atoms to be manipulated. Whitesides, and Smalley represent the scientific argument against the radical viewpoint; they are particularly skeptical that the Drexlerian vision of molecular manufacturing is feasible. These highly respected scientists argue that this conception of nanotechnology does not fit within the laws of physics and chemistry as they operate on the nanoscale, or is redundant due to the superior power of biological processes.

Drexler's vision for nanotechnology is one of the atomic precision and perfect and complete control over molecular reactions. It is essentially an engineer's vision. Smalley's vision in turn, insists on production of detectable and controllable phenomena, and takes a crucial part of scientific activity the manipulation and stabilization of the phenomena. This is essentially a chemist's vision. The writing on nanotechnology has been discussed in terms of two dimensions: its conception of nanotechnology and its perception of the possible social and economic effects. There is an emerging concern that the needs of society to be considered as part of the development process and that nanotechnologists not be left alone to dictate what materialises. This implies that any assessment of possible social and economic effects be incorporated into this process as early as possible, and hence that social science, as a major provider of such understanding, can help shape the future of nanotechnology.

3.8 SOCIAL AND ETHICAL IMPLICATIONS OF NANO TECHNOLOGY

Many of the applications arising from nanotechnology may be the result of the convergence of several technologies. The technological development and its implementation do not operate in a vacuum, and nanotechnology will be influenced by other scientific developments, social reactions, and local and global politics. The extreme supporters claim that nanotechnology can rebuild the human body from within and effectively abolish death, while its critics fear that instead, it could do away with life, by turning the surface of the Earth into an uninhabitable grey mass. However, the social science reading can help us understand nanotechnology in a better way than technological deterministic view. Nanotechnology in relation to society has to explore the driving forces behind the technology development process and the issues of inequities and economic divides and how society deals with risks under uncertainty. There are further apprehensions about nanotechnology since its closeness to market forces and research is mostly carried by the interests of advanced nations and market forces in corporate laboratories. Nano is a big business. National Science Foundation of USA predicts that nano-related goods and services could be $ 1 trillion market by 2015. It is the fastest growing industry than any other in the recent history.

While nanotechnology offers opportunities for society, it also involves profound social and environmental risks, not only because it is an enabling technology to the biotech industry, but also because it involves atomic manipulation and will make possible the fusing of the biological world and the mechanical. There is a critical need to evaluate the social implications of all nanotechnologies. There is a possibility that domination of nano-robos in every day life will make human intervention difficult, if not impossible. Another risk is that the hazard posed to human life and health by nano particles inhaled in the factory and elsewhere. Environmentalists also question the safety of nanoparticles. The first concerns the biological and chemical effects of nanoparticles on human bodies or natural ecosystems; the second concerns the issue of leakage, spillage, circulation, and concentration of nanoparticles that would cause a hazard to bodies or ecosystems. The potential dangers of nano technology include rampant nano-devices, military weapons, or invasive surveillance. On ethical side, the issues of intellectual property as well as the access of nano technology to developing countries have to be addressed. The public policies to protect our society from harmful developments are another concern based on strong foundations of ethics.

If technology is fascinated towards control and over taking of nature, nanotechnology is mainly concerned with the control of nature at the most basic level, i.e. level of atomic building blocks. However, Nanotechnology has been generating new ethical dilemmas and in future we have to necessarily negotiate with a big deal of uncertainties. The ethical theories have to be reformulated with changing context that had predominantly influenced by nanotechnology. Nanoethics have emerged as a new field of applied ethics that looks at the issues of right and wrong in the development and application of nanotechnology. (Lin and Allhoff, 2007)

3.9 DEMOCRATIZATION OF TECHNOLOGY

Philosophers are concerned about the technology and came with different perspectives of philosophy of technology. Two dominant streams in this regard are theories of technological determinism and social construction. The interface of technology and society and rational and ethical understanding of that situation is the main concern of the philosophers. The Marxists

though find technology as a means of liberation argues for a socialization of its wealth by abolition of classes. They view a harmony between man and nature against the alienation. The phenomenologist Heidegger considers technology is not a simplification of artifacts, but an all encompassing world view that revealing the world. Objects enter into our experience only in so far as we notice their usefulness in the technological system. He also believes that releasing from this needs a new mode of revealing, but he has no idea how revealing come and go. The pragmatic thinker John Dewey considers scientific theories and logic are tools used in a certain social practices. So the success of technology depends upon its usefulness. Herbert Marcuse, the Frankfort school thinker in *One Dimensional Man* (1964) argues that technology leads to a new form of domination in industrial society. He forwards a view that restoration of harmony of man and nature through new science and technology. It requires the abolition of class society. Hebermas contests the Marcuse's new science and technology as a romantic myth. He argues that problems of capitalist modernity are due to obstacles it places in the way of rationalization in its moral- practical sphere. Andrew Feenberg by consolidating these debates in *Questioning Technology* (1999) argues that society is organized around technology. Technological power is the principal form of power in the society. Feenberg's major focus and distinctive position within current debates on technology has an emphasis on democratic potential for the social reconstruction of technology. Feenberg rejects both neutralist positions which see technology as a mere instrument of human practice, amenable to any and all projects and uses, and determinist notions which see it as an instrument of domination in the hands of ruling elites whose very construction determines the uses, limits, and applications of technology. Instead he sees technology as a contested field where individuals and social groups can struggle to influence and change technological design such that the very construction of technology is subject to democratic debate and contestation. He proposes for a possibility of alternative rationalizations, alternative modernity through alternative politics. Feenberg is interested in the possibility of *alternative rationalizations*, particularly forms of rationalization necessary for socialism, which would embody responsibility for humanity. He strongly proposes that a technological society requires a democratic public sphere sensitive to technical affairs.
Most of these perspectives are evolved from the reflections on industrial society. These views have relevance for the context of nanosociety too. Nano technology has not only going to change significantly but also producing inequalities in society through monopoly of technology and control over many nations and social groups. Democratization of the nanotechnology is an immediate concern as raised by the conscious scholars and civil society organizations. Rather negating the technology per se, we can shape the technology with our social and ethical concerns emerged out of our struggles for democracy. Currently, corporations, developed nations, entrepreneurs and technologists are the main driving forces behind nano technology. Mostly the research and its products are market oriented. There is a need to understand the driving forces and the process of decision making in relation to nano technological development. Nano technology is invariably related with information technology and biotechnology. As a result, nanotechnology has become crucial for economic growth of nations. At this juncture, political regulation and consensus is required to control technological change.

There are consensus and campaigns in civil society from different sections on the issue of nano technology for its future implications to humanity. Their concerns are mainly for democratization of technology and egalitarian social order. It is argued that the point is not that the technologies are bad… [but] the evaluation of powerful new technologies requires broad social discussion and preparation". Sue Mayer(2002), who sees parallels between the emergence of nanotechnology and of genetically modified (GM) 15-20 years ago. The lack of democratic consultation keeps the assessment of any risk within the realm of the 'expert'; the public is then considered ignorant, and the authorities attempt to calm any fears with 'sound science', a concept that to Mayer is shaped "not by scientific facts but by its political, social, economic and cultural context". Mayer's concerns, however, extend beyond the lack of democracy in technological development to the effects that this may have over the safety of nanoparticles for humanity and the environment. Moreover alternatives will not have been explored and the economic benefits of nanotechnology may be less than they would be if the public had been involved in its design. The perceived lack of democratic consultation also raises concerns regarding the control and ownership of the technology, the possibility of its monopolisation and the "implications of corporate control over matter." ETC, *Action Group on Erosion, Technology and Concentration* envisages that the recent trend of the control of technology development being lost to the public arena, the "privatisation of science and a staggering concentration of power in the hands of giant multinational enterprises" will be further reinforced by nanotechnology. In ETC's picture of the future, the "control of the technology will accrue to those with power and the commercialisation of the technology will inevitably give them greater monopoly control". ETC does not trust big business, or governments, to use this knowledge, power and control ethically. Allied to these issues of monopoly and control is the negative vision that nanotechnology will reinforce global inequalities between rich and poor. It dismisses the eradication of poverty as a myth propagated by the enthusiastic nanotechnologists. The commercial forces are purely concerned with profit. Comparing the dawning of a nanotechnology revolution to previous industrial revolutions, ETC raises the question of "a decline in the well-being of poor people and increased disparity between rich and poor", as only those with sufficient wealth may have access to the technology. In other words, ETC predicts a future in which the ruling elite has "unlimited surveillance capacity" at the nanoscale leading to an Orwellian scenario of "Big Cyborg Brother".

Check Your Progress II

Note: Use the space provided for your answers.

1) Explain the nature and scope of nanotechnology.

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2) Critically examine the social and ethical implications of nanotechnology.

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3) Evaluate the perspectives of philosophy of technology with reference to nanotechnology.

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3.10 LET US SUM UP

Nanotechnology is an important development in our society that going to revolutionize our lives in a grand way. Nanotechnology involves working with matter at the atomic or molecular scale. It is a technology of rearranging and processing of atoms and molecules to fabricate materials to nano specifications such as a nanometre. It is a result of convergence of several technologies. Nano technology is set to bring about a fundamental change in several areas- materials science, electronics, information technology, biology, medicine- and is expected to profoundly change the pattern and standard of life of people. Apart from advantages, it has serious social ethical implications. Nanotechnology projects a new world and also brings with it new social problems. From these ethical dilemmas evolved a new discipline called nanoethics. Philosophers are predicting that we have to negotiate with a big deal of uncertainties and chaotic situation with the advent of nanotechnology. Apart from the risks and threats of nanotechnology, control and monopoly of this technology in the hands of advanced nations and corporate companies' interests is another critical concern. Democratization of nanotechnology, in its design and application, is the prime concern in the discourse of philosophy of technology and the struggles from civil society.

3.11 KEY WORDS

Nano technology, Nano scale, Atomic rearrangement, Scanning Tunneling Microscopy, Nano particles, ETC group, Philosophy of technology, Technological Determinism, Social construction, Democratization, Public participation

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UNIT 4 NATURE OF NATURE: PHILOSOPHICAL IMPLILCATIONS

Contents

4.0 OBJECTIVES

- To appreciate the evolving nature of humans.
- To realize that our nature is engineered or our nature has become part of our culture.
- To appreciate the radical changes taking place in our self-understanding ("singularity").

4.1 INTRODUCTION

What is unique about contemporary nature? How does culture and nature differ today? Has technology transformed our culture and our nature beyond recognition? Are we at the cross roads in the evolution of culture? In this unit our aim is to show how culture has evolved so awesomely that it has conquered every possible space, including our own human body, our very nature. In other words, given the technological prowess available to humans today, cultural has really radically altered nature and even merged with nature. In such a scenario, we need to evolve new ways of living, relating and experiencing the presence of each other.

In other words, ours have become an "engineered nature." By "engineered nature," I mean a nature that been so artificially and technologically created that it almost eats itself, like the uroboros snake (Fox 1982) Such a substantially different culture, that also encompasses nature, I want to argue, gives rise to different understanding of body, relationship and presence.

So in the first part of this article, we want to focus on the blurred relationship between the real, imaginary and the hyperreal. The hyperreal or vitual, we say, is ambiguous term that connects the real and its opposite and in the process makes reality far more profound than we imagine. In the next section we want to extend this complex relationship to the triads of nature, nurture and culture. Here our specific aim is to show that today culture has to be understood as a larger and complex phenomenon, that includes also its antonym, namely, nature. Because of the technology available to contemporary humans, we have developed our culture so much that it radically alters our nature.

This takes us to the uniqueness that contemporary human experience: the singularity. Here we takes us different kinds of singularities and focuses mainly on the technological singularity, that changes our body profoundly. Such a technologisation of our body has to be placed in the philosophical context of physical body, namely "lived body", which we undertake in the next section. Then in the final section we take up some related cultural issues like cultural singularity and its implications for body, presence and relationship. Thus our main argument in this article is to show that the very notion of culture has undergone dramatic changes and today we stand at the cross-roads of our culture possessing us almost totally.

4.2 TheREAL, IMAGINARY AND HYPERREAL

In common parlance, 'real' can be an antonym for 'imaginary.' The dictionary definition of 'real' (as an adjective) has following two meanings: (1) NOT ARTIFICIAL, something that is real is actually what it seems to be and not false, artificial or pretended and (2) NOT IMAGINARY, actually existing and not just imagined. In the first case, antonyms of 'real' are 'fake', 'artificial', and so forth. In the second case, I think 'imaginary' can be an antonym of 'real'.

Today many philosophers do not share this view. when photographers say 'photo real' or 'super real', with the word 'real', they mean their images that are actually just in their minds. In this case, 'real' does not actually means 'fact' but more 'real' feeling than 'fact' which they feel about photos. That's why." That is why some of the contemporary thinkers use the term hyperreal, to go beyond the duality between real and imaginary (or artificial).

Hyperreality is used in semiotics and postmodern philosophy to describe a hypothetical inability of consciousness to distinguish reality from fantasy, especially in technologically advanced cultures like ours. Hyperreality is a means to characterize the way consciousness defines what is actually "real" in a world where a multitude of media can radically shape and filter an original event or experience. Some famous theorists of hyperreality include Jean Baudrillard, Albert Borgmann, Daniel Boorstin, and Umberto Eco (Hyperreality 2010).

Most aspects of hyperreality can be thought of as "reality by proxy" (Smiles and Moser 2005). Baudrillard in particular suggests that the world we live in has been replaced by a copy world, where we seek simulated stimuli and nothing more. Baudrillard uses the example of a society whose cartographers create a map so detailed that it covers the very things it was designed to represent (Lane 2009). When the empire declines, the map fades into the landscape and there is neither the representation nor the real remaining – just the hyperreal. Baudrillard's idea of hyperreality was heavily influenced by phenomenology and semiotics.

Thus contemporary society blurs the distinction between real, imaginary and hyperreal. Though for practical purposes such words are still useful, in fact, the blurring of the boundaries between them is a characteristic feature of contemporary society.

4.3 NATURE, NURTURE, CULTURE

The nature versus nurture debate is one of the oldest issues in psychology and in philosophy. The debate centers on the relative contributions of genetic inheritance and environmental factors to human development. Some philosophers such as Plato and Descartes suggested that certain things are inborn, or that they simply occur naturally regardless of environmental influences. Other well-known thinkers such as John Locke believed in what is known as *tabula rasa*, which suggests that the mind begins as a blank slate. According to this notion, everything that we are and all of our knowledge is determined by our experience.

For example, when a person achieves tremendous academic success, did they do so because they are genetically predisposed to be successful or is it a result of an enriched environment? Today, the majority of experts believe that behavior and development are influenced by both nature and nurture. However, the issue still rages on in many areas such as in the debate on the origins of homosexuality and influences on intelligence.

Nature and culture are classical opposites, or complements. It is usually claimed that by nature we are "born that way"; by nurture we learn to become civilized (Nature vs Nature 2011).

In one sense, "nature" refers to everything generated or produced. Etymologically, the Latin *natura* is the source from which all springs forth. For metaphysical naturalists, perhaps also for methodological scientists, nature is all that there is, without contrast class. Nothing non-natural or supernatural exists. Humans evolved within nature and break no natural laws. Another view holds that a straightforward contrast class for nature is culture, which nurtures humans into an inherited linguistic and symbolic system, a worldview, by which they communicate, perpetuate, and develop knowledge. This cultural genius makes possible the deliberate and cumulative, and therefore the extensive, rebuilding of nature. Humans reshape their environments, rather than being themselves morphologically and genetically reshaped to fit their changing environments. Humans come into the world by nature unfinished and become what they become by nurture.

Cultural Transmission

Etymologically, "culture" is related to "cultivate," while "nurture" is related to "nurse" and "nourish," with overtones of rearing and training. Religious persons find their traditions vital in such nurture, and absent from nature.

In contemporary biological and human sciences (anthropology, psychology, sociology), as well as in philosophy, there is much effort to naturalize culture, with equal amounts of resistance to such reduction (if that is what it is). Sociobiologists hold that genetic constraints are the principal determinants of culture; only those people and cultures survive that can place genes in the next generation. Evolutionary psychologists discover that humans have an "adapted mind," a modular mind with multiple survival subroutines more or less instinctive—in contrast to the highly rational *tabula rasa* (empty, pliable mind) once favored by humanist philosophers. Philosophical pragmatists may agree that the mind is mostly a survival tool, even in its cultural education (Barkow et al 1992; Bock 1980; Cavalli-Sforza & Feldman 1981).

Culture remains a major determinant, nevertheless. Information in nature travels intergenerationally on genes; information in culture travels neurally as persons are educated into transmissible cultures. The determinants of animal and plant behavior are never anthropological, political, economic, technological, scientific, philosophical, ethical, or religious. Animal imprinting and limited transmitting of acquired information notwithstanding, humans gain a deliberated modification of nature that separates humans in their cultures from nature, increasingly so in high-technology cultures. Since decoding the human genome, completed in 2001, people stand at the threshold of rebuilding even their own genetic nature (Nature vs Nature 2010).

Beyond Nature-Culture Dualism

Humans have a dual inheritance system, nature and nurture. The intellectual and social heritage of past generations, lived out in the present, reformed and transmitted to the next generation, is regularly decisive. Cultures, especially modern ones, change rapidly in a few decades; the human genome hardly changes in thousands of years. Slow-paced genes are difficult to couple with fast-paced cultures (Plumwood 2002).

A relatively pliable, educable mind is as great an adaptive advantage as is a mind with instinctive routines. The mind is so complex that the number of neurons and their possible connections (with resulting myriads of cultural options) far exceeds the number of genes coding the neural system; so it is impossible for the genes to specify all these connections. Human genes have generated an organism whose behavior results from an education beyond direct genetic control. As more knowledge is loaded into the tradition (fire building, agriculture, writing, weaponry, industrial processes, ethical codes, electronic technology, legal history) the genome selected will be one maximally instructible by the increasingly knowledgeable tradition. This will require a flexible intellect, able to accommodate continual learning speedily, adopting behaviors that are functional in whatever cultures humans find themselves. This is consistent with the unusually long period of child rearing in nuclear families with unusually large-brained babies, found in human evolutionary history and uncharacteristic of any other species (Durham 1991).

Critics complain that nature-culture dualism is an undesirable Cartesian legacy (perhaps also a Christian or Greek one). The "versus" in the title of this entry frames the connections wrongly. Nature is the milieu of culture, and supposing our cultures to be in exodus from nature is at the root of our environmental crisis. Culture remains tethered to the biosystem, and the options within built environments, however expanded, provide no release from nature. In fact, ecology always lies in the background of culture; no nurture is adequate that forgets these connections (Rolston 1999).

Perhaps cultural nurturing reinforces natural genetic dispositions for some practices (such as incest avoidance), but not for others (learning nuclear physics). Whether adults have enzymes for digesting fresh milk will determine their pastoral practices. But the differences between the Druids of ancient Britain and the Dravidians in India are nongenetic and to be sought in the radically differentiating historical courses peculiar to these cultures—even though Druids and Indians have a biological nature largely held in common and despite differences in skin color or in blood groups.

Humans are only part of the world in biological, evolutionary, and ecological senses—their nature; but *Homo sapiens* is the only part of the world free to orient itself with a view of the whole, to seek wisdom about who they are and where they are, and to develop their lives on

Earth by means of culture. Such cumulative, ongoing nurture determines outcomes in the uniquely historical behavior of humans, making the critical difference, while human universals, biological, psychological, or social, which are a legacy of nature, have limited explanatory power (Nature vs Nature 2010).

Check Your Progress I
Note: Use the space provided for your answers.s.
1) How is culture and nature related?
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2) What is hyper-real and give its relevance?
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4.4 SINGULARITY IN THE WORLD

In general singularity may be defined as "the quality or condition of being unique". It implies someone or something having a trait or quality "marking one as distinct from others". It is a peculiarity that is unique and essential. In this first part, we want to familiarise ourselves with the general notion of singularity so that we can apply it to technological or engineered singularity.

A General Understanding of Singularity

Seen from this perspective, Big Bang is a singularity. The origin of the universe is a uniquely singular moment, which cannot be compared with any other events. Though scientists are in the dark as to the exact nature of the origin of the universe, they seem to have a very good idea of what took place later on.

Similarly the origin of life may be considered as another singular event. All of us experience life and we know quite a lot of it. Though every experimenters gave a lot of information on the conditions that gave rise to life, the exact origin of life still remain an enigma. With the arrival of genetic engineering and synthetic biology (including the creation of artificial life), it may change. Today we can safely claim that the origin of life, just like the origin of life is a singularity. Abiogenesis or biopoesis is the study of how life arises from inorganic matter through natural processes, and the method by which life on Earth arose. In modern, still somewhat limited understanding, the first living things on Earth are thought to be single cell prokaryotes (lacking a cell nucleus), perhaps evolved from protobionts (organic molecules surrounded by a membrane-like structure). The oldest ancient fossil microbe-like objects are dated to be 3.5 billion years old), approximately one billion years after the formation of the Earth itself roughly 4.7 billion years ago.

When we speak of the third example for singularity, it is still more complex: the origin of human beings? As such here we are on familiar field. Biologists and anthropologists have made significant contributions to the study of human evolution. Though theories vary, we may trace human beings even up to 400,000 years. As to the exact origin of Homo sapiens There are two theories about the origin of modern humans: 1) modern arose in Africa and spread to different continents from there and 2) pre-modern humans migrated from Africa to become modern humans in other parts of the world. Most evidence points to the first theory because of fossils of modern-like humans are found in Africa. Further stone tools, other artifacts and DNA studies support African origin theory.

In short, genetic and fossil evidence suggests that our own species, *Homo sapiens*, first appeared between 150 and 200 thousand years ago in Africa and 40 thousand years ago in Europe (Walkins 2011). By that time human populations exhibit the entire suite of physical characteristics that define anatomically modern humans: a large, rounded brain case; a vertical forehead; a small and flat, or orthognathic, face; reduced brow ridges and a chin.

Understanding Technological Singularity

In mathematics, a singularity is in general a point at which a given mathematical object is not defined, or a point of an exceptional set where it fails to be well-behaved or orderly. For example, the function $f(x) = 1/x$ on the real line has a singularity at $x = 0$, where it explodes to $\pm\infty$ and isn't defined. So disorder, unpredictability and exceptional quality characterizes mathematical singularity.Taking one more step “a technological singularity” may be viewed as “a predicted point in the development of a civilization at which technological progress accelerates beyond the ability of present-day humans to fully comprehend or predict. The Singularity can more specifically refer to the advent of smarter-than-human intelligence, and the cascading technological progress assumed to follow. Whether a singularity will actually occur is a matter of debate.

The concept of a technological singularity as it is known today is credited to mathematician Vernor Vinge. His 1993 "Technological Singularity" (Vinge 1993) contains the oft-quoted statement that "Within thirty years, we will have the technological means to create superhuman intelligence. Shortly thereafter, the human era will be ended." In fact singularity is commonly misunderstood to mean technological progress will rise to infinity, as happens in a mathematical singularity. Actually, the term was chosen as a metaphor from physics rather than mathematics: as one approaches the Singularity, models of the future become less reliable.

The Singularity is often seen as the end of human civilization and the birth of a new one. In his essay, Vinge asks why the human era should end, and argues that humans will be transformed during the Singularity to a higher form of intelligence. After the creation of a superhuman intelligence, according to Vinge, present human be regarded as a lower lifeform in comparison to them. Such a singularity is enabled by the exponential technological progress that we witness today. Though all the technologies may not lead to such a singularity, the claim is the convergence of such technology will yield unforeseen developments and consequences. Some of such technologies that facilitate the dawn of technological singularity are:

Artificial intelligence

An artificial intelligence capable of recursively improving itself beyond human intelligence, will invariably cause a technological singularity. Only one such AI, many believe, would be needed to bring about the Singularity. Most Singularitarians believe the creation of such AI is the most likely means by which humanity will reach the Singularity. One of the most anticipated of these technologies for some is the possibility of human intelligence enhancement, including brain-computer interfacing. Direct brain-computer interfaces may potentially improve an individual's memory, computational capacity, communication abilities, and knowledge base. A more traditional human-computer interfaces may also be seen as intelligence augmenting improvements: traditional expert systems, computer systems recognizing and predicting human patterns of behavior, speech and handwriting recognition software, etc.

Nanotechnology

The potential dangers of molecular nanotechnology are widely known even outside of futurologist and transhumanist communities, and many Singularitarians consider human-controlled nanotechnology to be one of the most significant existential risks facing humanity. Therefore they wish that nanotechnology will be used primarily by transhumanists communities. Other technologies like globally-connected high-bandwidth wireless communication fabric, etc., while not likely to cause the Singularity themselves, are regarded as signs of levels of technological advancement assumed to precipitate the Singularity.

Check Your Progress II

Note: Use the space provided for your answers.s.

1) What is the significance of singularity?

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2) What is technological singularity?

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4.5 TECHNOLOGIZATION OF HUMAN NATURE

The drive for technologisation of human nature through Enhance Human Biology has been a characteristic feature of contemporary human beings. Since ancient times we have been involved in it, but in rudimentary ways. Examples of such enhancements are physical and mental training and use of stimulant and mind altering substance. But modern technology with its growing mastery over the human physiology, biochemistry and cognition is in position to transform the human condition, particularly our human body and its relation to the larger world. This takes us to the vital issue of Integration of Technology and Human body. The advance of technology into the human body has two important domains today: 1) therapeutic purpose or 2) performance enhancement To the extent we use the human enhancement technology to further our body, it functions and nature, we can speak of an engineered singularity in the body. The emergence of such a singularity can be traced through three key notions: prosthesis, bionics and fyborgs.

Beginning with Prosthesis

Human Body is on the threshold of undergoing the same fate of Nature in the precious centuries. Technological innovations may soon replace the naturalness of body. In fact in many cases the replacement or substitutes appears better than the original. This is true especially in the case of prosthesis, which may be considered as the first stage in the human intervention in the body. Simple traditional prosthetic devices like crutches, spectacles of the past are simple external extensions of the human body. Today we have evolved and a contemporary prosthesis is an artificial device used to replace a missing body part, such as a limb, tooth, eye, or heart valve. Prostheses are typically used to replace parts lost by injury (traumatic) or missing from birth (congenital) or to supplement defective body parts. Inside the body, artificial heart valves are in common use with artificial hearts and lungs seeing less common use but under active technology development. Other medical devices and aids that can be considered prosthetics include artificial eyes, palatal obdurate, gastric bands, and dentures. Cardiac pacemakers, dental prostheses, implantable pumps to assist the lungs, bionic limbs, steel implants on bones are already embedded in our physical bodies.

Bionics and More

In general bionics (which may also be known as biomimicry) is the application of biological methods and systems found in nature to the study and design of engineering systems and modern technology. It implies utilizing electronic devices and mechanical parts to assist humans in performing difficult, dangerous, or intricate tasks, as by supplementing or duplicating parts of the body.The word bionic coined by Jack E. Steele in 1958, possibly originating from the Greek word βίον (*bíon*), meaning 'unit of life' and the suffix -ic, meaning 'like' or 'in the manner of', hence 'like life'. Some dictionaries, however, explain the word as being formed as a portmanteau from biology + electronics.

The transfer of technology between lifeforms and manufactures is, according to proponents of bionic technology, highly desirable because evolutionary pressure typically forces living organisms, including fauna and flora, to become highly optimized and efficient. A classical example is the development of dirt- and water-repellent paint (coating) from the observation that the surface of the lotus flower plant is practically unsticky ("Lotus effect").

Fyborg and the Future

The "natural artificialization of body," traced to the very ancients is the clothing and ornamentation covering human's 'state of nature'. From the fine cloths we wear, we are moving towards wearable computers and communicative machines Similarly from the healing of the sick bodies we speak of intervention in the healthy bodies to prevent sickness. This takes us to the world of cyborgs and fyborgs.

The word *cyborg* (1960) is short form for *cybernetic organism* and it refers to an organism that is part-human, part-robot. Technology does not just approach the body but enters the space of our body and then we become cyborgs. Transhumanists claim that since we make use of technology in our everyday life, we are at least fyborgs or functioning cyborgs. For instance, Gregory Stock, the director of the Program on Medicine, Technology, and Society at *University of California, Los Angeles*, approaches humans from two starting points (Stock 2003): one is mechanical and the other biological. On the mechanical side, he is clearly convinced that cyborgs are not the way humans are going to extend and enhance their range of abilities. He argues instead that we are more likely to become "fyborgs" by developing extracorporeal electromechanical devices to improve and widen the scope of existing sense and effector organs (Spier 2002).

It was Alexander Chislenko who coined the term "fyborg" to differentiate between the man-machine creations of science fiction and the everyday ways we extend ourselves using technologies such as eyeglasses, hearing aids, and cell phones. In fact, to varying degrees, many enhancement enthusiasts believe that we have become biological organism functionally supplemented with technological extensions and so are fyborgs or organism that has become a kind of cyborg by extending its senses and abilities using technology .

But it is interesting to read the Fyborg Self-Test

Are you dependent on technology to the extent that you could not survive without it?

Would you reject a lifestyle free of any technology even if you could endure it?

Would you feel embarrassed and "dehumanized" if somebody removed your artificial covers (clothing) and exposed your natural biological body in public?

Do you consider your bank deposits a more important personal resource storage system than your fat deposits?

Do you identify yourself and judge other people more by possessions, ability to manipulate tools and positions in the technological and social systems than primary biological features?

Do you spend more time thinking about — and discussing — your external "possessions" and "accessories" than your internal "parts"?

If you answered "yes" to most of these questions, please accept my congratulations (and/or condolences): you are already a cyborg! (Chislenko 1995)

Further, futurists with their techno-exuberance promises a golden future. Some instances are illustrative. The famous author Ray Kurzweil holds (Kurzweil 1999): 'We will enhance our brain gradually through direct connections with machines and intelligence until the essence of our thinking has fully migrated to the far more capable and reliable new machinery.'

Kevin Warwick, made a great leap in 1998 with his first glass-encased chip implant just beneath the skin of his upper arm. It enabled the computer to monitor his presence by radio signal as he moved about his department. In fact, his experience led him to emotionally identify with his implant as he felt that he and the computer were working in complete harmony.

Similarly, Thad Starner of Massachusetts Institute of Technology, dresses in a wearable computer and lives connected to the Internet using a miniature computer terminal at all times. His device is the first stage of what he calls "the BodyNet, a computer network wired through human bodies"(Maguire and McGee 1999).

Steve Mann, a professor of electrical and computer engineering at the University of Toronto, has developed an Internet-connected computer that he has dubbed "WearCam." By combining wireless communication with information systems, WearCam allows one to augment and enhance experiences and, through networking, share them with others.

Again, some computer visionaries speak of implantable computer chips acting as actuators that will enhance `our memory, ability to acquire a language without learning, recognize people that we have not met. They promise that computer implants on brain can restore memory losses and give sight to the blind, hearing to the deaf. So G. Q. Maguire Jr and Ellen M. McGee promises: "These bioelectronic developments, combined with progress in facilitating interfaces between neural tissues and substrate micro probes, are setting the stage for implantable brain chips. The first steps have already been taken in research on the cochlear implant and on retinal vision. Cochlear implants enable totally deaf people to hear sound by directly stimulating the auditory nerve. In a similar way, retinal implantable chips for prosthetic vision may restore vision to the blind" (Dobelle, Mladejovsky and Girvin 2011).

These developments may leads to an almost total technologisation of the human body. All thinkers are not enamored by such a scenario. However, Pat Roy Mooney, executive director of ETC, a technology watchdog group, he Right and winner of Livelihood Award (the "*Alternative Nobel Prize*") blows the whistle and sings a cautionary **Note:** "Particles of that size can go

anywhere they please. They pass the entire immune system, they can pass the blood-brain barrier, and they can go into the spinal cord" (Robbins 2004).
Therefore we have reasons to be cautious. Some critiques speak of an impending "hive mind" for the future humanity, that is, a group mind with almost complete loss of individual self and identity. Without seeming to be antediluvian, we still need to raise certain issues: In the process of its technologisation, is the human body reduced to an appendix. Is science fiction becoming a reality? Are we really aware of the some of the serious consequences of intervening in our own body?

4.6 NATURE OF NATURE

Confronted with today's technology and artifacts, something extraordinary is happening. Human culture, or more precisely technology, is intervening in the human nature (body) causing changes that were unimaginable even twenty years ago. Today we are at stand at the threshold of re-creating our own bodies and thus re-making our own nature. So the cultural singularity will soon arrive and we are at the moment witnessing the pangs of the new child-birth: the merging of nature and nurture. Such a merger, resulting from cultural singularity, hopefully will impact our lives – in fact our enhanced lives or existence – tremendously. Technological innovations are not merely healing our bodily functions, but enhancing them dramatically. Some of such enhancements will make the distinction between nature and nurture, almost redundant. This implies that our culture is capable of radically altering our nurture and making it truly part of an inter-twined and mutually enriching reality.
Further, as technology advances further, our cultural pre-conditions will change. We can imagine feed-back mechanisms between advanced technologically driven culture and our pre-given nature, which together constitute a highly complex and undifferentiated reality, where the body is directly linked to technology and vice-versa. In such a context, the meaning and significance of the body – and of our nature - will be quite different. The body that transmits presence and relationship between persons will be vastly enhanced technologically, and so it is conceivable that the very understanding we have of presence and relationship will be changed. As such we this will have consequences on the way humans relate to each other, after the cultural singularity. We may really have to talk of a culture that is invaded and enhanced by technology!
This will radically change the way we understand our human body. Long ago, we ceased to understand human body merely as a material object of scientific study. Phenomenology has made us aware of the uniqueness of the body. But the technological and cultural singularity urges us to understand our bodily differently and in the process the culture form part of our (bodily) existence is also very much reshaped and re-moulded. One special question that we need to raise is: Will such engineered singularity and culture enable us to broaden our consciousness? Only if we can wider our perception of reality and broaden our consciousness can we claim that we are truly progressing, at least at the non-technological (or spiritual) realm. Thus the uniqueness of our contemporary society is that we are at the threshold of, let us say, "overcoming ourselves," whereby our culture almost behaves like the uroborous snake, that is eating itself. In this very process, an all-encompassing culture may emerge that affects our very existence, understanding and even search meaning and significance.

Check Your Progress III

Note: Use the space provided for your answers.s.

1) "Today nature is indistinguishable from culture." Do you agree?

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2) What is the importance of cyborgs and fyborgs?
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4.7 LET US SUM UP

In this unit we saw how human nature is radically changing and is becoming part of our culture. Today our technology has made it possible that we mould our own nature.

4.8 KEY WORDS

Bionics: Having anatomical structures or physiological processes that are replaced or enhanced by electronic or mechanical components

Cyborg: A cyborg is a cybernetic organism (i.e. an organism that has both artificial and natural systems). The term was coined in 1960 when Manfred Clynes and Nathan Kline used it in an article about the advantages of self-regulating human-machine systems in outer space.

Fyborg: A human who has certain physiological processes aided or controlled by mechanical or electronic devices

Prosthesis: An artificial body part, such as a leg, a heart, or a breast implant.

Singularity: The quality or condition of being singular or unique, where the normal laws do not apply.

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Indira Gandhi National Open University
School of Interdisciplinary and
Trans-disciplinary Studies

MPYE – 013

Philosophy of Technology

Block 2

LIFE: GENETICS AND HUMAN GENOME PROJECT

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School of Humanities
IGNOU

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Panthanmackel,
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IGNOU

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Thiruvanmiyur
Chennai – 600 041

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Vishwa Jyoti Gurukul
Varanasi

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Salesian College &
IGNOU Study Centre
Dimapur, Nagaland

Dr. Sathya Sundar
Sethy
Dept of Humanities
IIT, Chennai.

Dr. Joseph Martis
St. Joseph's College
Jeppu, Mangalore – 2

Dr. Jaswinder Kaur
Dhillon
147, Kabir park
Opp. GND University
Amristar – 143 002

Prof. Y.S. Gowramma
Principal,
College of Fine Arts,
Manasagangotri
Mysore – 570 001

Block Preparation

Units 1 & 2	Gini T.G. Jnana-Deepa Vidyapeeth Ramwadi, Pune.
Units 3 & 4	Gini T.G & Julilana Plana Jnana-Deepa Vidyapeeth Ramwadi, Pune.

Content Editor
Dr. V. John Peter
St. Joseph's Philosophical College,
Kotagiri, Tamil Nadu.

Format Editor
Prof. Gracious Thomas
IGNOU, New Delhi.

Programme Coordinator
Prof. Gracious Thomas
IGNOU, New Delhi.

BLOCK INTRODUCTION

Technology is a boom or doom for humanity is the question basically raised when one deals with the Genetics, Stem Cell Research and Human Genome project etc., Techniques, however grand they may be, must reduce man to technical animal, the king of the slaves of technique. While creating and relying on the Human- made environment, we ourselves is being modified with new outlook and orientations. The technology limits our outlook in certain way leading to the consumer outlook, materialistic and military orientations etc. The human being now becomes different and he/she can be called the technological man/woman because of the dominance of technology over his/her life. The issues involved here are not merely scientific and technological, but also ethical, legal and social.

Unit 1 has an introduction and over-all perspective of philosophy of technology with its larger implications of technology and philosophy of technology. It speaks also of the relationship between science and technology. The placing of this introduction in the second block has a purpose of first introducing the context of viewing reality through Chaos theory and Nano technology which we dealt in the previous block.

Unit 2 gives details of Genetics and Stem Cell Research. Human life today has been enormously impacted by advances in the science of genetics and related work on the physiology of human reproduction. The field of Genetics is in the news daily, with researchers mapping the human genome cloning animals, and identifying new disease genes. The first part of this unit deals with Genetics and Genetic engineering. It also deals with the history of Genetics and future prospects of Genetic engineering.

Unit 3 deals with the Human Genome Project that ranks right up there at the top of the scale of scientific advances. Although the Human Genome Project is a great achievement in Science and especially in Genetics, there is a need for Ethical, social and moral concern. Human Genome Project has already identified many genetic abnormalities and will no doubt identify many more. Ethical guidelines are essential to the success of the Human Genome Project. This scientific paper gives the overall picture of Human Genome project with all its pros and cons. It not only deals with the scientific methodologies involved in the human Genome Project but also on the philosophical implication which is the mail concern.

Unit 4 philosophically analysizes all technologies that are developed, used and controlled by human beings evidently affecting the humanity at large, both positively and negatively. Rapid advances in the science of genetics and its applications have presented new and complex ethical and policy issues for individuals and society. Ethical, Legal and Social Issues (ELSI) programs that identify and address these implications have been an integral part of the U.S. Human Genome Project (HGP) since its inception. The unit gives the students the general overview of ELSI programs and its significance to genetic engineering together with an overview of the ethical, legal and social issues related to genetic research.

UNIT 1 INTRODUCTION AND OVERVIEW OF THE COURSE

Contents

1.0 OBJECTIVES

- To have an introduction and over-all perspective of philosophy of technology.
- To see the larger implications of technology and philosophy of technology.
- To see the relationship between science and technology

1.1 INTRODUCTION

If philosophy is the attempt "to understand how things in the broadest possible sense of the term hang together in the broadest possible sense of the term", (Sellars 1962), philosophy should not and cannot ignore technology. It is largely by technology that contemporary society hangs together. It is hugely important not only as an economic force but also as a cultural force. During the last two centuries, much philosophy of technology has been concerned with the impact of technology on society (Franssen, Lokhorst and van de Poel 2011). This unit starts with a brief historical overview, then presents an introduction to the modern philosophy of technology, and ends with a discussion of the societal and ethical aspects of technology. Then we see the course outline and its rationale.

1.2 HISTORICAL DEVELOPMENTS

It may be claimed that philosophical reflection on technology is about as old as philosophy itself. It started in ancient Greece. One early theme is the thesis that technology learns from or imitates nature (Plato). According to Democritus, for example, house-building and weaving were first invented by imitating swallows and spiders building their nests and nets, respectively. Aristotle referred to this tradition by repeating Democritus' examples, but he did not maintain that technology can only imitate nature: "generally art in some cases completes what nature cannot bring to a finish, and in others imitates nature" (Franssen, Lokhorst and van de Poel 2011)

Another theme related to philosophy of nature is the claim that there is a fundamental ontological distinction between natural things and artifacts. According to Aristotle the former have their principles of generation and motion inside, whereas the latter, insofar as they are artifacts, are generated only by outward causes, namely human aims and forms in the human soul. Natural products (animals and their parts, plants, and the four elements) move, grow, change, and reproduce themselves by inner final causes; they are driven by purposes of nature. Artifacts, on the other hand, cannot reproduce themselves. Without human care and intervention, they vanish after some time by losing their artificial forms and decomposing into (natural) materials. For instance, if a wooden bed is buried, it decomposes to earth or changes back into its botanical nature by putting forth a shoot. The thesis that there is a fundamental difference between man-made products and natural substances had a long-lasting influence. In the Middle Ages, Avicenna criticized alchemy on the ground that it can never produce 'genuine' substances. Even today, some still maintain that there is a difference between, for example, natural and synthetic vitamin C. Aristotle's doctrine of the four causes—material, formal, efficient and final—can be regarded as a third early contribution to the philosophy of technology. Aristotle explained this doctrine by referring to technical artifacts such as houses and statues (Wikipedia)
A final point that deserves mentioning is the extensive employment of technological images by Plato and Aristotle. In his "Timaeus," Plato described the world as the work of an Artisan, the Demiurge. His account of the details of creation is full of images drawn from carpentry, weaving, modelling, metallurgy, and agricultural technology. Aristotle used comparisons drawn from the arts and crafts to illustrate how final causes are at work in natural processes. Despite their criticism of the life led by merely human artisans, both Plato and Aristotle found technological imagery indispensable for expressing their belief in the rational design of the universe. Considered under the rubric of the Greek term techne (art, or craft knowledge), the philosophy of technology goes to the very roots of Western philosophy. In his "Republic," Plato sees techne as the basis for the philosophers' proper rule in the city. In the "Nicomachean Ethics," Aristotle describes techne as one of the four ways that we can know about the world. The Stoics argued that virtue is a kind of techne based upon a proper understanding of the universe.

Some prominent 20th century philosophers to directly address the effects of modern technology on humanity were John Dewey, Martin Heidegger, Herbert Marcuse, Günther Anders and Hannah Arendt. They all saw technology as central to modern life, although Heidegger, Anders, Arendt and Marcuse were more ambivalent and critical than Dewey. The problem for Heidegger was the hidden nature of technology's essence, Gestell or Enframing which poised for humans what he called its greatest danger thus its greatest possibility. Heidegger's major work on technology is found in "The Question Concerning Technology." He argues that technology is not just a tool used by humans but it has become an overarching frame, which essentially makes up humans.

1.3 DIFFERENT FIELDS OF PHILOSOPHY OF TECHNOLOGY

The vast field of philosophy of technology can treat any or all of the following areas of study.

- Critique of technology
- Ethics of technology
- History of technology
- Industrial sociology

- Philosophy of engineering
- Technological evolution
- Theories of technology
- Analytic Philosophy of Technology

These different fields of study give us an idea of the various dimensions of philosophy of technology and its relevance.

Check Your Progress I
Note: Use the space provided for your answers.s.
1) What is "techne"?
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2) Give the different fields of philosophy of technology?
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1.4 THE RELATIONSHIP BETWEEN TECHNOLOGY AND SCIENCE

The close relationship between the practices of science and technology may easily keep the important differences between the two from view. The predominant position of science in the philosophical perspective did not easily lead to a recognition that technology merited special attention for involving issues that did not emerge in science. This situation is often presented, perhaps somewhat dramatized, as coming down to a claim that technology is 'merely' applied science (Franssen, Lokhorst and van de Poel 2011).

A questioning of the relation between science and technology was the central issue in one of the earliest discussions among analytic philosophers of technology. In 1966, in a special issue of the journal "Technology and Culture," the Polish Philosopher, Henryk Skolimowski. argued that technology is something quite different from science. As he phrased it, science concerns itself with what is, whereas technology concerns itself with what is to be. A few years later, in his well-known book "The sciences of the artificial" (1969), Herbert Simon, an American political scientist, emphasized this important distinction in almost the same words, stating that the scientist is concerned with how things are but the engineer with how things ought to be. Although it is difficult to imagine that earlier philosophers of science were blind to this difference in orientation, their inclination to view knowledge as a system of statements may have led to a conviction that in technology no knowledge claims play a role that cannot also be found in science.

In the same issue of "Technology and Culture," Mario Bunge, an Argentine philosopher and physicist, defended the view that technology is applied science, but in a subtle way that does justice to the differences between science and technology. Bunge acknowledges that technology is about action, but an action heavily underpinned by theory—that is what distinguishes technology from the arts and crafts and puts it on a par with science. According to Bunge, theories in technology come in two types: substantive theories, which provide knowledge about the object of action, and operative theories, which are concerned with action itself. The substantive theories of technology are indeed largely applications of scientific theories. The operative theories, in contrast, are not preceded by scientific theories but are born in applied research itself. Thus, as Bunge holds, operative theories show a dependency on science in that in such theories the method of science is employed. (Franssen, Lokhorst and van de Poel 2011).

1.5 ETHICAL AND SOCIAL ASPECTS OF TECHNOLOGY

Neutrality Thesis

It was not until the twentieth century that the development of the ethics of technology as a systematic and more or less independent subdiscipline of philosophy began to take shape. This late development may seem surprising given the large impact that technology has had on society, especially since the industrial revolution (Franssen, Lokhorst and van de Poel 2011).

A plausible reason for this late development of ethics of technology is the instrumental perspective on technology. This perspective implies, basically, a positive ethical assessment of technology: technology increases the possibilities and capabilities of humans, which seems in general desirable. Of course, since antiquity, it has been recognized that the new capabilities may be put to bad use or lead to human hubris. Often, however, these undesirable consequences are attributed to the users of technology, rather than the technology itself, or its developers. This vision is known as the instrumental vision of technology resulting in the so-called neutrality thesis. The neutrality thesis holds that technology is a neutral instrument that can be put to good or bad use by its users. During the twentieth century, this neutrality thesis met with severe critique, most prominently by Martin Heidegger and Jacques Ellul, who have been mentioned in this context, but also by philosophers from the Frankfurt School (Adorno, Horkheimer, Marcuse, Habermas). Today most philosophers do not subscribe to the neutrality thesis, since technology is not always in itself neutral.

Ethics of specific technologies

The last decades have witnessed an increase in ethical inquiries into specific technologies. One of the most visible new fields is probably computer ethics, but biotechnology has spurred dedicated ethical investigations as well. Also more traditional fields like architecture and urban planning have attracted specific ethical attention. More recently, nanotechnology and so-called converging technologies have led to the establishment of what is called nanoethics. Apart from this, there has been a debate over the ethics of nuclear deterrence (Franssen, Lokhorst and van de Poel 2011).

Obviously the establishment of such new fields of ethical reflection is a response to social and technological developments. Still, the question can be asked whether the social demand is best met by establishing new fields of applied ethics. This issue is in fact regularly discussed as new fields emerge. Several authors have, for example argued that there is no need for nanoethics because nanotechnology does not raise any really new ethical issues. The alleged absence of newness here is supported by the claim that the ethical issues raised by nanotechnology are a variation on, and sometimes an intensification of, existing ethical issues, but hardly really new, and by the claim that these issues can be dealt with the existing theories and concepts from moral philosophy. Thus every new technology creates its own specific ethical issues which are usually addressed in philosophy of technology.

Responsibility

Responsibility has always been a central theme in the ethics of technology. The traditional philosophy and ethics of technology, however, tended to discuss responsibility in rather general terms and were rather pessimistic about the possibility of engineers to assume responsibility for the technologies they developed. The French philosopher an law professor, Jacquis Ellul, for example, has characterized engineers as the high priests of technology, who cherish technology but cannot steer it. In engineering ethics, the responsibility of engineers is often discussed in relation to code of ethics that articulate specific responsibilities of engineers. Such codes of ethics stress three types of responsibilities of engineers: 1) conducting the profession with integrity and honesty and in a competent way, 2) responsibilities towards employers and clients and 3) responsibility towards the public and society. With respect to the latter, most US codes of ethics maintain that engineers 'should hold paramount the safety, health and welfare of the public'. The larger issue of the responsibility technology has for the human welfare needs to be addressed both generally and in its particular fields. So ethical, social and even legal issues arising out of emerging technologies is definitely part of philosophy of technology.

1.6 PHILOSOPHIZING AS A SEARCH

In this section we briefly try to relate philosophizing and technology. Wolfgang Stegmüller, a German philosopher, distinguishes three different kinds of practising philosophy.

1. Philosophy as *Weltanschauung* (world-view). The aim is either to enhance (or replace) religion or at least to give some advice to master the difficulties of life. (Marxism, Existentialism)
2. Philosophy as science that aims to acquire theoretical knowledge, either independent on the natural sciences or expending them and approaching a kind of overall view or "*Gesamtschau*" (Brentano, Husserl, Hartmann, Schelers)
3. Philosophy as investigation of the fundamentals of the empirical and theoretical sciences (Vienna Circle and analytical philosophy)

Whatever be the view of philosophy we hold, we cannot avoid technology and its overall effects in our philosophising. In this course, our aim is not to study some of the significant technological innovations that contemporary society is facing and to dialogue with them critically and creatively. We believe that some of the emerging technological fields contribute much to the growth of human understanding and philosophical reflection.

In general we may speak of three areas of philosophizing: the self (humanity in general), the world and God (which implies only the Transcending nature of humans is one does not believe in God).

In the overview of this course, we have been trying to see how technology can through light on each of these individual areas of philosophizing. The first unit that we have covered throws further light on the nature of reality. The second one throws light on life in general and human life in particular. The third unit that deals with consciousness and artificial intelligence is an attempt to speak more on individual identity and also on God. Neuroscience and neurotheology, while trying to understand the mysterious nature of the brain, attempts to throw light on our understanding of self and of God. The final unit takes seriously the phenomenon of death which is intrinsic to human beings. Recent claims by technology that it can overcome death radically alters the way humans understand ourselves and God.

Check Your Progress II

Note: Use the space provided for your answers.s.

1. How does Jacquis Ellul characterize engineers?
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2. Who view philosophy as a *Weltanschauung*?
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1.7 COURSE OVERVIEW AND THE RATIONALE

The way we understand the world and ourselves is to a large extent shaped by the world we live in . Or better, our world-view truly shapes our understanding of ourselves and the world. For instance, the static world view of the ancients was radically altered by Newton's model of the world as a machine. Such an understanding brought about by the scientific discoveries of Newton changed our understanding of humans, world and God also. That is the theme of the first block.

In the last century two of the greatest scientific theories have been the theory of relativity ("the most creative theory") and the theory of quantum mechanics ("the most successful theory"). Together they have altered radically the way we understand the world: our cosmology. Big Bang Theory, which is intimately connected to these two theories explain the origin of the universe. The very nature of time, space at the macro-world and micro-world that these two theories provide are quite different from the classical view of nature. Even after 100 years of their discoveries we have not really fathomed the depth of these insights regarding the nature of the empirical world.

It is in this background that we have introduced two further theories that furthers our understanding of nature. The theory of chaos and nanotechnology, which we have discussed in the previous block, proposes to us a world quite different from the classical, Newtonian or even Einsteinian worlds. These two theories through different insights into the nature of reality.

For instance the theory of chaos tells us that there is a very close connection between apparent order and chaos. The butterfly effect may point to the fact that some events in the universe may go beyond the principles of causality. The fractal nature of reality tells us that roughness in the world (not the idealisations of the world) is what really counts.

Coming to the nanotechnology, which is the science of building machines at a subatomic level, we have a lot to learn. At that realm, which is far greater than the quantum level, some substances develop different qualities. There will be tremendous revolution in our life-style brought about by nanotechnology in the immediate future. Many of these path-breaking discoveries will have philosophical implications. It changes the way we understand the world. It shatters our old world-view and ushers in a more dynamic and even extremely complex and involved nature of reality, of which we are part of.

The next block, moves from reality to life. The tremendous changes brought about my quantum mechanics (or electronics) in the last thirty years will pale away in comparison to the changes that will be brought in biotechnology in the next few decades. Quantum mechanics shattered our way of understanding the world. Biotechnology, most probably, will shatter the way we approach life, something much more intimate to us. Such changes will occur in the coming years and that is why this century is called the "century of biotechnology." The way we feel about life, the respect and dignity we ascribe to it and the way we treat other living beings will be challenged by the latest inventions of biotechnology. Already there are talks about "artificial life" and "artificial cells." Though they still remain at the theoretical realm, they will have quite significant repercussions on our own lives and on our understanding of life. The danger posed by such technologisation is the commodification of life. The opportunity provided by such technologies is the human ability to enhance life.

This leads us to the third block that deals still more intimate aspects of human life: our own self-identity and self-consciousness. The latest neurological findings will surely throw further light on our self-understanding, consciousness, self-identity and all those aspects that make our human life so unique. Advances in brain studies, it is hoped, will provide solace to many sick people, prevent many neurological sickness and further help us to understand ourselves. Though we are just beginning in the process of understanding our brain, it is hoped, that technological advances will improve and enhance our own self-understanding.

Closely connected with our self-understanding is our understanding of God. There are some news that some scientists have discovered the "God-spot" in the brain or that there are "spiritual neurons." Even if we do not discover such specific God pointers, we need to appreciate the fact that it is our brain that enables us to approach and accept God. We do not believe that God is an illusion created by God. But we can rightly claim that it is the brain that enables us to experience God. The mystical experiences have a neurological basis and spirituality and the transcendental feeling of being united with the whole cosmos is enabled and stimulated by brain. Therefore, without doubt, our understanding of God will be sharpened by the advances in brain studies. That is the topic that we deal with in the third Block.

The last block deals with death. After dealing with the philosophy of death, we take up some technological marvels that claims that death may be eliminated. They are still tall claims. But many techno-enthusiasts have sold themselves to this idea. So much of money is invested into this kind of death. Though we ought to remain skeptical of such claims, we need to realize the tremendous such an idea can have on the society. The idea that death may be overcome, even when it remains merely an idea all the time, can affect our very understanding and philosophizing.

Finally we talk of the crucial possibilities open to ourselves at this point in history: cosmic extinction or collective extension. Truly humanity can destroy ourselves and the whole of life from our precious planet earth. We have the technological prowess for it. We can also positively enhance life in its totality. We do have the technology for it. At the moment we are at the cross-roads! We can either choose life or death, for ourselves and for the rest of humanity.

1.8 LET US SUM UP

In this unit, after introducing philosophy of technology, we have seen the relationship between science and technology. Then we saw the ethical dimensions of technology. Finally, we saw the rationale of our course.

Check Your Progress III

Note: Use the space provided for your answers.

1. How do you relate philosophizing to technolgy?

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2. How does neuroscience change the way we understand God and ourselves?
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1.9 KEY WORDS

Techne or ***techné***: As distinguished from episteme, is etymologically derived from the Greek word τέχνη which is often translated as craftsmanship, craft, or art. It is the rational method involved in producing an object or accomplishing a goal or objective. Techne resembles *epistēmē* in the implication of knowledge of principles, although techne differs in that its intent is making or doing, as opposed to "disinterested understanding."

Gestell or Enframing: Gestell (or sometimes Ge-stell) is a German word used by Twentieth century German philosopher Martin Heidegger to describe what lies behind or beneath modern technology. According to him, the essence of technology is Gestell. Indeed, "Gestell, literally 'framing', is an all-encompassing view of technology, not as a means to an end, but rather a mode of human existence."

Hubris: In Greek tragedy hubris is excessive pride toward or defiance of the gods, leading to nemesis (destruction and death). This is the danger that humans are all exposed to.

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UNIT 2 GENETICS AND STEM CELL RESEARCH

Contents

2.0 OBJECTIVES

- To have an over-all understanding of Genetics
- To see some of its possibilities and dangers of stem-cell research.
- To visualise how genetics will change life in the coming decades.

2.1 INTRODUCTION

Human life today has been enormously impacted by advances in the science of genetics and related work on the physiology of human reproduction. Today human beings could be understood as "Evolution become capable of consciously extending or eliminating itself" (Pandikattu 2006).This is true with regard to genetics and its breakthrough in science. There is explosion of genetic knowledge especially in recent history has helped us to reach a position in which we can extend and eliminate ourselves. The potential applications of Genetics, Biotechnology, and Molecular biology - when used responsibly - will make valuable contributions to human society as a whole. The field of Genetics is in the news daily, with researchers mapping the human genome cloning animals, and identifying new disease genes. For many people, the problem is putting this information into context and understanding what recent genetic "breakthroughs" really mean in terms of our health and life.

The first part of this unit deals with Genetics and Genetic engineering. It would give us an understanding of what is Genetics and its applications today in our scientific field. It also deals with the history of Genetics and future prospects of Genetic engineering. In the second partwe explainabout the stem cell research with particular reference to the Human Genome Project. The explosion of genetic knowledge especially in recent history has helped us to reach a position in which we can extend and eliminate ourselves. Here we have a choice to make. It is a matter of conscious choice that we make- a collective, creative, coherent choice. As the book of

Deuteronomy in the Holy Bible says “I have set before you today life and prosperity, death and adversity.” Choice is ours….this choice is not for profit, not for progress, but for humanity, for life.

2. 2 GENETICS AND GENETIC ENGINEERING

GENETICS AND DNA- OVER VIEW

As a scientific study of hereditary, Genetics deals with the passing on of characteristics of one generation to the next. Geneticist investigates the structure, function and transmission of genes. Genes are the basic units of hereditary information and are present in the cells of all organisms. For example, each of the cells in the human body has about 30,000 to 40,000 genes. They determine over all body build up and traits such as eye, hair and skin color. The term Genetics is a term coined by W. Bateson to designate the portion of Biology that deals with heredity, variation development and evolution. According to British geneticist J. B. S Haldane, “Genetics is the branch of Biology which is concerned with innate differences between similar organisms……” however Genetics can be defined as the science that deals with the structure, organization, transmission and function of genes and the origin of variation in them (Singh 2002).

DEOXYRIBONUCLEIC ACID (DNA)

We human beings need to be educated to become more "DNA literate” - as our understanding of the science of Genetics is the key to its future uses. Every human cell contains a nucleus, within which lie the 46 human chromosomes that determine each individual's genetic makeup (genotype). Chromosomes are made up of DNA, which in turn is made up of nitrogenous bases. In other words, DNA (Deoxyribonucleic Acid) is a thin, long, and chainlike, molecule that is contained within almost all of our cells in a compartment called the nucleus and found in every living cell on earth. However it is important to note that DNA even occurs in bacterial cells, which do not have a nucleus and in some viruses (WBE 2004).

DNA directs the formation, growth, and reproduction of cells in the organisms. It is composed of individual units called nitrogenous bases. The DNA molecule is shaped like a twisted ladder, or double helix. The sides of this ladder are made of alternating sugar and phosphate molecules. The rungs of the ladder are made of four nitrogenous bases - guanine, cytosine, adenine, and thymine. These bases, abbreviated G, C, A, and T, respectively, and form pairs on the ladder to create a complete rung. Adenine only pairs with thymine(A-T) and guanine only pairs with cytosine(G-C). Therefore, the sequence of bases on one side of the ladder always predictably complements the sequence on the other side (Postiglione and Brungs 1993).

Check Your Progress I

Note: Use the space provided for your answers.s.

1) What is DNA?

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2) "I have set before you today life and prosperity, death and adversity." Comment in the light of Genetic engineering.
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2.3 BRIEF HISTORY OF GENETICS

References to Genetics can be traced back to biblical times. We know from the book of Genesis, Jacob, the son of Isaac had a method by which his sheep and goats gave birth to spotted and speckled offspring (Genesis 30: 37-39).

The Babylonians had the knowledge that for a date to be fruitful, pollen from the male palm had to be introduced to the pistils of the female palm. The ancient Greek philosophers were the first to look at the world in a scientific fashion. They developed theories of everything and Genetics was no exception. Aristotle through his observation learned that the male and female do not make equal contribution to their offspring. According to him their contributions were qualitatively different: the female gives "matter" and the male gives "motion".

The modern science of Genetics began in 1900, when the fundamental laws determining the transmission of hereditary traits from one generation to the next were discovered. We human beings carry within us "not simply not an injunction to reproduce after our kind, but to reproduce specific features of height, weight, skin color, eyes, hair and so on" (Guttman et al 2006). The fundamental laws of hereditary are laws which apply to all plants and animals as well as many microorganisms for they demonstrate similarities among life forms.

In late 1970's, the ability to directly manipulate the genes of plants and animals was developed. Much controversy started when the proposals to begin human gene manipulation were put forth in the early 1980's. A small number of researchers argued in favour of germ line manipulation, but the majority of scientists and others opposed it. In 1983 a letter signed by 58 religious leaders said, "Genetic engineering of the human germline represents a fundamental threat to the preservation of the human species as we know it, and should be opposed with the same courage and conviction as we now oppose the threat of nuclear extinction." In 1985 the U.S. National Institute of Health (NIH) approved somatic gene therapy trials, but said that it would not accept proposals for germline manipulation "at present."

Though the advocates of germline manipulation received many setbacks, germline engineering moved to the status of an openly acknowledged political cause in March 1998, when Gregory Stock, Director of the Program on Medicine, Technology and Society at the University of California at Los Angeles,organized the symposium "Engineering the Human germline." All the speakers were avid proponents of germline engineering. Stock declared that the important question was "not if, but when" germline engineering would be used. The symposium was attended by nearly 1,000 people.

After few months of the University of California, Los Angeles(UCLA) conference one of the key participants, somatic gene transfer pioneer W. French Anderson, submitted a draft proposal to the NIH to begin somatic gene transfer experiments on human fetuses. He was of the view that this procedure could have a "relatively high" potential for "inadvertent gene transfer to the germline." Anderson's proposal is widely acknowledged to be strategically crafted so that approval could be construed as acceptance of germline modification, at least in some circumstances.

In 1966, the first successfully cloned sheep Dolly became the symbol of the progress of cloning and has helped the population to understand the significance of cloning for humanity. Dolly was born 5 July 1996 to three mothers (one provided the egg, another DNA and a third carried the cloned embryo to term) She was created using the technique of somatic cell nuclear transfer.

Meanwhile the official announcement of the success of Human Genome Project and the mapping of the "working draft" Human Genomes became the climax of the genetic march forward. The Human Genome Project was formally completed in April 2003. Research on development of Genetics had put us in a situation where we can transform what we are, where we are and the way we live both positively as well as negatively.

If the current pace of research and development continues, there will be an explosion of genetic knowledge and capability over the next several years. We will be able to transform the Biology of plants, animals, and people with the same detail and flexibility as today's digital technologies and the microchip enable us to transform information. The challenge before us is to summon the wisdom, maturity, and discipline to use these powers in ways that contribute to a fulfilling, just, sustainable world, and to forgo those uses that are degrading, destabilizing and – quite literally – dehumanizing (Pandikattu 2005).

2.4 GENETICS- FUTURE PROSPECTS

Genes play an important role in shaping what we are today and for all our so-called genetic traits. The genetic information of parents is passed down to their children, grand children, or even great grand children. Similarly we have also inherited a number of genetic traits from our ancestors. All our physical characteristics, personality traits, and talents can be the result of the genetic make-up of our ancestors. We have 23 pairs of chromosomes in almost every cell in our body. Each pair consists of a chromosome from our mother and a chromosome from our father. The color of our hair, our height, and even our predisposition to health concerns are some of the genetic traits that we have inherited from our parents. Our genetic make-up is also responsible for a number of health problems that we face. Some examples of genetic, or inherited, health problems include obesity, heart disease, cancer, diabetes and hypertension. Many health concerns come about due to a combination of our inherited genetic make-up.

With the human Genome decoded, researchers have the daunting task of sifting through the newly-discovered genes in search of those that lead to disease. These efforts will change the way we view diseases and receive medical care. Once researchers know which genes are involved in a disease, they can develop a test to screen people who are at risk and also start looking for a cure. This will identify high-risk people who may require more intensive screening or preventative action. Knowing what genes cause a given disease can also help researchers understand what goes wrong in that disease, which can help drive the search for drugs that counteract the problem.

Genomic Medicine
The genomic medicine has helped the humanity in disease gene discovery (Disease taxonomy), clinical introduction of drugs with novel therapeutic actions, more sensitive diagnostic tests, medical treatmenttailored to individual genotypes, predictive testing for genetic diseases and new methods of preventive medicine. Before the flowering of genome science, disease taxonomy was captive to relatively insensitive morphological techniques (Chan and Chia 2003). The emergence of Transcription profiles has helped scientists to understand that diseases that were previously considered to be single entities posses several distinct genetic signatures.

Personalized Treatments
Personalized treatment, unlike the treatment of symptoms that has been common practice, is based on evidence that an individual's genotype (genetic bar code). For example, heart disease can be caused either by a mutation in certain genes, or by environmental factors such as diet or exercise. Doctors can easily diagnose a person with heart disease once they have symptoms. However, doctors can't easily tell what the cause for the heart disease is in each person. Thus, all people receive the same treatment regardless of underlying cause of the disease. In the future, a panel of genetic tests for heart disease might reveal the specific genetic factors that are involved in a given person. People with a specific mutation may be able to receive treatment that is targeted to that mutation, thereby treating the cause of the disease rather than just the symptoms.

Genetic Chips
Theoretically everything that could be known about us genetically is known (Chan and Chia 2003). Today information containing the function of our kidneys or brain, heart disease, manifestation of whole range of cancers and even ability to cope with stress or our proneness to depression are available. It is only a matter of reading out and then analyzing our genetic blue prints. It can be employed to enhance people's understanding of themselves and the world.

Check Your Progress II

Note: Use the space provided for your answers.s.

1) What is the significance of Dolly?
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2) What are some of the future prospects offered by genetic engineering?
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2.5 CLONING AND GENETIC MANIPULATION

Cloning and genetic manipulation works towards ever increasing precision of control over what we are biologically as human beings. In 1997, a sheep named Dolly was supposedly cloned, making her the first "artificial" mammal on Earth (Wilmut, Ian and Highfield 2006).

It has been speculated that the cloning of humans could be employed to create an unstoppable "designer army". This army would be made up of genetically identical, enhanced individuals with great physical strength and artificial immunity to many diseases. The members of this hypothetical army would most likely be capable of enduring extreme physical hardship, and could even be "tailored" to the environment in which they were fighting. For example, an army sent to the tropics would be immune to tropical diseases and would be capable of fighting in extremely hot weather. An army sent to the Arctic Circle would be tolerant of exposure to very cold temperatures for long period of time.

There is a possibility of taking human DNA and clone specific organs or body parts, such as the liver, spine, or skin. This type of cloning cannot be seen as anything but a good thing. It could save thousands of lives by replacing damaged organs or body parts - for example, cloning skin for a burn victim, a spine for a paraplegic, or a liver for a hepatitis victim. This technology could vastly reduce the demand for donated organs while simultaneously eliminating the possibility of organ trade and organ rejection among patients. In addition, it would eliminate the need for immunosuppressive drugs that render organ recipients vulnerable to common diseases.

2.6 GENETIC ENGINEERING

Genetic engineering is a radical new technology, one that breaks down fundamental genetic barriers-not only between species, but also between humans, animals, and plants (Cummins 2010).It is the term applied to techniques that alter the genes (hereditary material) or combination of genes in an organism. The cells of all living organisms contain genes. Genes carry chemical information that determines the organism’s characteristics. In this way scientists can give the organism and its descendents different traits. By combining the genes of dissimilar and unrelated species, permanently altering their genetic codes, novel organisms are created that will pass the genetic changes onto their offspring through heredity. Beginning in the 1970’s, scientists developed ways to introduce individual genes into cells or into plants, animals, or other organisms. Scientists are now snipping, inserting, recombining, rearranging, editing, and programming genetic material. Animal genes and even human genes are being inserted into plants or animals creating unimagined transgenic life forms. For the first time in history, human beings are becoming the architects of life. Bio-engineers will be creating tens of thousands of novel organisms over the next few years.

2.7 HUMAN GENETIC ENGINEERING

Human genetic engineering is about genetically engineering human beings by modifying their genotypes before birth. The Genotype is the genetic constitution of an individual with respect to a particular character under consideration. This is done to control the traits possessed by the individual after his/her birth. The cells of our body contain encoded information about the body’s growth, structure and functioning in the form of genes. Human genetic engineering aims at decoding this information and applying it to the welfare of mankind.

There are two types of genetic engineering. They are: **Somatic modification:** Genes are added to the cells. This can prove to be a cure for diseases caused by defective genes. Somatic modifications cannot be inherited. **Germline modification:** In this form of human genetic engineering, genes in the early embryos are changed. The genes modified in this way are inheritable. This is an effective form of Genetic engineering, as it results in permanent modifications.

Human genetic engineering can be classified as positive genetic engineering and negative genetic engineering. In the positive type of genetic engineering, the positive traits of individuals are enhanced. This can mean increasing longevity or increasing human capacity. The negative genetic engineering is about introducing the good copy of a certain gene into the cells of a living being. Consequently, the suffering characteristic to genetic diseases can be reduced to a great extent.

Advantages

Gene therapy is one of the most important benefits of human genetic engineering. Over the past decade, gene therapy has succeeded in finding treatments for certain heart diseases. Researchers hope to find cures for all the genetic diseases. This will result in a healthier and more evolved human race. A future benefit of human genetic engineering is that a fetus with a genetic disorder will be treated before the baby is born. Parents will be able to look forward to a healthy baby. In case of in-vitro fertilization, gene therapy can be used for embryos before they are implanted into the mother. Genes can be cloned to produce pharmaceutical products of superior quality. Researchers are hopeful about being able to bio-engineer plants or fruits to contain certain drugs.

Disadvantages

The process of cloning can lead to risking the fundamental factors such as the individuality and the diversity of human beings. Ironically, man will become just another man-made thing (Song 2002).There are certain social aspects to human genetic engineering. This new form of medical treatment can impose a heavy financial burden on the society. Along with its feasibility, its affordability will also determine its popularity. Though it seems easy to cure diseases by genetic modifications, gene therapy may manifest side effects. While treating one defect, it may cause another. Any given cell is responsible for many activities and manipulating its genes may not be that easy.

Human genetic engineering is a widely growing field. It can work miracles. But its benefits and threats need to be assessed carefully. The potential advantages of the field can come into reality only if the Genetic engineering of humans is handled with responsibility.

2.8 STEM CELL RESEARCH

We have seen in the first part how hereditary play a very important role in our life. It discussed and summarized the processes of inheritance and this chapter would reveal how changes to genes at the molecular level influence large-scale metabolic and physical Characteristics. It also discussed the organization and internal structure of cells. This section also deals with stem cells. Stem cells have the remarkable potential to develop into many different cell types in the body during early life and growth. In addition, in many tissues they serve as a sort of internal repair system, dividing essentially without limit to replenish other cells as long as the person or animal is still alive. When a stem cell divides, each new cell has the potential either to remain a stem cell or become another type of cell with a more specialized function, such as a muscle cell, a red blood cell, or a brain cell.

Stem cells can be defined as:-

Self-renewal: the ability to divide itself into exact copies numerous times, without changing into specific cell types . **Potency**: the ability to divide itself into cells that will form specific cell types that will build special tissues in the body (heart, brains, blood). Embryos formed during the blastocyst phase of embryological development (embryonic stem cells) and adult tissue (adult stem cells). Both types are generally characterized by their potency, or potential to differentiate into different cell types (such as skin, muscle, bone, etc.). Stem cells are distinguished from other cell types by two important characteristics. First, they are unspecialized cells capable of renewing themselves through cell division, sometimes after long periods of inactivity. Second, under certain physiologic or experimental conditions, they can be induced to become tissue- or organ-specific cells with special functions. In some organs, such as the gut and bone marrow, stem cells regularly divide to repair and replace worn out or damaged tissues. In other organs, however, such as the pancreas and the heart, stem cells only divide under special conditions (Humber and Almedev 2006).

Until recently, scientists primarily worked with two kinds of stem cells from animals and humans: embryonic stem cells and non-embryonic somatic or adult stem cells. The functions and characteristics of these cells will be explained in this document. Scientists discovered ways to derive embryonic stem cells from early mouse embryos nearly 30 years ago, in 1981. The detailed study of the biology of mouse stem cells led to the discovery, in 1998, of a method to derive stem cells from human embryos and grow the cells in the laboratory. These cells are called human embryonic stem cells. The embryos used in these studies were created for reproductive purposes through in vitro fertilization procedures. When they were no longer needed for that purpose, they were donated for research with the informed consent of the donor. In 2006, researchers made another breakthrough by identifying conditions that would allow some specialized adult cells to be "reprogrammed" genetically to assume a stem cell-like state. This new type of stem cell is called Induced pluripotent stem cells (IPSC’s).

Stem cells are important for living organisms for many reasons. In the 3- to 5-day-old embryo, called a blastocyst, the inner cells give rise to the entire body of the organism, including all of the many specialized cell types and organs such as the heart, lung, skin, sperm, eggs and other tissues. In some adult tissues, such as bone marrow, muscle, and brain, discrete populations of adult stem cells generate replacements for cells that are lost through normal wear and tear, injury, or disease. Given their unique regenerative abilities, stem cells offer new potentials for treating diseases such as diabetes, and heart disease. However, much work remains to be done in the laboratory and the clinic to understand how to use these cells for cell based therapies to treat disease, which is also referred to as regenerative or reparative medicine. Laboratory studies of stem cells enable scientists to learn about the cells’ essential properties and what makes them different from specialized cell types. Scientists are already using stem cells in the laboratory to screen new drugs and to develop model systems to study normal growth and identify the causes of birth defects.

2.9 SOURCES OF STEM CELL

Research on stem cell continues to advance knowledge about how an organism develops from a single cell and how healthy cells replace damaged cells in adult organisms. Stem cell research is one of the most fascinating areas of contemporary biology, but, as with many expanding fields of scientific inquiry, research on stem cells raises scientific questions as rapidly as it generates new discoveries.

EMBRYONIC STEM CELLS

Embryonic Stem Cells as their name suggest, are derived from embryos. Most embryonic stem cells are derived from embryos that develop from eggs that have been fertilized in vitro -in an in vitro fertilizationjavascript:glosspop('ivf') clinic—and then donated for research purposes with informed consent of the donors. They are not derived from eggs fertilized in a woman's body.Embryonic stem cells are derived from a four- or five-day-old human embryo that is in the blastocyst phase of development. The embryos are usually extras that have been created in IVF (in vitro fertilization) clinics where several eggs are fertilized in a test tube, but only one is implanted into a woman (Humber and Almedev 2006).

Sexual reproduction begins when a male sperm fertilizes a female ovum (egg) to form a single cell called a zygote. The single zygote cell then begins a series of divisions, forming 2, 4, 8, 16 cells, etc. After four to six days - before implantation in the uterus - this mass of cells is called a blastocyst. The blastocyst consists of an inner cell mass (embryoblast) and an outer cell mass (trophoblast). The outer cell mass becomes part of the placenta, and the inner cell mass is the group of cells that will differentiate to become all the structures of an adult organism. This latter mass is the source of embryonic stem cells - totipotent cells (cells with total potential to develop into any cell in the body).

ADULT STEM CELLS

An adult stem cell is thought to be an undifferentiated cell, found among differentiated cells in a tissue or organ that can renew it and can differentiate to yield some or all of the major specialized cell types of the tissue or organ. The primary roles of Adult Stem Cells in a living organism are to maintain and repair the tissues in which they are found. Scientists also use the term Somatic Stem Cells instead of adult stem cells, where somatic refers to cells of the body (not the germ cells, sperm or eggs) (Humber and Robert F. Almedev 2006). Unlike embryonic stem cells, which are defined by their origin, the origin of adult stem cells in some mature tissues is still under investigation.

Adult stem cells have been identified in many organs and tissues, including brain, bone marrow, peripheral blood, blood vessels, skeletal muscle, skin, teeth, heart, gut, liver, ovarian epithelium, and testis. They are thought to reside in a specific area of each tissue (called a "stem cell niche"). In many tissues, current evidence suggests that some types of stem cells are pericytes, cells that compose the outermost layer of small blood vessels. Stem cells may remain quiescent (non-dividing) for long periods of time until they are activated by a normal need for more cells to maintain tissues, or by disease or tissue injury.

Typically, there is a very small number of stem cells in each tissue, and once removed from the body, their capacity to divide is limited, making generation of large quantities of stem cells difficult. Scientists in many laboratories are trying to find better ways to grow large quantities of adult stem cells in cell culture and to manipulate them to generate specific cell types so they can be used to treat injury or disease. Some examples of potential treatments include regenerating bone using cells derived from bone marrow, developing insulin-producing cells for type 1 diabetes, and repairing damaged heart muscle following a heart attack with cardiac muscle cells.

INDUCED PLURIPOTENT STEM CELLS (IPSC's)

Induced pluripotent stem cells (IPSC's) are adult cells that have been genetically reprogrammed to an embryonic stem cell–like state by being forced to express genes and factors important for maintaining the defining properties of embryonic stem cells. Although these cells meet the defining criteria for pluripotent stem cells, it is not known if IPSC's and embryonic stem cells differ in clinically significant ways. Mouse IPSC's were first reported in 2006, and human IPSC's were first reported in late 2007. Mouse IPSC's demonstrate important characteristics of pluripotent stem cells, including expressing stem cell markers, forming tumors containing cells from all three germ layers, and being able to contribute too many different tissues when injected into mouse embryos at a very early stage in development. Human IPSC's also express stem cell markers and are capable of generating cells characteristic of all three germ layers.

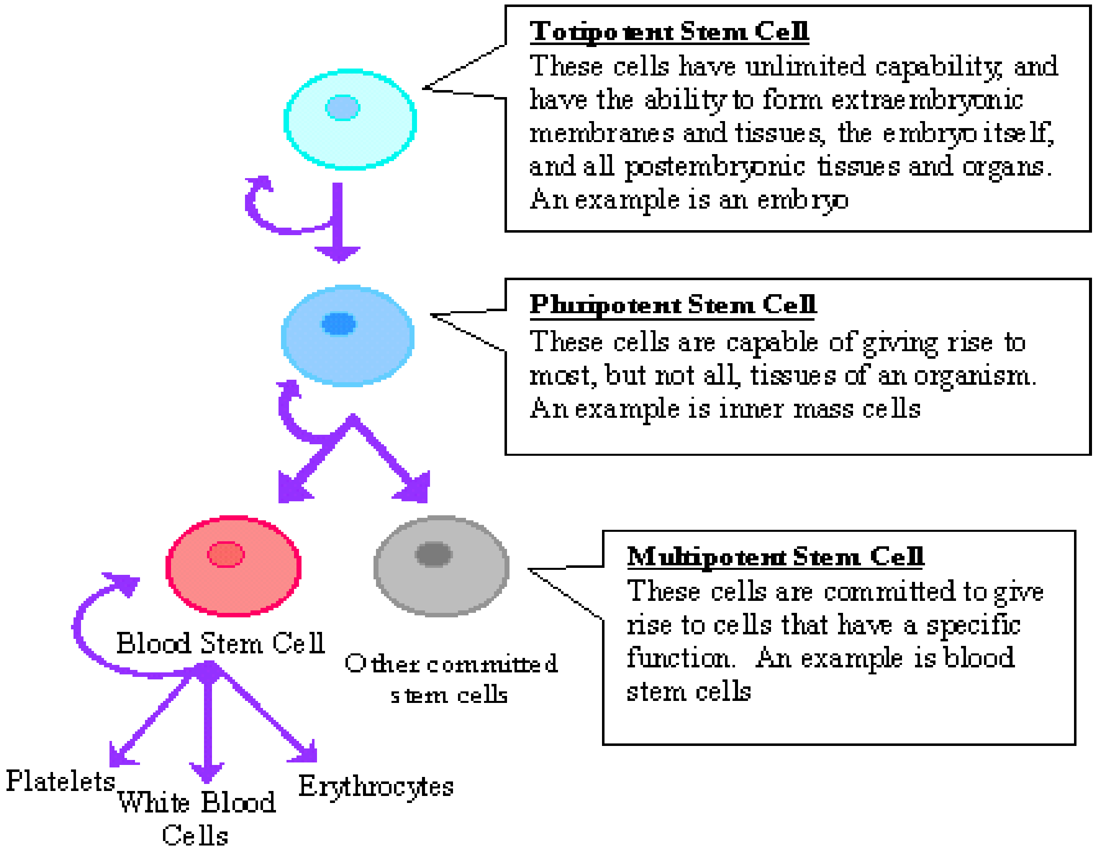
Although additional research is needed, IPSC's are already useful tools for drug development and modeling of diseases, and scientists hope to use them in transplantation medicine. Viruses are currently used to introduce the reprogramming factors into adult cells, and this process must be carefully controlled and tested before the technique can lead to useful treatments for humans. In animal studies, the virus used to introduce the stem cell factors sometimes cause cancers. Researchers are currently investigating non-viral delivery strategies. In any case, this breakthrough discovery has created a powerful new way to "de-differentiate" cells whose developmental fates had been previously assumed to be determined. In addition, tissues derived from IPSC's will be a nearly identical match to the cell donor and thus probably avoid rejection by the immune system. The IPSC strategy creates pluripotent stem cells that, together with studies of other types of pluripotent stem cells, will help researchers learn how to reprogram cells to repair damaged tissues in the human body.

2.10 POTENCY AND PROPERTIES OF STEM-CELLS

Stem cells are categorized by their potential to differentiate into other types of cells. Embryonic stem cells are the most potent since they must become every type of cell in the body. The full classification includes:

Totipotent - the ability to differentiate into all possible cell types. Examples are the zygote formed after the fertilization and the first few cells that result from the division of the zygote.

Pluripotent - the ability to differentiate into almost all cell types. Examples include embryonic stem cells and cells that are derived from the mesoderm, endoderm, and ectoderm germ layers that are formed in the beginning stages of embryonic stem cell differentiation.


Totipotent Stem Cell
These cells have unlimited capability, and have the ability to form extraembryonic membranes and tissues, the embryo itself, and all postembryonic tissues and organs. An example is an embryo
Pluripotent Stem Cell
These cells are capable of giving rise to most, but not all, tissues of an organism. An example is inner mass cells
Multipotent Stem Cell
These cells are committed to give rise to cells that have a specific function. An example is blood stem cells
Blood Stem Cell
Other committed stem cells
Platelets
White Blood Cells
Erythrocytes

of stem cell research is politically charged, prompting biologists to begin engaging in ethical debates, and generating in the general public an unusually high level of interest in this aspect of biology. but excitement notwithstanding, there is a long way to go in basic research before new therapies will be established, and now the pressure is on for scientists and clinicians to deliver.

Check Your Progress III

Note: Use the space provided for your answers.s.

1) What are some of the advantages of Genetic Engineering?

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2) What is a pluripotent cell?

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2.11 LET US SUM UP

One of the characteristic features of human being is that he/ she can go beyond many limits and move to higher levels of existence. This quality of going beyond or being superior to was manifested through technology especially in Genetic science. We must not be the slaves of the technology. Techniques, however grand they may be, must reduce man to technical animal, the king of the slaves of technique. While creating and relying on the Human- made environment, we ourselves is being modified with new outlook and orientations. The technology limits our outlook in certain way leading to the consumer outlook, materialistic and military orientations etc. The human being now becomes different and he/she can be called the technological man/woman because of the dominance of technology over his/her life. From a contextual study we become aware of the very nature of human being and how we are constantly becoming different through the advancement in Genetics and other technological developments. So in this unit we have studied the basics of Genetic engineering and Stem-cell research.

2.11 KEY WORDS

Genetic Engineering: The deliberate modification of the characteristics of an organism by manipulating its genetic material.

Germline: Genetic material in a cell lineage that is passed down through the gametes before it is modified by somatic recombination or maturation.

Stem cell: An undifferentiated cell of a multicellular organism that is capable of giving rise to indefinitely more cells of the same type, and from which certain other kinds of cell arise by differentiation.

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UNIT 3 BASICS OF HUMAN GENOME PROJECT

Contents

3.0 OBJECTIVES

- To have an over-all understanding of Human Genome Project
- To see some of its advantages and dangers.
- To have a general idea of the technological growth that has made Human Genome Project possible.

3.1 INTRODUCTION

The Human Genome Project ranks right up there at the top of the scale of scientific advances. The opportunity to read our own instruction manual is holistic and astounding. What else in science could compete with that? This is the most important organized scientific endeavor that human kind has ever mounted. Human Genome Project has already identified many genetic abnormalities and will no doubt identify many more. New treatments and better safer treatments are likely to follow as a result. For this reason, we believe that the Human Genome Project is important scientific project of the century and probably, the most important of all time. Although it is based on the findings of many researches over many years, the efforts of the Human Genome Project have the potential for creating better humanity than any single scientific venture in world history.

For every good that a technology can bring to society, there is also a potential for abuse. Ethical guidelines are essential to the success of the Human Genome Project. This scientific paper gives the overall picture of Human Genome project with all its pros and cons. It not only deals with the scientific methodologies involved in the human Genome Project but also on the philosophical implication which is the mail concern. We will see in the paper how the Human Genome Project is useful in many ways and also can be misused in many ways. Although the Human Genome Project is a great achievement in Science and especially in Genetics, there is a need for Ethical, social and moral concern. Just as dynamite which was discovered in a good intention to break the rocks were eventually misused to kill people so also the Human Genome Project which was initially a knowledge seeking project, which aimed to study the genetic nature of human being later could be misused in many ways due to the unethical , immoral and anti-social elements. Any venture must uphold the human dignity and must not dehumanize. Any sort of oppressive structures in the scientific world should be counterattacked or guided by proper ethics so that every development is based on the welfare of the whole of human race. Thus we come to a critical analysis and reflection so that we can decide for ourselves and let others know what good things we can take from this and what misuses we can avoid for the welfare of the whole of humanity at large.

Human Genome Project, international scientific collaboration that seeks to understand the entire genetic blueprint of a human being.This genetic information is found in each cell of the body, encoded in the chemical deoxyribonucleic acid (DNA). Through a process known as sequencing, the Human Genome Project has identified nearly all of the estimated 31,000 genes in the nucleus of a human cell. The project has also mapped the location of these genes on the 23 pairs of human chromosomes, the structures containing the genes in the cell's nucleus.

The data derived from mapping and sequencing the human genome will help scientists associate specific human traits and inherited diseases with particular genes at precise locations on the chromosomes. This advance will help provide an unparalleled understanding of the fundamental organization of human genes and chromosomes. Many scientists believe that the Human Genome Project has the potential to revolutionize both therapeutic and preventive medicine by providing insights into the basic biochemical processes that underlie many human diseases.

The idea of undertaking a coordinated study of the human genome arose from a series of scientific conferences held between 1985 and 1987. The Human Genome Project began in earnest in the United States in 1990 with the expansion of funding from the National Institute of Health (NIH) and the Department of Energy (DOE). One of the first directors of the U.S. program was American biochemist James Watson, who in 1962 shared the Nobel Prize for physiology or medicine with British biophysicists Francis Crick and Maurice Wilkins for the discovery of the structure of DNA. Many nations have official human genome research programs as part of this collaboration, including the United Kingdom, France, Germany, and Japan. In a separate project intended to speed up the sequencing process and commercialize the results, Celera Genomics, a privately funded Biotechnology company, used a different method to assemble the sequence of the human genome. Both the public consortium and Celera Genomics completed the first phase of the project, and they each published a draft of the human genome simultaneously, although in separate journals, in February 2001. Scientists from the public consortium completed the final sequencing of the human genome in April 2003.

3.2 HISTORY OF HGP

The idea of the HGP was initiated in 1977, when simple and efficient methods for sequencing DNA were described. Before that time the possibility of sequencing the entire human genome was no more than extreme wishful thinking. In the 1980's it was becoming increasingly apparent to many scientists that an understanding of basic biology would be greatly enhanced if the detailed structure of DNA was understood. Over the last two decades, automated DNA sequencers have made the process of obtaining the base-by-base sequence of DNA easier. In

1984, for the first time a meeting was sponsored by the Department of Energy (DOE) to address the problem of detecting extremely low levels of very rare changes in DNA (mutations) in humans exposed to radiation and other environmental hazards (Postiglione and Brungs 1993). At that time, it was realized that the level of effort including the automation of DNA analysis techniques would be similar to the requirements for sequencing the human genome. Several other meetings followed until the first formal proposal appeared in 1986 published by Renato Dulbecco who focused on potential benefits to cancer research from the availability of the complete genomic sequence (McConkey 1993). The immediate public response was considerable skepticism about the possibility and economical feasibility of the HGP, the value of the results, its impact on the rest of biological research, goal definitions, funding, and potential risks of information abuse.
As a $3 billion project, it was a 15-year effort to find the estimated 80,000-100,000 human genes and determine the sequence of the 3-billion chemical bases that make up human DNA and underlies all life's diversity.
In 1976, the genome of the RNA virus Bacteriophage MS2 was the first complete genome to be determined, by Walter Fiers and his team at the University of Ghent (Ghent, Belgium). The idea for the shotgun technique came from the use of an algorithm that combined sequence information from many small fragments of DNA to reconstruct a genome. This technique was pioneered by Frederick Sanger to sequence the genome of the Phage Φ-X174, a virus that primarily infects bacteria that was the first fully sequenced genome (DNA-sequence) in 1977. The technique was called shotgun sequencing because the genome was broken into millions of pieces as if it had been blasted with a shotgun. In order to scale up the method, both the sequencing and genome assembly had to be automated, as they were in the 1980s.

Those techniques were shown applicable to sequencing of the first free-living bacterial genome (1.8 million base pairs) of *Haemophilus influenza* in 1995 and the first animal genome. It involved the use of automated sequencers, longer individual sequences using approximately 500 base pairs at that time. Paired sequences separated by a fixed distance of around 2000 base pairs which were critical elements enabling the development of the first genome assembly programs for reconstruction of large regions of genomes. Three years later, in 1998, the announcement by the newly-formed Celera Genomics that it would scale up the pair wise end sequencing method to the human genome was greeted with skepticism in some circles. The shotgun technique breaks the DNA into fragments of various sizes, ranging from 2,000 to 300,000 base pairs in length, forming what is called a DNA "library". Using an automated DNA sequence, the DNA is read in 800bp lengths from both ends of each fragment. Using a complex genome assembly algorithm and a supercomputer, the pieces are combined and the genome can be reconstructed from the millions of short, 800 base pair fragments. The success of both the public and privately funded effort hinged upon a new, more highly automated capillary DNA sequencing machine, called the Applied Bio systems 3700, that ran the DNA sequences through an extremely fine capillary tube rather than a flat gel. Even more critical was the development of a new, larger-scale genome assembly program, which could handle the 30–50 million sequences that would be required to sequence the entire human genome with this method. At the time, such a program did not exist (Davies 2001).

One of the first major projects at Celera Genomics was the development of this assembler, which was written in parallel with the construction of a large, highly automated genome sequencing factory. Development of the assembler was led by Brian Ramos. The first version of this assembler was demonstrated in 2000, when the Celera team joined forces with Professor Gerald Rubin to sequence the fruit fly Drosophila melanogaster using the whole-genome shotgun method. At 130 million base pairs, it was at least 10 times larger than any genome previously shotgun assembled. One year later, the Celera team published their assembly of the three billion base pair human genome. This project is closely associated to the branch of biology called Bio-informatics. The human genome project international consortium announced the publication of a draft sequence and analysis of the human genome the genetic blueprint for the human being. An American company Celera, led by Craig Venter and the other huge international collaboration of distinguished scientists led by Francis Collins, director, National Human Genome Research Institute, U.S., both published their findings (Zweiger 2003).

This Mega Project is co-ordinated by the U.S. Department of Energy and the National Institute of Health. During the early years of the project, the Welcome Trust (U.K.) became a major partner, other countries like Japan, Germany, China and France contributed significantly. The two factors that made this project a success is:

1. Genetic Engineering Techniques, with which it is possible to isolate and clone any segment of DNA.
2. Availability of simple and fast technologies, to determining the DNA sequences.

Being the most complex organisms, human beings was expected to have more than 100,000 genes or combination of DNA that provides commands for every characteristics of the body. Instead their studies show that humans have only 30,000 genes – around the same as mice, three times as many as flies, and only five times more than bacteria. Scientist told that not only are the numbers similar, the genes themselves, baring a few, are alike in mice and men. In a companion volume to the Book of Life, scientists have created a catalogue of 1.4 million single-letter differences, or single-nucleotide polymorphisms (SNPs) – and specified their exact locations in the human genome. This SNP map, the world's largest publicly available catalogue of SNP's, promises to revolutionize both mapping diseases and tracing human history.

The sequence information from the consortium has been immediately and freely released to the world, with no restrictions on its use or redistribution. The information is scanned daily by scientists in academia and industry, as well as commercial database companies, providing key information services to bio-technologists. Already, many genes have been identified from the genome sequence, including more than 30 that play a direct role in human diseases. By dating the three millions repeat elements and examining the pattern of interspersed repeats on the Y-chromosome, scientists estimated the relative mutation rates in the X and the Y chromosomes and in the male and the female germ lines. They found that the ratio of mutations in male vs female is 2:1. Scientists point to several possible reasons for the higher mutation rate in the male germ line, including the fact that there are a greater number of cell divisions involved in the formation of sperm than in the formation of eggs (Sloan 2000).

Check Your Progress I

Note: Use the space provided for your answers.s.

1) When did HGP start?

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2) Give two factors that made this project a success?
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3.3 HUMAN GENOME PROJECT: AN OVERVIEW

A genome is the complete collection of an organism's genetic material. The human genome is composed of about 31,000 genes located on the 23 pairs of chromosomes in a human cell. A single human chromosome may contain more than 250 million DNA base pairs, and scientists estimate that the entire human genome consists of about 3 billion base pairs.

The first steps in the Human Genome Project are to develop the needed technologies, then to "map" and "sequence" the genome. But in a sense, these well-publicized efforts aim only to provide the raw material for the next, longer strides. The ultimate goal is to exploit those resources for a truly profound molecular-level understanding of how we develop from embryo to adult, what makes us work, and what causes things to go wrong. The benefits to be reaped stretch the imagination. In the offing is a new era of molecular medicine characterized not by treating symptoms, but rather by looking to the deepest causes of disease. Rapid and more accurate diagnostic tests will make possible earlier treatment for countless maladies. Even more promising, insights into genetic susceptibilities to disease and to environmental insults, coupled with preventive therapies, will thwart some diseases altogether (Podimattom 2002).
New, highly targeted pharmaceuticals, not just for heritable diseases, but for communicable ailments as well, will attack diseases at their molecular foundations. And even gene therapy will become possible, in some cases actually "fixing" genetic errors. All of this is in addition to a new intellectual perspective on whom we are and where we came from.
Begun formally in 1990, the U.S. Human Genome Project was a 13-year effort coordinated by the U.S. Department of Energy and the National Institute of Health. The project originally was planned to last 15 years, but rapid technological advances accelerated the completion date to 2003. More than 1100 top level scientists from over 18 outstanding research centers spread over 6 nations, participated in this mega project.

Francis Collins was the director of this venture. Later in 1999 Craig Venter, an eminent scientist joined and did a super-fast radical approach of short gun cloning rather than the orderly linear sequencing. The working draft DNA sequence and the more polished 2003 version represent an enormous achievement, akin in scientific importance, some say, to developing the periodic table of elements. And, as in most major scientific advances, much work remains to realize the full potential of the accomplishment. The genome is an organism's complete set of DNA. Genomes vary widely in size: the smallest known genome for a free-living organism (a bacterium) contains about 600,000 DNA base pairs, while human and mouse genomes have some 3 billion. Except for mature red blood cells, all human cells contain a complete genome.

DNA in the human genome is arranged into chromosomes—physically separate molecules that range in length from about 50 million to 250 million base pairs. A few types of major chromosomal abnormalities, including missing or extra copies or gross breaks and rejoining (translocations), can be detected by microscopic examination. Most changes in DNA, however, are more subtle and require a closer analysis of the DNA molecule to find perhaps single-base differences (Brungs 1993).

Each chromosome contains many genes, the basic physical and functional units of heredity. Genes are specific sequences of bases that encode instructions on how to make proteins. Genes comprise only about 2% of the human genome; the remainder consists of non-coding regions, whose functions may include providing chromosomal structural integrity and regulating where, when, and in what quantity proteins are made.

Although genes get a lot of attention, it's the proteins that perform most life functions and even make up the majority of cellular structures. Proteins are large, complex molecules made up of smaller subunits called amino acids. Chemical properties that distinguish the 20 different amino acids cause the protein chains to fold up into specific three-dimensional structures that define their particular functions in the cell.

The constellation of all proteins in a cell is called its proteome. Unlike the relatively unchanging genome, the dynamic proteome changes from minute to minute in response to tens of thousands of intra- and extracellular environmental signals. A protein's chemistry and behavior are specified by the gene sequence and by the number and identities of other proteins made in the same cell at the same time and with which it associates and reacts. Studies to explore protein structure and activities, known as proteomics, will be the focus of much research for decades to come and will help elucidate the molecular basis of health and disease (Singh 2002).

3.4 GOALS OF HGP

The sequence of the human DNA is stored in databases available to anyone on the Internet. The U.S. National Centre for Biotechnology Information house the gene sequence in a database known as Gen Bank, along with sequences of known and hypothetical genes and proteins. Other organizations such as the University of California, Santa Cruz, and Ensemble present additional data and annotation and powerful tools for visualizing and searching it. Computer programs have been developed to analyze the data, because the data itself is difficult to interpret without such programs.

The process of identifying the boundaries between genes and other features in raw DNA sequence is called genome annotation and is the domain of bioinformatics. While expert biologists make the best annotators, their work proceeds slowly, and computer programs are increasingly used to meet the high-through put demands of genome sequencing projects. The best current technologies for annotation make use of statistical models that take advantage of parallels between DNA sequences and human language, using concepts from computer science such as formal grammars. Another, often overlooked, goal of the HGP is the study of its ethical, legal, and social implications. It is important to research these issues and find the most appropriate solutions before they become large dilemmas whose effect will manifest in the form of major political concerns.

All humans have unique gene sequences. Therefore the data published by the HGP does not represent the exact sequence of each and every individual's genome. It is the combined reference genome of a small number of anonymous donors. The HGP genome is a scaffold for future work in identifying differences among individuals. Most of the current effort in identifying differences among individuals involves single-nucleotide polymorphisms and the Hap-Map. The Human Genome Project (HGP) was an international scientific research project with a primary goal to determine the sequence of chemical base pairs which make up DNA.

The project began in 1990 and was initially headed by James D. Watson at the U.S. National Institutes of Health. A working draft of the genome was released in 2000 and a complete one in 2003, with further analysis still being published. A parallel project was conducted outside of government by the Celera Corporation. Most of the government-sponsored sequencing was performed in universities and research centers from the United States, the United Kingdom, Japan, France, Germany, China, India, Canada, and New Zealand. The mapping of human genes is an important step in the development of medicines and other aspects of health care.

While the objective of the Human Genome Project is to understand the genetic makeup of the human species, the project has also focused on several other non-human organisms such as E.coli, the fruit fly, and the laboratory mouse. It remains one of the largest single investigational projects in modern science. The Human Genome Project originally aimed to map the nucleotides contained in a human haploid reference genome. Several groups have announced efforts to extend this to diploid human genomes including the International Hap Map Project. The "genome" of any given individual (except for identical twins and cloned organisms) is unique; mapping "the human genome" involves sequencing multiple variations of each gene. The project did not study the entire DNA found in human cells; some heterochromatic areas remain un-sequenced.

3.5 ADVANTAGES OF HUMAN GENOME PROJECT

The main advantages of HGP could be seen two: (i) Knowledge of the effects of variation of DNA among individuals can revolutionize the ways to diagnose, treat and even prevent a number of diseases that affects the human beings. (ii) Providing clues to the understanding of human biology.

Diagnosing and Predicting Disease and Disease Susceptibility

All diseases have a genetic component, whether inherited or resulting from the body's response to environmental stresses like viruses or toxins. The successes of the HGP have even enabled researchers to pinpoint errors in genes--the smallest units of heredity--that cause or contribute to disease. The ultimate goal is to use this information to develop new ways to treat, cure, or even prevent the thousands of diseases that afflict humankind. But the road from gene identification to effective treatments is long and fraught with challenges. In the meantime, biotechnology companies are racing ahead with commercialization by designing diagnostic tests to detect errant genes in people suspected of having particular diseases or of being at risk for developing them.

An increasing number of gene tests are becoming available commercially, although the scientific community continues to debate the best way to deliver them to the public and medical communities that are often unaware of their scientific and social implications. While some of these tests have greatly improved and even saved lives, scientists remain unsure of how to interpret many of them. Also, patients taking the tests face significant risks of jeopardizing their employment or insurance status. And because genetic information is shared, these risks can extend beyond them to their family members as well.

Hazards of Human Genome Project: We also need to be aware of the various dangers we are exposing ourselves into, while pursuing such a venture. This will be taken up in the next units.

Bioinformatics

The completed human genome sequence generated a catalog made up of around 31,000 human genes; high-resolution maps of the chromosomes, including hundreds of thousands of landmarks; and billions of base pairs of DNA-sequence information. Laboratory information-management systems, robotics, database-management systems, and graphical user interfaces were among the computing tools required to help genome researchers make sense of this flood of data. A new field of research, bioinformatics, has developed in part to address the computing challenges raised by the project. Researchers in bioinformatics have developed public databases connected to the Internet to make genome data available to scientists worldwide, along with analytical software for making sense of this flood of biological information. For example, DNA-sequence information is stored in several databases, including the NIH's Gen Bank, the European Molecular Biology Laboratory's Nucleotide Sequence Database, and the DNA Data bank of Japan.

Check Your Progress I

Note: Use the space provided for your answers.s.

1) Mention some of the advantages of HGP?

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2) What is Bioinformatics?

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3.6 ACHIEVEMENT OF HUMAN GENOME PROJECT

In April 2003, researchers announced that the Human Genome Project had completed a high-quality sequence of essentially the entire human genome. This sequence closed the gaps from a working draft of the genome, which was published in 2001. It also identified the locations of many human genes and provided information about their structure and organization. In addition to the human genome, the Human Genome Project sequenced the genomes of several other organisms, including brewers' yeast, the roundworm, and the fruit fly. In 2002, researchers announced that they had also completed a working draft of the mouse genome. By studying the similarities and differences between human genes and those of other organisms, researchers can discover the functions of particular genes and identify which genes are critical for life.

3.7 HGP: FUTURE PROSPECTS

The benefits of Human Genome Project research include the improvements in medicine, microbial genome research for fuel and environmental cleanup, DNA forensics, improved agriculture and livestock, better understanding of evolution and human migration, and more precise and accurate risk assessment.

Our knowledge about human genetics clearly expands at a great rate over the coming years. This fundamental understanding will permit control over many biological processes, and biological control will transform medicine, agriculture, animal husbandry, and pharmaceutical production. The project has already stimulated significant investment by large corporations and lead to the creation of new companies hoping to capitalize on the project's profound and inestimable implications. Great desire exists among Biotechnology companies to acquire efficient technologies such as the genome-driven drug discovery. An understanding of human DNA certainly will be an important key in understanding a host of human diseases. Cancers, in particular, are now being understood as genetic diseases, since cancerous growths arise from either acquired or hereditary changes in cellular DNA (Postiglione and Brungs 1993). Once we know how altered DNA induces cancer development, effective tools can be developed to prevent or treat malignant growths. It is important that this knowledge will be used well, and not to stigmatize or discriminate, but to improve human health.

The HGP should illuminate fundamental functions of the body and become invaluable basis for genomic technology; however it will primarily open a fascinating area for exploration. A large portion of the value of the projects rests on the expansion of our basic understanding of biological life in general and the explicit promise of the relief of suffering from the more than 4,000 genetic hereditary diseases (i.e. Huntington disease and cystic fibrosis) either through prevention or cure.

- **Medicine**: improved diagnosis of disease. The HGP will accelerate the acquisition of probes for genes that determine an individual's susceptibility to heart disease, to certain types of cancer, to diabetes, and to some types of mental illness. We expect to learn the underlying causes of many genetic diseases, including sickle cell anemia, Huntington disease, cystic fibrosis, and several forms of cancer. This will enable us to predict the likelihood of the disease occurrence in any individual.
- **Microbial research**: new energy sources, bio fuels.
- **DNA forensics**: identifying potential suspects at a crime scene.
- **Agriculture**: more nutritious produce.*
- **Evolution and human migration**: study migration of different population groups based on female genetic inheritance.
- **Risk assessment**: reduce the likelihood of heritable mutations and cure. Understanding of the human genome will have an enormous impact on the ability to assess risk posed to individuals by exposure to toxic agents and scientists know that genetic differences make some people more susceptible and others more resistant to such agents. Far more research work will be needed to determine the genetic basis of variability. This knowledge will

help us to understand the effects of low level exposures to radiation and other energy-related agents, especially in terms of cancer risk.

The advantage of the Human Genome Project has been the recognition that it attracted extra funding to the work, raised the profile of the effort within the scientific communities, and provided elements of organization and cooperation that would not have occurred with individual scientists pursuing projects based on their personal interest. Knowledge gained by such efforts as the human genome project will help enable experts to analyze individual differences among genomes (Zweiger 2003). Because genetic variations cause or contribute to certain diseases, we need to be aware of the dangers and hazards that HGP and Genetic Research can cause. Analysis of a person's genome could reveal health information that should remain private. People are concerned of preventing the misuse of such information and the hazardous side-effects of Genetic Research.

3.8 PHILOSOPHICAL REFLECTIONS

Throughout the age's human has struggled with the subject of right and wrong, ethics and justice. Ethics consists of the actions an individual takes on for oneself. No matter how criminal an individual is, he will be trying, one way or another, to put ethics on himself. The nature of the human person is the basic criterion in deciding upon ethics. Aristotle (384-322 B.C.) also got involved with ethics. He explained unethical behavior by saying that humans' rationality became over ruled by his desire. Ethics consists basically of rationality towards the highest level of survival for the individual, family, group, mankind and the environment collectively. Ethics is a reason and the smartest solution to any problem is that solution which creates the greatest good for the greatest number. Any solution that falls short of this model contains weaker reasoning. Survival is not merely the barest necessities of life; it is a graduated scale with pain and death at the bottom and immortality at its top. Everyone has an infinite ability to survive. How well one accomplishes this is depended on how well one applies ethics to life. Ethical actions are survival actions. Know that the fundamental principal of existence is to survive. Evil, illness, misfortune, and decay go hand in hand, all are the fruits of one's misdeeds!

The nature of the human person has to be considered seriously. The technologies and scientific advancements are for the welfare of the human society. There is inequality in this world based on money, race, sex, and caste. But the underlying principle of humankind is the human nature which is uphold by many religions. Even some religions do not allow the women, children to be treated equally as men. The frame of reference of some religions, that is the scriptures, bring out inequality in seeing the same fellow human beings under the banner of the caste and out caste.

Media again projects the human being as a sexual, luxurious and dreaming being which has no relevance to the existential reality. Science, Religion and Society seem to take a different route in their journey. In this situation there has to be a common understanding of taking the human person seriously with the core importance given to the poor and the rich, the learned and the illiterate, the black and the white etc. All need to understand that they are in one cosmos and sharing the same existence. Scientism and religious fanaticism has to be dealt with some concrete ways as it misleads people to become more oppressive and dehumanizing.

Goodness and advancements have to be taken as an overall welfare or affair which is a necessary one. All these years without much genetic knowledge people have been living with harmony. Hitler came to improve his race. With the advent of Human genome project, the epiphany of its misuse is already known to us. Pain and suffering has been ruling the world and humanity in so many ways. Humanity in the form of advancement is thinking newly, differently and independently for the welfare of its future. What is welfare for some becomes horror news for the others. Well-wishers of humanity have to think in a more liberative way so as to bring in a constructive reality which will unify all peoples – where the dignity of human kind preserved and maintained with its utmost care.

Human beings are end in themselves and they are not mere means. Trans Human Species: Some scientists have proposed that there could be a trans-human species (Homo sapiens super) would emerge due to genetic manipulation which will eventually look down upon the Homo sapiens. What would be the future of the present Homo sapiens?

Beyond the moral significance of the project itself, the human genome project does indeed raise many interesting and challenging questions, questions related to the use of the tests and information it will produce. For example, it will be necessary to consider the ways in which resultant genetic probes should be used in matter of employment, insurability, money lending, reproduction, counseling and so on.

One of the major expectations of the genome project is that its information will offer people better health. But genetic characterizations are one thing and successful medical interventions to correct genetic defeccts are quite another. The goal of the genome project is to produce a characterization of the human genetic complementation in the way that anatomy produces a representation of the structural components of the human body or in the way that physiology represents bodily function. Thus genomic characterization will not identify the genome as a single person any more than anatomical or skeletal characterizations representation a given individual.

French philosopher and mathematician Blaise Pascal wrote in an essay "Prayer to ask God for the use of sickness". The title here is problematic to contemporary consciousness. What could thus signify? That if there is a right use of sickness, there is also a wrong use of sickness? What is the purpose to sickness at all? However strange that the question might appear today, in Pascal's view, sickness could be put to the use of personal transformation and was useful in guiding one to correct moral priorities.

What is the right use of the human genome project? Will it be used to prop the existing scientific status quo and perhaps thereby impede the aims of science? Will it be used in a campaign against difference, or will it be used to map the fullness and plenitude of existence? Will it be used as a stratagem to create a new kind of inferiority? Or will we able to understand the way in which genomic characterizations represent one possible map of a small corner of the vastness of existence? Will the goal of biomedicine be the leveling of all genetic difference in order to accommodate the social requirements of the time? Even as it offers some answers, science also creates uncertainty; even as it conquers some social evils, it also may cause evasion of social problems.

Check Your Progress III
Note: Use the space provided for your answers.s.
1) What is risk assessment?
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2) In the light of the research on HGP, do you consider that sickness has a positive value?
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3.9 LET US SUM UP

In this unit we have studied the basic issues connected with HGP in a very general and descriptive manner. We have not dealt with its disadvantages and hazards, but focussed on its achievements and advantages.

3.10 KEY WORDS

Bioinformatics: Bioinformatics is the application of statistics and computer science to the field of molecular biology. It is used extensively in Human Genome Project.

E. coli or *Escherichia coli*: A bacillus *or a type of bacteria* normally found in the human gastrointestinal tract and existing as numerous strains, some of which are responsible for diarrheal diseases. Other strains have been used experimentally in molecular biology.

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UNIT 4 ETHICAL, LEGAL AND SOCIAL ISSUES

Contents

4.0 OBJECTIVES

- To give the students the general overview of ELSI programs and its significance to genetic engineering.
- To see the significance of ELSI, particularly in genetic research.
- To have a comprehensive notion of both the positive and negative side effects and consequences of HGP.
- To give an overview of the ethical, legal and social issues related to genetic research.
- To see some of the dangers posed and possibilities offered by HGP and such such cutting-edge technologies

4.1 INTRODUCTION

Rapid advances in the science of genetics and its applications have presented new and complex ethical and policy issues for individuals and society. Ethical, Legal and Social Issues (ELSI) programs that identify and address these implications have been an integral part of the U.S. Human Genome Project (HGP) since its inception. These programs have resulted in a body of work that promotes education and helps guide the conduct of genetic research and the development of related medical and public policies.

A continuing challenge is to safe guard the privacy of individuals and groups who contribute DNA samples for large-scale sequence-variation studies. Other concerns have been to anticipate how the resulting data may affect concepts of race and ethnicity; identify potential uses (or misuses) of genetic data in workplaces, schools, and courts; identify commercial uses; and foresee impacts of genetic advances on the concepts of humanity and personal responsibility.The project's goals included not only identifying all of the approximately 24,000 genes in the human genome, but also to address the ethical, legal, and social issues (ELSI) that might arise from the availability of genetic information. Five percent of the annual budget was allocated to address the ELSI arising from the project.

The main criticism of ELSI is the failure to address the conditions raised by population-based research, especially with regard to unique processes for group decision-making and cultural worldviews. Genetic variation research such as HGP is group population research, but most ethical guidelines, according to Harry, focus on individual rights instead of group rights. She says the research represents a clash of culture: indigenous people's life revolves around collectively and group decision making whereas the Western culture promotes individuality. Harry suggests that one of the challenges of ethical research is to include respect for collective review and decision making, while also upholding the Western model of individual rights.

4.2 ELSI RESEARCH GOALS

The HGP is probably one of the most profound research efforts in human history, which will certainly impact all of us because of the many implications for medicine and human health. The Genetic advancements and Human Genome Project has the potential to heal and restore the brokenness of creation. However it has serious ethical, social, philosophical and religious implications. Ethical, legal and social implications of the Human Genome Project are privacy and confidentiality, psychological impact and stigmatization, genetic testing, reproductive issues, education, standards, and quality control, commercialization, conceptual and philosophical implications.

1. **Fairness and privacy**: fairness in the use of genetic information. Who should have access to your genetic information? (Chan and Chia 2003)
2. **Psychological stigmatization:** how does knowing your predisposition to disease affect an individual?
3. **Genetic testing:** should screening be done when there is no treatment available?
4. **Reproductive issues:** Reproductive issues including adequate informed consent for complex and potentially controversial procedures, use of genetic information in reproductive decision making, and reproductive rights.
5. **Clinical issues:** implementation of standards and quality control measures in testing procedures.
6. **Commercialization:** commercialization of products includes property rights (patents, copyrights, and trade secrets) and accessibility of data and materials.

Some of the other related issues that are related to ELSI are:

- Examine issues surrounding the completion of the human DNA sequence and the study of human genetic variation.
- Examine issues raised by the integration of genetic technologies and information into health care and public health activities.
- Examine issues raised by the integration of knowledge about genomics and gene-environment interactions in non-clinical settings.
- Explore how new genetic knowledge may interact with a variety of philosophical, theological, and ethical perspectives.
- Explore how racial, ethnic, and socioeconomic factors affect the use, understanding, and interpretation of genetic information; the use of genetic services; and the development of policy.

Check Your Progress I

Note: Use the space provided for your answers.s.

1) What is ELSI and give its significance?

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2) What are some of the research goals of ELSI?

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4.3 ETHICAL ISSUES

It is often asked whether it is right for human beings to manipulate human genes at all, as if this in some sense "playing God" by altering fundamental aspects of human makeup which are God's prerogative only, or simply that it is a dangerous "tampering with nature" in a way which we have neither the right nor the skill to do. We need to worry about whether genetic technology generated from the HGP will make us less accepting of people who are different. For example, if it is possible to predict and prevent the birth of a child with a gene-related disorder, how will we react to children who have that disorder? At the same time the non reproductive cloning requires abortion (Kilner, Pentz and Young 1997). Here life is created specifically for the purpose of destroying it and then cannibalizing it essentially for spare parts. Human life is intrinsically sacred even at this early stage of development.

Genetic modification of trees to reduce Co2 levels is a new attempt in genetic world. It aims to bring a benefit to all people which would be treating them as an end in themselves. A comparison with the duty based ethics of Kant would show more light into this. Immanuel Kant says that we should treat each person as an end in themselves and not merely as a means to an end. Kant see it as a duty to implement this technology, provides we look as much care as possible to ensure that it was for the welfare (Lewis 2007). Thus the humanity will benefit from a stabilization of the climate by genetically modified trees. It is Kantian duty to act in the interests of future generations to treat them all as ends in themselves. However if something goes wrong, then humanity would suffer from changes to their eco-system.

What are some of the Ethical considerations for using gene therapy?

Some questions to consider are:

- What is normal and what is a disability or disorder, and who decides?
- Are disabilities diseases? Do they need to be cured or prevented?
- Does searching for a cure demean the lives of individuals presently affected by disabilities?

- Is somatic gene therapy (which is done in the adult cells of persons known to have the disease) more or less ethical than gremlin gene therapy (which is done in egg and sperm cells and prevents the trait from being passed on to further generations)? In cases of somatic gene therapy, the procedure may have to be repeated in future generations.

- Preliminary attempts at gene therapy are exorbitantly expensive. Who will have access to these therapies? Who will pay for their use?

What are the ethical issues surrounding gene?
Because gene therapy involves making changes to the body's set of basic instructions, it raises many unique ethical concerns. The ethical questions surrounding gene therapy include:

- How can "good" and "bad" uses of gene therapy be distinguished?
- Who decides which traits are normal and which constitute a disability or disorder?
- Will the high costs of gene therapy make it available only to the wealthy?
- Could the widespread use of gene therapy make society less accepting of people who are different?
- Should people be allowed to use gene therapy to enhance basic human traits such as height, intelligence, or athletic ability?
- Short-lived nature of gene therapy – Before gene therapy can become a permanent cure for any condition, the therapeutic DNA introduced into target cells must remain functional and the cells containing the therapeutic DNA must be long-lived and stable. Problems with integrating therapeutic DNA into the genome and the rapidly dividing nature of many cells prevent gene therapy from achieving any long-term benefits. Patients will have to undergo multiple rounds of gene therapy.
- Immune response – Anytime a foreign object is introduced into human tissues, the immune system has evolved to attack the invader. The risk of stimulating the immune system in a way that reduces gene therapy effectiveness is always a possibility. Furthermore, the immune-system's enhanced response to invaders that it has seen before makes it difficult for gene therapy to be repeated in patients.
- Problems with viral vectors – Viruses, the carrier of choice in most gene therapy studies, present a variety of potential problems to the patient —toxicity, immune and inflammatory responses, and gene control and targeting issues. In addition, there is always the fear that the viral vector, once inside the patient, may recover its ability to cause disease.
- Multi-gene disorders – Conditions or disorders that arise from mutations in a single gene are the best candidates for gene therapy. Unfortunately, some of the most commonly occurring disorders, such as heart disease, high blood pressure, Alzheimer's disease, arthritis, and diabetes, are caused by the combined effects of variations in many genes. Multi-gene or multi-factorial disorders such as these would be especially difficult to treat effectively using gene therapy.

Current gene therapy research has focused on treating individuals by targeting the therapy to body cells such as bone marrow or blood cells. This type of gene therapy cannot be passed on to a person's children. Gene therapy could be targeted to egg and sperm cells (germ cells), however, which would allow the inserted gene to be passed, on to future generations. This approach is known as germ-line gene therapy (Harwood 1994).

The idea of germ-line gene therapy is controversial. While it could spare future generations in a family from having a particular genetic disorder, it might affect the development of a fetus in unexpected ways or have long-term side effects that are not yet known. Because people who would be affected by germ-line gene therapy are not yet born, they can't choose whether to have the treatment (Harwood 1994). Because of these ethical concerns, the U.S. Government does not allow federal funds to be used for research on germ-line gene therapy in people.

- At the ethical level we also need to ask the following questions:
- What is normal and what is a disability or disorder, and who decides? Are disabilities diseases?
- Do they need to be always cured or prevented?
- Does searching for a cure demean the lives of individuals presently affected by disabilities?
- Is somatic gene therapy (which is done in the adult cells of persons known to have the disease) more or less ethical than germ line gene therapy (which is done in egg and sperm cells and prevents the trait from being passed on to further generations)?
- In cases of somatic gene therapy, the procedure may have to be repeated in future generations. Can we give this burden to the future generation?

Preliminary attempts at gene therapy are exorbitantly expensive. Who will have access to these therapies? Who will pay for their use? The eradication of disease through germ-line therapy might not seem, by itself, to raise many ethical questions. After all, humans have eradicated the smallpox virus from the world, why not diseases with genetic components? Do doctors not have the moral obligation to provide the very best treatment to their patients and would not the eradication of the disease be more cost effective in the long run than continually treating adults with somatic gene therapy? The main ethical problem arises in defining a "treatable" disease. Some might say that eradication of a genetic disease for which there no treatment is and which is always fatal, should be pursued with all means possible. Others say that this would be the start of a slippery slope moving on toward the treatment of less obvious diseases and then to genetic enhancement.

Some argue that if the technology is advanced in order to eradicate some diseases, it will inevitably be used by parents wishing to "enhance" their children, giving them the genes for raven black hair and blue eyes or athletic prowess. It was serious ethical concerns about genetic enhancement that prompted the Council of Europe to adopt the Convention for the Protection of Human Rights and Dignity of the Human Being with Regard to the Application of Biology and Medicine: Convention on Human Rights and Biomedicine. Article 13 of the Convention states that "an intervention seeking to modify the human genome may only be undertaken for preventive, diagnostic or therapeutic purposes and only if its aim is not to introduce any modification in the genome of any descendants.

"Article 11 of the UNESCO (Universal Declaration on the Human Genome and Human Rights) states that "practices which are contrary to human dignity, such as reproductive cloning of human beings, shall not be permitted." It is left to individual states; however, to define exactly what they believe these practices to be. Thus, while some countries, such as the signatories to the European Convention, may prohibit germ-line therapy, others may not. It is the existence of national differences in regulation of research on human embryos that has allowed controversial research to be performed, for example, in Singapore. Regulation has thus slowed down the progress of research but not prevented it.

Another ethical consideration with respect to germ-line therapy is defining what is normal, what a disability is, and what a disease is. Which of the genetic variations within a population ought to be eradicated, if any? In trying to eradicate a certain variation, are we demeaning those in the population who currently carry the gene? Somatic gene therapy has its own, less controversial, set of ELS implications. These may be less ominous than eugenics but are of perhaps more immediate concern, given the more advanced state of the technology. Effectively, gene therapy involves the introduction of a properly functioning gene into target tissues in the hopes that it will be translated into a properly functioning protein, which will mask the malfunctioning protein. Often the new gene is placed into a modified virus, which is then introduced into a patient in the hope that the gene will be introduced into a tissue and properly expressed.

Such types of therapy, after much research on laboratory in animals, have now reached the clinical trial stage. Unfortunately, what works for a mouse does not always work for a human being. In one highly publicized case, a patient, Jesse Gelsinger, was given an injection of a virus in the hope of introducing a protein into the liver. Mouse studies showed good absorption of the gene into the liver; however, the mouse has a much higher concentration of viral receptors on its liver cells than do humans. The virus did not absorb well into the human patient and, for still unknown reasons, created a massive immune response, causing the patient to die. The original plan for the trials had been to use the virus only on children in a coma caused by the lack of the particular liver enzyme; however, ethical and safety reviews caused the researchers to change the trial direction and use adults only.

Many questions are now being asked regarding the ethics and scientific judgment of those performing such clinical trials. How well are "volunteer" patients informed of the possible risks and benefits? How objective are investigators who have equity in the companies that are funding the trials? One of the risks at this stage of gene therapy is the excessive public anticipation, created in part by some researchers, with respect to future benefits. This anticipation may turn to public distrust of science, if the benefits fail to be realized and problems such as that in the Gelsinger case continue to occur. Some clinical trials have shown positive results, and so there is still hope that somatic gene therapy will become a powerful medical tool (Green 2007).

4.4 LEGAL ISSUES

Medical therapies: Scientists are now discovering the genes which "trigger" various genetic diseases which, in turn, constitute a large part of the inherited causes of the suffering of humanity. For example, the genes which express Huntington's disease, a serious affliction, have been identified on the human genome. Their discovery permits the conduct of extremely accurate tests which can now identify those people who carry and may transmit this genetic condition. That knowledge would, theoretically, in combination with prenatal tests and abortion, permit the future elimination of carriers of Huntington’s. So we need to ask the following questions:

- Is such elimination of carriers of Huntington’s.desirable? Can it be distinguished from the abortion of a foetus with Down syndrome?
- Where does this process of medical elimination of the results of "defective" genes begin and end?

- Is there a less life-destructive means of using the genetic information to delay the onset or diminish the symptoms of Huntington's disease whilst respecting the life of a person born with those genes or others like it?

Criminal Law: For the lawyer, the discovery of genetic causes of disorders and of some antisocial conduct may have implications for the future. The criminal law is built upon a general hypothesis of free will. For the crime to be established it is normally necessary to prove both the act of the accused and the will occasioning that act. Some related issues are:

- What are the implications for the law of discovering that, in some cases at least, for some people, the act is practically nothing but the product of a genetic characteristic?
- Can we persist, in all cases, with the unquestioned hypothesis of free will in the face of scientific knowledge which casts doubt upon it?

- Privacy and Confidentiality: The basic rule of the healthcare professions has long been respect for the confidences of the patient. This rule goes back at least to the Hippocratic Oath. It existed in ancient civilisations.
- When a disorder is of a genetic characteristic, is the "patient" the individual or the entire family?
- Does a family in such circumstances have a right to override the wishes of the patient and to secure data about the patient's genes relevant to genetic features important for them all?
- Should a patient have a right not to know the determinants of his or her future medical conditions?

Third Party Interests: This last question leads to the rights of third parties. Should an employer have a right to require an employee to submit to genetic testing to show, with greater perfection, the likely future health status of the employee? Should an insurer be entitled to secure a detailed genetic profile of the insured? Until now, insurance has generally involved the sharing, within the community, of the risks attached to medical conditions which are largely unpredictable.

If such conditions can be predicted with perfect or near perfect accuracy, would that not shift the scales unfairly to the advantage of insurers? Where insurers can require those seeking insurance to submit to old-fashioned medical tests, is it sensible to close off knowledge of the best medical information that may be made available by genetic tests?

Intellectual Property: One of the key issues of genetic research concerns the desirability of permitting the patenting of human genes or their sequences as the basis for future therapeutic applications. Of course, in every country, the patentability of such matter depends upon the terms of the local law on intellectual property protection. That law is itself normally the product of national legislation and is often influenced by international law. At conferences on the genome, strong views are commonly expressed by participants from developing countries and elsewhere about this topic. They urge that the human genome is the common heritage of humanity. That it belongs to the human species as a whole - some say to God - and not to private corporations engaged in research, however potentially beneficial such research may prove to be. They point to the fact that Watson and Crick never attempted to secure the slightest commercial advantage for themselves from their discoveries.

Human Rights: An important element in UNESCO's Universal Declaration on Human rights and the Human Genome, to which I will now turn, is the attempt to reconcile the development of genetic technology and research on the human genome with fundamental human rights and human dignity inhering in every individual (Podimattom 2003).

4.5 SOCIAL ISSUES

The HGP is rich with promises, but also fraught with social implications. It is quite likely that the new knowledge from the HGP will be used in ways that don't always have to do with health. Our challenge is to reduce any negative impacts, which result from the misuse of genetic information. Researchers, scientists, business and governmental people who are involved in the HGP must avoid any activity that could cause harm while they pursue professional and personal goals.

On the other hand, individuals not directly participating in genetic research are responsible to educate themselves and seek information about potential risks and benefits of genetic research and about the interventions that it produces before they utilize new genetic technologies. Individuals with access to information about their genetic endowments will be able to predict their susceptibility to genetically related disorders in the future (Chan and Chia 2003). Threats evolve around the major question of whether or not an individual has access to genetic technologies. One type of threat occurs when individuals are denied access to technologies that would benefit them. The likelihood of genetic technologies becoming available to some peoples but not to others, and that a major determinant of access will be wealth, raises profound social issues. In view of Global collaboration the HGP should also has to deal with rules especially fair regulations that concern the access and uses of the new information.

The regulation of access of technologies and information obtained from the HGP should be handled very carefully and is probably one of the most difficult tasks for the future. This is especially true since the project has international dimensions and opinions on this issue differ among participating countries. That leads into another question, whether countries that do not directly contribute to the success of the HGP should be treated differently in terms of access to information and technologies being generated from the HGP.

Humans are the moral agents in this world with a capacity to think, evaluate, choose, communicate and articulate. It has been argued that the most significant issue genetic science forces on society concerns the understanding of human nature. Objectification also represents a fundamental breach of human dignity. To treat persons who are the sources of genetic material for cloning or persons who are created through cloning as mere objects, means or instruments violates the religious principle of human dignity as well as the secular principle of respect for persons.

Genetic Discrimination

One of the problems some fear might result from knowledge of the human genome is the emergence of a whole population of socially marginalized individuals, unable to obtain a job, a family, insurance, or health care and stigmatized by the rest of society. Insurance companies already insist that those identified at risk of Huntington's disease must take a genetic test. If the results are positive, insurance is frequently refused. Insurance companies are on record as saying that if genetic information was available, they would use it in their risk assessment.

In Canada, the refusal to insure a Huntington's patient does not have dire consequences; in general, public insurance covers many aspects of care, though the level of care varies across the country and the coverage for pharmaceuticals is less clear. In countries without a public health insurance system, however, the plight of such a non-insured person can be a nightmare. Care may be available but finding it is very difficult. As more genetic tests become available, insurance is likely to be more and more expensive for those carrying what the insurance companies deem to be risky genes.

The public insurance schemes may also start to feel the pressure for such genetic testing, and be forced to make policy decisions based on the funding available and the knowledge of genetic predisposition to disease within populations. Gene therapy is at the experimental stage at this point but will certainly be very expensive when it first comes into regular use. Who will pay for it? If not public insurance, will the therapy be available only to rich people, thus creating an ever widening gap between groups in society, based on both money and genetic inheritance? Employers may also want access to genetic information. Some genes might reveal a susceptibility to environmental damage that was incompatible with a certain workplace environment. Employers might choose to screen out workers carrying that gene rather than trying to improve the environment. Individuals with genes associated with certain behavioural traits might also be excluded from the workplace (Olyshevsky 2002).

Racial Discrimination

Although no genetic-employment discrimination case has been brought before U.S. federal or state courts, in 2001 the Equal Employment Opportunity Commission (EEOC) settled the first lawsuit alleging this type of discrimination. EEOC filed a suit against the Burlington Northern Santa Fe (BNSF) Railroad for secretly testing its employees for a rare genetic condition that causes carpal tunnel syndrome as one of its many symptoms. BNSF claimed that the testing was a way of determining whether the high incidence of repetitive-stress injuries among its employees was work-related. Besides testing for this rare problem, company-paid doctors also were instructed to screen for several other medical conditions such as diabetes and alcoholism. BNSF employees examined by company doctors were not told that they were being genetically tested. One employee who refused testing was threatened with possible termination.

On behalf of BNSF employees, EEOC argued that the tests were unlawful under the Americans with Disabilities Act because they were not job-related, and any condition of employment based on such tests would be cause for illegal discrimination based on disability. The lawsuit was settled quickly with BNSF agreeing to everything sought by EEOC. Besides the BNSF case, the Council for Responsible Genetics claims that hundreds of genetic-discrimination cases have been documented. In one case, genetic testing indicated that a young boy had Fragile X Syndrome, an inherited form of mental retardation. The insurance company for the boy's family dropped his health coverage, claiming the syndrome was a pre-existing condition. In another case, a social worker lost her job within a week of mentioning that her mother had died of Huntington's disease and that she had a 50% chance of developing it.

Despite claims of hundreds of genetic-discrimination incidents, an article from the January 2003 issue of the European Journal of Human Genetics reports a real need for a comprehensive investigation of these claims. The article warns that many studies rely on unverified, subjective accounts from individuals who believe they have been unfairly subjected to genetic discrimination by employers or insurance companies. Rarely are these subjective accounts assessed objectively to determine whether actions taken by employers and insurers were truly based on genetic factors or other legitimate concerns.

The cultural implications of the concept of gentrification come into full view when they search for genes that may for example explain alcoholism, homosexuality, aggressive behaviour, or difficulties in learning are the cases in point. While in the past certain types of individual behaviour were interpreted as representations of individual life choices within the parameters of a given society, Genetification of Life interprets these same choices as ultimately constituted at the genetic level and expression at the biological level "beyond freedom and dignity" (Nelson 1994).

Check Your Progress II
Note: Use the space provided for your answers.
1) How do you related the need for privacy and genetic determination?
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2) Briefly describe some of the social issues connected with Human Genome Project?
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4.6 CRITICAL REMARKS

The Human Genome Project also include work on identifying and addressing the ethical, legal, and social issues that are and will be created by this new knowledge. The societal concerns identified include:

- Fairness in the use of genetic information by insurers, employers, courts, schools, adoption agencies, and the military, among others.
- Privacy and confidentiality of genetic information.
- Psychological impact and stigmatization due to an individual's genetic differences.
- Reproductive issues, including adequate informed consent for complex and potentially controversial procedures, use of genetic information in reproductive decision making, and reproductive rights.
- Clinical issues, including the education of doctors and other health service providers, patients, and the general public in genetic capabilities, scientific limitations, and social risks; and implementation of standards and quality-control measures in testing procedures.
- Uncertainties associated with gene tests for susceptibilities and complex conditions(e.g., heart disease) linked to multiple genes and gene-environment interactions.

- Conceptual and philosophical implications regarding human responsibility, free will vs genetic determinism, aim concepts of health and disease.
- Health and environmental issues concerning genetically modified foods (GMFs) and microbes.
- Commercialization of products, including property rights (patents, copyrights, and trade secrets) and accessibility of data and materials. Commodification of Human beings will become a major concern as human beings would turn out to be marketing products.

4.7 SOME LARGE PHILOSOPHICAL ISSUES

The new breakthroughs in genetics will question the traditional/religious understanding of the concept of God, creation and death. Are we at the beginning of a New World, where we can attain immortality? We are at the stage of Playing God for the whole Universe? Here the famous Nietzsche words would be applicable. “Is man one of God’s Blunders? Or is God one of man’s blunders ". Science allows us to either transcend or arrest our own aging process. “Given all the responsibility to God and to our fellow human beings, do we have a right to let experimentations and ownership of new life move ahead without public regulation?” (Evans 2002)

One of the most interesting and profound changes is not with the biotech firms or venture capitalists but with the way we see ourselves. We live in a culture that links genes or DNA sequences to complex predispositions and patterns of behavior, usually without even bothering to think about what a gene actually is. Thus when we talk about a gene for crime and gene for love as if the gene determines the behavior by rigid mechanical chain of deterministic slavery (Chan and Chia 2003). It calls us to critically analyze the human responsibility, free will vs. genetic determinism. Designer drugs like Prozac and Ritalin have the effect of modifying and muting human diversity. It has a serious impact on human diversity, dignity and human rights based on our sense of innate human nature since it is the human nature that gives us moral sense and provides us with social skills to live in a society and serves as a ground for philosophical discussions of rights, justice and morality.

Genetics advancement must not act as a barrier in our life especially in taking responsibility for our lives and the choices we make. In Germany, there is a widespread opposition to learning a lot about human genetics The Hitler Nazi regime in Germany between 1933 and 1945 killed millions of Jews, Gypsies, mental patients, and disabled people in concentration camps in the name of the pseudoscience eugenics. Any suggestion that eugenic improvements may be feasible, as a result of gained knowledge from the HGP, are alarming signs and create strong objections to the sequencing of human genome. That eugenics philosophy which lead to the horrors of National Socialism in Germany have made many people appropriately sensitive to the potential abuses of genetic science.

Genetics shortens the gap between us and other species. However it widens the view of human variation (DeGrazia 2005). There are differences among us that go to the heart of our self and our personhood. What is then considered acceptable diversity? Where is the line between medical treatment and enhancement? These are the some of the important and significant questions for the philosophers to ponder. Genetic manipulation becomes arbitrary and unjust when it reduces life to an object, when it forgets that it is dealing with a human subject. Life is the supreme good of man. First of all, anything that is harmful to it must be opposed. Only then what is good must be sought out and pursued. The question before human beings is whether they are capable of seizing the moment of creative opportunity and deciding how to make this new technology serve the well- being of human kind. If they succeed in doing so, this will go down in history as crowning of life. On the other hand, if the human beings deal with it irresponsibly without giving their critical and reflective ability a chance, they might end up in clowning life which in no way is the choice of humanity.

4.8 LET US SUM UP

Many of the ethical, legal and social issues that are being discussed with respect to the Human Genome Project are not new. Genetic tests for a variety of diseases are currently available and some people are already struggling with the ethical and practical implications. What will change over the next few years, as a result of the Human Genome Project, is the scale of the issues and how society will have to cope with the greyer areas of genetic disease and disability. Dealing with a single gene that causes death or chronic disability is one issue; dealing with whole sets of genes whose impacts vary depending on environmental interactions is another.

The rate of scientific advancement has tended to outstrip the legislative capacity of governing bodies and there has been some media "overhype" with respect to genetic research and its potential for treatment of disease. It will be years before many of the genetic tests are available and before genetic diseases can be treated. Society as a whole must use this time to discuss and decide on how genetic information ought to be used, before the choices are made for them. It is a discussion that those with genetic dispositions to diseases such as Huntington's have long wanted to make more public.

The Human Genome Project is a remarkable breakthrough in medical science and biological study and while there are ethical questions about the use of the information, overall, knowing the map of the human genome has allowed incredible medical breakthroughs in recent years. Processes such as genetic testing and gene therapy have created more awareness about certain inherited diseases such as cystic fibrosis and sickle cell anaemia and have helped countless people alter their lifestyles so they do fall prey to diseases such as Alzheimer's or breast cancer, which are both inherited susceptibilities. While there are still moral questions to be answered, such as those addressing the issue of altering the genome of unborn children, the Human Genome Project can certainly be identified as a benefit to the world when the data is handled by the right people? So in this unit we have taken up some of the basic ethical, legal, social and philosophical issues related to Genetic Engineering. Larger discussion and debate on these issues are really needed.

Check Your Progress III

Note: Use the space provided for your answers.s.

1) What is commodification of human beings?

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2) Describe some of the larger philosophical issues dealing with genetic engineering?

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4.9 KEY WORDS

Commodification: The tendency to treat humans beings as commodities or objects for use.

GM: Genetically modified (GM) foods are foods derived from genetically modified organisms. Genetically modified organisms have had specific changes introduced into their DNA by genetic engineering techniques.

GMO: A genetically modified organism (GMO) or genetically engineered organism (GEO) is an organism whose genetic material has been altered using genetic engineering techniques

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Indira Gandhi National Open University
School of Interdisciplinary and
Trans-disciplinary Studies

MPYE – 013

Philosophy of Technology

Block 3

CONSCIOUSNESS: ARTIFICIAL INTELLIGENCE AND NEUROTHEOLOGY

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Programme Coordinator
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IGNOU, New Delhi.

BLOCK INTRODUCTION

The problem of consciousness and human mind has been away from the scientific arena for a long time since many scientists considered it as a philosophical problem. But with the emergence of neuroscience as a well-established discipline and with the technological advancements by developing new methods of brain mapping neuroscientists also find it plausible to delve into this 'hard problem' Consciousness, as many hold, is a multi-dimensional phenomenon. However scientists like Francis Crick and the Paul Churchland firmly believe that this is the opportune time to begin the scientific attack on consciousness. Crick's astonishing hypothesis is that "it's all done by neurons" The brain after millions of years of evolution has developed the capability to conceptualize religious thoughts and feelings. Boyer is critical of neuroimaging for religious purposes. Neurotheology is primarily concerned with identifying the mechanisms underlying brain functions leading to the conceptualization of God, moral values, spiritual experience, guilt, faith and transcendental longings that have become an integral part of human personality. It does not address the subject of experience, beliefs, inner promptings that may belong to another dimension of reality, are also necessarily brain based.

Unit 1 introduces the key notion of artificial intelligence. In the first section, it focuses on the various definitions of artificial intelligence, and organize it into the four categories which are, systems that think like humans, systems that act like humans, systems that think rationally and systems that act rationally. In the second and third sections, we will explore the field of AI, and the issue of what computers can do, respectively.

Unit 2 is to understand the philosophical presuppositions of artificial intelligence; especially, the nature of mind as presupposed by artificial intelligence. Artificial intelligence as a programme in cognitive science is based on many theoretical presuppositions like the distinction between natural and artificial intelligence, the information-processing character of mental representations, the idea of mind as a computer, and so on. The nature of cognition is a complex process which needs to be studied for understanding the nature of artificial intelligence.

Unit 3 gives general overview of neurological studies to figure out the important fields of neurology and to see the relationship between neurology and consciousness. We first deal with the history of neurology. Then we deal with the development of brain leading to the evolution of consciousness. The word Neurology comes from the Greek word *neurologia* and deals with *disorders of the_nervous system*. Neurology can be defined as the medical specialty concerned with the diagnosis and treatment of disorders of the nervous system -the brain, the spinal cord, and the nerves.

Unit 4 enumerates some aspects of the relationship between neurological studies and religious experiences. It relates also some aspects of mystical experience through neurology. The discipline studies the cognitive neuroscience of religious experience and spirituality. Neurotheology is in fact primarily concerned with the mechanisms underlying brain functions like the conceptualization of God, moral codes, spiritual experiences, guilt, faith and transcendental longings that are an integral part of the human personality.

UNIT 1 ARTIFICIAL INTELLIGENCE (AI): KEY NOTIONS

Contents

1.0 OBJECTIVES

The objective of this unit is to introduce the key notion of artificial intelligence. . In the first section, we will focus on the various definitions of artificial intelligence, and organize it into the four categories which are, systems that think like humans, systems that act like humans, systems that think rationally and systems that act rationally. In the second and third sections, we will explore the field of AI, and the issue of what computers can do, respectively.

1.1 INTRODUCTION

The object of research in artificial intelligence (AI) is to discover how to program a computer to perform the remarkable functions that make up human intelligence. This work leads not only to increasing use of computers, but also to an enhanced understanding of human cognitive processes which constitute what we mean by 'intelligence', and the mechanisms that are required to produce it. What is needed is a deeper understanding of human intelligence and the human mind. The basic tenet of this thesis is that the brain is just a digital computer and that the mind is a software program. In the last section, we will focus on the relation between AI and the functional theory of mind.

1.2 WHAT IS ARTIFICIAL INTELLIGENCE?

It is difficult to give a precise definition of artificial intelligence. Some recent artificial intelligence scientists have attempted to define artificial intelligence (in short AI) in various ways. According to Haugeland, artificial intelligence is, "the exciting new effort to make computers think … machines with minds, in the full and literal sense (1985)" For Bellman, it is "the automation of activities that we associates with human thinking, activities such as decision making, problem solving, learning…(1978)." Charniak and McDermett define AI as "the study of mental faculties through the use of computational model(1985)." And for Winston, it is "the study of the computations that make it possible to perceive, reason and act (1984)" AI, for Kurzweil is "the art of creating machines that perform functions that require intelligence when performed by people (1990)." Rich and Knight say that AI is "The study of how to make computers thinks at which, at the movement, people are better (1984)" For Schalkoff, AI is "a field of study that seeks to explain and emulate intelligent behavior in terms of computational process (1990)" Luger and Stubblefield hold it to be "the branch of computer science that is concerned with the automation of intelligent behavior (1993)"

Let us look at all the definitions from different angles. Haugeland and Bellman point out that artificial intelligence is concerned with thought process and reasoning. They have explained the mind as a machine that is completely associated with human thinking. That is to say, computers do think. But Schalkoff, Luger and Stubblefield are concerned with the behavioural aspects of systems. For them, computers behave as intelligently as human beings. Moreover, Kurzweil, Rich and Knight are concerned with or measure success in terms of human performance. For them, artificial intelligence can be attributed to machines, but it belongs basically to the human mind. At last, Charniak, McDermett and Winston are concerned with an ideal intelligence. They explain the mental faculties through the use of computational models.

To sum up, all the definitions of AI can be organized into four categories. They are as follows:

(i) Systems that think like humans.
(ii) Systems that act like humans.
(iii) Systems that think rationally.
(iv) Systems that act rationally.

Now, we have to look at each aspect in detail.

(i) Acting Humanly: Turing Machine Approach

The Turing test, as named after Alan Turing, was designed to provide a satisfactory operational definition of intelligence. Turing defined that intelligent behavior as the ability to achieve human-level performance in all cognitive tasks to fool an interrogator.[10] In his 'C*omputing Machinery and Intelligence*', Turing says the new form of the problem can be described in terms of a game which we call the '*imitation game*.' It is played by a man (A), a woman (B), and an interrogator (C) who may be of either sex. The interrogator stays in a room apart from the other two. The object of the game for the interrogator is to determine which of the other two is the man and which is the woman. He or She knows them by labels X and Y, and at the end of the game, he or she says, either 'X is A and Y is B' or 'X is B and Y is A.' The interrogator is allowed to put questions to A and B. Thus, C: will X please tell me the length of his or her hair?

Now suppose X is actually A, then A must answer to the question. It is A's object in the game to try to cause C to make the wrong identification. His or her answer might therefore, be 'my hair is singled, and the longest strands are about nine inches long.'

However, because the tones of voice may not help the interrogator, the answer should be written or better still be typewritten. The ideal arrangement is to have a tele-printer for perfect communication. Alternatively, an intermediary can repeat the questions and answers. The object of the game for the second player (B) is to help the interrogator. The best strategy for her is probably to give truthful answers. She can add to her answer such things as 'I am the woman, do not listen to him,' but it is of no avail as the man can make similar remark.

Now, we can ask the question, what will happen when a machine takes the part of A in this game? Will the interrogator decide wrongly as often when the game is played like this as he does when the game is played between man and a woman?

Turing's answers to these questions are more or less summed up in the following passage; "I believe that in about fifty years time it will be possible to program computers, with a storage capacity of about 10^9, to make them play the imitation game so well that an average interrogator will not have more than 70 percent chance of making the right identification after five minutes of questioning (1950)"

What Turing had predicted at that time, now is a fact that the machine or the computer can imitate human behaviuor. It should be pointed out that Turing's beliefs about the capabilities and capacities of machines are not limited to such activities as playing the imitation game as successfully as human beings. Roughly speaking, the test Turing proposed is that the computer should be interrogated in the place of human beings.

Turing's test deliberately avoided direct physical interaction between the interrogator and the computer, because physical limitation of a person is unnecessary for intelligence. However, the so-called Turing test includes a-video signal so that the interrogator can test the subject's perceptual abilities. In order to pass through total Turing test, the computer will need computer vision to perceive objects and robotics to move them. Again, the issue of acting like a human comes up primarily when artificial intelligence programs have to interact with people, as when expert system explains how it came to its diagnosis, or a natural language processing system has a dialogue with a user. These programs must behave according to certain normal covertness of human interaction in order to make them understood. The Turing test shows that machines can interact with human beings the way human beings interact amongst themselves. That is to say that machine can behave the way the human beings do.

(ii) Thinking Humanly: The Cognitive Modeling Approach

The interdisciplinary field of cognitive science brings together computer models from Artificial Intelligence and experimental techniques from cognitive psychology to try to construct precise and testable theories of the workings of the human mind. And if we are going to say that a given program thinks like a human being, we must have some way of determining how human beings think. For that, we need to get inside the actual workings of the human mind. Stuart Russell and Peter Norvig say that there are two ways to do this: through introspection–trying to catch our own thoughts as they go by –or through psychological experiments. Once we have a sufficiently precise theory of the mind, it becomes possible to express the theory as a computer program. If the program's input/output and timing behavior matches human behaviour, that is evidence that some of the program's mechanisms may also be operating in humans.

Now it is almost taken for granted by many psychologists that a cognitive theory should be like a computer program. But we know that cognitive science is the science of mind. Therefore cognitive scientists seek to understand perceiving, thinking, remembering, understanding language, learning and other mental phenomenon. Their research is remarkably diverse, ranging from observing children's mental operation, through programming computers to do complex problem solving, to analyze the nature of meaning. In order to appreciate the work in artificial intelligence, which is a necessary part of cognitive science, it is necessary to have some familiarity with theories of human intelligence. The cognitive scientists introduce the notion of machine intelligence and emphasize the relationship between human and machine intelligence. The aim of artificial intelligence is to develop and test computer programs that exhibit characteristic of human intelligence. The most fundamental contribution of symbolic computational modeling has been the physical symbol system hypothesis. According to Newell and Simon, a physical symbol system has the necessary and sufficient means for general intelligent action. By 'necessary' we mean that any system that exhibits general intelligence will prove upon analysis to be a physical symbol system. By 'sufficient' we mean that any physical symbol system of sufficient size can be organized further to exhibit general intelligence. Lastly, by 'general intelligent action' we wish to indicate the same scope of intelligence as we see in human action; that in any real situation behaviour appropriate to the events of the system and adaptive to the demands of the environment can occur within some limits.

However, the ability of computer simulations to model such process is interpreted as a proof of the broader claim that a symbol system is at the center of human intelligence. In this hypothesis it shows that intelligence is an essential aspect of machines. If the machines have the capacity of intelligence, intelligence is the essence of human cognitions. Therefore, machines have cognitive capacity like the human beings. In the cognitive modeling approach, thus, human beings and machines show the property of being intelligent.

(iii) Thinking Rationally: The Laws of Thought Approach

"Right thinking" is the inferential character of every reasoning process. Aristotle in his famous syllogisms provided patterns of argument structures that always give correct conclusions from given correct premises. In the syllogisms, the Laws of Thought play a vital role because these give law the right explanation of a syllogistic inference. There are three Laws of Thought recognized by the logicians. These have traditionally been called the law of Identity, the law of Contradiction, and the law of Excluded–Middle. These Laws of Thought are appropriate to different contexts. The formulations appropriate as follows:

a) The law of Identity asserts that *if any statement is true, then it is true.* This law asserts that every statement of the form $P \supset P$ is true, and that every such statement is a tautology.
b) The law of Contradiction asserts that *no statement can be both true and false*. This law asserts that every statement of the form $P \;.\; {\sim}P$ is false, that is, every such statement is self-contradictory, and its negation is logically true.
c) The law of Excluded-Middle asserts that *any statement is either true or false*. This law asserts that every statement of the form $P \vee {\sim}P$ is true, that is, every such statement is a tautology.

In the 'Laws of Thought' approach to artificial intelligence, the whole emphasis is on correct syllogistic inferences. For example-

"Socrates is a man;
All men are mortal;
Therefore, Socrates is mortal."

In this inference, the conclusion is based on the premises according to the rules of inference. The above syllogistic inference is the best example to formulate an AI program. In all reasoning of this type the emphasis is on the logical inference of a conclusion from the premises. In the AI programme this type of logical inference is of much use since this programme provides a variety of logical reasoning. In an inference, a set of variables, a set of constant terms, a set of functions, the set of connectives *if, and, or,* and, *not,* the quantifiers *'exists'* and *'for all'* are the most important symbols to build an AI program. All these constants and variables are the arbitrary representations of the world. With the help of these symbols, the so-called logistic tradition within artificial intelligence hopes to build on such programs to create intelligent systems.[17]

(iv) Acting Rationally: The Rational Agent Approach

Here, the word 'agent' refers to mechanical agent (computer). Acting rationally means acting so as to achieve one's goal, given one's beliefs. An agent (mechanical) is something that perceives and acts. Stuart Russell and Peter Norvig point out that making correct inferences is a part of being a rational agent because one way to act rationally is to reason logically to the conclusion that a given action will achieve one's goals, and then to act on that conclusion.

According to them, the study of artificial intelligence as rational agent design therefore has two advantages. First, it is more general than the 'laws of thought' approach, because correct inference is only a useful mechanism for achieving rationality, and not a necessary one. Second, it is more amenable to the scientific development than approaches based on human behavior or human thought, because the standard of rationality is clearly defined and completely general. As we have seen, an agent is something that perceives and acts in an environment. The job of artificial intelligence is to design the agent program, that is a function that implements the agent mapping from percepts to action. We assume this program will run on some sort of computing device A human agent has eyes, ears, and other organs for sensors, and hands, legs, mouth and other body parts for effectors. The relationship among agents, architectures, and programs can be summed up as:

Agent = Architecture + Program.

The agent is autonomous to the extent that its behaviour is determined by its own experience. A truly autonomous intelligent agent should be able to operate successfully in a wide variety of environments, given sufficient time and scope. But before we design an agent, we must have a pretty good idea of the possible percepts and actions, the agent's goal is supposed to achieve, and what sort of environment it will operate in it.

Again, as we have mentioned, an agent is just something that perceives and acts. In this approach, artificial intelligence is viewed as the study and construction of a rational agent. One of the important factors is that correct inference is not the whole of rationality. There are also ways of acting rationally that cannot reasonably be said to involve inference. For example, pulling one's hand off a hot stone is a reflex action that is more successful than a slower action taken after careful deliberation.

1.3 THE FIELD OF ARTIFICIAL INTELLIGENCE

Artificial intelligence is a new research area of growing interdisciplinary interest and practical importance. People with widely varying backgrounds and professional knowledge are contributing new ideas and introducing new tools into this discipline. Cognitive minded psychologists have developed new models of the mind based on the fundamental concepts of artificial intelligence, symbols systems and information processing. Linguists are also interested in these basic notions while developing different models in computational linguistics. And philosophers, in considering the progress, problems and potential of this work towards non-human intelligence, have sometimes found solution to the age-old problems of the nature of mind and knowledge. However, we know that artificial intelligence is a part of computer science in which are designed intelligent systems that exhibit the characteristics we associate with intelligence in human behaviour, understanding language learning, reasoning, problem solving, and so on. It is believed that insights into the nature of the mind can be gained by studying the operation of such systems. Artificial intelligence researchers have invented dozens of programming techniques that support some sort of intelligent behaviour.

Now the question is: Is artificial intelligence a science or an Art? According to Tanimoto, the activity of developing intelligent computer systems employs both proved mathematical principles, empirical results of studying previous system, and heuristic, pragmatic programming techniques. Information stored in rational data structures can be manipulated by well–studied techniques of computer science such as tree searching algorithms. At the same, experimental or vaguely understood 'rules of thumb' for problem solving are often crucial to the success of a system and must be carefully accommodated in intelligent systems. Thus artificial intelligence is both an art and a science. It is a science because it develops intelligent computer systems by employing proved mathematical principles. It is an art because it designs systems by employing programming techniques. Information stored in relational data structure can be manipulated by well-studied techniques of computer science such as tree searching diagram. Thus, the field of artificial intelligence is fascinating because of this complementing of art and science.

Artificial intelligence research may have impact on science and technology in the following way:

- **(i)** It can solve some difficult problems in chemistry, biology, geology, engineering and medicine.
- **(ii)** It can manipulate robotic devices to perform some useful, repetitive, sensory-motor tasks;

Besides, artificial intelligence researchers investigate different kinds of computation and different ways of describing computation in an effort not just to create intelligent artefacts, but also to understand what intelligence is. According to Charniak and McDermott, their basic tenet is to create computers which think. Thus AI expands the field of intelligent activity of human beings in various ways. Now the question is: What would the world be like if we had intelligent machines? What would the existence of such machines say about the nature of human beings and their relation to the world around them? These questions have raised profound philosophical issues which will be discussed in due course.

The hypothesis of artificial intelligence and its corollaries are empirical in nature whose truth or falsity is to be determined by experiment and empirical test. The method of testing the results of artificial intelligence is of the following types:

(i) In the narrow sense, artificial intelligence is part of computer science, aimed at exploring the range of tasks over which computers can be programmed to behave intelligently. Thus it is the study of the ways computers can be made to perform cognitive tasks, which generally human beings undertake.

(ii) In the wider sense, artificial intelligence is aimed at programs that simulate the actual processes that human beings undergo in their intelligent behaviour. And these simulation programs are intended as theories describing and explaining human performance. But they are tested by comparing the computer output with the human behavior to determine whether both the result and also the actual behavior of computers and persons are closely similar.

A digital computer is an example of a physical symbol system, a system that is capable of inputting, outputting, storing, etc., following different courses of operation. These systems are capable of producing intelligence depending on the level of mechanical sophistication they are. The computers with these capabilities behave intelligently like human beings, according to the AI researchers.

One of the important tenets of cognitive science is that it stresses the relationship between human and machine intelligence. It is interested in using artificial intelligence techniques to enlighten us about how human beings do intelligent tasks.[24] For example, in getting a machine to solve geometric or integral calculus problems, we are also interested in learning more about the power and flexibility of the human capacity for problem solving. Thus, the AI researcher attempts to develop and test computer programs that exhibit characteristics of human intelligence. The AI researcher always works with an artifact, which is only inferentially related to the human mind. As Boden says, The ‘machines’ in question are typically digital computers, but artificial intelligence is not the study of computers. But it is the study of intelligence in thought and action. Moreover, as Bonnet would say, artificial intelligence is the discipline that aims to understand the nature of human intelligence through the construction of computer programs that imitate intelligent behaviour.

Further, Bonnet says, we cannot define human intelligence in general we can highlight a number of criteria by which it can be judged, such as the ability to make abstractions or generalizations, to draw analogies between different situations and to adopt new ones, to detect and correct mistakes in order to improve future performance, and so on. AI is concerned with the intelligent properties of the computational systems, which perform many intelligent tasks. These tasks can be of very varied nature, such as, the understanding of a spoken or written text in a natural language, playing chess, solving a puzzle, writing a poem, making a medical diagnosis, finding one’s way from Hyderabad to Delhi. The AI programme selects such activities include information and reasoning processes which are part of any intelligent system.

Artificial intelligence includes commonsensical tasks, such as understanding English language, recognizing scenes, finding a way to reach an object that is far overhead, heavy and frigid, and making sense of the plot of a mystery novel. In addition, artificial intelligence includes expert tasks, such as diagnosing diseases, designing computer systems, locating mineral deposits, and planning scientific experiments. The techniques that artificial intelligence applies to solve these problems are representation and inference methods for handling the relevant knowledge, and search based problem-solving methods for exploiting that knowledge. Although the tasks with which artificial intelligence is concerned may seem to form a very heterogeneous set, in fact, they are related through their common reliance on techniques for manipulation of knowledge and conducting search which we will discuss in the next section.

1.4 WHAT COMOUTERS CAN DO

Within the scientific discipline of artificial intelligence, there are several distinct areas of research, each with its own specific interests, research techniques, and terminology. However, as Avron Barr and Edward A. Feigenbaum point out, artificial intelligence is part of computer science concerned with designing intelligent computer systems, that is, systems that exhibit the characteristics we associate with intelligence in human behavior such as understanding language, learning, reasoning, solving problems and so on.

In artificial intelligence, this specialization includes research on language understanding, automatic programming, and several others. The following discussion of the status of artificial intelligence attempts to show the sub–fields identifying some aspects of intelligent behaviours and indicating the state of relevant research. Like the different sub–fields of artificial intelligence, the different behaviours discussed here are not at all independent; separating them out is just a convenient way of indicating what current artificial intelligence programs can do.

(i) The Problem Solving

The first big successes in artificial intelligence were programs that could solve puzzles and play games like chess. Techniques like looking ahead several moves and dividing difficult problems into easier sub-problems evolved in the fundamental artificial intelligence techniques of search and problem reduction. Another problem solving program that integrates mathematical formulas symbolically has attained very high level of performance and is being used by scientists and engineers. According to Avron Barr and Edward A. Feigenbaum, human beings often solve a problem by finding a way of thinking about it that makes the solution easy, but so far, artificial intelligence programs must be told how to think about the problems they solve.

Elaine Rich defines problem solving, as that which chooses the best technique(s) and applies it (them) to the particular problem. Another view is that a goal and a set of means of achieving the goal are called a problem solving. Before an agent can start searching for solutions, it must formulate a goal and then use the goal to formulate a problem. According to Stuart Russell and Peter Norvig, a problem consists of four parts. The initial state, a set of operators, a goal test function, and a path cost function. The environment of the problem is represented by a state space. A path through the state space from the initial state to a goal state is a solution. And a search can be judged on the basis of completeness, optimality, time complexity, and space complexity. There are different search paths for an intelligent agent. The agent has to search which is the minimum path to reach the goal. To solve a problem is the main task of the agent in artificial intelligence.

Moreover, one of the important searches in artificial intelligence is the technique of 'heuristic' search. The word 'heuristic' is derived form the Greek verb '*heuriskein*', meaning 'to find' or 'to discover'. Some people use heuristic as the opposite of algorithmic. According to Newell, Shaw and Simon, process that may solve a given problem, but offers no guarantees of doing so is called a heuristic for that problem.We know that heuristic techniques dominated early application of artificial intelligence. Heuristic method is still used in problem solving. For example, game playing is also a form of problem solving. Games have engaged the intellectual faculties of the humans. And game playing is also one of the oldest areas of endeavour in artificial intelligence. A chess-playing computer is a proof of a machine doing something though intelligence. Furthermore, the simplicity of the rules and their application in the program implies that it is easy to represent the game as a search through a space of possible game positions.

The initial state, the operators, a terminal test, and a pay-off function can define a game. According to Carpenter and Just, an intelligent machine can follow all these rules and play more efficiently than human beings. For example, in speed chess, computers have defeated the world champion, Gary Kosparov, in both five-minutes and twenty five minutes games. Such a system would be a significant achievement not just for game playing research, but also for artificial intelligence research in general, because it would be much more likely to be applied to the problem faced by a general intelligent agent. There are so many kinds of search in order to solve a problem. But we are not explaining the entire search. We are mainly concerned with how artificial intelligence programs solve different problems within a few seconds.

(ii) Natural Language Processing

The most common way that people communicate is by speaking or writing in one of the natural languages like, Hindi, English, French or Chinese. However, the computer-programming language seems to differ from human languages. These 'artificial' languages are designed so that sentences have a rigid format, or syntax, making it easier for compliers to phrase the programs and convert them into the proper sequences of computer instructions. Besides, being structurally simpler than natural language, programming language can easily express only those concepts that are important in programming: 'Do this, then do that', 'See whether such and such is true'.

One of the important facts is that if computers could understand what people mean when people use English language, the systems would be easier to use and would fit more naturally into people's lives. Artificial intelligence researchers hope that learning how to build computers that can communicate as people do would extend our understanding of human language and mind. The goal of cognitive linguistics is to specify a theory of language comprehension and production to such a level of detail that a person could write a computer program that could understand and produce natural language. Thus, the intelligent machine program has the capacity to understand natural language. It also responds to questions in an appropriate manner. Thus, if the question were 'Is Rome the capital of France?' the simple reply 'No' would be appropriate but, 'no, it is Paris,' or, 'No, Rome is the capital of Italy' would be more complex. Machine programs would also be able to explain the meaning of the word in other terms and also to translate from one language to another.

(iii) Machine Vision

Vision is the information processing of understanding a scene from its projected images. An image is a two-dimensional function (X, Y) obtained, with a sensing device that records the value of an image feature at all points (X, Y). Images are converted into a digital form for processing with a computer. The task of a computer-vision system is to understand the scene that an imaginary of pixels depicts. Generally, machine vision means the vision of a machine that can see or perceive the things in the world. According to David Marr, vision is the process of discovering form images what is present in the world, and where it is. Thus, vision is, first and foremost, an information-processing task. Moreover, there is a distinction between human vision (perception) and machine vision, because human vision is defined as the eye is just a sensor; the visual cortex of the human brain is our primary organ of vision. In the case of human vision, the sensory organ necessarily forms a representation or physical encoding of the received information that facilitates the answering of some questions about the environment, but makes it extremely difficult to answer others. For example, an examination of the encoded information produced by the human eye reveals that at any instant of time the eye has sensed only a small part of the electromagnetic spectrum, and has extracted an image of the scene from a particular viewpoint in space. It possesses the visual information with the help of the lens fitted within it. Thus machine vision works more or less like human vision.

Learning is now perceived as a gateway to understanding the problem of intelligence. Because seeing is also intelligence, seeing is also learning which is a key to the study of intelligence and biological vision. Visual neuroscience develops the methods of understanding how human visual systems work. Visual neuroscience is beginning to focus on the mechanisms that allow the cortex to adapt its circuitry and learn a new task. Machine vision as a part of the AI programme, however, tries to develop systems that can simulate human vision.

(iv) Machine Learning

Learning for an intelligent agent is essential for dealing with unfamiliar environments. Learning a function from examples of its input and output is called inductive reasoning. According to Bonnet, the ability to learn is one of the fundamental constituents of intelligence, 'learning' being understood in its general sense as indicating the way in which the humans and animals can increase their stock of knowledge and improve their skill and reasoning powers.

Moreover, from the very beginning of artificial intelligence, researchers have sought to understand the process of learning and to create computer programs that show learning behaviour. Ordinarily, learning is a very general term denoting the way in which people increase their knowledge and improve their skills. There are two fundamental reasons for studying learning. One is to understand the process itself. By developing computer models of learning, psychologists have attempted to gain an understanding of the way humans learn. Philosophers since Plato have also been interested in the process of learning, because it might help them understand and know what knowledge is and how it grows.

The second reason for learning research is to provide computers with the ability to learn. Learning research has potential for extending the range of problems to which computers can be applied. In particular, the work in machine learning is important for expert systems development, problem solving, computer vision, speech understating, conceptual analysis of databases, and intelligent authoring systems. In this way, a computer can do more work than human beings. According to James R. Slagle, computers can do arithmetic at an unbelievable speed, and no human can compete with them. Besides, computers can do many other odd jobs like detecting a certain disease from the available data.

1.5 LET US SUM UP

Thus, AI as a study of machine intelligence, especially of computers and robots, opens up new vistas of understanding mind and intelligence. Intelligent behaviour can be studied in many dimensions. This is made possible by the invention of computers as high-processing computing machines. The computers can do many things that seem to require intelligence and other mental abilities.

1.6 KEY WORDS

Artificial Intelligence, Turing Machine, and Physical Symbol System

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UNIT 2 PHILOSOPHICAL IMPLICATIONS

Contents

2.0 OBJECTIVES

In this unit, an attempt will be made to understand the philosophical presuppositions of artificial intelligence; especially, the nature of mind as presupposed by artificial intelligence. Artificial intelligence as a programme in cognitive science is based on many theoretical presuppositions like the distinction between natural and artificial intelligence, the information-processing character of mental representations, the idea of mind as a computer, and so on. The nature of cognition is a complex process which needs to be studied for understanding the nature of artificial intelligence.

2.1 INTRODUCTION

Cognition involves issues how we acquire, store, retrieve, and use knowledge. If we use cognition every time and acquire a bit of information, place it in, or use that information in some way, then cognition must include a wide range of mental processes. Cognition, generally, is a process in which information is encoded in the brain by receiving signals from the outer world through the sense organs. It seems that human cognition is largely different from that of other animals because of the enormous richness of the human cognitive process.

2.2 THE NATURE OF COGNITION IN MACHINES

There are different models of understanding cognition such as the neuro-scientific, psychological, representational, connectionist and computational model. These six approaches explain cognition from different standpoints. Neuroanatomy is the study of the nervous system's structure, and is concerned with identifying the parts of the nervous system and describing how the parts are connected to each other. Neuroanatomy can be made at many descriptive levels. According to neuroscientists, investigation can be made at two levels. Firstly, gross neuroanatomy is about general structures and connections, whereas fine neuroanatomy is the main task that describes the components of individual neurons. Secondly, histology is the study of tissue through dissection. The primary concern of neuroanatomy is to ideally connect the patterns of connectivity in the nervous system, and to layout the mechanism that allows information to get from one place to another. For neuroscientists, this neuroanatomy is the analogy of cognition.

While explaining neuro-scientific approach to cognition, Francis Crick, a famous neuro-scientist observes that the brain does not make a distinction between hardware and software, as a computer does. Theories [of thought] have made this distinction are unfortunate. Crick argues for theories of cognition that are strictly tied to biology, which implicitly force him to argue for the study of simple cognitive acts, such as visual word detection, rather than the complex acts such as paragraph comprehension, etc. For neuroscientists, mental action depends on the psycho-neurological factors underlying in it. No mental action is without these factors which determine the mental history of an agent. Although Crick's general discussion is on the concept of conscious thought; virtually all the specific studies he cites deal with visual cognition. For him, it might be most profitable to deal with vision entirely within the field of neuro-science, while dealing with language comprehension in terms of psychological machines has no known neural basis. Cognition is a multi-dimensional process which needs a many-sided approach.

The psychological approach to cognition is defined as the psychology of understanding and knowing. It is also the study of mental processes. It is concerned with the way we take in information from the outside world, and how we make sense of that information, and what use we make of it. According to Groome, there have been three main approaches to the study of cognitive psychology, namely, experimental psychology, computer modelling, and cognitive neuropsychology. Firstly, experimental psychology involves the use of psychological experiments on human subjects to investigate the ways in which we perceive, learn, remember or think. Secondly, cognitive psychology is the use of computer modelling of cognitive processes. This approach involves the simulation of some aspects of human cognitive function by writing computer programs, in order to test out models of possible brain function. Lastly, cognitive neuropsychology is concerned with the activities of the human brain during cognitive processing. These three approaches of cognitive psychology explain the psychological levels of cognitions.

The representational theory of cognition tries to show how our knowledge of the world is represented in the mind. When human knowledge is represented in an abstract format, we call it propositions. Thus all knowledge representations take place in language. The representational theory studies the mental representation in a formal language called language of thought by Jerry Fodor. A representation is something that stands for something else. For example, the words of any human language are forms of a representation because they stand for objects, events, and ideas; words are an abstract representation because the relation between a word and the object signified or the idea it represents is arbitrary; words in other language can refer to the same objects and ideas, and in few cases the referent of a word cannot be predicted from its auditory form. But in the case of mental representations, mind preserves information about objects or events in the world. For example, when we have a mental representation of table and this representation preserves locations of objects in the space, it supports a number of abilities, including imaging the place, estimating distance from memory, and so on. This mental representation is necessary because human behaviour cannot be explained without specifying how individuals represent the world to themselves.

According to cognitive scientists, all cognitive processes are computational processes, and all computational processes require internal representations as the medium of computation. And then the nature of this medium is such that the internal representations are symbols. The symbol-system facilitates the computational processes. Computational modelling in cognitive science and artificial intelligence has profoundly affected how human cognition is viewed and studied.

Computational levels of cognitions show that the mind is a computer, which is based on symbolic computation. In symbolic computation, the abstractions provided are symbols and rules. But according to the classical computational theory of mind, mental representations are symbolic structures, and the mental processes consist in the manipulation of these representations according to symbolic algorithms as computation is based on symbolic rules.

Herbert Simon, one of the founders of Computer Science, discusses the nature of cognition while constructing models of human mental activity. According to him, cognition is a mental process based on mechanisms of the brain. The brain mechanisms can be studied by neurophysiology. Further, he argues that human brain functions like a computer so that the human cognitive processes are computational in nature. Therefore, if we manage to programme a computer to play chess, we may well have discovered how human thought proceeds. Thus, Simon argues for a sharp distinction between the brain as a physical system and the programs the brain executes; and therefore, he urges us to concentrate our attention on the program. A great deal of the modern study of cognition depends on the insight that representational level and neural level events can be linked through the development of intermediate, computational theories of thought. Newell and Simon point out that this insight is based upon a rather sophisticated notion, both of thinking and computation as activities that are carried out by physical symbol systems.

As we know, a machine or computer is a physical device that manipulates electrical signals that stand for the symbols in the equation. The physical systems translate signal system into a symbol system. Computers and engineer-paper-pencil devices are general computing systems in the sense that they can, in principle, compute any computable function that is defined by a symbol system. In order to actually compute something, the physical device must be given a set of instructions which are stated in terms of symbols. Thus computing systems operate systems of symbols to arrive at results. We have to note that the algorithm is not stated in terms of the physical machine, because the physical operations that achieve the primitive function such as writing down, multiplying, and subtracting have not been specified.

According to Newell, a physical symbol system has the necessary and sufficient means for general intelligent action. By ‘necessary’ we mean that any system that exhibits general intelligence will prove upon analysis to be a physical symbol system. By ‘sufficient’ we mean that any physical symbol system of sufficient size can be organized further to exhibit general intelligence. Lastly, by ‘general intelligent action’ we wish to indicate the same scope of intelligence as we see in human action. Thus physical symbol systems as discussed above give rise to intelligent actions because of the presence of symbol manipulations according to rules.

The physical symbol system hypothesis plays an important role in showing computational levels of cognition because the symbol system hypothesis implies that the symbolic behaviour of humans arise because he or she has the characteristics of a physical symbol system. Hence, the success in modelling human behaviour on the symbol systems becomes an important part of the evidence for the hypothesis. The hypothesis helps research in cognitive psychology. Research in information processing psychology involves two main kinds of empirical activity. Firstly, it conducts observations and experiments on human behaviour in tasks requiring intelligence. Secondly, it formulates the hypothesis about the symbolic processes found in the human system. Not only are psychological experiments required to test the veridicality of the human behaviour, but also out of experiments come new ideas for the design and construction of physical symbol systems.

According to Newell, Rosenbloom, and Laird, human beings can be described at different levels of the system. For him, at the top is the knowledge level which describes the persons having goals and knowledge about the world, where knowledge is used in the service of attaining goals. The person can operate at the knowledge level because that involves a symbol system, which is a system that operates in terms of representations and information processing operations on this representation. They says that the symbol level must also be realized in terms of some substrate, that the architecture is that substrate defined in an appropriate descriptive language. For computers this turns out to be the register-transfer level, in which bit-rectors are transported from one functional unit (such as an adder) to another, subject to gating by control bits. For human beings it is neural circuit level, which currently seems well described as highly parallel interconnected networks of inhibitory and exlitatory connections that process a medium of continuous signals.

Thus according to Newell, Rosenbloom, and Laird, the role of architecture in cognitive science is to be the central element in a theory of human cognition. The fixed structure provides the frame within which cognitive processing in the mind takes place. This structure is called architecture. The central function of architecture is to support a system capable of universal computations. Symbols do provide an internal representation function, but representation of the external world is a function of the computational system as a whole so that the architecture supports such representation. It is not the sole or even the predominant determinant of the behaviour of a person, but it is determinant of what makes human behaviour psychological. For him, to have a theory of cognition is to have a theory of the architecture.

The model of the brain, on the other hand, is a technique for analyzing the anatomy and physiology of the brain. This view suggests that the brain consists of a network of simple electrical processing units, which simulate and inhibit one another. This style of explanation of the brain, in cognitive science, is generally considered as the brain-style computation. Now, the question is: Why should there be a brain-style computation? The basic assumption is that we seek explanation at the program or functional level rather than the implementational level. Thus it is often pointed out that we can learn very little about what kind of program a particular computer may be running by looking at the electronics with which it is made. In fact, we do not care much about the details of the computer at all. All we care about it is the particular program that is running. If we know the program, we will know how the system will behave in any situation. It does not matter whether we use vacuum tubes or transistors, the essential characteristics are the same. It is true for computers because they are all essentially the same. Whether we make them out of vacuum tubes or transistors, we invariably use computers of the same design. But when we look essentially at a difficult architecture, we see that the architecture makes a good deal of difference. It is the architecture that determines what kind of algorithms are most easily carried out on the machine in question. It is the architecture of the machines that determine the essential nature of the program itself[12]. Thus, it is reasonable that we should begin by asking what we know about the architecture of the brain and how it might shape the algorithms underlying the biological intelligence and human mental life.

Rumelhart says that the basic strategy of the connectionist approach is to take the neuron as its fundamental processing unit. Computation is carried out through simple interactions among such processing units. Essentially, the idea is that these processing elements communicate by sending numbers along the lines that connect the processing elements. This identification already provides some interesting constraints on the kinds of algorithms that might underlie the identifications of human intelligence. A question may arise here: How does the replacement of the computer metaphor as model of mind affect our thinking? Rumelhart says that this change in orientation leads us to a number of considerations that further inform and constrain our model building efforts. Neurons are remarkably relative to the components in modern computers. These neurons operate in the time scale of milliseconds, whereas computer components operate in the time scale of nanoseconds- a vector of 10^6 time faster. This means that the human brain process that receives the order in a second or less can involve only a hundred or so times steps. Because, most of the computational processes like perception, memory retrieval, etc take about a second to function. That is, we seek explanations for these mental phenomena that do not require more than about a hundredth elementary sequential operations.

The human brain contains billions of such processing elements. As the computer organizes computation with many serial steps, similarly the brain can deploy many processing elements in cooperation and in parallel to carry out its activities. Thus, the use of brain style computational system offers not only a hope that we can characterize how brains actually carry out certain information processing tasks but also offers solution to computational problems that seem difficult to solve in more traditional computational framework. The connectionist systems are capable of exploiting and mimicking brain-style computation like artificial intelligence. Connectionism operates both as a system and a process. The connectionist systems are very important because they provide good solutions to a number of difficult computational problems that seem to arise often in models of cognition. Connectionism as a processing mechanism is carried out by a number of processing elements. These elements, called nodes or units, have a dynamics, which is roughly an analogue to simple neurons. Each node receives input from some number of the nodes and responds to that input according to a simple activation function, and in turn excites or inhibits other nodes to which it is connected.

All the levels of cognition, which we have discussed, are not universally accepted. There are levels of cognition which are better explained in the connectionist model. The connectionist approach refers to the functions of the neurons. According to Crick, the ‘astonishing hypothesis’ is that consciousness and all the thinking that goes with it are the product of neurons, and therefore, the primary business of the scientific study of thought has to be the reduction of cognitive psychology to neurology. He says that one may conclude, then, that to understand the various forms of consciousness, we need to know their neural correlates.
Crick is not opposed to the study of the computational level of cognition when they are linked to the physiological investigations of the brain. But, advocates of computational level models are careful to dissociate themselves from the idea that the computer, as a physical device, is being used as a model for the brain. According to David Chalmers, a computational basis for cognition can be challenged in two ways. First, it can be argued that computation cannot do what cognition does: that a computational simulation cannot reproduce a human cognition, because the causal structure in human cognition goes beyond what a computational description can do. Second, computation might capture the human capacities, but something more is required to replace the human capacity. The human cognition can be applied to what is known as memory attention, pattern recognition, language, problem solving etc. The most intriguing aspect of the human mind is the selection of information for further processing and storage. The information available during each moment, except sleep and unusual occasions, is vast and complex; we are constantly bombarded by our senses. All the external senses give us information which the mind

deals with at different stages. Cognition is the output produced after a long process of getting the inputs.

2.3 THE COMPUTATIONAL MODEL OF MIND

As we have already seen, artificial intelligence is the discipline that aims to understand the nature of human intelligence through the construction of computer programs that imitate intelligent behavior. It also emphasizes the functions of the human brain and the analogical functioning of the digital computer. According to one extreme view, the human brain is just a digital computer and the mind is a computer program. This view, as John Searle calls it is strong artificial intelligence. According to strong artificial intelligence, the appropriately programmed computer with the right inputs and outputs literally has a mind in exactly the same sense that you and I do. This tells that not only the devices would just referred to indeed be intelligent and have minds, etc. but mental qualities of a sort can be attributed to teleological functioning of any computational device, even the very simplest mechanical ones such as a thermostat. Here, the idea is that mental activity is simply the carrying out of some well-defined operations, frequently referred as an algorithm. We may ask here as to what an algorithm actually is. It will be adequate to define an algorithm simply as a calculation procedure of some kind. But in the case of thermostat, the algorithm is extremely simple: the device registers whether the temperature is greater or smaller than the setting, and then, it arranges for the circuit to be disconnected in the former case and to remain connected in the latter. For understanding any significant kind of mental activity of a human brain, a very complex set of algorithms has to be designed to capture the complexity of the human mental activities. The digital computers are approximations to the complex human brain.

The strong artificial intelligence view is that the differences between the essential functioning of a human being (including all its conscious manifestations) and that of a computer lies only in the much greater complication in the case of brain. All mental qualities such as thinking, feeling, intelligence, etc. are to be regarded, according to this view, merely as aspects of this complicated functioning of the brain; that is to say that they are the features of the algorithm being carried out by the brain. The brain functions like a digital computer according to this view. The supporters of strong AI hold that the human brain functions like a Turing machine which carries out all sets of complicated computations. The brain is naturally designed like a computing machine to think, calculate and carry out algorithmic activities. To strong AI supporters, the activities of the brain are simply algorithmic activities which give rise to all mental phenomena like thinking, feeling, willing, etc.

David Chalmers, mentions that the field of artificial intelligence is devoted in large part to the goal of reproducing mentality in computational machines. The supporters of strong AI argue that we have every reason to believe that eventually computers will truly have minds. Winston says that intelligent robots must sense, move and reason. Accordingly, intelligent behaviour is interpreted as giving rise to abstract automation. That is to say that an artificial, non-biological system could thus be the sort of thing that could give rise to conscious experience. For the supporters of strong AI, humans are indeed machines, and in particular, our mental behaviour is finally the result of the mechanical activities of the brain.

John Searle, in his *Is the Brain a digital computer*? mentions that the basic idea of the computer model of the mind is that the mind is the software and the brain is the hardware of a computational system. The slogan is that the mind is to the program, the brain is to the hardware.

For strong AI, there is no distinction between brain processes and mental processes. Because the process which is a happening in the brain is a computational process, the mind is the alternative name of the brain which is a machine.

According to David Chalmers, the theory of computation deals wholly with abstract objects such as Turing machine, Pascal program, finite state automation and so on. These abstract objects are formal structures which are implemented in formal systems. However, the notion of implementation is the relation between abstract computational objects and physical systems. Computations are often implemented in synthetic silicon based computers.

Whereas the computational systems are abstract objects with a formal structure determined by their states and state transition relations, the physical systems are concrete objects with a causal structure determined by their internal states and the causal relations between the states. It may be pointed out that a physical system implements a computation when the casual structure of the system mirrors the formal structure of the computation. The system implements the computation, if there is a way of mapping states of the system onto states of the computations so that the physical states which are causally related map onto the formal stares that are correspondingly formally related. The fact is that there is rich causal dynamics inside computers, as there is in the brain. There is real causation going on between various units of brain activity precisely mirroring patterns of causation between the neurons. For each neuron, there is a specific causal link with other neurons. It is the causal patterns among the neurons in the brain that are responsible for any conscious experiences that may arise.

The brain, as Marvin Minsky says that happens to be a meat machine. He points out that the brain is an electrical and chemical mechanism, whose organization is enormously complex, whose evaluation is barely understood and which produces complex behavior in response to even more complex environment. Artificial intelligence understands the nature of human intelligence in terms of the computational model of the brain.

2.4 ARTIFICIAL INTELLIGENCE & THE FUNCTIONALIST THEORY OF MIND

Functionalism arose as a result of the phenomenal rise of interest in computing machines and artificial intelligence. The functionalists say that mental processes are computational processes realized in a machine. Functionalism is a theory that explains mental phenomenona in terms of the external input and the observable output. It explains the mind as a machine. Functionalism as a conception of mind explains the reality of the mental phenomena in terms of the mechanical phenomena. Mind is not just a part of the physical organism but is itself characterized as the physical organism called the brain. The brain is further characterized as a complex physical system working like a computing machine. Functionalism explains the mechanical behaviour of the brain/mind. Functionalism as a theory of mind is supported by various scientific theories like those of artificial intelligence, cognitive science, and neuroscience, etc., Artificial intelligence advocates a computational theory of mind which argues in favour of the functional similarity between the computation states of the artificial system and the neurophysiological states of the brain.

The hypothesis of artificial intelligence that “machine can think” became very popular after Alan Turing’s “C*omputing Machine and Intelligence.*” Turing’s hypothesis is that machines think intelligently like human beings. Putnam says that probabilistic automation has been generalized to allow for ‘sensory inputs’, and ‘motor outputs’, -that is, the Machine Table specifies, for every possible combination of ‘state’ and a complete state of ‘sensory inputs’ an ‘instruction’ which determines the probability of the next 'state' and also probabilities of the 'motor out puts'. The following are the steps which explain how a machine functions in general:

(i) The description of the sequence of states (procedure)
(ii) Description of rules
(iii) The explanation of the rationale of the entire procedure.

The computing machine is thus a system constructed out of different subsystems that function inside it to process the inputs and to produce the output once the input is simulated in the machine. It tries to match the simulating state with the states already computed and mapped in the system. This mapping order follows certain syntax or rules. The syntax is responsible for the correlation of total cognitive states. Thus, the entire process of simulation can be called an intelligent process. This simulation process takes place between the functions of the two functionally isomorphic systems. As Putnam defines that two systems are functionally isomorphic if there is a correspondence between states of one and the states of the other that preserves the functional relation.

There is functional isomorphism, according to Putnam, between the brain/mind and a machine. This functional isomorphism holds due to the causal capacity of the functional states of the machine. For example, when I have a pain, there is a neurophysiological process corresponding to the mental state because of the firing of the C-fiber. The brain/mind identity follows as there is functional identity between the two. Thus, identity between the mental states and the physical processes of the brain is established from the functional point of view. That is, in functional terms, the brain state is isomorphic with the mental state. That is, there is identity between software that constitutes the program and the hardware of the machine, which helps the software to be realized in the machine.

There can be indefinitely many different physical properties, which constitute the realizations of the same functional property. However, it is also true that the same physical state can realize different functional properties at different times or in different circumstances or in different creatures. The functional states are 'multiply realizable' in the sense that a functional state cannot be identical to any particular physical realization of it. For example, someone could write a program using two completely different types of computer, which use different sorts of hardware to run the same program. In this sense, the program is said to be 'multiply realizable' in that any number of computers may be used to realize the same program. Functionalism takes states of mind and mental properties to be functional states and properties. Mental properties are realizable by, but not identical with, material properties. For example, the same mental property, the property of being in pain, may be realized by one property in a human being and to a certain extent by another property in an invertebrate. For the functionalist, if someone has now a particular pain, then he/she can imagine that this pain is realized through a particular neural state. That neural state has an identifiable material structure, and this may be studied by a lower-level hardware science like neurobiology. Therefore, for functionalism, what makes the state a realization of pain, is not its material constitution but it's occupying a particular kind of causal role within our nervous system. Multiple realizability thus implies that there is a higher-level functional description of physical states in terms of their causal role, which abstracts from their lower-level physical constitution. It is with such functional properties that mental properties can be identified.

In his essay "*Mad Pain and Martian Pain*", David Lewis discusses two kinds of beings, which experience pain differently than normal humans. In the case of mad pain, the subject experiences pain when doing moderate exercise in an empty stomach; further, it improves his concentration for mathematical reasoning. On the other hand, Martian pain takes place in a Martian organism constructed of hydraulic hardware rather than neurons. Here the point is that pain is associated only contingently with either its causes (as in mad pain) or its physical realization (as in Martian pain). We cannot specify *a priori* its causal role or physical

Daniel Dennett has suggested a multiple-draft-model, approach to the nature of mind. According to this model, there is similarity between the functions of the human mind and those of the computer. The brain system functions in relation to different sub-systems. So there are multiple drafts, which operate within an artificial system. Such an analogy is beneficial because it analyses consciousness from the point of view of language processing. This is given importance precisely in the sense that a linguistic or language speaking being is considered not only as a conscious being but also a rational being. Even the robots as information processing systems can also be characterized as intelligent systems. According Dennett, we are machines! we are just very, very complicated, evolved machines made of organizes molecules instead of metal and silicon, and we are conscious, so there can be conscious machines – us. So the human thought process and language processing in the artificial systems are analogous to each other. In the case of the conscious thought process, we are aware of our thoughts, at the same time, there is physico-chemical process, which goes on in our brain.

Dennett's functional analysis of consciousness is divided into two parts. There are the sub-personal view of consciousness and the multiple draft-model of consciousness respectively. The sub-personal model explains consciousness and other mental activities through the help of neurological states and processes of the organism, whereas the multiple-draft-model discusses how an artificial system behaves intelligently. Thus Dennett provides a functional explanation of consciousness at the sub-personal level. According to him, sub-personal theories proceed by analyzing a person into an organization of subsystems (organs, routines, nerves, faculties, components-even atoms) and attempting to explain the behaviour of the whole person as the outcome of the interaction of these subsystems. Thus in the present instance the short-coming emerged because the two access notions introduced computational access *simpliciter* and the computational access of a print-out faculty, were defined at the sub-personal level; if introduced into a psychological theory they would characterize relations not between a person and a body, or a person and a state of affairs or a person and anything at all, but rather, at best relations between parts of person (or there bodies) and other things.

Therefore, the sub-personal level of explanation of consciousness tries to explain not only how the human beings are systems of organism but also how the system is being constituted and how the various functions involved in different physiological parts of the organism function together. And that functional structure would help us in defining the capacity involved in causing consciousness or what we call conscious behaviour. A state of consciousness is simply one which exhibits a certain characteristic pattern of causal relations to other states, both mental and physical.

We know that human beings perform various activities; they learn language; acquire various knowledge states or belief states, and there are changes in their belief states, and so on. All these activities are independent biological activities of human life. Dennett anticipates that there would be a system whose programs would be such that it would be self-dependent in all its functions. That would be able to replace or stand parallel to human intelligence. Further, the functions of the artificial system help us in explaining the various mysterious features that are ascribed the human life. Thus, the strong notion of functionalism advocates the identity between the mental states and the brain processes. It also explains the different basic features of human beings such as consciousness, intentionality and subjectivity, etc, by bringing the feature of the functional isomorphism into account.

Functionalism holds that the mental states are abstract, functional states, characterized solely in terms of their casual relationships to each other, to input, and to outoput.[37] Human purposive behaviour is then explained in terms of how this hypothesized system of states take the organism from sensory input to behaviour. Because functionalism insists upon a network of mental states, it insists upon the holism of the mental upon the way in which mental states operate together to explain behaviour. It accepts structure of mental states in which each is necessarily connected with the other. The mental states do not function in isolation; rather they function within the causal co-relationship with other mental states. The function of mental states also takes into account the effect of the environment in which the subject or agent is placed with the system that must be well equipped to receive the input from the environment and to produce the output.

The functionalist program has been strongly influenced by analogies drawn from computer science and AI, both in its general outlook and in several of its specific applications to problems about the nature of mind. Because a functional state is like a computational state of a computer. A computer program can be described as a functional organization of the hardware. As already discussed, the functionalists argue that mental states are like the 'information processing' states of a computer. Accordingly, for computer functionalism or artificial intelligence, the brain is a computer, and the mind is a computer program implemented in the brain. Thus artificial intelligence is strongly founded on a functionalist conception of mind. It is dependent on the idea that human functions like a digital computer with multifunction computational abilities.

2.5 LET US SUM UP

In this unit an attempt is made to understand the philosophical presuppositions of artificial intelligence; especially the nature of mind as presupposed by artificial intelligence. Artificial intelligence as a programme in cognitive science is based on many theoretical presuppositions like the distinction between natural and artificial intelligence, the information-processing character of mental representations, the idea of mind as a computer, and so on. The nature of cognition is a complex process which needs to be studied in order to understanding the nature of artificial intelligence. In this way, we have explored mental representations like beliefs and thoughts which constitute the broad domain of cognitive science. These representations explain how cognition takes place in the human mind. Cognitive science (including cognitive linguistics and cognitive psychology) has brought about a cognitive revolution in the study of mind.

2.6 KEY WORDS

Artificial intelligence, functionalism, cognitions & computational theory of mind

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UNIT 3 NEUROLOGICAL STUDIES AND CONSCIOUSNESS

Contents

3.0 OBJECTIVES

- To give general overview of neurological studies.
- To figure out the important fields of neurology.
- To see the relationship between neurology and consciousness/

3.1 INTRODUCTION

This introductory unit tries to give an over-view of neurology. We first deal with the history of neurology. Then we take up some general features of brain. Then we deal with the development of brain leading to the evolution of consciousness.

3.2 ETYMOLOGY

The word Neurology comes from the Greek word *neurologia* and deals with *disorders of the nervous system*. Specifically, it deals with the diagnosis and treatment of all categories of disease involving the *central, peripheral, and autonomic nervous systems,* including their coverings, blood vessels, and all effector tissue, such as muscle. Neurology can be defined as the medical specialty concerned with the diagnosis and treatment of disorders of the nervous system -the brain, the spinal cord, and the nerves. According to the World English Dictionary; Neurology means the study of the anatomy, physiology, and diseases of the nervous system. Similarly, a neurologist is a specially trained physician who diagnoses and treats disorders in the nervous system, whether caused by disease or injury. This includes diseases of the brain, spinal cord, nerves and muscles. Neurologists possess a comprehensive knowledge of the neurological structures of the body, including the cerebral cortex and its division into various lobes and their individual jobs in making the body work as a whole. In short neurology can be defined the branch of medical science that deals with the nervous system.

3.3 HISTORICAL DETAILS OF NEUROLOGY

We list below some of the major discoveries that have advanced neurological research and studies. The list is only indicative and not exhaustive.

a. The first scientific studies of nerve function

All living things are built of cells. These are not just passive building blocks; they are busy active places. The first scientific studies of nerve function were done in the 18th century. However, clinical neurology had very less scope for further development and findings until the mid-19th century as a result it was very difficult to name and find out the information about the causes of epilepsy, aphasia and other problems due to brain damage. It is interesting to note that the Knowledge of the brain and nervous functions came from studies of animals and the analysis of human nerve cells under the microscope.

b. Beginning of Neurology

With the invention of the electroencephalograph (EEG) in the 1920s which was meant to record electrical brain activity, the diagnosis of neurological disease became easy and speedy. Next came the development of cerebral angiography which helped to see the blood vessels in the brain. Specific drug therapies have been introduced to treat neurological conditions. Thus the future form of neurology will be shaped by knowledge of the human genome and proteome. Electroencephalograph is particularly useful in picking up abnormal brain activity that might be associated with seizure disorders like epilepsy, head injury, brain tumours, infection and inflammation of the brain, chemical disturbances and some sleep disorders.

c. New findings in Neurology

Positron emission tomography in clinical neurology was researched by Karl Herholz MD, and W.D. Heist MD from the Department of Neurology, University Cologne, and Max-Planck Institute for Neurological Research, Köln, Germany. According to them, the Positron emission tomography (PET) imaging in clinical neurology serves different purposes like differential diagnosis, especially in the early stage of neurological disorders, description of path physiologic changes that are responsible for manifestation and course of a disease, and evaluation and follow-up of treatment effects and so on. Positron emission tomography relies on a radioactive phenomenon, "positron decay". Certain radioactive materials will release positively charged particles, called positron as they decay (Al-Chalabi, Turner, Delamont 2006).

MRI- Magnetic resonance imaging

It is helpful in revealing the blood vessels of the brain- angiography. An abnormal expansion of a blood vessel, an aneurysm can be made visible by injecting a dye into the blood vessels. the dye is opaque to X-rays and so outlines the aneurysm (Al-Chalabi, Turner, Delamont 2006).

Computed axial tomography- the CT scan

CT was discovered independently by a British engineer named Sir Godfrey Hounsfield and Dr. Alan Cormack. It has become a mainstay for diagnosing medical diseases. For their work, Hounsfield and Cormack were jointly awarded the Nobel Prize in 1979. CT scanners first began to be installed in 1974. Further, in the late 1980s the spiral CT was invented .in this , the X- ray camera rotates spirally downwards and can encompass data from an entire organ within half a minute. this has also permitted the development of CT angiography (Al-Chalabi, Turner, Delamont 2006).

Check Your Progress I

Note: Use the space provided for your answers.s.

1) What is the etymology of neurology?

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2) How did EEG help the progress in neurology?

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Developmental dyslexia and animal studies

At the interface between cognition and neurology was researched by the American neurologist, Albert M. Galaburda. Recent findings in autopsy studies, neuroimaging, and neurophysiology indicate that dyslexia is accompanied by fundamental changes in brain anatomy and physiology, involving several anatomical and physiological stages in the processing stream, which can be attributed to anomalous prenatal and immediately postnatal brain development. Epidemiological evidence in dyslexic families led to the discovery of animal models with immune disease, comparable anatomical changes and learning disorders, which have contributed a lot in finding about mechanisms of injury and plasticity to indicate that substantial changes in neural networks concerned with perception and cognition are present.

Identifying a Molecular Switch That Controls Neuronal Migration in the Developing Brain

St. Jude Children's Research Hospital investigators have identified key components of a signaling pathway that controls the departure of neurons from the brain niche where they form and allows these cells to start migrating to their final destination. However the defects in this system affect the architecture of the brain and are associated with epilepsy, mental retardation and perhaps malignant brain tumors. Thus the findings provide insight into brain development as well as clues about the mechanism that are helpful in the other developing tissues and organ systems, particularly the epithelial tissue that covers body surfaces.

Neurological Diseases Major Discovery

Researchers at the University de Montreal and the Montreal Neurological Institute, McGill University have discovered that cells which normally support nerve cell (neuron) survival also play an active and major role in the death of neurons in the eye.

New Findings on the Neurological Organization of Dreaming

Sigmund Freud is still the most widely read author on the subject of dreams.he concluded his studies of dreams by saying that “the dreams serves preponderantly to guard against pain”

(Searle 2004). The fundamental neuropsychological mechanisms involved in dreaming appear to be (1) inhibitory mental control, (2) spatial thought, and (3) quasi-spatial (symbolic) operations. The essential factor in REM sleep, by contrast, is basic arousal. Dreaming is a natural mental activity. most dreams are clear, coherent, realistic and detailed accounts of a situation involving the dreamer and other people. More often than not, dreams are about very ordinary activities and preoccupations, although they can also be fantastic or ridiculous things.so dreamiong can be looked upon as a continuous stream of mental activity, which we become aware of when aroused, occurring particularly during REM and to a lesser extent during NREM sleep (Al-Chalabi, Turner, Delamont 2006).

Brain Underpinnings for Auditory and Visual Illusions and Everyday Experiences

New research indicates that the integration of senses and functions in the brain is very common. It is found that about two percent of the population has a condition called synesthesia, in which two different sensations, like color and sound, are experienced at once. Although this condition is rare, the new findings suggest the brain is wired in complex and sometimes overlapping ways to help people interpret and understand their environments. Scientists have also found the relationship between stroke and brain damage caused by the lack of oxygen. Dr Sharlin Ahmed, Research Liaison Officer at The Stroke Association says: "When a stroke strikes the brain is starved of oxygen and as a result brain cells in the affected area die. The use of stem cells to replace dead brain tissue is a promising technique which could help to reverse some of the disabling effects of stroke. Damage to the rhinal cortex of both hemispheres causes severe memory loss or amnesia. The crucial feature of the amnesic syndrome is a devastating absence of memory for events since the injury (Gellatly and Zarate1998).

Emergence of neuroculture

NeuroCulture is the relation between the sciences that study the functioning of the brain and culture. We normally understand culture as the knowledge, history, habits, ideas and values of the human race, and their manifestations in any form of expression: social, scientific, artistic, philosophical, moral or religious, etc. It is interesting to note that the basis of NeuroCulture is that everything a human being creates is generated in the brain, from the most primary functions which resulted from millions of years of evolution. This lead to superior expressions, like art, religious or scientific thinking. Thus, the link that relates the biological functioning of the brain to the results of its processes creates a method of explaining how human beings respond to their environment in every possible way. Neuroscience, together with the humanistic and scientific disciplines, creates a new level of study that leads to a reassessment of some of its fields of study and, of course, the enrichment of neurological studies.

3.4 THE GENERAL STRUCTURE OF THE BRAIN

The brain is the portion of the central nervous system in vertebrates (animals with bones) that lies within the skull. In humans, the brain weighs about 3 pounds. Differences in weight and size do not correlate with differences in mental ability. The brain is the control center for movement, sleep, hunger, thirst, and virtually every other vital activity necessary to survive. The brain is a pinkish-gray mass that is composed of about 10 billion nerve cells. The nerve cells are linked to each other and together play a vital role in the control of all mental functions. Nerve fibers in the brain are covered in a near-white substance called myelin and form the white matter of the brain. Nerve cell bodies, which are not covered by myelin sheaths, form the gray matter. The brain is

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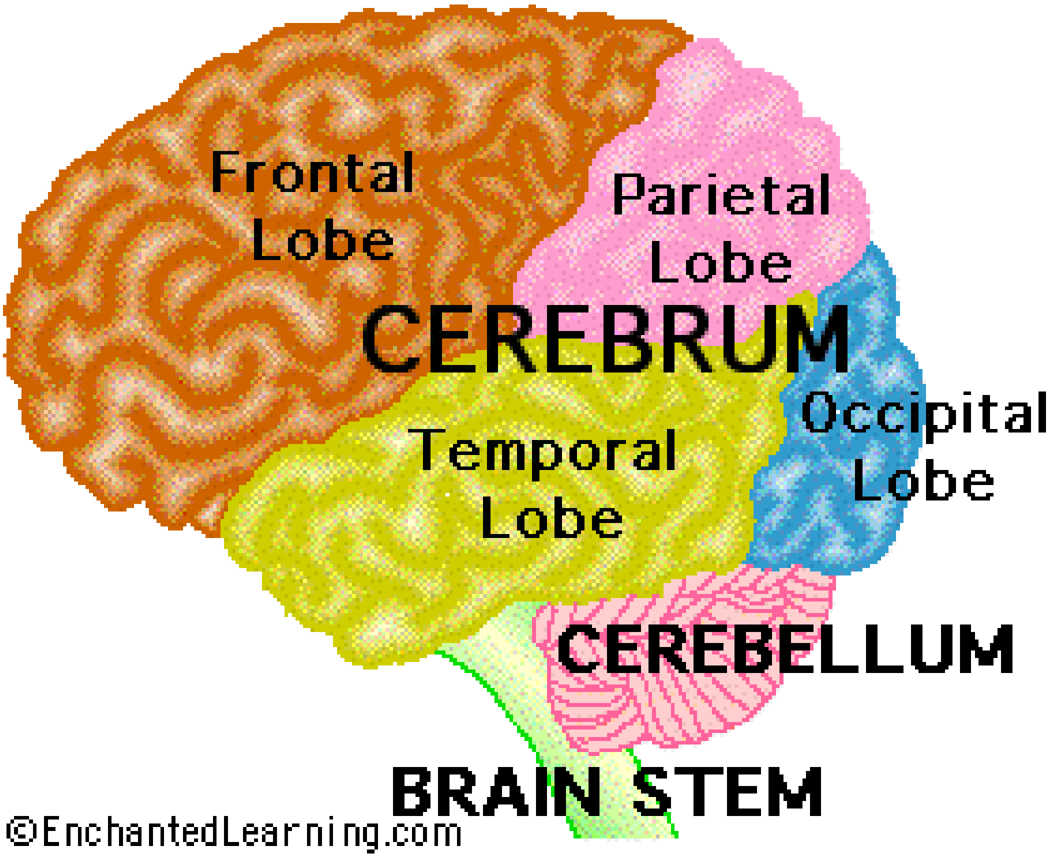
Frontal
Lobe
Parietal
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Occipital
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BRAIN STEM
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- Inhibition
- Coordination of movements
- Generalized and mass movements
- Some eye movements
- Sense of smell
- Muscle movements
- Skilled movements
- Some motor skills
- Physical reaction
- Libido (sexual urges)

Occipital Lobe

- Vision
- Reading

Parietal Lobe

- Sense of touch (tactile senstation)
- Appreciation of form through touch (stereognosis)
- Response to internal stimuli (proprioception)
- Sensory combination and comprehension
- Some language and reading functions
- Some visual functions

Temporal Lobe

- Auditory memories
- Some hearing
- Visual memories
- Some vision pathways
- Other memory
- Music
- Fear
- Some language
- Some speech
- Some behavior amd emotions
- Sense of identity

Right Hemisphere (the representational hemisphere)

- The right hemisphere controls the left side of the body
- Temporal and spatial relationships
- Analyzing nonverbal information
- Communicating emotion

Left Hemisphere (the categorical hemisphere)

- The left hemisphere controls the right side of the body
- Produce and understand language

Corpus Callosum

- Communication between the left and right side of the brain

THE CEREBELLUM

- Balance
- Posture
- Cardiac, respiratory, and vasomotor centers

THE BRAIN STEM

- Motor and sensory pathway to body and face
- Vital centers: cardiac, respiratory, vasomotor
-

Hypothalamus

- Moods and motivation
- Sexual maturation
- Temperature regulation
- Hormonal body processes

Optic Chiasm

- Vision and the optic nerve

Pituitary Gland

- Hormonal body processes
- Physical maturation
- Growth (height and form)
- Sexual maturation
- Sexual functioning

Spinal Cord

- Conduit and source of sensation and movement

Ventricles and Cerebral Aqueduct

- Contains the cerebrospinal fluid that bathes the brain and spinal cord

3.6 THE EVOLUTION AND DEVELOPMENT OF THE HUMAN BRAIN

The evolution of the brain acquired a process of continuous change and selection in all aspects of life on earth, including the human brain. The scientists have discovered that billions of years ago, life existed only in the form of single celled organisms. These organisms were continued through their own chemical processes until they gradually evolved into the multi-celled beings that first appeared approximately 680 million years ago. Thus the more complex animals, including man, afterward evolved from these multi-celled beings. The evolution of the human brain followed a similar course; moving from the simple to the complex over an extended period of time. The billions of cells that work together to make the brain and body function harmoniously have numerous critical functions. The brain is after all a far more multi-functional organ by nature than other, less complex organs such as the heart or the liver.

It is a fact that as man evolved, certain mutations took place within the nervous system that forced it to evolve in time with the body. For example, just as external physical changes were selected as either worthy or unworthy by the environment, mutations in the nervous system were also forced to prove their might against environmental challenges. The brain of an embryo starts off as a simple tube of tissue. It then develops three enlargements that will become the forebrain later divides into the two cerebral hemispheres, which grow outwards to cover much of the lower brain regions. (Angus Gellatly Oscar Zarate 1998)

Configuration of the brain

The adult human brain weighs on average about 3 (1.5 kg) with a size (volume) of around 1130 cubic centimeters (cm^3) in women and 1260 cm^3 in men, although there is substantial individual variation. Men with the same body height and body surface area as women have on average 100g heavier brains, although these differences do not correlate in any simple way with gray matter neuron counts or with overall measures of cognitive performance. At the age of 20, a man has around 176,000 km and a woman about 149,000 km of militated axons in their brains. The two cerebral hemispheres are the largest and most obvious features of human and other primate brains. Their surface grey matter is the cortex, sometimes called neo-cortex to distinguish it from the cortex found in lower, and more ancient, brain structures (Al-Chalabi, Turner and Delamont 2006).

Functions of the Brain

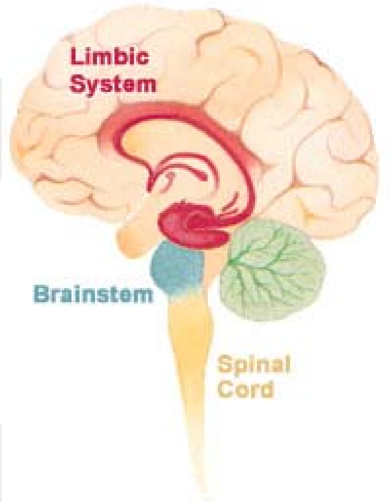
From an organismic perspective, the primary function of a brain is to control the actions of an animal. To do this, it extracts enough relevant information from sense organs to refine actions. Sensory signals may stimulate an immediate response as when the olfactory system of a deer detects the odor of a wolf; they may modulate an ongoing pattern of activity as in the effect of light-dark cycles on an organism's sleep-wake behavior; or their information may be stored in case of future relevance.

Functional subsystems. One of the most important of these is on the basis of the chemical neurotransmitters used by neurons to communicate with each other. Another is in terms of the way a brain area contributes to information processing: sensory areas bring information into the brain and reformat it; motor signals send information out of the brain to control muscles and glands; arousal systems modulate the activity of the brain according to time of day and other factors .In the first signs of a nervous system, the notochord develops and causes the elctoderm above to become tissue, which in turn sinks down to become a tube of nervous tissue- the future spinal cord and brain (Al-Chalabi, Turner and Delamont 2006).

As per the Neurotransmitter systems, with few exceptions, each neuron in the brain consistently releases the same chemical neurotransmitter, or combination of neurotransmitters, at all of the synaptic connections it makes with other neurons.Thus, a neuron can be characterized by the neurotransmitters it releases.

Sensory systems

Like animals, humans learn about the world through their senses. traditionally, there are five senses. taste and smell are closely associated with the limbic system. One of the primary functions of a brain is to extract biologically relevant information from sensory inputs. Even in the human brain, sensory processes go well beyond the classical five senses of sight, sound, taste, touch, and smell: our brains are provided with information about temperature, balance, limb position, and the chemical composition of the bloodstream, among other things. All of these modalities are detected by specialized sensors that project signals into the brain (Gellatly and Zarate 1998).


Limbic System
Brainstem
Spinal Cord

Some Interesting facts about the Brain

- The brain uses 20% of your body's energy, but it makes up only 2% of your body's weight.
- The average human brain weighs around three pounds or 1.4 kilos.
- Your brain is about 1300-1400 cubic centimeters in volume, about the size of a cantaloupe and wrinkled like a walnut.
- In 1874, Carl Wernicke discovered that damage to an area of the temporal lobe, close to tissue involved in hearing resulted in anoathaer type of language disorder (Gellatly and Zarate 1998).
- A brain generates 25 watts of power while you're awake enough to illuminate a light bulb.
- A newborn baby's brain grows almost 3 times in course of first year
- Humans have the most complex brain of any animal on earth.

The brain is divided into two sides. The left side of your brain controls the right side of your body; and, the right side of your brain controls the left side of your body.

Check Your Progress II

Note: Use the space provided for your answers.s.

1) When did neurology originate?

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2) What is NeuroCulture and its significance for neurological studies?

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3.7 DISEASES AND CONDITIONS OF THE BRAIN

There are many diseases connected with the brain. Advances in neurological studies, it is hoped, will be able to find remedy for at least most of these conditions.

- Stroke, meningitis, multiple sclerosis, coma, paralytic polio, Parkinson's disease, Leu Gehrig's Disease, Cerebral Palsy, and migraine headaches are all diseases and conditions that affect the brain.
- A stroke is damage to the brain due either to blockage in blood flow or to loss of blood from blood vessels in the brain.
- Coma is an extended period of unconsciousness from which a person cannot be aroused even with the most painful stimuli.

- Damage in the cerebellum has a variety of consequences .defects include loss of the ability to learn new movements, disruption of posture, jerkiness of movements inability to make rhythmic movements, and impaired sequencing of movements.
- People with Parkinson's disease, characterized by tremor and an inability to initiate movements, have a shortage of dopamine in the BG (Gellatly and Zarate 1998).

3.8 BRAIN DEATH AND THE LOSS OF PERSONHOOD

It is obvious that the sense of self or personhood (identity) is connected to the brain. And brain death is connected to the loss of personhood. There are two theories with regard to the death of a person from the neurobiological perspective; i) the whole-brain death definition and ii) the higher-brain death definition (Jones 2004). The whole-brain death is considered as the traditional definition of neurobiological death which states that death occurs due to the cessation of the functioning of the whole brain. This is considered a biological concept of death since it takes account of the irreversible cessation of the functioning of the whole brain and the whole body. In this definition of brain death there is no difference between the death of any other organism and that of a human being. Gareth Jones writes, "This (whole-brain death) entails the cessation of functioning of a biological unit, in the sense that there is no difference between the deaths of any biological life, be it a dog, rat or human being" (Jones 2004).
As opposed to the whole-brain death, higher-brain death defines death as the higher capacities of a human being ceasing irreversibly due to the irreparable cerebral cessation. This is known as the personalist conception of death, as a person is considered dead when his higher functions which are considered essentially human cease to function or stop working in an irrecoverable way. This definition of death accords the human being personhood which states that he is more than a biological organism.

This higher-brain definition stresses the irreversible loss of functions regarded as characteristic of human existence and of our meaning as human persons: our individual personalities, conscious life, and uniqueness, and the capacity for remembering, judging, reasoning, acting, enjoying and worrying. Such a personalistic concept focuses attention onto our humanness and onto the responsibilities lying at the core of human community." (Jones 2004) Whether we accept either of the definitions of death, the important point in this regard is that both are related to the cessation of the functioning of proper or total termination of the brain processes.

3.9 NEUROLOGY AND CONSCIOUSNESS

The problem of consciousness has been away from the scientific arena for a long time since many scientists considered it as a philosophical problem. But with the emergence of neuroscience as a well-established discipline and with the technological advancements by developing new methods of brain mapping neuroscientists also find it plausible to delve into this 'hard problem'. Francis Crick and Christof Koch write in a review of *the Astonishing Hypothesis*, "We have taken exactly the opposite point of view. We think that most of the philosophical aspects of the problem should, for the moment, be left on one side, and that the time to start the scientific attack is now" (Crick and Koch 2004).

a. Francis Crick's Theory

Consciousness, as many hold, is a multi-dimensional phenomenon. This is one of the problems that makes the explanation of consciousness a hard one, be it for scientists or for philosophers. However scientists like Francis Crick and the Paul Churchland firmly believe that this is the opportune time to begin the scientific attack on consciousness. Crick's astonishing hypothesis is that "it's all done by neurons" (Crick 1994). Francis Crick tried to crack the hard problem of consciousness through the explanation of the any single aspect of consciousness - visual consciousness. Here Francis Crick writes: In approaching the problem, we made the tentative assumption that all the different aspects of consciousness (for example, pain, visual awareness, self-consciousness, and so on) employ a basic common mechanism or perhaps a few such mechanisms. If one could understand the mechanism for one aspect, then, we hope, we will have gone most of the way towards understanding without further discussion" (Crick and Koch 2004). Francis Crick, thus, tries to solve the problem of consciousness by providing a solution to 'visual consciousness'.

For Francis Crick, the whole brain is not the part of the generation of consciousness. His whole attempt is to find the 'Neural Correlate of Consciousness'. His finding is that only specific types of neurons are conscious. These neurons should project themselves to the centres of the brain which control the motor activity and planning)Crick and Koch 2004) Francis Crick hopes to solve the problem of visual consciousness by the 'Frontal Lobe Hypothesis' where we may find the neural correlate of visual consciousness (Crick 1994). He solves the binding problem of perceptual unity by yet another neuron doctrine – mainly by the conjoining simultaneity and the speed of the firing of the neurons which may be involved in a particular act of perception, say, seeing an angry face. Crick writes: "The simplest idea would be that awareness occurs when some special set of neurons fire at very high rate (e.g., at about 400 or 500 Hertz), or that the firing is sustained for a reasonably long time. Thus "binding" would correspond to a relatively small fraction of cortical neurons, in several distinct cortical areas, firing very fast at the same time (or a long period)" (Crick 1994).

b. Qualia: The Opponent Pathway Hypothesis

The problem of qualia has been a thorn in the flesh of the philosophers and scientists who claim to explain all the aspects of human conscious experience. Among the *qualia* colour has attracted the attention of the philosophers and scientists. Neuroscientists try to solve the problem of *qualia* of colour through 'the opponent pathway hypothesis'. The opponent process account is one of the popular theories in neuroscience which explains how does the brain code sensory qualities. The scientists and philosophers who hold this view of processing sensory *qualia* by the brain generally hold the view that photoreceptor present in the human retina are in the opponent path ways like, red-green, black-white etc. (PN 2008). The colour that strike the retina of the human eye then activate the three dimensional vector space, production activity in each of the isolated pathways. In this understanding, the representation of colour *qualia* is due to the activation of the vector space in the colour opponent pathway. Each dimension in that three-dimensional space will represent the average frequency of action potentials in the axons of one class of ganglion cells projecting out of the retina.

The process of the representation of the colour, according to the opponent pathway hypothesis, is as follows. Each colour perceivable by humans will be in a region of a particular vector space in which opponent colours are present. For example, an orange stimulus produces a relatively low level of activity in both the red-green and yellow-blue opponent pathways and middle-range activity in the black-white opponent pathway. Pink stimuli, on the other hand, produce low activity in the red-green opponent pathway, middle-range activity in the yellow-blue opponent pathway, and high activity in the black-white opponent pathway (PN 2008). Location and geometrical proximity between regions reflect the structural similarities between the perceived colours.

c. Backward Referral Hypothesis

The backward referral hypothesis of consciousness has been proposed by the neuroscientist-philosopher Benjamin Libet, following an experiment he conducted to know whether conscious awareness precedes or follows an event (Libet, Sinnott-Armstrong and Nadel2011). Libet found out that the neural event happens in a delayed 500 milli-second time after the onset of the stimulating of the event (Gazzaniga, Ivry and Mangun 1998). According to him conscious awareness of an event actually follows the event, though we often think that we are aware of the event from its very onset. Rodeny Cotterill following the hypothesis of Libet, proposed a neural circuit called "vital triangle" (fig:2.1), for the cause of the delay in the conscious awareness of an event. This neural circuit includes, sensory cortex, frontal cortex and various thalamic nuclei. The delay in conscious awareness of an event, according to Rodeny Cotterill, is because these regions are not singly responsible for the consciousness awareness but it is the feedback–feed forward connections among these three partners that enable consciousness (Gazzaniga, Ivry and Mangun 1998).

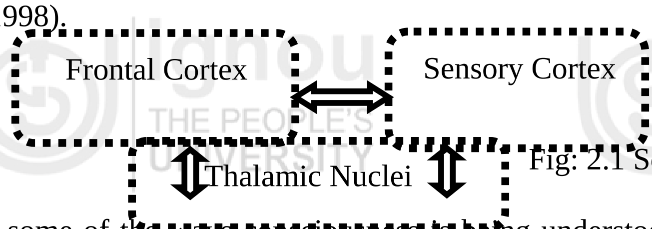

Fig: 2.1 Schematic of the Vital Triangle

There are some of the ways consciousness is being understood and explained by neuroscience. There is definitely a long way to go.

Check Your Progress III

Note: Use the space provided for your answers.s.

1) How is brain death related to the loss of personhood or identty?

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2) What is "Backward referral hypothesis"?

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3.10 LET US SUM UP

In this unit we tried to have an overall view of neurological studies and brain functions, with special focus on the emergence of human consciousness.

3.11 KEY WORDS

Aphasia: Inability to use or understand language (spoken or written) because of a brain lesion

Dyslexia: A general term for disorders that involve difficulty in learning to read or interpret words, letters, and other symbols, but that do not affect general intelligence

Hypothalamus: a region of the brain, between the thalamus and the midbrain, that functions as the main control center for the autonomic nervous system by regulating sleep cycles, body temperature, appetite, mood, etc., and that acts as an endocrine gland by producing hormones, including the releasing factors that control the hormonal secretions of the pituitary gland.

NeuroCulture: NeuroCulture is the relation between the sciences that study the functioning of the brain and culture.

Qualia: Qualia is the term used for the description of the sensory quality one subject experiences which is thought to be subjective and private.

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UNIT4 NEUROTHEOLOGY

Contents

4.0 OBJECTIVES

- The introduce the students to the basics of neurotheology
- To give some ideas of the relationship between nurological studies and religious experiences.
- To understand some aspects of mystical experience through neurology.

4.1 INTRODUCTION

Pascal Boyer is a professor at Washington University in St Louis, a pre-eminent scholar of religious behaviour in humans and the author of *Religion Explained: The Evolutionary Origins of Religious Thought.* Boyer is an atheist and proposes that religions exist because their proponents have learnt to successfully recruit a variety of low-level systems in the human brain. He views religions not as a source of morality but as a canvas on which people project their own folk ethics. However, Boyer seems to miss the concept of neurotheology. The brain after millions of years of evolution has developed the capability to conceptualize religious thoughts and feelings. Anthropologically why did the human species evolve this capability? Boyer is critical of neuroimaging for religious purposes. Still he acknowledges, "that people can experience a sudden feeling of peace, of communion with the entire world.... (that) can be to some extent correlated with particular brain activity; it is plausible that such experience stems from a particular activation of cortical areas that handle thoughts about other people's thoughts and those that create emotional responses to people's prescience" (Jacob 2006).

What Boyer has stated above is exactly what neurotheologians are trying to find out.] He misses the point that the brain's capacity to conceptualize religious tenets can be insinuated in all equations of brain evolution. The anthropological changes that occurred during evolution influenced the very nature of society, environment and human awareness of God, and their openness to religious an mystical experiences.

4.2 MEANING AND SIGNIFICANCE

Neurotheology, also known as spiritual neuroscience, is the study of correlations of neural phenomena with subjective experiences of spirituality and hypotheses to explain these phenomena using neurological terms. Neurotheology in other words is primarily concerned with identifying the mechanisms underlying brain functions leading to the conceptualization of God, moral values, spiritual experience, guilt, faith and transcendental longings that have become an integral part of human personality. It does not address the subject of experience, beliefs, inner promptings that may belong to another dimension of reality, are also necessarily brain based. Aldous Huxley used the term *neurotheology* for the first time in the utopian novel *Island*. The discipline studies the cognitive neuroscience of religious experience and spirituality. The term is also sometimes used in a less scientific context or a philosophical context. Some of these uses, according to the mainstream scientific community, qualify as pseudoscience. Huxley used it mainly in a philosophical context. "Only one or two thousand nerve fibers connect the brain to the hundred million nerve cells in the small intestine. Those hundred million nerve cells are quite capable of carrying on nicely, even when every one of their connections with the brain is severed..."

In fact, the word Neurotheology at first glance would seem to combine neurological science (which explains the mechanics or the HOW of brain phenomena) with religious doctrine (which explains the WHY behind our life experiences and brain functions). Neurotheology is in fact primarily concerned with the mechanisms underlying brain functions like the conceptualization of God, moral codes, spiritual experiences, guilt, faith and transcendental longings that are an integral part of the human personality. It does not address the subject of theology except to acknowledge that mystic experiences, inner promptings and other phenomena dealing with another dimension of reality are necessarily brain based. It is important for scientists and theologians alike to understand HOW the brain works in a particular phenomenon and WHY it works in that particular pattern.

Thus Neurotheology, still in its infancy promises to fill a very important hiatus in our understanding of things transcendental. The term Neurotheology has been in use for at least 15 or more years. The discipline came into being because tremendous innovations in the mapping of brain fuctions (like fMRI – Functional Magnetic Resonance Imaging and related techniques) created an explosion in the knowledge of how the brain works. These new techniques have been used to map changes in specific regions of the brain during deep meditation, drug consumption, the telling of falsehoods, track action in the brain of serial killers who show no remorse and study brain injured patients who suddenly exhibit abnormal or nonethical behaviour. Neurological science has become a tool readily available for analyzing the reductionist aspects of transcendental happenings (Abraham 2006).

4.3. THE POWER OF HUMAN MIND

A group of neuroscientists have identified a region of the human brain that has some connection to thoughts of spiritual matters and prayer. Their findings tentatively tell that we as a species are genetically programmed to believe in God. However these studies do not in any way negate the validity of religious experience or God rather they just give an explanation in terms of brain regions that may be involved. What is really important is that the only manifestation of God that the human mind can respond to in a coherent ways is God's love, because we are unable to relate or understand a spirit. The mind is what drives us, the spirit is our personality or ego, and the body is the vehicle that is used to experience the physical world. So what we perceive as reality is only a canvas waiting for us to draw upon it any picture we want .Anything is possible with us. As Buddha, holds: "We are what we think. All that we are arises with our thoughts. With our thoughts we make the world." Even at this neurological age, his insight is valid. It is by making using this very mind that humans have visions of God and neurologist try to explain it.

Check Your Progress I

Note: Use the space provided for your answers.s.

1) What do you understand by "Neurotheology"?

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2) In the light of neurotheology comment on Buddha's insight: "We are what we think. All that we are arises with our thoughts. With our thoughts we make the world."

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4.4 VISION & DREAMS

A mystical vision is more profound that ordinary seeing. Throughout the centuries, mystics, prophets, and ordinary people from all religions have experienced visions from their deities or higher levels of consciousness that have informed them, warned them, or enlightened them. From Genesis to Revelation, God uses visions and dreams as a principal means of communicating with his prophets and his people. For example, in Numbers 12:6, God declares, "If there is a prophet among you, I the Lord make Myself known to him in a vision and speak to him in a dream." And in Joel 2:28: "And it shall come to pass afterward that I shall pour out my spirit upon flesh; and your sons and your daughters shall prophesy, your old men shall dream dreams, your young men shall see visions."

Roman Catholics holds that there are two kinds of visions. One is the imaginative vision, in which the object seen is but a mental concept of symbol, such as Jacob's ladder leading up to heaven. For example, St. Teresa of Avila (151–1582) had numerous visions including images of Christ. The other is the corporeal vision, in which the figure seen is externally present. Along with visions, dreams are also connected to our inner world. Priests and prophets as well as the common people, often experienced God as well as animal spirits and the souls of the dead, during the course of a dream. Dreams occur only in sleep. So it is pertinent of us to review some of the current views on the nature of sleep. There are two types of sleep- REM (Rapid Eye Movement) Sleep and NREM (Non rapid Eye Movement) sleep. These nomenclatures are based on the simple observation that during REM sleep the eyeballs move rapidly and continuously beneath the closed eyelids. Sleep, new information is processed and stored in the memory banks.

REM sleep plays a role in problem solving, memory consolidation, information processing and creativity (Abrahm 2006).

Vision recorded in the Bible, are the result of activation of the neural circuits in a very organized sequential manner. Most visions occur as the result of deep concentration. However the brain-mind ability to interpret impulses that have by-passed the five senses is the key to most spiritual experiences. We might, therefore, think of God as a non-local reality, not only permeating the cosmos but also communicating with the individual man. Einstein talked of "a knowledge of the existence of something we cannot penetrate, our perception of the profoundest reason and the most radiant beauty." It is this knowledge and emotion that constitutes true religiosity. Are dreams, visions meditation just purposeless phenomena? Why does a sense of holiness permeate some of these encounters? We need to recognize that in these encounters God impinges the; Brian, and a deep spiritual awareness is created as "Spirit speaks to spirit". Everyone should realize as Moses did on the mountain of Horeb that we perhaps are on holy ground and in the presence of God, in these spiritual encounters (Abraham 2006).

4.5 NEUROTHEOLOGY AND RELIGIOUS EXPERIENCE

In the year 1844, long before the establishment of neuroscience as a separate field of investigation and study, Orson Flower wrote, "This science shows … that a large section of the brain is set apart exclusively for the exercise of the moral and religious feeling." Now with the introduction of the most sophisticated imaging machines and new evolutionary insights into the brain organization, neuroscientists are confident of mapping the 'God Spot' in the brain. Brain, although, it has come under the scanner of scientists over the recent years, its mysterious nature still remains intact. Eelectroencephalography (EEG) is used to measure the electrical activity in the brain. EEG is commonly used because of it is relatively noninvasive and produces images with very good temporal resolution. Functional neuroimaging studies of religious and spiritual phenomena have utilized positron emission tomography (PET), single photon emission computed tomography (SPECT), and functional magnetic resonance imaging (fMRI). In general, such techniques can measure functional changes in the brain in pathological conditions, in response to pharmacological interventions, and during various activation states.

Spirituality is the heritage of all humankind and a function for our brain-mind construct. In fact, it is the result of millions of years of biological evolution. It is true to say that my mystical journey that commenced with the Big Bang and the birth of life is ongoing even now. The mystic experience of oneness and dependent communion with the spiritual is actualized in finite conscious experience and thus brain has a significant role to play there.

There are some basic structural and functional patterns that essential for the mystical experience. Some of brain parts involved are:

- A highly developed complex brain and mind connections.
- During the mystic experience some areas of the Brain are metabolically more active than others, although the Brain works as a whole.
- The pre-frontal neuronal connections especially the right orbital and medical surfaces
- The temporal lobes and parts of the parietal lobes
- The limbic system

- The rest of the brain acting in coordination

Every mystical experience is a highly individual experience and the mystic is never able to express and interpret it for others as he actually experienced it. The mystic experience may take myriad forms because extensive areas of the right brain are involved in its manifestations. It is important to differentiate between hallucinations and mystic experiences though the brain areas involved may be identical in both phenomena. Mystic experiences may originate in the brain from energies impinging on the cortex from other dimensions .Hallucinations are initiated exclusively by focal cortical neuronal activation. Hallucinations may occur secondary to brain lesions in any part of the cortex or due to high fever, drugs, starvation etc. Basically hallucinations occur due to loss of sensory input like vison and hearing.

St. Teresa of Avila (1515- 1582), considered one of the greatest mystic saints of Christendom described her mystic experience as follows: "I threw myself down in despair before an image of the Mother of God. With many tears, I implored the Holy Virgin to become my mother now. Uttered with the simplicity of a child, this prayer was heard. From that hour on, I never prayed to the Virgin in vain." Therefore it is amazing to say that St Teresa Avila was one of the great Christian mystics. Overcoming physical ailments, she became fully absorbed in her devoted to God. In Spain, Teresa of Avila offered to the world something profoundly mystical. Her mystical experience is the most successful culmination of the divine marriage between the aspiring soul and the liberating Christ, and it is here that man’s helpless crying will and God’s omnipotent all-fulfilling will embrace each other.

a. Limbic System Hyper-activation Theory of Religious Experience

The main proponents of this neurobiological theory of religious experience are R. Joseph and Vilayanur Ramachandran. Their main contention is that religious experience is nothing but the activation of the limbic-amygdalial region of the human brain. These neuroscientists link the universality of religious experience to the fact that every human being has a limbic system. R. Joseph writes: The limbic system is common to all peoples; this might explain why belief in souls, spirits, haunted houses, angels or demons, and the capacity to have mystical experiences, including the sensation of being possessed by gods or devils or hearing their voices, is worldwide.”

That the limbic system is the seat of a number of activities inspires these types of neuroscientists to link all those activities to religious experience. It is commonly believed and is a scientifically proved fact that the limbic system has been the seat of sexual pleasure, and emotions such as violence, fear etc.; whose hyper activation may also lead to hallucination. R. Joseph writes: “Perhaps it is because activation of limbic system generates spiritual and religious, as well as fearful and enraged, murderous feelings that so many of those who claim to be religious, including members of innumerable religious sects, become “righteous” belligerent, hateful, and murderous. Indeed throughout the recorded history, cults and organized religious have employed torture and human or animal sacrifice and have sanctioned if not encouraged the murder of non-believers, what could be referred to us limbic system blood lust” (Joseph 2001).

He continues to write (Joseph 2001): “Sex and food (along with fear, rage and aggression) are probably the most powerful of all limbic emotions and motivators and when harnessed or stimulated they can completely overwhelm or control the brain and lead to limbic hyperactivation coupled with religious or spiritual sensation, or at a minimum, complex dreams or hallucinations. Hence, hungry men will dream of food, and those who are sexually aroused will dream sex. A parched and starving man however, will not just dream, he will hallucinate food and water and will attempt to slake his desires by consuming a hallucination."

Another important aspect of this kind of neurobiological explanation of religious experience is that religious experiences could be relegated to the level of a pathological state, especially with the temporal lobe epilepsy. The fact that many epileptic patients do exhibit signs of religious hallucinations and experiences of religious fervour leads these types of neuroscientists to make the bizarre conclusion that those religious experiences are pathological. Joseph writes (Joseph 2001): "Many modern-day religious writers who also happen to suffer from epilepsy are in fact exceedingly prolific, whereas conversely, those who feel impelled to preach tend to do just that. In part this is a consequence of amygdala activation of Wernicke's area, the adjacent inferior parietal lobe, and Broco's area, which give rise to "voices", or strange thoughts, and/or a desire to speak."

R. Joseph argues that Moses and St. Paul, the two epitomes of Christian religious fervor in the Bible, one in the Old Testament and the other in the New Testament, might have had such epileptic seizures, which brought them to the brim of the arduous religious fervour which they exhibited in life; Moses in the freedom struggle of his own people and Paul in the evangelisation of the Gospel of Jesus respectively after their 'visions.' R. Joseph writes in the following vein (Joseph 2001): "If Moses subsequently (*after the exposure to the scorching sun in the desert*) developed temporal lobe epilepsy, this could explain his hyperreligious fervor, his rages, and the numerous murders he committed or ordered. Similarly his speech impediment, hypergraphia, and hallucinations, such as hearing the voice of God are not uncommonly associated with temporal lobe seizures and limbic hyperactivation."

b. The Triune Brain and the God-Talk

The main proponents of this theory of religious experience in neuroscience are neuroscientists Paul D. MacLean and James B. Ashbrook and Carol C. Albright (See Rottschaefer 1999). The latter two authors take the basic idea of the triune brain from the former, who, largely depending on evolutionary theories, claims that our human brain has three main parts corresponding to the three main evolutionary stages of development (Ashbrook 1989).

According to MacLean the first level of human brain organization is the reptilian Brain – whose main anatomic structure is the brain-stem. MacLean calls this the primal mind, as this is the first type of mind in the evolutionary development. The main function of this part of the brain is "life support" and "self-protection" (Ashbrook and Rausch 1997). The basic characteristic of life support is the phenomenon called 'my-turf' in which each organism finds its own place of settlement. Ashbrook writes, "The primal mind is literally territorial-my place my prerogative, my space, my inherited niche in the scheme of things" (Ashbrook 1989). Taking these anatomical insights of the reptilian brain, Ashbrook and Albright connect it to religion showing it as the biological base for the linguistic expression of territoriality in religion (Ashbrook and Rausch 1997). He writes in another article, "Such expressions may point to geographical territory such as the biblical concept of a Holy Land for the people of the Lord. They also may be psychological and theological analogical of territory based on the primal mind of the reptilian like brain" (Ashbrook 1989).

The second level of brain organization is the limbic system which MacLean calls the 'emotional mind'. This region according to MacLean plays a significant role in the nurturing, motivation, and preservation of continuity of species and familial bonds (Ashbrook 1989). This part's role in the symbolic expression is also emphasised. Ashbrook and Albright hold that this region is responsible for the picturing of a God who is nurturing, preserving humankind and saving them from slavery (Ashbrook 1989).

Neo-cortex, the new brain, is considered as the rational mind of the primates, especially in humans. Neo-cortex with its two hemispheres having two contrasting features - the right involved in more integrative processes and the left more analytical processes - makes human distinctiveness by assisting in the making of culture and science. However Ashbrook and Albright suggest in their book that both these hemispheres, though possessing contrasting features, act with a greater degree of cognitive integration through the help of the corpuscallosum. These hemispheric distinctions and the resultant integration, according to Ashbrook and Albright, represent different images of God. Regarding left-brain analogy of brain with God, they write, "It seems clear that the left brain that can begin to grasp the work of a creator of such surpassing reasonableness must, indeed, reflect one of the images of God." (Ashbrook and Rausch 1997) On the right brain they write, "Our human right brain, which comprehends all together, may, in a feeble sort of way, provide an image of this encompassing God who is manifested in the whole of reality." (Ashbrook and Rausch 1997) On the integration they write, "Surely God cannot be limited to one or another way of being God. … The conclusion is that God the mother/father/lover/ground of Being has cunningly designed the world, and supports its interactions and its inhabitants by perceiving and penetrating it whole." (Ashbrook and Rausch 1997).

Check Your Progress II

Note: Use the space provided for your answers.s.

1) What is limbic system hyper-activation theory of religious experience?
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2) What is the rational mind of the primates and its significance?
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……. ……….. …………….. ………….. ……. ……….. …………….. …………..

c. The Biological Tendency to Transcendence: The Neurobiology of Mystical Experience

Andrew Newberg, Eugene D'Aquili, Victor Turner and Colwyn Tevarthen are the main proponents of this theory of religious experience in which they argue that the potency to transcend the material existence of this world to the immateriality of the mystical experience is a built-in mechanism of the human brain which has evolved. "After years of scientific study, and careful consideration of our results, Gene and I … saw evidence of a neurological process that has evolved to allow us humans to transcend material existence and acknowledge and connect with a deeper, more spiritual part of ourselves perceived of as an absolute, universal reality that connects us to all that is" (Newberg, D'Aquili and Rause 2001). The proponents of this theory further try to show this by demonstrating that there is a biological drive to make myths and rituals, which will lead to transcendental experiences.

The proponents of this theory do this by dividing the brain into six operators of which the holistic operator is the one intimately related to the religious transcendental experiences. Situating at the right hemisphere of the brain this holistic operator helps to explain the mystical experiences which transcend temporal and spatial limitations (Barbour 1998). Eugene G. d'Aquili writes, "In certain rare cases, often induced by meditation, ritual behaviour, starvation, hypoxia, prolonged sensory deprivation, or various drug effects, the holistic operator can function as if it were on its own, independent of content upon which to impose wholeness. In these rare states of absolute function the operator generates simply the sensation of wholeness itself devoid of any specific content." (A'quili and Newberg1993).

6. "WHOLLY OTHER" AND THE "ABSOLUTE UNITARY BEING"

In mystical experiences as well as religious practices two commonly occurring notions regarding God or the Absolute are "Wholly Other" and "Absolute Unitary Being." he phrase 'wholly other' refers to the experience of divine as somebody who is transcendent, high above the heavens. Religious experiences, in this tradition, refer to the religious experience of the divine as the mysterious 'other.' Neuroscientific explanation of this type of experiencing God as the totally other or the mysterious other revolves around the process of deafferentation of those neural circuits within the inferior parietal lobule which generate the sense of causality in our ordinary processing of sensory input, and which we have termed in previous works the causal operator (A'quili and Newberg1993). This process of cutting of the passage of the neuronal activities would generate a kind of 'reified causality' – the great cause: the mysterious other.

The absolute unitary being is the form of mystical experience where the practitioner experiences an obliteration of the self-other dichotomy. She feels totally one with such a being, thereby giving up her own identity. It is believed that posterior superior parietal lobe is responsible for the sense of space and the distinction of subject and object in our normal perception. While the total deafferentation of the left PSPL results in the obliteration of the self-other dichotomy the deafferentation of the right PSPL generates a sense of absolute transcendent wholeness. Though it the inputs to this area is cut-off, neuronal impulses can shoot out of PSPL, and pass to hippocampi and to the limbic structures which are responsible for the emotions of happiness and joy. Thus the practitioner would experience deep sense of quiescence coupled with ecstasy. hus some of the salient features of mystical and religious experiences can be better understood through neurotheology.

Check Your Progress III

Note: Use the space provided for your answers.s.

1) How do you relate the biological tendency to transcendence with neurotheology?
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2) What is the importance of "Absolute Unitary Being" in mystical experiences?
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4.7 LET US SUM UP

After having given a brief introduction to neurotheology, we have tried to understand and interpret visions and dreams. Then we saw how neurotheology can explain religious experiences. Finally we came to relate God ("Wholly Other" or "The Absolute Unitary Being") in terms of neurotheology. Ours is just the beginning of a long research that will be carried out further in the next decades.

4.8 KEY WORDS

Deafferentation: The elimination or interruption of sensory nerve fibers. Such destruction of the afferent connections of nerve cells, performed esp. in animal experiments, to study the effect on brain.

Eelectroencephalography: The measurement of electrical activity in different parts of the brain and the recording of such activity as a visual trace (on paper or on an oscilloscope screen. Abbr. EEG

Functional magnetic resonance imaging (**fMRI**): Functional magnetic resonance imaging, or fMRI, is a technique for measuring brain activity. It works by detecting the changes in blood oxygenation and flow that occur in response to neural activity – when a brain area is more active it consumes more oxygen and to meet this increased demand blood flow increases to the active area. fMRI can be used to produce activation maps showing which parts of the brain are involved in a particular mental process.

NREM sleep: A recurring sleep state during which rapid eye movements do not occur and dreaming does not occur; accounts for about 75% of normal time of sleep.

Positron emission tomography (PET): using a computerized radiographic technique to examine the metabolic activity in various tissues (especially in the brain).

Single photon emission computed tomography (SPECT): Single photon emission computed tomography (SPECT, or less commonly, SPET) is a nuclear medicine tomographic imaging technique using gamma rays. It is very similar to conventional nuclear medicine planar imaging using a gamma camera. It is able to provide true 3D information.

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Indira Gandhi National Open University
School of Interdisciplinary and
Trans-disciplinary Studies

MPYE – 013

Philosophy of Technology

Block 4

DEATH AND PHYSICAL IMMORTALITY

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Varanasi

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Dr. Sathya Sundar Sethy
Dept of Humanities
IIT, Chennai.

Dr. Joseph Martis
St. Joseph's College
Jeppu, Mangalore – 2

Dr. Jaswinder Kaur Dhillon
147, Kabir park
Opp. GND University
Amristar – 143 002

Prof. Y.S. Gowramma
Principal,
College of Fine Arts,
Manasagangotri
Mysore – 570 001

Block Preparation

Units 1-4 Shabin Varughese
Jnana-Deepa Vidyapeeth
Ramwadi, Pune.

Content Editor
Dr. V. John Peter
St. Joseph's Philosophical College,
Kotagiri, Tamil Nadu.

Format Editor
Prof. Gracious Thomas
IGNOU, New Delhi.

Programme Coordinator
Prof. Gracious Thomas
IGNOU, New Delhi.

BLOCK INTRODUCTION

Death – can we overcome it? Though the longing for an everlasting life has been a perennial quest, we are somehow used to our physical death. Therefore, the question on human immortality will shake people up. It is within these chilling prospects that the block introduces the concept of physical immortality. To understand the idea of living forever, according to Bowie, we must look at two very different aspects of physical immortality. It is only when we connect these two extremes, and find a way to live our lives as an unbroken continuum between these two points, that we fully achieve physical immortality. Ageing will be stopped, even reversed. Even those working in the fields of cellular biology, molecular genetics and life extension have not yet faced the fact that current research has already opened the path to human immortality. The authors of human physical immortality maintain that it is an achievable aim, an approachable goal. Scientists may develop new biotechnologies to slow down the body's aging process and vastly increase the length of the human lifespan in the future. Therefore, the research is called life-extension research. Our lifespan is maximum 100 years or so, better ways to treat and cure diseases have made it possible for people to live longer on an average. Ricoeur points out that the disproportion that characterizes human beings makes evil possible, though not necessary. Evil, according to Becker, is taking part in the immortality project.

Unit 1describes the scientific notion and techniques of the possibility of extension of human life span. There are some scientific techniques used for it. The unit also analysizes the theoretical possibility of overcoming physical death and longing for physical immortality.

Unit 2 is about the dangers of trying to eliminate death. It is not to give any philosophical basis for evil (death), but to understand phenomenologically, some dynamics underlying the prevalence and progress of evil in our midst. We shall see that evil perpetuates itself in the very process of fighting it. It could be that denying and fighting death is part of such a process. After first analysing the fallibility in human nature, we try to explore the symbolism of evil, and then finally the unit speaks of the dynamics of evil perpetuating itself in the very struggle against death, and consequently evil itself.

Death spares no one. Everyone should face death. Truly the word *death* is frightening for many. **Unit 3** initiates the students to reflect on death and see it as part of life. It help us have a general understanding of human death, with different views of Heidegger and Nagel on death. Death is the cessation of the connection between our mind and body. Intellectually, everyone knows that one day all will die. We are usually so reluctant to think of our death because this knowledge does not touch our hearts, and it is inauspicious even to talk about death. Everyone should face death.

The **unit 4** presents before the students the two crucial choices facing us - extinction and extension. Teilhard described human being as "Evolution become conscious of itself." Today this profound definition has become dated due to the tremendous technological progress. The unit first begins analysing how human being can extend (or enhance). Then we shall take up some possibilities, by which humans can destroy the whole of life from the precious planet. Finally, we end this unit, by urging us to make a conscious and collective choice for life.

UNIT 1 EXTENDING PHYSICAL LIFE INDEFINITELY: SCIENTIFIC TECHNIQUES

Contents

OBJECTIVES

- To show the possibility of extension of human life span.
- To see some of the scientific techniques useful for it.
- To see the theoretical possibility of overcoming physical death and longing for physical immortality. Please note that we speak only of the theoretical possibility. In reality, such physical immortality most probably will not take place.

1.1. INTRODUCTION

According to the creation myth of Konos tribes of Guinea, Sa or death existed before anything. Death is regarded as the primary creator in this tradition. Once, long time ago, there was only darkness and Sa lived there with his wife and daughter. Since he wanted something more durable he created a slushy kind of mud sea as a place to live. From nowhere appeared the god Alatangana and he decided to improve on the work of Sa. Alatangana made the slush solid and added animals and plants to it. Sa was pleased and they became friends. But when the god asked for Sa's daughter the friendship fell apart. However, Alatangana met the girl secretly and eloped to a distant place and they produced 14 children: four white boys, four white girls, three black boys and three black girls. The children spoke different languages and the parents could not understand them.

This made them so upset that they decided to return to Sa and ask for his advice. Sa was ready to reconcile and demanded that the black and white children do not intermarry. So the different race originated. Sa demanded further: "You have stolen my only child. Now you must give me one of yours whenever I wish it. When I wish to call one of your children I must never be denied. You will know I am called by the sound of the calabash rattle in your dream." (Lemming & Lemming 1994: 164) So it was that death for us humans is the bride-price for Alatangana's marriage with Sa's daughter. So death is intrinsically linked to human's origin.

This simple myth explains aetiologically both darkness and life, death and birth, sex and procreation and gives justification to the races. The main focus of my article is that this intimate link between death and life may be soon broken – at least in our collective consciousness. It will have shattering consequences for our human – philosophical and religious – longing and hope.

In this unit we first study the quest for human physical immortality as a religious search. We see the emerging religious and collective movements which try to overcome death. In the next section we see the scientific basis for physical immortality. Though there is no hard "scientific" evidence for physical immortality, there are so many scientific disciplines at their cutting-edge or frontier research which indicate at least the theoretical possibility for physical immortality. In the final part we see the social or religious response to such a scenario. We conclude by affirming that such a guiding of our total destiny requires a healthy dialogue between science and society.

1.2. PHYSICAL IMMORTALITY: A PRIMORDIAL HUMAN LONGING

Though the longing for an everlasting life has been a perennial quest, we are somehow used to our physical death. Since we all take our mortality for granted, the geronotlogist author Herb Bowie holds that we tend to ignore the most potent anti-ageing organ in your body – the mind! If so, then the subconscious messages we are constantly sending ourselves may be sabotaging human longevity. "Can you imagine yourself living for 100 years, 120, or even longer? If not, then you may be undermining your nutritional program by feeding yourself 'mental junk food' -- negative programming predicting your own deterioration and demise." (Bowie 1998)

The author exhorts that we should start feeding your mind a new food. His book, *Why Die?* speaks clearly and intelligently about the possibility of living virtually forever. By stretching the mind to accept this exciting new human possibility, we shall be conditioning ourselves to live a longer, healthier and happier life.

Most of us make the unconscious decision that we have to die. They assume that their fate is ordained by the laws of nature, or by destiny. This choice is made so early in life, and at such an unconscious level, that few people ever even challenge it. So ask the question on human immortality will shake people up. Because even to ask this question is to imply something unthinkable for many people -- that death is a choice, and not a foregone conclusion. Further, most of us feel disoriented and threatened by the consideration of physical immortality as a real possibility. It is within these chilling prospects that the author introduces the concept of physical immortality.

To understand the idea of living forever, according to Bowie, we must look at two very different aspects of physical immortality. On the one hand, it is about eternity, about surviving to some unthinkably distant point in the future. On the other hand, though, it is all about choosing how to live our lives today. It is only when we connect these two extremes, and find a way to live our lives as an unbroken continuum between these two points, that we fully achieve physical immortality. There is an element of paradox here.

This paradox is also expressed in these haunting lines from William Blake.

To see a world in a grain of sand
And a heaven in a wild flower,
Hold infinity in the palm of your hand,
And eternity in an hour. (Capra 1977: 288)

We believe that Blake was not speaking metaphorically though. In the book the author wants to talk about transforming the quality of our lives today, by focusing our attention on our own eternity. At the same time, I will be talking about actually living for hundreds and thousands of years, by focusing our attention on the quality of our lives today. The author asserts that if such a view seems like a paradox, then this is only because we view our today's and our tomorrow's as separate and unconnected.

Physical immortality is difficult, in a way, to talk about at length because it can be approached from so many different angles. Since all of these perspectives are equally valid, it is impossible to do the subject justice by discussing it in a strictly linear fashion. We can start with forever and work backwards. We can start with today and go forwards. We can talk about the fate of humanity, or we can discuss the personal feelings of one individual. No matter how we approach the subject, though, we always seem to arrive at the same conclusion: that living forever is a practical and meaningful goal.

Reaching the same conclusion from so many different starting points is reassuring in the long run, but can be a bit disconcerting at first, as we repeatedly shift perspectives. We may feel more comfortable with some approaches than with others, and so may be tempted to skip around.

Following similar lines of thought, another scholar claims that the first immortal human beings are living among us today. (Bova 2000) It is asserted by its proponents that there are men and women alive today who may well be able to live for centuries, perhaps even extend their life-spans indefinitely. For them, death will not be inevitable. Death will have to die for them!

Such immortal humans will not age. They will not become feeble and sickly. Ageing will be stopped, even reversed. One may be young and vigorous forever. Accidents and violence will not disappear, of course. People will still be vulnerable to poor judgement, bad luck and evildoers. But death from old age, death as the inescapable end of life, will become a thing of the past, a dark memory of primitive days. As the American immunologist William R. Clark put it, "Death is not inextricably intertwined with the definition of life." Just because human beings have always died does not mean that they always will die.

This same idea is reflected in the leading article of a acclaimed German weekly. (Spiegel 2000) It asserts that immorality belongs to the originary human desire (*Ursehrsucht*). It will not just redeem humanity from death but raise it almost to the level of gods. Michael Fossel, professor of Clinical Medicine in the State University of Michigan asserts: "the most significant turn in the human history has begun. In twenty years we can stop the process of ageing and reverse biological clock." He certainly is a super-optimist. Philipp Lee Miller of the Longevity Institute in Los Gatos, prophesies: "in a few years time 80 year olds will feel like 20 year olds and will play like teens." This sentiment is accentuated by the New Yorker Professor Michio Kaku, who expects a tripling of life expectancy and a cessation of ageing process in a few years time.

The above longings and claims make it abundantly clear that immortality is slowly distilling into the collective unconsciousness of humanity. We shall study further the claims of immortality and see if there is any psychological and scientific basis for it.

1.3. PHYSICAL IMMORTALITY: A LATENT HOPE OR TALL CLAIM?

The authors who write on this subject rightly maintain that in the quest for immortality time is on our side. The medical and biological advances that will be achieved over the next ten to twenty years will undoubtedly allow us to live long past one hundred; and the longer you live, the more knowledge that biomedical scientists glean, the farther and farther our life-span will be extended. Finally it is hoped to reach the unlimited and immortal state. Of course, most of the authors admit that very few scientists accept today that immortality is within our grasp. Even those working in the fields of cellular biology, molecular genetics and life extension have not yet faced the fact that current research has already opened the path to human immortality. That is the crucial issue. The authors of human physical immortality maintain that it is an achievable aim, an approachable goal.

A poignant case in this respect is a book. (Bowie 1998) Here we give a summary of the Book *Why Die* (Bowie 1998) The book consists of 12 parts. In the first part which deals with "The Vision" Herb Bowie offers a fictional look into the next century. This narrative focuses on one couple as they experience the possibility of living forever. The story gives a good overview of what is meant by physical immortality, and introduces many ideas that will be expanded on later in the book. The second part, "Beginnings," includes several different chapters that, in different ways, start the discussion of living forever. Our culture has produced many different images of physical immortality, so a terminological discussion on the term 'immortality' is called for. The origins of the idea of immortality is traced, pointing out that the idea of living forever is not really as strange as it may first seem. One may be surprised to hear what some experts in related fields have to say on the subject. Finally, the author looks at the case of someone who decided to stick with the safety of conventional beliefs, and strongly suggest that we try something different.

Part three, "The Decision to Live," suggests that life and death are the results of decisions we make, and not things that just happen to us. A straightforward quiz that will determine your IQ (Immortality Quotient) is given. Many forms of social conditioning prepare us to pack it in after only 70 or 80 years, and these will be pointed out. Also included here will be a discussion of the benefits that a belief in our own physical immortality can have on your life today.

Further, the next part, "How To Live Forever," reveals what the author calls the 15 minimum requirements for physical immortality. He believes that these techniques are bound to improve your life today, and offer real hope of extending our lives indefinitely. Part five, that deals with "Feelings," talks about the importance of recognizing and nurturing our feelings of being here forever. In this part of the book Bowie talk about what it feels like to look forward to eternity.

The next part of the book looks at the possibility of human physical immortality from a scientific perspective. It is pointed out that the physical and biological sciences have found no fundamental

quest for immortality is based on scientific facts. There are many ways of approaching this subject. Many fields are involved indirectly in the quest for immortality (Strout 1998).

We believe that there may be a real possibility to extend the human lifespan, although it may not be infinitely. Scientists may develop new biotechnologies to slow down the body's aging process and vastly increase the length of the human lifespan in the future. So the research is called life-extension research. Our lifespan is maximum 100 years or so, better ways to treat and cure diseases have made it possible for people to live longer on an average. But, life-extension research aims at making it possible for people to live much longer lives than we do today, not simply by treating or curing disease, but by slowing down the actual aging process itself. Some scientists estimate that we could live up to 150 years or more by intervening in the rate that we age. Also there are many possibilities that I mention below.

a. Ageing Associated with Mitochondria

The Journal *Science* (Science 2000) reports that specific changes in the mitochondria DNA (mtDNA) are associated with ageing. There are several reasons to believe that the mitochondria may be important in ageing. The mitochondria are the generators that power our cells. In performing this function they generate free radicals. Therefore changes in the mitochondria that occur with ageing are of practical interest for those who would like to extend the human life span. (Hewitt 1996)

Mitochondira are unique components of a cell because they possess DNA of their own and replicate in a manner similar to the cells in which they are found. This DNA is a remnant of the ancient forerunner of the mitochondria which was a free-living bacterium. This study, which was conducted at the California Institute of Technology focused on mutations in the region of mtDNA that controlled the replication of the mtDNA itself . It was found that specific mutations in the control region would appear and proliferate within individuals as they age. This complements prior work that demonstrated that the amount of active mtDNA declines as an individual ages. It may be that the accumulation of the mutations such as those detected in this study are the underlying cause of this phenomenon.

This study involved meticulous and laborious bench work and data analysis. Samples from over twenty individuals were assayed for multiple mutations. In some cases two samples from the same individual at different ages were processed. Certain mutations were common (57%) in older individuals (above 65 years) but absent in samples from younger individuals. In the samples taken from the same individual at different ages (longitudinal studies) the same frequency of mutations was also observed. This data indicates that specific mutations in mtDNA become more frequent with age. However, these results do not prove that these mutations are involved in ageing. Further studies will be required to determine if these mutations are related to impaired function of the mitochondria.

One concern that emerges from these experiments is related to the fact that the region being examined is involved in mitochondrial DNA replication. This means that it is possible that mutations in this region may impair or increase the efficiency of replication of the mutated mtDNA. Therefore, it is quite possible that the mutations observed in this study give rise to mitochondria that are more efficient at self-replication. This would explain the accumulation of mtDNA with these mutations with the passage of time (i.e. in older individuals) without any role in the phenomenon of ageing. (Hewitt 1996)

b. Cryonics

Cryonics is the low-temperature preservation of humans and animals who can no longer be sustained by contemporary medicine, with the hope that healing and resuscitation may be possible in the future. Ideally, cryonics would allow clinically dead people to be brought back in the future after cures to the patients' diseases have been discovered and aging is reversible. Modern cryonics procedures use a process called vitrification which creates a glass-like state rather than freezing as the body is brought to low temperatures. This process reduces the risk of ice crystals damaging the cell-structure, which would be especially detrimental to cell structures in the brain, as their minute adjustment evokes the individual's mind (Immortality 2011).

c. Cyborg or Cybernetic

A cyborg is the short form for a “cybernetic organism”. It is a being with both biological and artificial parts. Fictional cyborgs are portrayed as a synthesis of organic and synthetic parts, and frequently pose the question of difference between human and machine as one concerned with morality, free will, and empathy. The term was coined by Manfred E. Clynes and Nathan S. Kline in 1960 to refer to their conception of an enhanced human being who could survive even in extraterrestrial environments.

Transforming a human into a cyborg can include brain implants or extracting a human mind and placing it in a robotic life-support system. Even replacing biological organs with robotic ones could increase life span and depending on the definition, many technological upgrades to the body, like genetic modifications or the addition of nano-robots would qualify an individual as a cyborg. Such modifications would make one impervious to aging and disease and theoretically immortal unless killed or destroyed.

Their concept was the outcome of thinking about the need for an intimate relationship between humans and machines as the new frontier of space exploration was beginning to take place. Generally, the term "cyborg" is used to refer to a human with bionic, or robotic, implants. These mechanical parts enhance the body's "natural" mechanisms. Some theorists cite such modifications as contact lenses, hearing aids, or intraocular lenses as examples of fitting humans with technology to enhance their biological capabilities; however, these modifications are no more cybernetic than would be a pen or a wooden leg. Cochlear implants that combine mechanical modification with any kind of feedback response are more accurately cyborg enhancements.

d. Mind Uploading or Whole Brain Emulation

Mind uploading or whole brain emulation is the hypothetical process of scanning and mapping a biological brain in detail and copying its state into a computer system or another computational device. The computer would have to run a simulation model so faithful to the original that it would behave in essentially the same way as the original brain, or for all practical purposes, indistinguishably. The simulated mind is assumed to be part of a virtual reality simulated world, supported by a simplified body simulation model. Alternatively, the simulated mind could be assumed to reside in a computer inside a humanoid robot or a biological body, replacing its brain. In theory, if the information and processes of the mind can be disassociated from the biological body, they are no longer tied to the individual limits and lifespan of that body. Furthermore, information within a brain could be partly or wholly copied or transferred to one or more other substrates, thereby reducing or eliminating mortality risk (Mind Uploading 2011).

One idea that has been advanced involves uploading an individual's personality and memories via direct mind-computer interface. The individual's memory may be loaded to a computer or to a newly born baby's mind. The baby will then grow with the previous person's individuality, and may not develop its own personality. This could be accomplished via advanced cybernetics, where computer hardware would initially be installed in the brain to help sort memory or accelerate thought processes. Components would be added gradually until the person's entire brain functions are handled by artificial devices, avoiding sharp transitions that would lead to issues of identity. After this point, the human body could be treated as an optional accessory and the mind could be transferred to any sufficiently powerful computer. Another possible mechanism for mind upload is to perform a detailed scan of an individual's original, organic brain and simulate the entire structure in a computer. Whatever the route to mind upload, persons in this state would then be essentially immortal, short of loss or traumatic destruction of the machines that maintained them (Immortality 2011).

Check Your Progress II

Note: Use the space provided for your answers.

1) What is the significance of cryonics?

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2) What is mind uploading?

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e. Stem cell Research

Like the two sides of the coin, stem cells have both merits and demerits. It is always better to approach a thing in optimistic way. Likewise, I am going to deal with stem cells in more positively. Stem cells have the capacity to develop into all kinds of cells and also it can repair the damaged cells too. So it is used in medical field to cure the diseases like diabetes and heart disease. According to me stem cells are the pinnacle of achievement by modern science, because it cures very many diseases. Likewise it also cures some genetic problems too. Stem cells are divided and transformed into another cell to cure the damaged cell. It also can be used in cloning and can develop human arts in laboratory. Thus it helps humans to lead a long life. I feel that stem cells research paves way to the better living humanity for a long duration without diseases. Today, science has becoming the blessing in the life of many. My diseases no more control my life, but with the help of science I can construct my life and march towards a new horizon of hope

f. Cloning for Extending Life?

When Dolly was unveiled three years ago as the first cloned mammal it was as if the new millennium had already dawned. From the pages of pulp fiction and B movies came the clones with an all out media blitz which had pundits opining and scientists pontificating. On this occasion it seems that the media feeding frenzy was proportionate to the significance of the discovery. (Hewitt 1996)

One issue that was of particular interest was whether the age of Dolly's cells would reflect their previous incarnation or did Dolly start with a *tabula rasa* like any new-born. It was soon determined that Dolly's cells were older than sheep that had been born naturally. It had been hoped that the nuclear transfer cloning technique would be able to provide a limitless supply of cells for regeneration and repair of diseased tissues. The limited life-span of Dolly's cells were a setback for this goal.

The April 28th, 2000 issue of science features a report indicating that Dolly's premature frailty is not necessarily the rule when dealing with clones. On the contrary, it appears that clones can actually be younger than naturally born animals. The bearer of this joyous news is an aptly named young calf, Persephone.

The clones in this study were made by a technique that is somewhat distinct from how Dolly was produced. The cells that were used to generate Dolly and Persephone were halted at different stages of the cell cycle. Dolly was produced from cells that had temporarily withdrawn from the cell cycle into a stage referred to as G0 or quiescent phase. Persephone, on the other hand, was produced from a cell that had divided until it could undergo no further DNA replication and encountered a roadblock at the border of G1 and S phase. Persephone's mother cell was considered senescent. This may be the reason that Persephone is younger than she should be and Dolly is older than she should be.

The implications of the experiments with Persephone are enormous. This confirms that it is possible to produce a plenitude of cells through nuclear transfer and somatic cell cloning. These cells can be used to repair tissues that have been damaged by ageing or disease. This research has yielded a model system which enables the examination of the role that telomere length plays in ageing. It also gives rise to the more controversial possibilities of creating longer-lived human clones. Whatever future developments proceed from this discovery, it is a watershed development in ageing research and is particularly pertinent to the telomere theory of ageing.

1.5. REFLECTIONS

Right in the beginning we must assert that the search for physical immortality is still at the level of a search. Right now, we have no seen any real possibility for attaining physical immortality. At the same time, many of our technologies may be able to extend our physical life span, which is not the same as eliminating death (or physical immortality).

Such a possibility of physical immortality has deep rooted religious consequence. Religions can ignore the challenges posed by immortality only at the danger of instant self mortality. The obvious danger of such a possibility is that each one becomes so preoccupied with his own individual immortality and forgets the human community and life in general. There is a danger that the larger issues of providing justice for the impoverished, fostering of life in general and love as the most significant human value may be forgotten.

At the same time it must be reiterated that physical immortality does not render God superfluous, religion redundant and human longing unnecessary. Even in the situation of immortal humans there is scope for meaningful hope, for relevant religion and for a liberating God. At the same time Immortality necessitates a human hope that may be detached from physical death. In our ordinary understanding of human longing, death is seen as the starting point of eschatology or human hope. That view has to be given up and we need to delve deep into the "inaugurated eschatology" which theologians have taken seriously since few decades.

We still need to take death seriously. But death may not be given the supreme importance and inevitability that was it due once. So the human hope and fulfilment has to begin with this present world, with the here and now. There are of course social and existential problems like poverty and injustice which are to be tackled seriously.

It must be noted that overcoming physical death and attaining physical immortality does not solve the problem of human contingency. The issue of human finitude has to be addressed in a much wider sense. The tendency of those seeking physical immortality is to reduce human life to a physicalistic or mechanistic view point. They would stress that attainment of physical immortality – temporal unlimitedness – necessarily leads to human fulfillment. We need to focus also on the existential and ontological contingency of human condition, not merely that of the temporal conditioning.

So even in a world of immortal human beings, human longing and hope is imperative. Hope still remains intrinsic to humans. But it is a hope based on the day-to-day experience of humans and rooted in the present day, not one aimed primarily at a later world "a pie-in-the-sky-when-you-die" type. So life, today's precious, fragile life, has to be taken seriously. It has to be affirmed, respected and fostered in its entirety. We can hope to pay back the bride-price for Alatangana's marriage with Sa's daughter and life lives "full and abundant" and not necessarily temporally limited.

1.6. SOME QUOTES

"The ancient seers were not egoistic. They called the whole humanity – past, present future – *Amrutya putra*. You are all sons of immortality. Equal and eternal." Bhagawan Rajneesh (Osho 1998: ch3).

"Mankind will postpone human ageing substantially in the future, doubling the human lifespan at least, when we have accomplished this we will be ashamed that we did not work on it much sooner." Michael Rose, Evolutionary Biogerontologist

"The philosophy of immortality believed will produce death. That is, believed rather than practiced. Belief is past; everlasting life is an eternal daily consciousness. It is not something you did, but something you do." Leonard Orr (Author of The Science of Everlasting Life).

Check Your Progress III

Note: Use the space provided for your answers.

1) How does cloning extend human lifespan?

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2) What are some of the religious implications of physical immortality?

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1.7. LET US SUM UP

In this unit we have dealt with the theoretical possibility of physical immortality and other technological ways of extending human life. We also saw some of its philosophical implications.

1.8. KEY WORDS

Cryonics*:* The practice or technique of deep-freezing the bodies of those who have died of an incurable disease, in the hope of a future cure

Cyborg*:* a person whose physiological functioning is aided by or dependent upon a mechanical or electronic device. Combination of Cybernetics and Organism.

Gerontology: The scientific study of old age, the process of aging, and the particular problems of old people

Mitochondria: An organelle found in large numbers in most cells, in which the biochemical processes of respiration and energy production occur.

Ursehrsucht: *Sehnsucht* (German) is human longing. *Ursehrsucht* is the deepest or primordial human longing.

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UNIT 2 OVERCOMING DEATH: PHILOSOPHICAL REFLECTIONS

Contents

2.0 OBJECTIVES

- To see some of the dangers of trying to eliminate death.
- To trace the origin of evil that is born out of the very desire to over evil (including death).
- To see that mortality is essentially part of human existence today.

2.1. INTRODUCTION

Without attempting to give a philosophical analysis of the origin of evil, the we present some of the dynamics at work in the emergence of evil, based mostly on Paul Ricoeur and Ernest Becker. Ricoeur points out that the disproportion that characterizes human beings makes evil possible, though not necessary. The progress from *bios* to *logos* has enabled us greatly and also made evil possible. As a continuation of the philosophical analysis, Becker showed the psychological dynamics at work, whereby evil multiplies itself in the very attempt at eliminating it. Both the thinkers trace the existence of evil (and also goodness and freedom) to the disproportion or in-betweenness in the human condition. So this article is a phenomenological description of the emergence and progress of moral evil in individual human beings and human society.

Here our warning is that those who seek to eliminate death and search for physical immortality may be adding to the evil in the world, without wanting it. Evil, according to Becker, is taking part in the immortality project.

2.2. OUR PROCEDURE

"The essence of man is discontent divine discontent; a sort of love without a beloved, the ache we feel in a member we no longer have" (Ortega y Gasset 1940) "Divine discontent" and "denial of death" are characteristics of contemporary humans. And they are also intimately connected to the emergence and existence of evil. In this essay an attempt is first made to relate evil, at least moral evil, to the basic human condition of disproportionality. For this we draw insights from two prominent thinkers of the last century: philosopher Paul Ricoeur and psychologist Ernest Becker.

Our aim in this unit is not to give any philosophical basis for evil, but to understand phenomenologically, some dynamics underlying the prevalence and progress of evil in our midst. We shall see that evil perpetuates itself in the very process of fighting it. It could be that denying and fighting death is part of such a process. After first analysing the fallibility in human nature, we try to explore the symbolism of evil, and then in the final section, see the dynamics of evil perpetuating itself in the very struggle against death, and consequently evil itself.

Check Your Progress I

Note: Use the space provided for your answers.

1) What is disproportion of in-betweenness and how is it part of being human?

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2) “Denial of death itself is a way of fostering evil.” Comment.

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2.3. THE SYMBOLISM OF EVIL

a. The Symbol as the Starting Point for Thinking

We all can make mistakes and commit evil. Fallibility is our human inclination to make mistakes. The examination of human fallibility can show, where and how the evil in man can originate. The transition from innocence to guilt is not to be understood otherwise than as an execution of the confession by which man accepts his responsibility for his actions in symbolic language. In *The Symbolism of Evil*, Ricœur is engaged with the concrete expressions of the human experience of evil in symbols (which we also meet in myths and in primary confessions).

Before he actually proceeds with his task of studying the symbolism of evil through its concrete expressions, Ricœur gives an account of his procedure. “How do we move from the possibility of human evil to its actuality, from fallibility to its act?” (Thorer 1984) . This is the initial question for him. He wants to capture the transition from fallibility to its actualization by concentrating on the symbolism of evil from concrete human experiences. What he intends to do is a phenomenology of guilt, which repeats itself on its way to the imagination and to the projection of the confession of guilt. The phenomenology screens and orders the materials which would be the object of human thought. Thus there is an intimate connection between philosophical speculation and the pre-reflective expression (of guilt for example) in symbols. When one reflects on the philosophical expressions of evil, one is led back to the original expressions of it in the myths. Then there is the move from the myths to its building blocks – the symbols. The symbols characterise evil as blindness, as ambiguity, as anger. They refer to an oppressive experience and man in turn tries to grasp this experience with the help of language. The experience of evil forces itself to be expressed, so that all the speaking - including the philosophical reflection - about it refers back to its original experience.

The area of investigation in *The Symbolism of Evil* is limited, as Ricœur points out. It refers to a particularly important area: how evil touches on a central and crucial relationship between man and the sacred. So it is to be expected that an examination in this area will give us a deeper understanding of the myths and symbols. In this crisis, the whole vulnerability of reality is evident: "Because evil is in a special way the critical experience of the sacred, the threatening rupture of this relationship of man with the sacred may be urgently felt, and [also] how man is dependent on the power of this sacred" (Thorer 1984: 39).

b. The Symbols of Evil: Stain, Sin, Guilt

Ricœur elaborates his understanding of evil in terms of the primary symbols of stain, sin and guilt. In *The Symbolism of Evil*, the imagination goes back to the farthest region where crime and misfortune are not to be differentiated. The Stain, which is associated with definite actions, is something analogous to a material thing. Evil action brings with it punishment. Evil action effects suffering. So the symbolism of *Stain* is the first explanation and rationalisation of suffering. The imagination of a stain points to a judging and avenging instance, which though remaining anonymous, concretises itself in the laws and rules of society. When the guilty is accused of a crime, there is also a simultaneous expectation of responsibility, of proper punishment and with it a hope that the fear and consequences of this crime would thus disappear (Bradley 2005: 444f).

A new step in the development of evil is the building up of *sin consciousness.* This consciousness presupposes a personal relationship to the God who invites us. Sin shows that aspect of guilt felt in the presence of God. Biblically speaking, sin is the breaking of the covenant. The next stage of internalisation is reached with the formation of *guilt consciousness.* Guilt shows the subjective moment of the crime (to be differentiated from sin, the objective, ontological moment). Guilt consciousness consists of the fact that one is intensively aware of one's responsibility and of his ownership. In this sense, it is anticipated and internalised, leading to pricks of conscience.

The *imagination* of evil develops from a material understanding (Stain) of evil to a deeper internalisation (Guilt). In this process the symbols of the earlier stages of development are not just denied or negated, but are carried over to the later stages of development. Thus there exists a connection between all these symbols. "So there is a circular movement taking place between all the symbols: the last symbol relives the sense of the preceding symbol, but the first gives the last the full symbolic power". If one wants to name the concept towards which the development of the original symbols of evil leads, then one is confronted here with the paradox of the "Non-free Will". This concept – which is not identical with that of fallibility, but which is to be understood only in connection with the symbolism of evil, and which in turn gives it its significance – is characterised by Ricœur as having three moments (Thorer 1984: 42):

a. *Positivity:* Evil is a power
b. *Expressivity:* Evil presupposes the free decision of man and comes as a temptation
c. *Infection:* If humans give in to evil, first it is an outward act and then it spreads. It becomes contagious. At the same time, turning itself over, it tends to make the agent of the action to be innerly a slave.

So far we have analysed the philosophical contribution of Paul Ricouer on evil, which could be enhanced by the insights of social psychologist Ernest Becker, as we proceed to the next section.

Check Your Progress II

Note: Use the space provided for your answers.

1) Briefly explain the three symbols of evil?

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2) Which are the three moments of evil, according to Ricouer?

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2.4. EVIL AS DENIAL OF MORTALITY

Another prominent and insightful thinker of the last century who dwelt elaborately on evil is Ernest Becker in his two classics (Becker 1973 & 75). Like Riceour, he too felt that evil finds its driving force in the human's paradoxical nature: "in the flesh and doomed with it, out of the flesh and in the world of symbols and trying to continue on heavenly flight" (Becker 96). Becker humbly reminds humanity that we are still animals, with all of the instincts and seemingly irrational chaotic impulses befitting all animals. Yet, paradoxically, humanity is fitted with a sense of reason that wishes to attain a "destiny impossible for an animal" (Becker 1975: 96). What we perceive as evil, in every form, is essential to any temporal creature. It is a part of the very properties of humanity that we exhibit qualities of moral evil, according to Becker.

Ernest Becker provides part of the answer to the problem of evil; that is, the paradoxical nature of the human, just as Ricoeur does. Humanity is both animal and rational, and there lies the source of evil. A human being is a finite, limited and fallible being that is controlled mostly by animal urges based mostly around survival, while at the same time possessing a reasonable mind capable of transcending these things and reaching out to the Divine. Humans are capable of creating evil as part of their nature, choosing evil in the very search for the good. Our desire to eliminate evil may itself be our undoing (Hoffman 2002).

a. Participating in the Immortality Project

Why is it that of all the creatures on the earth human beings are the only ones to wage war, commit genocide, and build weapons of mass destruction? Social psychologist Ernest Becker raised this question and then proposed an insightful answer in his book, *Escape from Evil* (Becker 1975), going one step further than Ricoeur.

Becker's answer begins by recognizing that of all creatures, human beings alone seem to be the ones who are conscious of their own mortality. This awareness gives rise to an anxiety that most people would rather not feel. So people cope with this situation by essentially choosing sides. They choose to align themselves with the side of life rather than of death, or identifying themselves with "immortality projects" (Hoffman 2002). People align themselves with the side of life by seeking anything that promises to sustain and promote their own lives, such as power or money. Alignment with power can have two faces: malignant power over others, as the power created by autocrats, or benevolent power, as in the power vested in the skills of a physician. Likewise, alignment with money can result in exploitation or philanthropy.

It may be noted that people also seek to align themselves with the side of life by seeking alignment with things that endure beyond a single individual's lifetime. These can include making a "lasting" contribution to a field of art, literature, scientific inventions or knowledge. These can also include involvement with religious movements or specific cultures. These larger than life phenomena in some way assure the perpetuation of the significance of the people associated with them, a kind of immortality (Hoffman 2002).

From this point of view, a threat to a person's culture, religion, or "lasting contributions" is viewed as a threat to that person's *own* immortality project. The immortality project must be defended at all costs. This is the reason why some conflicts in the world can become so intractable. It's not just my country or tribe that is being threatened, but the very significance of my own life. Becker says, "This is what makes war irrational: each person has the same hidden problem, and as antagonists obsessively work their cross purposes, the result is truly demonic" (Becker 1975: 109).

People also try to align themselves with the side of life by aligning themselves with what is "good." This is because life is associated with "good" as opposed to death, which is "bad." Becker argues that this alignment with good may also be a major cause of evil. To follow his reasoning it is necessary to make a little digression to understand the psychological concepts of shadow and projection (Becker 1973).

b. Projecting the Shadow of the Shadow

The psychological shadow is the dark complement of the consciously expressed personality. It represents those personal qualities and characteristics that are unacceptable to the conscious ego. To borrow a fitting image from the poet Robert Bly, the shadow is like a sack that you drag behind you everywhere you go and into which you toss all the aspects of yourself that you are ashamed of and don't want to look at (Bly 1998). The psychological shadow is much like the normal human shadow: everybody has one; when you face toward the light you can't see your own shadow; and sometimes everybody else but you can see it.

Oftentimes these disowned contents of the psychological shadow are "projected" onto someone else. Then we see "out there" what is really "in here". Typically the person we choose to project onto is not entirely innocent. He or she has some "hooks" on which we can hang our projections. If we're ashamed of our own anger, we find a slightly irritated person and view her as totally enraged. That's how projection of the shadow works.

People with inflated self esteem find it easy to see themselves as being almost always on the side of the "good." Becker's argument is that in the process of taking the side of life and of the good, we project our shadow onto an enemy. Then we try to kill it, and in this process perpetrate evil, without our willing it. Psychologist Roy F Baumeister also reaches a similar conclusion. He holds that a major cause of evil in the world is the idealistic attempt to do good. Some examples include the Crusades, the Spanish Inquisition, the Thirty Years' War in Europe, in which Catholic and Protestant troops devastated much of Germany in attempting to wipe out the "evil" version of the Christian faith represented by the other side, murders committed to prevent the "evil" of abortion, and the Stalinist and Maoist purges in Russia and China. He points out that "studies of repressive governments repeatedly find that they perceive themselves as virtuous, idealistic, well-meaning groups who are driven to desperately violent measures to defend themselves against the overwhelmingly dangerous forces of evil" (Baumeister 1997).

For instance, in many ways the Nazis were idealists. The Nazi SS was composed of the elite, the noblest of the population; yet they willingly committed the most horrible deeds. The Nazis wanted to transform their society into a perfect one. They wanted to root out the elements that they considered "evil". Yet they almost never considered their own actions as evil, but perhaps at worst an unfortunate necessity in carrying out a noble enterprise (Baumeister 1997: 34, 38). The Nazis projected filth and evil on to the Jewish people and then tried to establish a "pure" state by eliminating the Jews. One of the professed motivations of racist lynchings in Western society was to maintain the "purity" of the white race. Many animal species, including coyotes, wolves, and prairie dogs have been irrationally persecuted by humans in the name of eliminating "varmints" and "filth" and "disease-carriers." Enemies are "dirty."

Historically, nations have been aroused to war by the depiction of the enemy as pure evil. In cases of reciprocal violence, such as war, each side tends to see itself as the innocent victim and the other as the evil attacker. If we, as a nation, do not do our own "shadow" work, we will simply respond to violence with more of the same and in this process we ourselves will perpetuate evil. Once a person has decided that some other is evil (or devil), the decision helps justify behaviours that tend to belittle or punish the other. Such behaviours are precisely the behaviours that justify the other person in seeing the first person as evil. This reciprocal projection and dehumanization usually leads to a downward spiral. Patterns of violence often grow worse over time. The typical pattern for marital violence and violence among strangers is for minor insults and slights to escalate more or less slowly to physical attacks and violent aggression (Baumeister 1997: 283).

As Baumeister points out, one of the reasons why violence tends to spiral downward is that there is typically a huge discrepancy between the importance of the act to the perpetrator and to the victim. Baumeister calls this the magnitude gap (1997: 18). For example, rape is a life-changing event for a woman, while it may be only a few moments of excitement and limited satisfaction to the rapist. Whether an SS officer murdered 25 or 30 Jews in a given day was a matter of additional work for the SS officer, but a matter of life and death for the 5 additional Jews. Hoffman notes that the magnitude gap functions in a way that makes evil worsen over time. In a pattern of revenge, as occurs in terrorism and occupation, the roles of victim and perpetrator are constantly being reversed. The perpetrator (A) may think he has harmed the victim (B) only at a level of, say, one damage point. The victim (B) however feels harmed at a level of ten points. To exact tit-for-tat revenge, B perpetrates harm on A at a level of ten, which from B's point of view may seem only fair, but from A's point of view may feel like harm at a level of 100. This of course seems totally out of proportion and requires further revenge as A and B switch roles again (Hoffman 2002).

Becker's analysis offers a way understanding the instances of genocide and mass murder in human history. He suggests, chillingly, that one way to gain the illusion of psychological power over death is to exert physical control over life and death. He points out that the killings in the Nazi concentration camps increased dramatically toward the end of the war, when the Nazis began to have a sense that they might actually lose. Mass slaughter gave the illusion of heroic triumph over death/evil.

In Becker's terms, people who maximize their own take are maximizing the "side of life" narrowly understood as their own welfare. They act to eliminate the "evil" of their own impoverishment. They ignore the fundamental fact of our human interrelatedness, a fact attested to by spiritual traditions throughout history (Hoffman 2002) and in this process aggravate the evil they wish to alleviate.

2.5. FINAL REFLECTIONS

In this unit we had the modest aim of indicating some of the dynamics in the working out of evil. Ricoeur's understanding of the disproportion that characterizes human beings was, he came to conclude, insufficient to account for occurrences of actual will. No direct, unmediated inspection of the cogito, as Descartes and Husserl had proposed, could show why these evils, contingent as each of them is, in fact came to be. Recognizing the opacity of the cogito in this respect confirmed his suspicion that all self-understanding comes about only through "signs deposited in memory and imagination by the great literary traditions." The progress from *bios* to *logos* has enabled us greatly and also made evil possible. Thus we have arrived at an antinomy and this is where philosophy has to stop.

By refusing to accept mortality as part of their very nature, humans deny their animality and attempt to be divine. In this very process of denial of death and anxiety, the humans join the "immortality projects" and disrespects the disproportion that is intrinsic to the human condition, enabling evil to emerge. As a continuation of the philosophical analysis, Becker showed the psychological dynamics at work, whereby evil multiplies itself in the very attempt at eliminating it. Though both the thinkers trace the existence of evil to the disproportion or in-betweenness in the human condition, it has not been our aim to give any account of the origin of evil.

So Tao Te Ching's insight, formulated 2500 years ago, is valid even today.

There is no greater misfortune
than to underestimate your enemy.
Underestimating your enemy
means thinking that he is evil.
Thus you destroy your three treasures
and become an enemy yourself (Lao-Tzu 1995).

Check Your Progress III

Note: Use the space provided for your answers.

1) How is participating in the immortality project something wrong?
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2) How and why do we project our own shadow unto ourselves?
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2.6. LET US SUM UP

In this unit we have analysed our existential condition. In our very quest to eliminate evil, we add to it. This warning must be taken seriously even in our quest to eliminate physical death.

2.7. KEY WORDS

Fallibility: Tendency inclination to be erroneous or to make mistakes

Immortality project: The human project to overcome physical death and become immortal through different means.

Shadow: In Jungian *psychology*, the *shadow* or "*shadow* aspect" is a part of the unconscious mind consisting of repressed weaknesses, shortcomings, and instincts. The *shadow* refers to the personality traits and tendencies that one has rejected in

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UNIT 3 DEPTH OF DEATH: A PHILOSOPHICAL OVER VIEW

Contents

3.0 OBJECTIVES

- To initiate the students to reflect on death and see it as part of life.
- To have a general understanding of human death.
- To understand the different views of Heidegger and Nagel on death.

3.1. INTRODUCTION

Death is the cessation of the connection between our mind and body. Intellectually, everyone knows that one day all will die. We are usually so reluctant to think of our death because this knowledge does not touch our hearts, and it is inauspicious even to talk about death. Death spares no one. We can affirm with certainty that we all fall prey to death sooner or later. It is inevitable and pervades everything. Everyone should face death. Truly the word *death* is frightening for many. People like to live happily and not to suffer or get pain in the universe.

The moment we are born it is sure we will die one day. In the course of our life on earth, death plays a significant role in shaping our personality. Our time on earth or our longevity in this world is very limited; we may live at the most a hundred years. According to me death should not be threatening or fearsome to us, because it is completely natural. We need not be indifferent to death; instead we need to face death with courage, because being indifferent to something is not a solution to that problem or difficulty. The way we live decides, the way we die. Similarly the way we die announces boldly and clearly the way we lived. Instead of worrying about death that will happen in the future, living happily and facing death authentically could shape our lives meaningfully. Many people's fear of death is tied into their religious beliefs. Particularly they think about what will happen after death, but worrying about death is futile.

Philosopher Martin Heidegger (1889 –1976) states that as soon as I am born, I enter into the flow of time spanning from birth to death. Death is the final condition, the end of my being-thrown. Death is my way of being-in-the-world. Also death is unique and singular to everyone. Death is a part of my life. Death is what is the most authentic in my life. So whether we like it or not we know that we are headed toward death. He clearly advises us that against a fear of death because it is a future event, and in the attempt to escape this fear is a cowardly action. So the authentic attitude to death involves accepting it as a present possibility, awaiting it as something certain possible at any moment. Authentic human living implies facing up to the reality of what death means in our lives. It means accepting the possibility of coming to the end of life at any instant as Heidegger suggests. We must face the fact of death, as Heidegger offers us several positive potentialities.

One of the famous living American philosophers Thomas Negal's notions of death is not easily acceptable for Christians. For Nagel, death is bad for us. In one sense this may be true, because it deprives us of an extended life. Most people are of the view that life is good even though they experience pain and suffering in their lives. Sometimes tragedy can also be a very positive state. Nagel goes further to point out some important observations about the value of life. A person may wish to do or fulfil his/her desires. But unfortunately he/she may face death at the age of twenty five or thirty. As a result death negates all our desires and wishes. Death controls our freedom by removing our longings. Looking now at what is bad about death instead of what is good about life, Nagel presents some thought-provoking insights regarding this point. Life is good because we have the conscious ability to experience and appreciate all that life has to offer. So death could be called bad because it deprives us of these experiences, and not because the actual state of death is bad for us.

3.2. UNDERSTANDING OF DEATH IN GENERAL

Here we shall see some general view and impression of death by different philosophers.

a. The Epicureans

Death is nothing to Epicureans. According to them, we fear death because of the belief that death is painful and that the soul may have to suffer in an afterlife. But both of these beliefs are not true. Death is not painful. It is a painless loss of consciousness. It is just like falling asleep and therefore nothing to be feared. "Death is nothing to us… It does not concern either the living or the dead, since for the former it is not and the latter are no more"- Epicurus (*in Letter to Menoeceus*). The principal criticism against this view is that the Epicureans have falsely diagnosed the cause of humankind's fear of death. Death terrorizes us, not because we fear it as painful, but because we are unwilling to lose consciousness permanently. For some anti-Epicureans, death is bad for a person, primarily because it deprives him/her of certain goods. Life would be unbearable, death is taken to be a misfortune for the one who dies, and we feel that he/she has suffered a great misfortune.

b. The Stoics

The stoics, especially Seneca, Epictetus and Marcus Aurelius offered a more complicated and elusive view of death. Seneca (4BCE-65CE), a Roman adherent of Stoicism with a particular interest in ethics said that to overcome the fear of death, we must think of it constantly. They felt that there is no need to fear death. In order to overcome this fear, we should think of it in the proper manner. It reminds ourselves that we are part of nature and we must accept this truth.

c. Spinoza (1632-1677)

The Dutch Jewish philosopher Benedict de Spinoza wrote "A fearful man thinks of nothing less than of death, and his wisdom is not a meditation upon death but upon life (Ethics, Prop. LXVII)". It is interpreted to mean that man can and should allay the fear of death, simply by diverting his attention from it, and some persons have argued that by his/her nature he/she tends to follow this advice. The criticism consists in pointing out that the fear of death is frequently an involuntary sentiment that cannot be conquered by a merely conscious decision or a bare act of will. It is not enough to tell people not to think of death, one must explain how they can avoid thinking of it.

d. Leonardo de Vinci (1452-1519)

He observes that when a day is spent well one can fall asleep happily. Similarly if one can spend one's life well, one will have a happy death. A happy person would not be seriously worried about death. But the question is: can one attain full happiness on Earth? Moreover if one wants to achieve happiness in life, one must conquer the fear of death.

e. Schopenhauer and other Existentialists

Full happiness is not possible. Therefore embrace the tragedy of the human condition with a complete awareness of all evils, including death. According to Schopenhauer there is no life after death and death is totally meaningless and it is absurd. We are destined to live a life in suffering and pain. For Friedrich Nietzsche (1844-1900) the 'super man' will not permit death to seek him out in ambush to strike him down unawares. The superior man will live constantly in the awareness of death joyfully and proudly assuming death as the natural and proper terminus of life (Seelan 2010).

Check Your Progress I

Note: Use the space provided for your answers.

1) What is Spinoza's attitude to death?
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2) "Death is part of life." Comment.
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3.3. DEATH IN MARTIN HEIDEGGER'S THOUGHT

So far, we have just introduced the general understanding of death in the above section. Here we want to go little deeper to discuss my subject based on two prominent contemporary philosophers: Martin Heidegger (1889-1976) and Thomas Nagel (1937).

Martin Heidegger (1889-1976)

The most representative figure of existentialism in Germany is Martin Heidegger (1889-1976). He has also the widest influence of any of the existentialists. Heidegger brings to his personal reflection a solid erudition in the whole range of the history of the philosophy. His most famous work is *Sein Und Zeit* (Being and Time) published in 1972. He urges us to cultivate the awareness of death chiefly to our sense of life. He makes the additional claim that the awareness of death confers upon humans a sense of his/her own individuality. Dying he says is one thing no one can do for you; each of us must die alone. To shut out the consciousness of death is therefore to refuse one's individuality, and to live in-authentically. Heidegger often makes his case in dramatic language that is difficult to convey in summary form. He argues that mortality is our defining moment that we are thrown into the limited world of sense shaped by our being-toward-death. In this part, I would enumerate about death in the light of Heidegger in a detailed manner.

a. The meaning of the word *'Dasein'*

The word Dasein has been used by several philosophers before Heidegger, most notably Ludwig Feuerbach, with the meaning of human "existence" or "presence". It is derived from da-sein, which literally means being-there/there-being, though Heidegger was adamant that this was an inappropriate translation of Dasein. In German, Dasein is the German vernacular term for existence, as in I am pleased with my existence (ich bin mit meinem Dasein zufrieden). According to Heidegger, however, it must not be mistaken for a subject that is something definable in terms of consciousness or a self. Heidegger was adamant about this distinction, which carried on Nietzsche's critique of the subject. Dasein, as a human being that is constituted by its temporality, illuminates and interprets the meaning of Being in Time. Heidegger chose this term as a synonym for "human entity" in order to emphasize the critical importance "being" has for our understanding and interpretation of the world. Some scholars have been confused on this issue, arguing that for Heidegger "Dasein" denoted some sort of structured awareness or an institutional way of life but the textual evidence for this claim is not strong.

Heidegger used the concept of Dasein to uncover the primal nature of "Being" (Sein) which Descartes and Kant left unexplored. Like Nietzsche, Heidegger criticized the notion of substance, arguing that Dasein is always a being engaged in the world. The fundamental mode of Being is not that of a subject or of the objective but of the coherence of Being-in-the-world. This is the ontological basis of Heidegger's work.

Heidegger attempted to maintain the definition of Dasein as we all are in our average everydayness. Dasein does not spring into existence upon philosophical exploration of itself. Heidegger intended Dasein as a concept, in order to provide a stepping stone in the questioning of what it means to be. When Dasein contemplates this, what seems circular in ontic terms, is recursive in an ontological sense, because it brings the necessary appearance of time to the center of attention (Dasein 2010).

The word is *da has many* meanings.. It means 'there' (there they go) and 'here' (here they come) as well as 'then', 'since'. Prefixed to *sein*, 'to be' it forms *Dasein*, 'to be there' 'present' 'available, 'to exist'. In the seventeenth century the infinitive was nominalised as *(das) Dasein* originally in the sense of 'presence'. In the eighteenth century *Dasein* came to be used by philosophers as an alternative to the Latinate *Existenz* ('the existence of God') and poets used it in the sense of 'life'. In the Being and Time, Heidegger uses *Dasein* for, 1). the being of human, and 2). the entity or person who has this being. In lectures he often speaks of *das menschliche Dasein* ‘human *Dasein’*, and this too can mean either the being of human or the human being (Inwood 1999).

b. Death in Heidegger

For Martin Heidegger (1889–1976), who revives the Pre-Socratic tradition, the human person is “being-towards-death.” Death does not lie at the end of life; it pervades the entire life. As soon as I am born, I enter into the flow of time spanning from birth to death. Death is the final condition, the end of my being-thrown. Death is my way of being-in-the-world. This is the finitude that characterizes all human experience. However, death is unique and singular to everyone. If there is something that is not shared, it is my death; it is my own, but it remains non-representable. It always escapes me even when I will be dead, I do not possess it. Death is a part of my everything, which escapes me.

But in reality, we do not think of death; we just shy away from it as if it happens only to others. We take refuge in our everydayness that brushes aside or even buries the thought of death. Yet death is at the very heart of my being-in-the-world. So for Heidegger death is to be thought of in order to bring out my being-towards-death. This is the very condition of my freedom as well, for by evading the thought of death, I escape from the authentic “my-self” to hide in the inauthentic “they-self.” By my being-thrown into the world, I am originally thrown into the “they-self,” which makes me evade the question of death and of nothingness thus distracting and alienating me from “my-self.” Death is what is the most authentic in my life. However *Dasein* wants to flee from death because of its anxiety before nothingness. This nothingness has its origin in the being-towards-death. This nothingness is the ontological origin even of the dialectical negation. Care is the way out of anxiety and consciousness is an appeal for care, which allows Dasein to get out of the anxiety of its originary being-towards-death.

Also Being-there (Dasein) is Heidegger’s term for human existence, as opposed to that of things and animals. It is Heidegger who says, that I shall die. It is uncertain when I shall die. I may die at any moment. I cannot do anything after my death. No one can die for me. I shall die alone. This is not to deny the soldierly comradeship induced by imminent death. Every individual human must die for him/herself which reduces each individual to his/her own uttermost individuality (Inwood 1999).

c. Being-toward-death in Heidegger

Heidegger describes the human person as a “Being-toward-death in Heidegger” (Heideggger 1962). It is simply not possible for humans to live only for the moment as animals does. Whether we like it or not we know that we are headed toward death. Heidegger describes two possible attitudes that we can adopt. On the one hand we can refuse to face the full implications of the human condition by objectifying death as something that ‘happens’ to others and will ‘happen’ to each of us at some future date, but not something that affects us now in our living. This is an ‘inauthentic’ attitude. So, one is not enable to escape the reality of death. It results in fear of death as a future event, and in the attempt to escape this fear as ‘something cowardly’. On the other hand the authentic attitude to death involves accepting it as a present possibility, awaiting it as something certain possible at any moment and at the same time indefinite and accepting the anguish or anxiety of the possibility of death. This authentic attitude sets one free to choose among the various possibilities that may be realized before the ultimate possibility of death is fulfilled. Choices will be made in the face of the fact that life may come to an end at my instant. Authentic human living implies facing up to the reality of what death means in our lives. It means accepting the possibility of coming to the end of life at any instant as Heidegger suggests. We must face the fact of death, as Heidegger gives positive potentialities.

d. Heidegger's Death: The Mortals and the Immortals

The conception of death as an existential appears in the designation of human as "the mortal"; Heidegger's favourite expression for mankind is "The Mortals" (Demske 1970). Nobody can take one's death away from one, or die in one's place. So as soon as one comes to life, he/she is at once old enough to die. Death is inevitable. All humans are mortal. Heidegger understands it as a statement about the self-revelation of being. The character of death as an existential is confirmed, in the term "the mortals". It signifies mortality as the proper and essential mode of human being. Here, what may be called being-mortal is the same existential determination which was encountered as being unto death. The immortals and mortals belong equally to the holy. Neither the one nor the other can relate directly to the holy. Humans require the gods and the heavenly one require the mortals in order to accomplish this. In this reciprocal relation, the heavenly ones mediate between the holy and the mortals. They convey the greeting of the holy to human. So "it is the death that touches the mortals in their essence and so sets them on the way to the other side of life and thus the whole of the pure net work (of being)" (Demske 1970).

Heidegger's notion of immortality springs from his notion of the *Dasein*. In Heidegger, the *Dasein* is being-unto death. For Heidegger, Death does not happen after life but happens already while living, in the experience of sickness and aging. Heidegger denies that death is external to life or another event after life. It makes the very experience of living a dying. Heidegger does this because his mode of philosophizing is contemplation of Being. There is nothing to know after death since we go back to nothingness so he has no choice but to interpret death in terms of existence, while still living. *Dasein* (there being) is Heidegger's notion of the universal human person in every individual person that has openness to Being or truth. The human being is the venue where truth appears. The positive aspects of being-unto-death are that the person already anticipates the idea of death while living and comes to reflect on the origin of things which is Being (truth). The individual person dies but the *Dasein* does not die. The individual is tasked to deliver truth to his/her fullest capacity because this affects the *Dasein*. This is the form of immortality. For Heidegger, this is not in the event of death after life, but within life. Heidegger's *Dasein* sponsors an obsession of humans to live forever. Heidegger is not interested in the discussion of God but his concept of being-unto-death sponsors the idea of faith in God as the giver of eternal life which depends upon the conduct of our life. We work hard to earn immortality.

e. Heidegger's authentic attitude to death

Death brings human existence to an end and so completes it, but no can experience his/her own death. For Heidegger death is "that possibility is one's own most, which is non-relation and which is not be outstripped" (Heidegger 1962). Death is *Dasein's* own most possibility in that it most intensifies the fineness of existence. Death is a non-relational possibility because no one else can substitute for me with respect to my death. It impends as something that strips away all relations to others. We mostly relate to our own most, non-relational possibility by feeling in the face of it by living out inauthentic modes of Being–towards death. We tend to think of it as something that will happen but not yet. No one dissents from the proposition that everyone will die. This is seen as a well established empirical fact. Mainly each of has our own, and own our own death to die. Ordinary, each of us want to avoid the fact that we have our own, and only our own life to live (Heidegger 1962).

This is the core insight of what Heidegger understands to be an authentic attitude to death. Authenticity does not demand the actualization of the relevant possibility. Suicide is not even a mode of Being–towards death. Authenticity demands that we live expecting death to come at the very next moment. Death would overwhelm rather than provide the background to our existential choices.

Check Your Progress I

Note: Use the space provided for your answers.

1. Give a brief explanation of "Being-unto-death"?
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2. How should human being respond to death authentically?
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3.4. THOMAS NAGEL'S VIEWPOINT OF DEATH

Nagel was born of a Jewish family on July 4, 1937, in Belgrade, Yugoslavia (now Serbia). After his studies at Oxford in 1960, he pursued his PhD from Harvard University in 1963 under the supervision of John Rawls. Before settling in New York, Nagel taught briefly at the University of California, Berkeley (from 1963 to 1966) and at Princeton University (from 1966 to 1980)..

Nagel is a Fellow of the American Academy of Arts and Sciences and his *Mortal Questions* (1979) gained wide notice for its examination of a number of the central themes of human existence, including death, sexuality, and socio-political issues. Nagel's quest for 'a philosophical method that aims at personal as well as theoretical understanding' was fulfilled by the book's success in combining analytical rigor with a breadth of appeal to common experience. The humane orientation of his work was sustained in *The View from Nowhere* (1986), a compellingly lucid analysis of the tensions between the subjective and objective aspects of intellection and identity; the quasi-instinctual desire to achieve objectivity is seen as fundamental to the central preoccupations of philosophy in the course of the wide-ranging development towards a concluding treatment of major ethical problems. Other works by Nagel include *What Does It All Mean* (1987), a stimulating survey of nine essential topics for beginners in philosophy, and *Equality and Partiality* (1991), in which he discusses questions of justice.

a. Thomas Nagel's Viewpoint of Death

Thomas Nagel begins his collection of essays with a most intriguing discussion about death. Death being one of the most obviously important subjects of contemplation, Nagel takes an interesting approach to define the truth as to whether death is, or is not, harmful for that individual. Nagel does a brilliant job in attacking this issue from all sides and viewpoints, and it only makes sense that he does it this way in order to make his own observations more credible. He begins by looking at the very common views of death that are held by most people in the world, and tells us that he will talk of death as the permanent end to our existence.

The first view that Nagel decides to discuss is the view that death is bad for us because it deprives us of more life. Most people are of the view that life is good even though they experience bad events in their lives. Sometimes tragic is also a very positive state. Nagel goes further to point out some important observations about the value of life. Nagel gives the example of death and being in a coma before dying. Both of these situations would be equally bad situations.

Looking now at what is bad about death instead of what is good about life, Nagel presents some obvious thoughts regarding this point. Life is good because we have the conscious ability to experience and appreciate all that life has to offer. So death is bad because it deprives us of these experiences, not because the actual state of death is bad for us. The next point that Nagel makes is that there are certain indications that show how people do not object to death simply because it "involves long periods of nonexistence" (Nagel 1979). We do not look at the state being before we are born as a misfortune, or deprivation of life, because that life has not yet begun and, he refutes the possible argument that the person could have been born earlier and had more life, with the fact that if that person was born substantially earlier, he would cease to be that person, but instead someone else entirely.

b. Three Problems about Death

Nagel discusses next three problems. The first is a view that there are no evils that are not rooted in a person consciously "minding" those evils. Nagel puts this view in to easier terms by saying that this is the same as saying "what you don't know can't hurt you". There are several examples that can illustrate this theory. People who think this way would say that it is not harmful for a person, if he/she doesn't know about it. If he/she doesn't experience evil, it is not bad for him/her. In the view point of Nagel, if we do not experience death, it will not hurt us. But I feel that death always, in one way or other way, hurts people, though we do not experience it.

The second problem is that there are special difficulties, in the case of death, about how the supposed misfortune is to be assigned to a subject at all. Harm can be experienced by a person before death; nothing can be experienced after death. So, when is death itself experienced as harm? When does he/she undergo it? So as long as a person exists, he/she can not experience death and once he/she has died, he no longer exists.

The third problem deals with posthumous and prenatal existence (Nagel 1979). Contemplating the good or bad aspects of death, Nagel observes that we must look at the possible circumstances surrounding a death, and the pertinent history of the person who dies. This is important because we miss a lot that is important to the argument if what we take into consideration is exclusively the state of the person at the moment of death. Nagel gives an example of a very intelligent man sustaining an injury that causes him to regress to the mental capacity of an infant. His needs can be fulfilled like those of an infant and he kept happy as long as simple needs are met. His family and friends would look at this as a terrible misfortune, even though the man himself is not aware of his loss. This situation is unfortunate because of the deprivation of what might have been had he not been injured in this way. He could have gone on to accomplish great things for the world and his family, and live out his life through old age as an accomplished and acclaimed individual. This would have led him to great happiness, but it can be observed that this same man in a state of mental capacity to match that of a child is also happy, but Nagel agrees that what happened to this man is a tragedy because of the terrible loss of the life the intelligent man could have led. This situation can relate to death in this way of thinking about deprivation. Death is bad because it robs you of what could have been.

After making these observations, Nagel states that there are endless circumstances and happenings going on that affect a person's fortune or misfortune. Many of these never coincide directly to the person's life. We must consider that there is no way to pinpoint the exact position of a misfortune in a person's life, nor a way to define the origin. People have dreams and goals in life that may or may not be fulfilled. There is no way to find all of the circumstances and possibilities that go into whether or not these hopes and dreams are eventually fulfilled, but Nagel tells us that we must simply accept that "if death is an evil, it must be accounted for in these terms, and the impossibility of locating it within life should not trouble us."

There are some who view the time before birth and the time after death as the same. We exist in neither, though Nagel argues that there is a difference. This whole essay has expressed exactly his view that though we do not exist in either case, death deprives us of time that we could have been living our lives. Nagel makes an interesting observation about whether we can assign as a misfortune an event or aspect of life which is normal to all humans in general. We all know that we all will die and that the maximum amount of life is somewhere around 100 years. So is it still plausible to say this is a misfortune? We are brought into this world and brought up with aspects of our lives that we appreciate. The deprivation of these things that we learn to appreciate is a misfortune, because we have learned to live with these privileges. It is unfathomable for a human being to grasp the concept of a finite life, in the truest meaning of understanding. We do not think of our lives right now as a set out plan or a finite sequence of events. We do not live day to day thinking of what we should do according to how much time we have left. Our lives are essentially an open-ended sequence of good and bad circumstances and possibilities. Death is the abrupt interruption of this sequence that we cannot help but be in the mindset will never end. This is how death is a deprivation, and ultimately, a bad thing for a person.

In conclusion, Nagel offers a good argument in his essay on “death” - death itself is harm. Whether a person believes in the immortal life or not, it must still be considered that dying deprives us of the goods and experiences of life. This view seems unavoidable (Crawford 2010). There is obvious disagreement about the fact of death. Some people may think that death is dreadful; others may not have objection to death. Thomas Nagel wants to ask whether death is in itself an evil; and how great an evil, and of what kind it might be. The question should be of interest even to those who believe in some form of immortality, for one's attitude towards immortality must depend in part on one's attitude toward death.

c. Death is an Evil

If death is an evil, it cannot be positive features, because it deprives us what we have. Thomas Nagel tries to deal with the difficulties surrounding the natural view that death is an evil because it brings to an end all the goods that life contains (Nagel 1979). Especially death deprives humans' desire, activity, goal, and so on. A person who dies at age 92 has lived a full life to the best of his ability and has experienced more than someone who dies at age 32. The person dying at age 32 had many things that he/she wished to accomplish and experience in his/her life, and since the event of death has taken away all possibility of any of these goals coming to pass, and undermines all the work that he/she has put forth up to that point in pursuit of his/her goals, death is a terrible tragedy for him/her.

First, the value of life and its contents does not attach to mere organic survival; almost everyone would be indifferent between immediate death and immediate coma followed by death twenty years later without reawakening. And second, like most goods, this can be multiplied by time: more is better than less. There are two other indications that we do not object to death merely because it involves long periods on nonexistence (Nagel 1979). First, as Nagel has been mentioned, most of us would not regard the temporary suspension of life. I think that it may be true, because our earthly life is not permanent or eternal. As soon as one is born he/she starts to count the final day of his/her life. It is undeniable. Second, none of us existed before we were born (or conceived), but few regard that as a misfortune. The point that death is not regarded as an unfortunate state enables us to refute a curious but very common suggestion about the origin of the fear of death. It is often said that those who object to death have made the mistake of trying to imagine what it is like to be dead.

The first type of objection is expressed in general form by the common remark that what you don't know can't hurt you. It means that even if a man is betrayed by his friends, ridiculed behind his back, and despised by people who treat him politely to his face, none of it can be counted as a misfortune for him so long as he does not suffer as a result. The death of Keats at 24 is generally regarded as tragic; that of Tolstoy at 82 is not. Although they will both be dead for ever, Keats' death deprived him of many years of life which were allowed to Tolstoy; so in a clear sense Keats' loss was greater. However, this does not prove that Tolstoy's loss was insignificant. The fact that it is worse to die at 24 than at 82 does not imply that it is not a terrible thing to die at 82. The question is whether we can regard as a misfortune any limitations, like mortality, that is normal to the species. Blindness or near-blindness is not a misfortune for a mole, nor would it be for a man, if that were the natural condition of the human race.

Check Your Progress I

Note: Use the space provided for your answers.

1. What are the main insights of Nagel on death?

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2. How do you respond to Nagel's view that death is evil?

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3.5 LET US SUM UP

Here we have seen different views of death, including that of Martin Heidegger and Thomas Nagel. Though people have divergent views and perspectives on death, everyone has to encounter death in her own life. So our challenge is to live an authentic life. Each one is invited to discover the meaning of life and death in her own lives.

3.6 KEY WORDS

Dasein: Dasein - is a German word and is sometimes translated as "being-there" or "being-here" (da combines in its meaning "here" and "there", excluding the spatial-relational distinction made by the English words; Sein is the infinitive, "to be"). It is the human person, who is aware of her existence. Mostly it is not translated at all.

Sein-zum-tode: Being-toward-death, or *Sein zum Tode*, represents the finite nature of life. This belief that death *defines* life. It is a typical Heideggerian usage.

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UNIT 4 COLLECTIVE EXTENSION OR COSMIC EXTINCTION

Contents

4.0 OBJECTIVES

- To present before the students the two crucial choices facing us.
- To become aware of the need to collectively make the choice for ourselves.
- To see various reasons for our extinction and extension.

4.1 INTRODUCTION

Fifty years ago the French philosopher and scientist, Pierre Teilhard de Chardin, described human being as “Evolution become conscious of itself.” Today this profound definition has become dated due to the tremendous technological progress. Nowadays we can define human beings as “evolution capable of extending or eliminating itself.” Human beings are essentially a social being and is expressed through his culture. Today the culture is progressing so radically that the very defining of human being cannot be understood apart from the cultural evolution, that is characteristic of human life in an emerging global community. Along with the cultural transgressions, humans have evolved so awesomely, in the technological (robots, computers, artificial intelligence) fields enabling them to create virtual reality that is capable of shaping the human destiny. Some scientists talk today of a “transhumanist” future leading to a the emergence of a new species guided by human beings. Further recent developments in genetics and the successful completion of Human Genome Project has enabled humans to take life into his/her own hands by guiding, fostering and even eliminating evolution. The danger of our own extinction caused by ourselves cannot be overlooked! So we first begin analysing how human being can extend (or enhance). Then we shall take up some possibilities, by which humans can destroy the whole of life from the precious planet. Finally, we end this unit, by urging us to make a conscious and collective choice for life.

4.2 SPECIES EXTENSION

Fifty years ago Pierre Teilhard de Chardin described human being as “Evolution become conscious of itself” (Teilhard de Chardin 1999). Today after so much of technological and moral evolutions, we can extend this understanding. At present human beings can be understood as “Evolution become capable of consciously extending or eliminating itself.”

In this unit we would place before the students the mind-boggling alternatives that humanity is confronted with: that of either enhancing ourselves collectively or annihilating ourselves totally. We argue that as moral and spiritual beings, humanity as a whole has to make today a decisive choice consciously, collectively and freely.

In the first part of this unit we show that today the cultural and sociological dimension of human life has evolved so complex that from individual objects, each one of us is evolving into complex cultural ménage with much more profound religious, social and scientific implication. In the second part of this unit we deal briefly with the technological advancement that has placed before us the decisive choice, which will be elaborated in the next two sections. The firsts choice of collective species transformation is not necessarily placed as a positive one. The second one of collective self-annihilation is a threat to humanity as well as to life. We deal with some reasons (natural and artificial) which make the choice possible and crucial for us.

The next section only raises some philosophical questions. We believe that the answers to these questions are both complex and multifaceted. Even before arriving at answers, I believe that posing the questions properly is the first philosophical requirement needed to cope with today’s cultural and technological advancement.

Because philosophy and religion have significant roles to play in shaping the destiny of humanity, it is important for us to realise that raising the questions and living with these questions is the beginning of the process of solution. So no attempt is made to raise solutions that humanity faces. At the same time after realizing the gravity of the situation, we can suggest some criteria that could be very important in encountering the questions and opting for the answers that will determine our very destiny.

Because of the very nature of the argument, the data presented is very sketchy. The questions raised are also not elaborate. But it is hoped that this article will at least raise some serious philosophical questions on issues that are central to being human today. The prospects of being human today, we believe, lies in raising these questions and wrestling with them and only at the next level in finding solutions to the questions.

a. Cultural Advancement

Never has human beings lived as pure independent individuals. So the basic insight of sociology is that humans are essential “social beings.” None can become or remain a human being apart from the family, community or society that constitutes and enables him. Still one of the liberating factors of modernity has been the rediscovery of the individual or person as the ‘focus’ of social and cultural life. Modernity emphasized the role of individual and that of person as the basic constituent of the society. Because of that humans became aware of the fact that the society cannot sacrifice the rights of the individuals for a long time. Though the society may demands the curtailment of the freedom of the individual in emergency situation, that cannot be the normal way of living. So humans today talk of the need for self-realisation, personal growth grown and individual assertion of one's rights. Many of the fundamental inalienable rights, including the United Nations Declaration of Human Rights have been based on the assumption that the individuals should be given free space to grow.

Within the span of the last thirty years things seem to look drastically different on many accounts. Today humans tend to attain a collective, cultural and multifaceted identity that is definitely different from the tribal or collective identity of the "primitive human beings." Some of the ways humans extend their horizon of self or identity are;

From individual to cultural identity: The first commonly accepted extension is through cultures. Humans create the culture collectively and the culture in turn forms the individuals. In the course of time the culture may overpower the individual entities and may at times even suffocate him. But in general the individual growth is intimately linked to that of the culture. As the culture evolves, the individual growth also advances. From biological to collective evolution: at a still deeper level the biological or physiological evolution, of which we are all part of, is moving beyond the strictly biological to a collective evolution. The physical traits are transmitted genetically and the process of biological evolution has been known to humans from the time of Charles Darwin. But today human capability, human aspirations go beyond that of his or her biological aspiration. One's own meaning system, values and identity itself is determined by the social and global phenomenon which is much larger than the cultural phenomenon discussed in the previous paragraph.

From individual to corporate identities: With the emergence of well established city states with well-defined boundaries, this extensions of individuality takes on a new turn. An individual soldier, for example, is not even a "cog in the wheel" compared to the defense establishment. A private individual does matter to a nation, but the larger interest of a nation can easily be scarified for the personal interests of the ordinary citizen. Going one more step, the multi-national corporations (Korton 1995), that have become so powerful in the last three decades have redefined the workers as a collective entity. Today the individual identity seems to be either merged or even overpowered by (sometimes even anonymous) collective identity of a sect, nation or corporation.

From biological to cybernetic identities: Another dramatic extension of human beings' identity is made possible through technological innovations. Going beyond the classical understanding of technology as "extension of human senses," today's technological marvels allow us to go beyond the limits imposed on us by our materiality. Today's cybernetic and biological technologies (like robots, cyborgs, coupled with nanotechnology and biotechnology) enables human beings to drastically redefine themselves. In the process of such redefinition of themselves, they are going beyond the classical understanding of human self. The human being who are "best fitted," will thrive in such situation and in this plane the human self advances with the help of technology. The obvious danger is that humans identity may become superfluous and the cyborgs may take over human destiny!

Going beyond the truism that human beings are essentially social beings and expresses themselves through cultures, today we note that culture is changing so globally and so rapidly, that humans have no time to cope with it (Toffler 1974). Today the cultural entities – and the human self – are progressing so radically that the very definition of human being cannot be understood apart from the cultural revolution in the emerging global community. Globalization, together with technological progress, effects today a culture that transcends anything that the humanity has even seen! The radical changes and progress that we encounter in every sphere of human life (and culture) along with their global impact almost make the very definition of human being obsolete. Not only are we not used to the "future shock" that technological era bring with it, but we are also in the very process transformed without being informed by it.

b. Technological Progress

Along with the cultural transgressions, humans have evolved so awesomely at the technological level. The marvel brought about by technology – be they aeroplanes, communication media, information technology, nanotechnology – is so gigantic that people living just hundred years ago could never have imagined the life style of the present generation. The stupendous developments in transport, communication and mass media has brought about tremendous changes to the way that we perceive ourselves. Our very self-identity is dramatically altered by the technology at our disposal.

But today with the arrival of artificial intelligence and ushering in of virtual reality, we have gone far beyond the simple understanding of technology as a human tool. Today technology enables us to create reality according to our own making. The classical distinction between "the given" and "the made" is getting blurred. The difference between the "natural" and "artificial" has also become ambiguous. Today we are in a position to create virtual reality that is capable of shaping the human destiny, to degrees unimaginable in the past. To a limited extent at least, we have becomes creators of our own reality, masters of our own destiny and shapes of our human nature.

In spite of the fabulous technological progress, Einstein's assertion is still valid: "All our lauded technological progress – our very civilization – is like the axe in the hand of the pathological criminal." (Einstein 2009). That is a pity! At our disposal is the technological wonder that can almost make anything. But our human heart – the realm of values, vision and spirit – remains very "primitive." Again the visionary statement of Einstein is valid: "The release of atomic energy has not created a new problem. It has merely made more urgent the necessity of solving an existing one" (Einstein 2009). We may be able to restate this and affirm that in spite of the technological progress, the basic problem is at a moral or spiritual level and we have not been able to handle it. We have not learnt to remedy our moral and spiritual backwardness and this is extremely dangerous given the technology at our disposal.

Check Your Progress I

Note: Use the space provided for your answers.

1) What is Teilhard de Chardin's understanding of the human person? How do you reformulate that definition for today?

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2) What are some of the implications of species transformation?
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4.3 COSMIC EXTINCTION

Confronted with the fact of unbridled technological progress and moral stagnation, the danger of our own extinction caused by ourselves cannot be overlooked! Without trying to appear apocalyptic and promoting doomsday arguments, we should still be able to look with a sense of realistic objectivity. We shall be very brief in this section and try to point out areas which may lead to our own self-annihilation. Humans could become extinct. Launch of nuclear weapons, an outbreak of disease, an unforeseen side effect of technical and medical advancements, or unusual environmental changes are the main causes of human extinction. Here, I enumerate the possible disasters in the future.

a. John Leslie's The End of the World

John Andrew Leslie (born August 2, 1940) is a Canadian philosopher. He was educated at Wadham College, Oxford, earning his B.A. in English Literature in 1962 and his M.Litt., in Classics in 1968. He is currently Professor emeritus at the University of Guelph, in Ontario, Canada. In his famous book *"The End of the World: The Science and Ethics of Human Extinction*", he argues that there is a significant probability of a disaster on the Earth, which is relatively in the near future. Mainly, the disaster would cause the extinction of human life. He argues in two stages. In the first stage is the disaster which is made by humans and the next is a non-human made disaster (Leslie 1996).

b. Non-Human Made Disaster

John Leslie calls attention to possible disasters which could cause the extinction of the human race. Leslie probably knows more possible ways in which human life might be eliminated than anyone else in the world. He reviews a wide range of possible causes of disaster which do not depend on human activities. There are, for example;

- A nearby supernova - a stellar explosion perhaps equivalent to that of a hundred thousand trillion-trillion mega ton H-bomb.
- Essentially unpredictable break down of a complex system, as investigated by 'chaos theory'. The system in question might be Earth's biosphere: its air, its soil. Its water and its living things interact in highly intricate ways. On a very long timescale it might be the solar system itself, because planetary motions could be chaotic.
- Other massive astronomical explosion produced when black holes complete their evaporation or by the merger of the two black holes or two neutron stars, or of a black hole and a neutron star (Leslie 1996).

Of course, while a collision with a comet is not something that human activity causes, conceivably human effort could prevent such a disaster which would otherwise have occurred.

Mass extinction events, like the wiping out of dinosaurs 65m years ago, are impressive and dramatic, but account for only around 4% of now extinct species. On the other hand, the majority slip away quietly and without any fanfare. Over 99% of all the species that ever lived on Earth have already passed on, so what happened to the species that weren't annihilated during mass extinction events? (Ravilious 2009).

A few other reasons may be enumerated:

- Another biological reason leading to our possible annihilation is perm counts. Reduction in male sperm count may indicate severe telomere erosion and it could be an added reason for the elimination of human species.
- Coming to the cosmological level, the occurrence of a supervolcano and the arrival of extreme ice age leading to Iceball Earth could lead to our death.
- Further, in about 3 billion years, the Andromeda Galaxy is expected to collide with our Milky Way galaxy. In about five billion years the Sun's stellar evolution will reach the red giant stage, in which it will expand to engulf the Earth. Before this date, its radiated spectrum may alter in ways Earth-bound humans could not survive.
- Finally, in the *very* long term the ultimate threat to humanity may be entropy, with the postulated heat death of the universe predicted by the second law of thermodynamics, or other endings caused by physical constraints (Leslie 1996).

Check Your Progress II

Note: Use the space provided for your answers.

1) Briefly discuss some of the reasons for the end of the world?

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2) Is cosmic extinction a realistic possibility? Give your reflections.

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c. Human Made Disaster

The second causal factors do depend on such human activities. These factors are include items such as human industrial and agricultural activities, research in theoretical physics, war, and systems of human beliefs. The disasters might result from some unintended event, something highly toxic and highly infectious to the human society. Disaster could result from unexpected consequences of deliberate acts of some human beings. Small changes in complex systems can have unpredictable consequences. If human existence depended on the continued functioning of some such system, the disintegration of the ecosystem would spell the end of human existence. Here Leslie gives some of the reasons of collective human extinction such as;

- Human population tends to increase geometrically over time, so that a historical graph of world population produces a Malthusian slope. Over population is the main cause of the deterioration of the environment which may lead to global warfare.
- A disaster from nanotechnology-very tiny self reproducing machine could be developed fairly soon and it might spread worldwide within a month in a 'gray goo' calamity.
- Disaster associated with computer-it initiated nuclear war is the one often discussed. There might be a breakdown of a computer network which had become vital to humanity's day-to-day survival and computer replaces us and humans become more and more computer controlled. An advanced computer might be superior to humans.
- Some other disaster in a branch of technology, perhaps agricultural is dangerously dependent on polluting fertilizers and pesticides and progressively fewer genetic varieties.
- Also chaos theory warns us that any very complicated system and in a particular system involving new technologies interacting in a complex manner might break down in an essentially unpredictable fashion. So a small change in complex systems can have unpredictable consequences (Leslie 1996).

  Mainly Leslie states that if Doom were to strike in about AD 2090, then it would be because of population growth. Also many writers considered such things as the dangers of nuclear war or of pollution..

Conscious Reasons for Annihilation

Unlike natural reasons for our own demise, there are human-made reasons which could lead to our own annihilation. Since many of these reasons are so obvious, I am not going to dwell on them elaborately. The first candidate is obviously war: Warfare, whether nuclear, chemical or biological in the scale of World War would easily lead to the demise of the whole humanity.
Other reasons that could see ourselves wiping out of existence are:

- Universal pandemic involving a genetic disease, virus, prion, or antibiotic-resistant bacterium.
- Famine resulting from overpopulation (see Malthusian catastrophe)
- Long term habitat threats resulting in environmental collapses
- Catastrophic climate change as a result of global warming or the effects of extensive deforestation or pollution.
- Genetic engineering and manipulation resulting in an (advanced human) species unable to inter-procreate, accidentally resulting in actual (rather than pseudo) extinction.

In view of these phenomena, "The Voluntary Human Extinction Movement" with their motto *"May we live long and die out"* tries to accelerate the process of our extinction both scientifically and religiously! Public discourse is an unassailable obligation.

4.4 COLLECTIVE SPECIES TRANSFORMATION

Scholars such as Nick Bostrom (2008 & 2008) and Hans Moravec (1988 & 1999) argue that humanity will eventually be supplanted and replaced by artificial intelligence or other forms of artificial life; while others have argued that humanity will inevitably experience a technological singularity, and furthermore that this outcome is desirable. They see the technological change dynamically and positively. In fact, they see that technology can cure us of our illness (both physical and even mental, leave alone spiritual) and could be a contributing factor to eliminate the natural reasons for human extinction. On the other hand technology could be the source of going beyond ourselves to a level unimagined in the past (Bostrom 2008).

Some scientists go even further and talk today of a "transhumanist" future leading to a the emergence of a new species guided by human beings. Further recent developments in genetics and the successful completion of Human Genome Project has enabled humans to take life into his/her own hands. By proper use of genetic, information and nanotechnology, they feel that we are at the threshold of a new era in human life. By guiding, fostering and even (hopefully not!) taking evolution into our own hands, we can go guide and accelerate the process of evolution according to our designs. Cloning and Human Genome Project coupled with computer and nanotechnology give us a unique position, where we are in a position to create life according to our design. They also provide us with both artificial intelligence and virtual reality which makes human existence far more noble and even spiritual. So according to these scientists we are on the verge of transforming ourselves collectively into posthumans or extropians. So they dream of a possibility when humans will transform themselves and take hold of the evolution to their own advantage.

Though many of these dreams are utopian and illusory, I do believe that they have a point to make. Technology, we are capable of controlling and modifying evolution. Biologically we are capable of intruding into life in ways totally unimaginable in the future. The robots and cyborgs of tomorrow will definitely transform the way we think, feel and reality and in the process we will be able to create a new reality for ourselves. The distinction between the real world and artificial world is getting blurred. Though the dream of creating a new species may not be achieved, human being are in a position to alter significantly and positively the flow of evolution. So without getting into the bandwagon of posthumanists, we can still appreciate the possibilities offered by science to enhance human life and extend life-span. To the extent science can relieve us from unnecessary pain it is a noble enterprise.

So the future that awaits us is both frightening and promising. Science can truly help us to attain a future that is more human and authentic. It can also, as pointed out in the earlier section, offer us the frightening prospect of complete annihilation of life. We stand at a crisis point? Where will science take us? What will we humans decide for ourselves? To take these issues seriously science needs to dialogue with religious and philosophical streams of thought.

4.5 POSING SOME PHILOSOPHICAL CHALLENGES

Confronted with the crucial possibility of collective annihilation or enhancement of human beings, made possible by scientific and technological advancement, we are in search of both adequate questions and answers. The bewildering technological possibilities force us to revise our very questions to ourselves, besides challenging us for new answers. The philosophical implications of these for our understanding of the human person are mind-boggling. Some of the crucial issues and questions that emerge are: Who will speak for (human) life? In such a pliable atmosphere, what is really human life? Then there are still more basic issues: What is life? Who owns life? How far am I responsible for my life? How far are we collectively responsible for our human life? Can we humans claim responsibility for the whole of life? Still more pointed questions arise: Can some corporations determine the collective destiny of humanity based on the sole criterion of profit?

Further, wider issues and concerns rise: What is a human being? What is human nature? In the context of the cultural and virtual extension of human species, can we still meaningfully speak of nature and nurture? Going one more step ahead, we can ask:

What is the human society? Humans have become much more shaped by the society than earlier. Can we at all speak today of human individuality, dignity and situate him apart from the social structure that shape him?

What is nature? Can we still afford a dichotomized view of nature? Should we not evolve a philosophy that takes into account the various dimensions of life and attempt an integral understanding of life, which includes also human life?

Finally in this context self-appraisal of the role of philosophy and religion is important. So the question: What is the new role of religion, philosophy? How does it affect human activity?

The answers to these questions are multifarious and involved. That is precisely the significance of philosophical concerns. Because we do not have simple solutions to these profound questions, we just cannot ignore the questions. The questions – along with it the attempted answers – are too important to be ignored. The future generation depends on how we choose to pose the questions (leave alone attempting to answer them). So for a philosopher raising these issues and bringing the concerns to the level public discourse is an unassailable obligation.

4.6 THE CHOICE IS STILL OURS: BUT NOT FOR LONG!

The essay has made it abundantly clear that today humanity, both individually and collectively, is in colossal crisis and are confronted with a radical choice. The first thing we need to realize as humans beings and as philosophers is to realise the seriousness of this crisis without either ridiculing it to oblivion or exaggerating it to doomsday!

After having realistically and critically assessed the choice between us, the second step is to ask if we humans are capable of responding to this crisis consciously, collectively and responsibly. Here lies precisely the greatness and frailty of being human today! Without burying our head in the proverbial ostrich manner can we face the problem squarely and dare to ask the questions that are indispensable?

We are truly happy that we humans being can make a choice: for ourselves and for the rest of life. We can assume the role of the spokesperson for the larger family of life. But we must remember that this choice will not be available to us for long time. The choice is *still* ours, but will not be with us for too long! So the imperative to pose the questions and respond to them urgently. We are sure that humanity has the spiritual wisdom and the moral conviction to make a collective, creative, coherent choice. A choice based not solely based on profit, nor on progress, but for humanity, for life! Let us not leave the decisions to a few individuals (the so called 'experts')! Humanity has a collective stake and we humans must collective decide on it, not only on our behalf but also for the rest of living beings. In making this choice for ourselves, we can contribute a little to the flow of life that takes place in and through us.

Check Your Progress III

Note: Use the space provided for your answers.

1. What are the crucial choices humanity faces today?
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2. For a philospher, "public discourse is an unassailable obligation" Why?
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4.7 LET US SUM UP

In this unit we have offered the two possibilities facing humans today: either that of total extinction of life or that of enhancement or extension of life. We humans are capable of both. That is our greatness and also our weakness. The choice is before us now!

4.8 KEY WORDS

Collective Extension: The glorious possibility that humans can by their technological, moral and spiritual power enhance (or extend) life on the planet earth. Even the possibility of humans becoming another species (Transhumans or Posthumans) is not ruled out.

Cosmic Extinction: The possibility that humans can annihilate ourselves and even possibly destroy every trace of life from the planet earth.

Doomsday arguments: Calculation of statistical probability for the total extinction of human species, based on various arguments and reasons.

Species transformation: The hope that we humans will be able to bring about another species, by their own technological innovation.

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