DECODING THE HUMAN BODY

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INTRODUCTION:

It is the most expensive, most ambitious, and a very controversial biology mission ever- 'The Human Genome Project'. It promises to provide no less than the operating instructions for a human body and will revolutionize the detection, prevention, and treatment of conditions from cancer to depression to old age itself. In the eyes of critics it threatens to undermine privacy and bring on genetic discrimination in insurance and employment. It took thirteen years, $250 million, and over 1,100 biologists, computer scientists, and technicians working in six countries to decipher 31 billion chemical letters of the human genome.

Every human has 23 pairs of chromosomes, one of each pair derived from each of individual's parent. In the nucleus of every cell are the chromosomes containing the genes composed of segments of DNA within which genetic information is stored. Each DNA is composed of a Nitrogen base, a Sugar molecule (deoxyribose), and a Phosphate molecule. The Nitrogen base in DNA is adenine & guanine (purines), and cytosine and thymine (pyrimidines). And all of it will emerge from something like this: ATGCCGCGCT..... on and on, for about 3.2 billion such letters. Each letter representing a molecule-adenine, cytosine, guanine, and thymine. Every cell of human body, from skin to muscle to liver and everything in between contain copy of the same DNA. The totality of DNA present in the cells of a species is its genome.

The human genome is known to contain three billion base pairs, which contain information that would more than fill 500,000 pages textbook. There is enough DNA to form several thousand genes, however it is known that only about 67,000 genes encode for a human being. The remaining of DNA is used to provide structure, regulatory information, and other as-yet-unknown function. The primary action of gene is to synthesize protein by various combinations of 28 different amino acids.

CLONING:

In February 1997, a young sheep named 'Dolly' made headlines around the world. What was so newsworthy about this little lamb? She was a clone, made from the cell of a fully-grown sheep and was its genetic duplicate. People were amazed, fascinated, and even more, horrified. Could this mean that human cloning was just around the corner? President Clinton immediately ordered a government advisory board to review the legal and ethical issues involved in human cloning and to hold off such experiments until the ethical issue has been fully explored.

Cloning is an artificial way of doing what happens naturally through sexual reproduction. American Medical Association (AMA) defined cloning as "the production of genetically identical organisms via somatic cell nuclear transfer".

To understand cloning, it helps to review what happens in sexual reproduction. A sperm fertilizes an egg cell to begin process of sexual reproduction. When a male's sperm fertilizes a female egg, it creates a single cell in which an equal number of chromosomes from the male and female parents are united. The fertilized egg then divides again and again, each cell carrying a complete copy of the chromosomes that where present in the original cell. This process keeps repeating to form a many-celled embryo. After the first round of divisions, cells begin to specialize into stem cells that produce certain tissues and then organs eg. some cells become nerve cells, and some skin cells. Different genes come into play in the making of these different cell types. These genes dictate the production of particular proteins that make up the cell's structure and direct its activity.

The process by which cells become specialized is called 'differentiation'. Until recently, scientists had thought that once a cell had specialized it could not be returned to the unspecialized state of an egg cell. But this is just what researchers who produced Dolly were able to do. First they removed some

cell from the udder of a six-year-old sheep. The removed cells were cultivated, or kept alive, in a laboratory dish. Then they reduced the nourishment they had been giving these cells. The cells went into a resting state, like coma. At this point researchers took one of these cells and removed its nucleus containing the chromosomes. They also took an egg that had been removed from the ovary of a second adult sheep and cut out its nucleus. The nucleus that had been removed from the first sheep's udder cell was inserted into the nucleus-free egg with a tiny jolt of electricity, the two parts fused together. The egg began dividing just like a fertilized egg. It was cultivated until it had grown into several-celled embryo. Then it was implanted in the uterus of a third sheep, a surrogate, who carried the lamb until she was born and became known to the world as Dolly.

Human cloning is not only possible but also highly probable. Males could clone to have a baby without involving any female, besides a surrogate mother. If a couple is infertile, cloning could give them a genetically related baby. If a couple shares the same recessive gene for a disorder, cloning could give them a baby who will not inherit the disorder. One may clone a dying child by taking cells from his body and create a duplicate copy of the loved child in order to keep a part of him alive. Others may wish for clones of sports heroes, celebrities, or gifted scholars. There are endless possible reasons people may have for wanting to clone a human being.

GENETIC SCREENING:

The first use these genetic discoveries are put to is in creating diagnostic tests. For example, haemochromatosis, one of the most common inherited disease which leads to high level of iron in the blood causing organ failure and death was previously diagnosed by taking a tissue sample from the liver-a painful and risky procedure. Now, however, a drop of blood or even amniocentesis before the child is borne is sufficient for diagnosis. Researchers have now been able to map out exactly the faulty genes responsible for many of the inherited genetic disorders such as wilson's disease, polycystic kidney disease. severe combined immune deficiency (SCID), the list is endless. More common diseases such as cancers of breast, colon, and prostrate, malignant melanoma, chro myeloid leukaemia, diabetes mellit schizophrenia, depression involve comp interactions between faults in several genes. B is possible to predict with reasonable certa which individuals are likely to develop the dis in their lifetime and therefore take precaution screening procedures. Having a gene for br cancer means that the risk for getting ca. br during lifetime is as high as 85%, and similarl ovarian cancer 50%, and schizophrenia 50%.

GENE THERAPY:

Treating disorders by altering genes is called therapy. The earliest applications of gene the was based on the principle that disease is ca by a faulty gene (or combination of genes); a such genes can be replaced with correct vers diseases might be controlled, prevented, or c One abnormal gene can be cut out and replace a healthy version delivered by a tamed virus.

It is now realized that short stature is due to defi production of growth hormone brought abou mutation in a single gene. Such patients are tre giving growth hormone. However with re advances in gene therapy, it is now possible to these patients by locating the faulty gene replacing it with a healthy one so that normal gr hormone is produced within the body and no growth takes place. Gene therapies are being stu in a variety of disorders from SCID to diseases schizophrenia, diabetes, and parkinsonism. An recent application of gene therapy has been i treatment of alzheimer's disease, parkinsonism degenerative disorders of the CNS. These diso are due to degeneration of specific cells withi brain. Research is now going on to treat patients by replacing these degenerated cells normal neural cells developed from one's own by means of cloning.

Another important application of cloning has in the field of 'Transplantation'. This techn can be used to make spare parts such as kidne liver for your body. During the embryonic st part of the embryo can be removed and kept fr If the child later develops an illness su leukaemia or end stage renal failure the froze can be thawed and implanted into a surr mother, to be culled as spare parts after

months' gestation. Gene therapy is also being harnessed to prevent the acute and chronic rejection of transplanted tissues by introducing new genes that are important in preventing rejection. The delivery of genes that encode foreign donor antigens (allo antigens) might also be an effective means of introducing donor specific unresponsiveness (immunological tolerance) in the recipient; eliminating the requirement for potentially harmful whole body immunosupression. Animals can also serve as organ donors for humans. Researchers are putting human genes into pigs and baboons. They are trying to design animals whose organs are not rejected when transplanted into the human body.

GENETIC ENGINEERING:

There are some genes that are found only in human beings. However there are some genes that are found both in humans and in other species. And some parts of our DNA are found in nearly every other species. All but a small fraction of Human DNA is the same as Chimpanzee DNA. So it will not be surprising to see that one day you could even create human beings by cloning chimpanzee cells and making only few alterations in the genes; or you could create a chimpanzee with behaviour, thoughts, and emotions like that of human being by inserting a few of the human genes.

Numerous genetic studies are going on to identify the roles played by each of the 67,000 human genes. Scientists have so far identified more than 8000 human genes responsible for various traits. It is now believed that even traits like intelligence, memory, behaviour, thoughts, emotions, and even skills are carried by genes. Babies can be designed before conception. There may soon come a time when you could choose the characteristics of your children- height, built, colour of hair, eyes, or skin, intelligence, memory, and personality. The world could end up with 'designer people' perfect in every way.

BIOTECHNOLOGY AND GENETICALLY MODIFIED FOOD:

Biotechnology is the use of living things to make products. Big achievements have been made into the genetic manipulation of plants and animals. By inserting, removing, or making changes to genes, new forms of animals and plants are being created. Improved forms of crops are developed. The world's population is growing rapidly. It is too risky to assume that we will have enough food for everyone. A better solution is to use biotech to develop more efficient ways of making food.

Super-sized and super-fast-growing animals are being produced. Genes that instruct for growth in humans and cows have been inserted into pigs, sheep, and fish. Through these experiments researchers are trying to figure out how to increase the amount of food that farms and fisheries can produce. They hope to develop animals that have bigger litter and birds that lay more eggs. Cows are being engineered to produce more milk and even milk that is more like human breast milk. This would mean that women who do not nurse would have a better formula to feed their babies. Coffee plants are being engineered to produce beans low in caffeine. Researchers have developed vegetables that stay ripe longer and tomatoes that take longer to rot. Silkworm genes have been inserted into bacteria. As the bacteria grow, they create a new kind of thread that is as soft as silk, but as strong as steel. Researchers have already developed potato plants that contain vaccine proteins. Doctors hope that vaccine developed through food would be less expensive and an easier way than injection to give vaccine protection to people in poor countries.

However there are bigger worries about biotech farming. One big questions that biotech raises is whether it is right to alter the genes of animals and create transgenic animals. Once released, genetically altered bacteria and crops can never be recalled. As a result new and virulent toxins could be spread. New and virulent organisms- bacteria and viruses could be developed that are resistant to antibiotics.

BARRIERS OF HUMAN CLONING:

There are some serious concerns about the new breakthrough. Beyond the issue of safety of the procedure, concerns relating to psychological harm to children and effects on moral, religious, and cultural values of society should be looked into. The idea that parents would be able to decide upon the child's sex, image, intelligence, and behaviour is not only absurd but also very frightening. It would lead away from the bonds between men and women. A custody battle could arise between people who

contribute a clone such as egg donor, nucleus donor, the genetic parents of the nucleus donor, and the women who carries the foetus to term. And what about the right to decide to clone her dying son? That might be something only the child could decide rather than the parents. Say a star athlete gets bloodied in a tough basketball game. Can a fan rush down to the court, wipe out some blood, and run to have a clone made? Imagine another situation. An agent approaches a celebrity and convinces him that there is a huge potential market for his clones. The celebrity signs a contract to market his body tissues. Right now it's against the law for anyone to sell his or her organs. But could they sell their cells? What happens to a marriage when the 'father' sees his wife's clone grow up into the exact replica (by appearance) of the beautiful 18 yr. old he fell in love 33 yrs. ago? And imagine Transgenic life forms being created.

Knowing that you are at extreme risk of breast cancer may help you protect yourself. But suppose you know that you have got a gene for Huntington's disease, or early onset Alzheimer's disease? There is nothing that you can do if you test positive. It is like pronouncing death sentence.

CONCLUSION:

If anyone were to ask what the next decade has to offer for medicine, it certainly is going to be the decade of genetics: decoding human body, find out the details of genes which are responsible for various ailments and traits that make human be what he is, and gene therapy-altering various ge and make human being all to one's wish.

Genomics holds out the promise of healthier li From oncology to infectious diseases to he ailments, genetic science is transforming medi practice. The dream of outfitting people w theraputic genes may still be decades away, scientists are finding simpler ways to harness power of DNA. Many potential diseases will diagnosed and cured at the molecular level by go inside cells to genes before they manifest. Th may soon come a time when everyone will sequenced at birth and parents will get a CD-R(with their child's genetic sequence. And physici will use it to optimize treatment.

Unfortunately knowledge is not always pow Serious concerns regarding its safety as well moral, ethical, and social issues should be loo in depth. Genetic manipulation can potentia produce a large number of unknown and exo creatures and chemical substances that can h completely imponderable effects. These effe include direct poisoning, unknown allerge serious and even fatal illnesses. What would hap if a transgenic creature eg. 'Humonkey' is crea having intelligence more than a human being? M is fiddling with nature. If mankind could con the evolution process, it would be a much big threat to humanity than a nuclear holocaust.