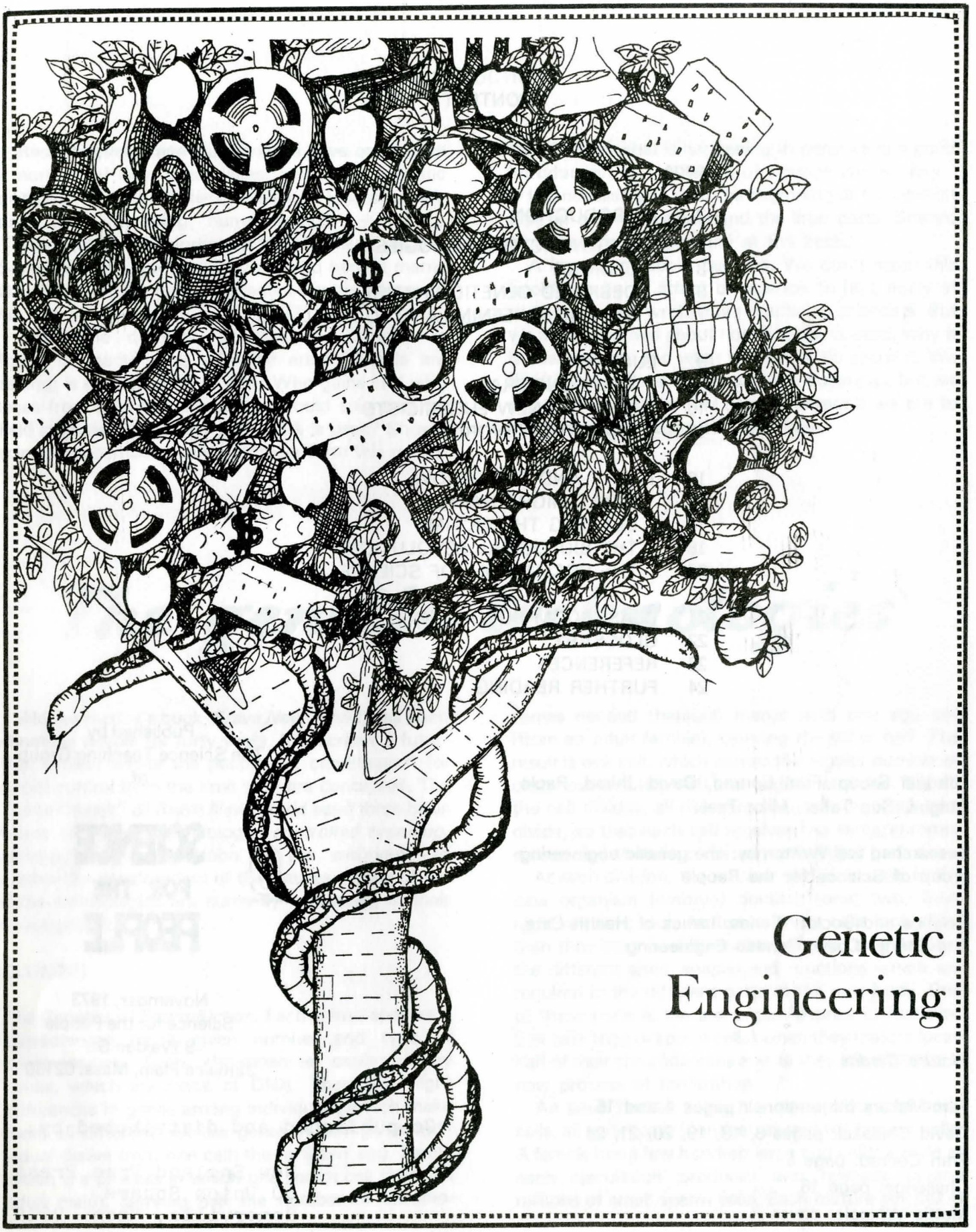

Genetic Engineering

SCIENCE AND SOCIETY SERIES NO 3

CONTENTS

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Editorial Group: Fran Conrad, David Jhirad, Paolo Strigini, Sue Tafler, Mike Teel

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INTRODUCTION

Recent developments in genetics have opened up a number of new possibilities: eliminating genetic diseases, test-tube babies, armies of look-alike soldiers, and "improving" human beings.

Some of the developments benefit many people. Some benefit a few people, but could benefit many. Others could have harmful effects on some classes or on the whole society.

The same dilemma—benefits vs. dangers—is found in many other scientific areas. People are asking: Is science good or bad? Who gains and who loses from scientific progress? Should scientists be held responsible for how their work is used? Should science be democratically controlled? For this reason the study of what is happening in genetics is a good introduction to the issues of science and society.

It is necessary to read the beginning of the booklet first, in order to understand the later parts. Starred words are in the glossary at the back.

A few words about our bias. We don't mean this booklet to be an attack on science. In fact, many of the people who wrote it are practicing scientists. But we are concerned about how science is used, why it is used as it is, and what we can all do about it. We don't have all the answers to these questions, but we see that we have to find *some* answers if we are to exercise control over our own lives.

The genetic technologies

Aldous Huxley's book, *Brave New World,* has been shocking people for forty years. It describes a futuristic society where the people are conditioned* for social control from the time they are conceived. The "conditioners" of *Brave New World* used three basic forms of genetic technology—*controlled breeding, cloning,* and *manipulation of the embryos**—to control the development of the fetuses. Many of the same technologies are currently well along in their development.

CLONING

The Genetics of Reproduction. Each animal species is characterized by a given number and type of chromosomes. Each chromosome carries many genes, which are made of DNA. There are slight differences in genes among individuals, which make them all different. All the genes in any given individual derive from *one* cell: the fertilized egg. Fertilization is a process in which one sperm cell (from an adult male), carrying half the number of chromosomes needed (haploid) merge with one egg cell (from an adult female), carrying the other half. The result is one cell, which carries the regular number of chromosomes (diploid) and begins to divide. Before the cell divides, all the chromosomes duplicate and divide, so that each cell receives the same chromosomes and therefore the same identical genes.

At each division, the number of diploid cells in the new organism (embryo) doubles (one; two; four; eight; sixteen; etc). At first all these cells look alike, then they start to differentiate, that is, they assume the different sizes, shapes and functions which are required in the different parts of the new body. One of these parts is the sex organ: ovaries or testicles. Sex cells (egg or sperm cells) when they mature loose half of their chromosomes and so they are ready for a new process of fertilization.

An adult human being has many billions of body cells, all genetically identical, except for the sex cells. A female has a few hundred large egg cells; a male at each ejaculation produces and releases several millions of small sperm cells. Each mature sex cell is

genetically different from each other, as a result of loosing different chromosomes or part of them. Thus each new organism which is born naturally from fertilization (the merging of one sperm and one egg cell) is genetically unique, although it derives half of its genes from its father and the other half from its mother. The new combination is unique, like a new song made up with a number of old words and notes. Cloning is a process by which this diversity can be eliminated, by transplanting the nucleus (where the chromosomes are) of a body cell into an egg cell, from which its own nucleus has been removed. In this way a new organism can be produced, which will be genetically identical to the donor of that one nucleus. Theoretically, it is possible to produce billions of individuals identical to each other like carbon copies (like identical twins, which are naturally born from the *same* fertilized egg).

Making Carbon Copies of individuals The conditioners of *Brave New World* cloned large numbers of identical individuals to perform specialized functions. This was one of their "Major instruments for maintaining social stability". To many people, cloning is perhaps the most frightening prospect of genetic engineering, since its misapplications in a totalitarian society are easily imagined. At the same time, most people (including many scientists) relegate talk of cloning people to mere science fiction fantasy, or disregard the matter completely as being irrelevant. For example, Joshua Lederberg, a Nobel prize winning geneticist, states simply:

> There is no urgent social problem to be addressed by such a technique.... Cloning a man is one of the least important questions I can think of. (Lederberg, 1970)

And yet, achieving human cloning is likely to be one of the most simple forms of genetic technology.

Cloning has already been carried out with at least one species of animal, the frog. (Watson, 1971) The technique is straight-forward. Unfertilized frog eggs are collected and by delicate surgery the nucleus* is removed and replaced by the nucleus obtained from a body cell of an adult frog. Introduction of the body cell nucleus apparently stimulates the egg as if it had been fertilized by a sperm, and the egg with the transplanted nucleus matures into a frog identical to the donor frog. Since the donor frog is composed of millions of cells, it is possible, at least in theory, that any particular frog could be the "parent" of literally millions of cloned replicas of itself—and each of these replicas could, in turn, serve as parents for millions of additional replicas etc.

Why clone a frog? In the field of animal development, the cloning experiment was central in the proof that each body cell retains all of the genetic information originally found in the sex cells. But once this fact has been established in frogs, why is it necessary to repeat the experiment in mammals*, which is considerably more difficult? In particular, why is the specialized technology required for human cloning being developed?

There are basically two reasons why the techniques for human cloning are being studied—to increase the knowledge of how fetuses* grow and for use in medicine to treat infertility and genetic diseases. There is certainly a lot that could be learned by studying human fetal growth outside the mother. But most embryologists, like other scientists, prefer not to think about the impact their research might

have on society, about how it will probably be used. They prefer to concentrate on their science, including "test-tube babies," and leave the moral and political decisions to someone else. According to Joshua Lederberg, the "...scientific community should impose criteria of scientific validity for funding or dissociate itself from responsibility when it does not have the authority to make the critical decisions." (Lederberg, 1970)

Test-tube babies. Outside of the pursuit for "pure" knowledge, the techniques for cloning are being developed bit by bit for medical uses. For example, Edwards and Steptoe have perfected techniques to allow women with blocked fallopian tubes* to have babies. The techniques involve removing mature eggs from the ovaries* just prior to ovulation (in an operation called laparoscopy), fertilizing the eggs in a test tube, growing the fertilized egg until the cells differentiate (blastocyst stage), and finally, implanting the embryo in the uterus*. The entire operation has been carried out successfully with mice and the first three steps with human eggs. The result of an attempt to implant a human embryo has not been reported yet. The embryo could be implanted in the original mother, in another woman, or in an artificial placenta (when one is developed).

In addition to the work of Edwards and Steptoe, methods have recently been perfected to remove the nucleus from mammalian* cells (Ladda and Estensen, 1970), and the same method will probably work on egg cells as well. Therefore, probably the major difficulty which remains before human cloning is feasible, is the introduction of a body cell nucleus. Even this difficulty may be short-lived since efficient methods have been known for some time for fusing mammalian cells to form a hybrid which contains the genetic information of both parent cells. (Ephrussi and Weiss, 1969) This method could probably be extended and used to fuse enucleated egg cells and adult body cells.

In any case, the rapid advances in mammalian cell biology in recent years and the increasing amount of research in experimental embryology probably means that the first clonal mammal will be "born" sometime in the not too distant future. Whether the technique is extended to humans depends on many factors—medical, social, legal and political. However, if the current scientific attitude of "what can be done, should be done" prevails, the cloning of a human being is very likely. The following statement by J.D. Watson (developer of a model for DNA) probably represents the sentiments of many in the field:

> "We must, therefore, assume that techniques for the *in vitro* manipulation of human eggs are likely to be general practice, capable of routine performance in many major countries, within some ten to twenty years." "Thus, if the matter proceeds in its current nondirected fashion, a human being born of clonal reproduction most likely will appear on the earth within the next twenty to fifty years, and even sooner, if some nation actively promotes the venture." (Watson, 1971)

But what should be done?

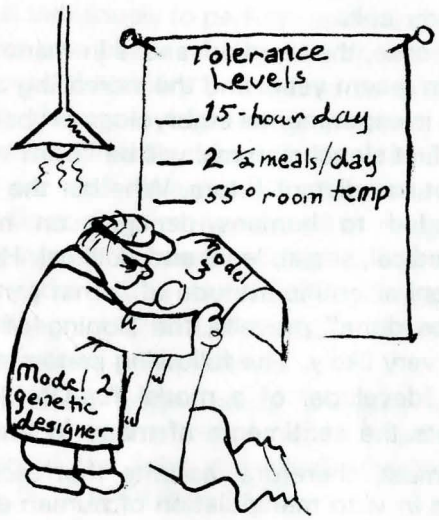
1. Who will decide what kinds of individuals will be cloned? What are the potential dangers of producing a caste* system based on one's predetermined genetic makeup?

2. Is it desirable to limit the genetic diversity among the population? Would this make the human race less adaptable?

3. Do the scientific reasons for developing cloning outweigh the potential misuse of the cloning techniques? Do you think the possible misapplication of cloning techniques is considered by the people either doing or funding the research?

4. What form, if any, should opposition to cloning take: letters? legislation? demonstrations? banning *all* cloning experiments?

5. What are the reasons for pursuing the goal of test tube fertilization? Is it to spare women the problems of childbearing: the risks, discomforts, inability to pursue a career? What are the benefits a researcher himself expects to derive from such experiments?



6. Consider that a woman donating eggs for fertilization might not actually carry the child after implantation. Who might the replacement mother be?

7. One justification that Edwards gives for his experiments is that infertile women will be able to have their own (biological) children. Is it society's duty to guarantee every human being the possibility of procreation?

DESIGNED GENETIC CHANGE

Another means of manipulating the human gene pool which is developing rapidly but which was not predicted in *Brave New World*, is the changing of genetic constitution by introducing a different gene or set of genes into human cells. Most of the interest in these techniques has focused on the possibility of repairing genetic "defects" by bringing in a "good" copy of the gene in question, preferably at some very early stage of development. The main efforts in this area have been attempts to introduce into the cells new genes carried as part of the genetic material of a virus. There is one report of the successful conversion of the genes of a cell using a bacterial virus, but these experiments have so far not been convincingly confirmed. (Merril et. al., 1971) In another case, a virus was found to carry a gene for an enzyme normally present in animal cells (thymidine kinase). When the virus was introduced into cells defective for this gene, the cells were "cured" of their defect. (Munyon et al, 1971) Various combinations of the techniques of molecular biology and virology are being explored which may broaden the possibilities.

There are many problems to be solved, however, before it will be possible to use these techniques. Can the genes be introduced into the cells where they are needed? Will they function inside those cells? Will the incorporation of the virus which carries those genes be harmful? Despite the fact that we don't know the answer to those questions, this is one of the most actively explored areas in the general field of genetic engineering. Why? First, research in this field is certainly going to advance our knowledge of human genes. Second, the prospects for its application are much more specific and refined than cloning, since it is conceivable to replace only *one* defective gene.

This technique has been called *gene therapy*. Its scope is very limited, precisely because of its great specificity. Only one gene-defects (like galactosemia*), may be curable, after the technical problems are solved, not defects involving several genes, like diabetes. In addition, the "good" gene is likely to be introduced only into part of the cells of the body. Will then the whole body be healthy? Despite the technical problems, the uncertain hazards and the limitations, gene therapy has been saluted as a new real medical possibility. This is likely to mislead the public and generate frustration and reaction.

GENETIC SCREENING AND COUNSELLING

"Defective" genes can either be replaced by *designed genetic change* (described in the last section), or they can be removed from the human gene pool by *selective breeding*. For selective breeding, parents with "defective" genes are encouraged, enticed, or legally required not to have children. An approach to determining who should and who should not breed is provided by genetic screening and counselling, which are becoming more widespread in this country.

As we begin to understand the basis of more and more of the genetic diseases, it becomes possible to screen potential parents for the probability of their having kids with any of these diseases. In many states mandatory screening laws have been passed. For instance, in Massachusetts, a sickle cell trait screening law has been passed which requires that the Commissioner of Health require such screening in school children of "a population at risk". (B. Culliton. *Science* 178;138, 1973. As a result of such screening and counseling, parents may make the decision as to whether they wish to take the chance of having a diseased child.

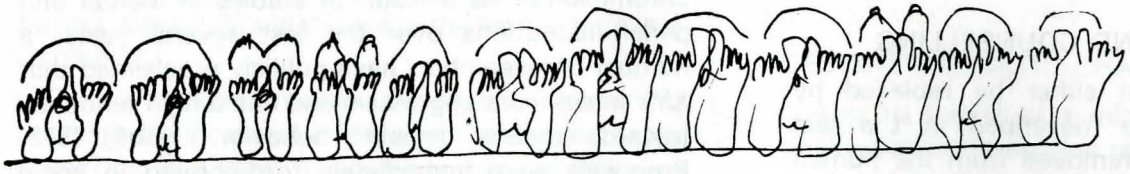
Amniocentesis and Abortion. The procedure of amniocentesis, in which a doctor examines the genes of a fetus* at a relatively early stage of pregnancy, provides a new tool for genetic screening. (Friedmann, 1971) Amniocentesis is done by withdrawing amniotic fluid that surrounds the fetus, usually at around 10 to 14 weeks of pregnancy, examining the cells obtained either biochemically or by chromosome* analysis, and determining whether a potential defect exists. This technique can be used, for example, to detect a mongoloid* fetus in older mothers. Already, 60 or more diseases or "defects" can be detected in this way. The parents may then choose to abort the fetus. This is becoming more and more of a common occurrence. Thus, parents, rather than having to choose between no children and the risk of bearing a diseased child, may have as many "normal" children as they want and abort the "abnormal" fetuses.

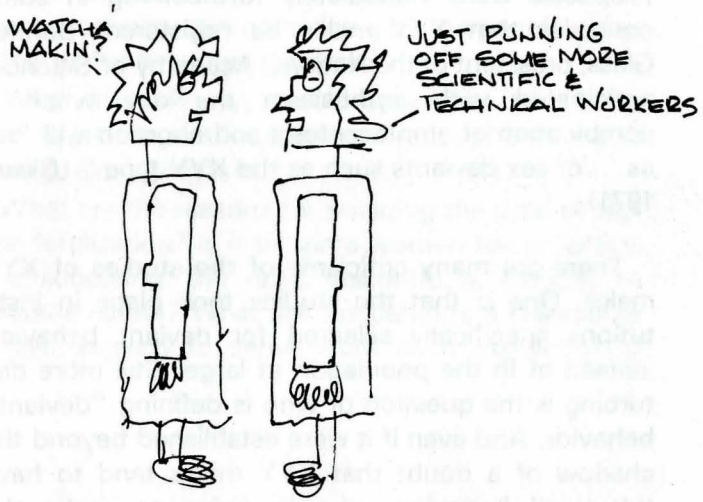
The XYY male. Not all cases are as clear cut as having a mongoloid baby or not. Some males are born with the unusual property of having an extra Y chromosome. As a result of studies in mental and penal institutions over the last several years, a number of researchers have publicly proclaimed that XYY males were aggressive and had a high tendency towards socially deviant* behavior. (Hook, 1973) Proposals were immediately forthcoming in some countries that XYY males be registered. Bentley Glass, president of the National Academy of Science, anticipated with enthusiasm the day when a combination of amniocentesis and abortion will "rid us. . . of sex deviants such as the XYY type." (Glass, 1971)

There are many criticisms of the studies of XYY males. One is that the studies took place in institutions specifically selected for deviant behavior, instead of in the population at large. Still more disturbing is the question of who is defining "deviant" behavior. And even if it were established beyond the shadow of a doubt that XYY males tend to have "deviant" behavior, who is going to make the decision about what is deviant enough to be deprived of life? If eugenic legislation compelling abortion in *some* cases is adopted, then it will be hard to draw the line on aborting many other kinds of genetic "defects."

The XYY male debate is part of a much larger debate about the origins of "antisocial" behavior. Recently some scientists have been trying to show that the cause of antisocial behavior is in *individuals.* The proposed explanations include genetic deficiencies, brain damage, epilepsy, and low "intelligence." These scientists say that antisocial behavior can be cured by treating individuals (by psychosurgery, for example), rather than by making social and economic changes. Much of their work is funded by the U.S. Justice Department, whose research budget rose 400% from 1970 to 1972. People on the other side of the debate claim that social and economic conditions are to blame and that those who blame individuals are defending an unjust social system.

Sickle-cell anemia. Sickle-cell anemia is a potentially serious inherited disease that mainly hits people originally from North and Central Africa. The disease usually appears by the age of six or seven and is often fatal. Its seriousness is affected by factors such as malnutrition and generally poor living conditions. It has received a lot of publicity in the last few years,





but with little notice many states have passed screening laws for it. These screening laws have brought out many of the difficulties and dangers of genetic legislation.

Several of the laws are based on faulty information, calling the disease "contagious" or not distinguishing between sickle-cell *trait* and the disease itself. People who carry the trait have only one sickle-cell gene. They can pass the gene on to their children, but they themselves lead normal, healthy lives. Sickle-cell anemia, the disease, is caused by inheriting two sickle-cell genes, one from each parent. Some laws require sickle-cell testing of new-born babies (when it is too soon to tell) or first graders (after the disease has already appeared).

The largest group of sickle-cell screening laws *require* testing before marriage. A number of blacks consider the laws discriminatory—and to the extent that they discourage blacks from having children, threatening to the whole black race. After all, there are no laws covering any of the other ethnic diseases. And perhaps totally eliminating the sickle-cell gene by selective breeding is not such a good idea. Sickle-cell trait is known to provide protection from malaria. Of course, we have ways of treating malaria, and none exists for sickle-cell anemia. But the point is that a genetic condition can have several effects, and we risk throwing out the good ones when we eliminate the bad.

Many of the difficulties surrounding sickle-cell come from the confusion between the *trait* and the *disease*. There have been reported cases of job discrimination against people with the trait, and some insurance companies will not give normal life insurance. Also, people carrying the trait can be really scared if they think they have the disease.

The only cure to the confusion is widespread, detailed, repeated, and objective *counselling.* But this costs alot of money—much more than just the testing. So right now there is very little counselling going on. Without the necessary counselling the genetic screening may cause more problems than it solves.

What should be done?

1. In genetic counselling, what influence does the physician have over the patient's decision? How far should the counselling go?

2. What is normal and "antisocial" and who defines it? How does the dominant sector of society influence that definition?

3. What are the risks of amniocentesis in our society? How can we balance the risks against the benefits of eliminating well-defined genetic diseases?

4. What are the evolutionary implications of amniocentesis and abortion? Is there a genetic basis for social disorders?

5. The XYY gene combination results in certain characteristics (like tallness and severe acne) which could, in a particular social setting, make it more difficult for the individual to avoid "antisocial" behavior. Explain.

6. E.B. Hook describes an example of a mother who chose to abort an XYY fetus after amniocentesis. She did this after being "told of what little was known of the prognosis at the time." Obviously the doctor gave her the information. What information did the doctor have and where did he get it? Is this a good way for such decisions to be made?

7. In Boston amniocentesis costs between $300 and $400. What does it cost in your town? Is it available to all segments of society?

Eugenics

A BYGONE ERA?

A widespread application of cloning and gene therapy to human beings may appear frightening but not very likely to happen soon. More "reasonable" and "sensible" approaches to manipulate the human gene pool—like genetic screening and counselling—are readily available and have been used in the past more drastically than they are now. What is the justification for such manipulation?

Eugenics is a theory which maintains the necessity of improving physically and mentally the human race by controlling human reproduction. Eugenics in the past has tried to intervene in this natural process in two major ways: (1) by eliminating the "bad" genes from the human gene pool* (this means sterilization* of certain individuals, laws restricting marriage and procreation, genetic screening and counselling); (2) by propagating the "good" genes (this means forcing or enticing certain individuals to marry and procreate). The second part of the eugenic program has always appeared more repugnant and has been seldom implemented, exept in Nazi Germany. The development of the new genetic technology, however, could bypass some of the crudest aspects of such program, by manipulating sperm and egg cells in the laboratory, without tramping on the individual freedom of their donors.

Few people realize how influential and widespread the eugenics movement was between the end of last century and the thirties, in this country and elsewhere. By 1931 the eugenics movement had convinced some thirty states to pass laws for the sterilization of criminals, prostitutes, the insane, and the feebleminded. Although the laws were seldom enforced, at least 60,000 people were sterilized for reasons such as "feeblemindedness" and epilepsy in the three decades prior to World War II.

Although appearing high-minded and scientific, the eugenics movement developed what we would now consider a racist outlook. In response to the violent struggle to organize unions—led primarily by immigrant workers—industrial leaders such as Carnegie, Kellogg, and Harriman established the Carnegie Institution for Experimental Evolution, The Race Betterment Foundation, and the Eugenics Records Office.

This eugenics movement used scores from I.Q. tests (see the section on I.Q.) given to immigrants as a basis for the quotas in the highly restrictive immigration laws passed by Congress in the 1920's. (Kamin, 1973) These laws were constructed to keep out the "inferior" races: the Jews, the Irish, and Southern and Eastern Europeans. Similarly the eugenics movement was behind the state laws (also in the 1920's) prohibiting certain races from marrying whites.

The scientific establishment of the time gave support to the eugenics movement, as is described by Mark Haller in his book, *Eugenics* (1963):

> "In this enlightened day, it is perhaps well to reflect upon the scientific reception accorded Madison Grant's publication of *The Passing of the Great Race* in 1916. This pro-Nordic and viciously anti-Semetic book, the height of elitist racism, was on the whole received respectfully in the scientific community. The magazine *Science* called the book a 'work of solid merit', while the *Journal of Heredity*, official organ of this American Genetic Association, declared, 'the book contains little with which specialists are not familiar, but it supplies a readable account of recent work....' and added for good measure: 'in the field of anthropology he has followed the latest authorities.'"
>
> "William McDougall, speaking with authority as the chairman of the department of psychology at Harvard University, specifically called for the replacement of democracy by a caste system based upon biological capacity, with legal restrictions upon breeding by the lower castes and upon intermarriage between the castes. By the 1920's such views appeared to predominate among the scientists and social scientists who were hereditarian* in their outlook."

Madison Grant's was just one of many fashionable and respectable books that appeared in Europe and in

the U.S. between the end of the last century and the thirties (these included Spencer's popular philosophy, Jack London's and Rudyard Kipling's novels and President Theodore Roosevelt's speeches). The period before World War I was marked by celebration of the White Man, glorification of violence and war as the Man's proper challenge, epical amplification of colonial adventures and conquests. After World War I the tone of this literature became more pathetic. Both Madison Grant (in the book mentioned above) and the philosopher Oswald Spengler (whose famous book *The Downfall of the West* was praised by the Nazis) mourned the passing away of the dominant white western civilization, as due to the moralistic weakness of its present democratic political leaders.

At the turn of the century, anthropologists, psychologists and physicians were pressured by the dominant cultural concern to produce "scientific" criteria to prove the genetic superiority of the white man over the non-white. The sons of the good old families were also considered superior to working class people. Man superior to woman. Such race, class and sex superiority of the White (upper class) Man was considered a matter of good sense, not to be discussed but just to be demonstrated. When women, working class people and non-white Americans were tested and found to be more perceptive, quick and coordinated than the average by psychomotorial tests, the scientific explanation was that all these people were more alert with their senses just because their mind was more primitive. A positive proof of superiority for the White upper class Man, however, was still missing, until the I.Q. test was introduced. To quote again historian Mark Haller:

> "The introduction of Binet tests, which had been developed for the diagnosis of feebleminded-ness, produced remarkable and satisfying results. Wherever the tests were used in the early and uncritical days, they appeared to show not only that feeblemindedness was widely distributed through the American population, but also that most criminals, prostitutes, tramps, and other undesirables were hereditary morons. The tests also appeared to provide conclusive proof that, except for Jews, those races that were believed to be inferior were inferior in fact."
>
> (Haller, 1963)

During the 1930's the blatant and repulsive extension of eugenic thinking by the Nazis in Germany did much to take away support for the eugenic movement in the U.S. Not only did Hitler go too far with his racism, but he also claimed for Germany too big a share of the world. In addition, many sons of the Jewish, German, Irish and Italian immigrants—the targets of the old eugenic movement—had been integrated into the ruling or the middle class. They had become respectable politicians, businessmen and professionals, including scientists. These new scientists, the sons of poor immigrants, could not share the strict racist views of William McDougall. By the end of World War II it seemed that eugenic ideas—which had helped the rise of the Fascist powers—were no more to be taken into serious consideration.

I.Q. THE NEW EUGENICISTS

In the past few years there has been a revival of theories which claim to show inherited differences in intelligence between races and social classes. On the basis of their studies, the theorists have suggested changes in social policy ranging from school segregation to sterilization of the "unfit." Both the theories and the policy suggestions have received a lot of coverage in the media.

The "new eugenicists" include A.R. Jensen, R. Herrnstein, H.J. Eysenck, and W. Shockley. In general they argue that:

1—I.Q. measures intelligence
2—I.Q. is an inherited trait (that is, your I.Q. score depends almost exclusively on your genes)
3—Non-white and lower class people have generally lower I.Q. scores (the average I.Q. of blacks is lower than the average of whites, the teamsters' lower than academics', etc.)
4—Therefore, educational and social changes can do nothing to improve the I.Q. of these people.

So they conclude that lower class people—which include most African and Spanish Americans—generally deserve their social position, and neither reforms nor revolutions can do anything about it. They argue instead that if some individuals in the lower classes are born with a high I.Q. trait, they will rise by themselves to equally deserved upper class positions. Furthermore, the new eugenicists argue that the human race is deteriorating due to the accumulation of undesirable genes and that such process is accelerated by the softness of liberal legislators, educators and social workers. Many of them claim, more or less openly, that reproduction of

the intellectually unfit should be controlled and that sterilization should be considered.

The first proposition of the new eugenicists is that I.Q. scores measure intelligence. A general objection is that nobody knows exactly what intelligence is and even less whether it can be measured all together by scoring a person with one figure. In any case let's take a look at how I.Q. is measured.

The I.Q. test [*Stanford-Binet*] French psychologist Alfred Binet designed the first I.Q. test in 1905 to predict the success or failure of children in the French public school, largely middle class. The test was constructed as an exam, consisting of a series of items (like questions, puzzles, multiple-choice problems) graduated according to the child's age. Note that the purpose of such a test was not—as in an exam—to judge whether the child has studied with profit, but to predict the child's future achievement and career (at first, only his scholastic career) and decide which kind of school would better fit him. So, when the test was first tried on school children, it had to be adjusted. Items that fit teachers' estimates of their pupils' abilities or could be shown subsequently to have predicted future achievements were retained; other items were dropped or replaced. In this way the test was made into a tool fit to measure a set of attitudes useful in white middle class society.

Many political decisions have been built into the test, as it was continually revised. For instance, in the first Stanford-Binet revision (1916), girls scored lower than boys; in the 1937 revision of the test, questions were added and dropped so that the average middle class girl would score as high as the average middle class boy. Why was a similar adjustment not made for non-white and lower class children? Somebody must have decided (another political decision) that their attitudes and values were not acceptable.

A major section of the Stanford-Binet test is the vocabulary list, mostly learned words which a child would rarely come across except by reading English literature. Other questions are even more obvious tests of background and attitude: "Which one is prettier?" and "What's the thing for you to do when you have broken something that belongs to someone else?" The correct answer *must* include an offer to pay for it as well as an apology; "Feel sorry" and "Tell 'em I did it" are wrong answers (Age 7-8, Stanford-Binet, 1960).

Probably more important than the response to any single question is the attitude of the child taking the test. If the child dislikes school, rebels against his teacher or is intimidated by tests he will score low, no matter what his intelligence. Jane Mercer (1972) describes how many black and Chicano children are unjustly tracked into programs for the retarded on the basis of I.Q. tests. For these reasons, the I.Q. test is no longer used as a basis for tracking children in Philadelphia, New York City, Washington, D.C., Los Angeles, and San Francisco.

"Which is prettier"? (Stanford-Binet, 1960)

Tne Genetics of I.Q. The claims that I.Q.. is largely inherited and scarcely modifiable by education and social change are based primarily on two types of comparisons between I.Q. scores: those of *separated twins* and those involving *adopted children.* In the twins' case two individuals with identical genes are brought up in different families: if their I.Q. scores are very similar in most instances, it is concluded that a change in the environment affects very little the I.Q. score of any one. In the second case an individual (having a given genetic set-up) is brought up in a family which is not his own (therefore having a different genetic set-up): if his I.Q. score, in spite of this, is similar in most instances to that of his natural mother, it is concluded that the genetic set-up is the main factor in determining the I.Q. of any one.

Jensen and Herrnstein, having reviewed and summarized the results of several such studies (made by others), draw the four propositions of the new eugenicists and state very definitely that no reasonable and knowledgeable person may reach different conclusions. In fact Kamin and Lewontin, to quote only two other scientists, state that on the basis of the *same* data the heritability of I.Q. might well be zero.

There is *no* raw data available for the separated twins studies of Sir Cecil Burt, studies upon which much of Jensen's conclusions are based. So no one can check his work. As Kamin shows, these studies are filled with inconsistencies and in some cases there are reasons to suspect that he may have manipulated his scores (not available) to fit with his conclusions. In most studies, the I.Q. tests given were not even standardized for age and sex. In addition, the twins were placed, whenever possible, in very similar environments, such as the homes of relatives or next door-neighbors. Certainly not enough difference in their environment to justify the claim that education and social change cannot change our I.Q.

The adopted children studies are equally biased. Adoption agencies follow very strict procedures, like matching the social condition and educational level of the adoptive family with that of the natural mother. Therefore the child may show a similar I.Q. score as his natural mother's not because he has inherited it, but rather because his mother's I.Q. is similar to that of his adoptive family. Two such studies show that the I.Q. scores of adopted children are different from those of their adoptive families. A glaring observation, however, emerges from these studies and is conveniently ignored by the new eugenicists. The I.Q. of the child is different from that of his adoptive parents even when the head of this family is his natural father. Therefore the I.Q. of the child is different in such families from the I.Q. of his father. A reasonable explanation is that children conceived out of wedlock (whether or not their natural father is the head of that family) are given in such families a differential treatment. Nothing new, but nothing upon which to base the claim that I.Q. is 80% inherited.

Why all this fuss? The four propositions of the new eugenicists have generated an ongoing debate. Their critics argue: first, that they give a rationale for racist social policies; and second, that they are not scientific. We have shown that there are incredible errors and bias in the first two propositions, that I.Q. measures intelligence and that it is inherited. There are also several misrepresentations of genetic theory in the last two propositions. First of all, even though a trait may be inherited, there is no reason to expect this trait (I.Q.) not to change, if there is a sufficiently large change in the environment (society). Secondly, even though a trait may be highly inherited within one group (middle class Americans and Europeans), the same trait in a different group in a different environment may not be (among poors or blacks). And thirdly, there is no ground for stating that the *difference* in a trait (I.Q.) between two groups (blacks and whites) must be inherited and go on for ever, even if it was true that the trait itself is inherited.

In any case, if the I.Q. score does *not* measure intelligence and if it is *not clear how much* of whatever determines the I.Q. scores is inherited, to find that non-white and lower class people score low averages is not impressive any longer. Not any more than to discover that Afro-Americans are generally darker and for some reason they often have an accent. Both the third proposition of the new eugenicists and the final one, that education and social change cannot affect the I.Q. score, appear much less important as scientific statements than they are as political decisions. One such decision has been *not to adjust* the I.Q. test for different social classes, different cultures and races the same way it was adjusted, back in 1937, under the presidency of F.D. Roosevelt, for white middle class boys and girls. Another decision has been *not to change* the educational system and the economic and political structure of this society, so as to maintain a pretended cultural superiority of the dominant classes.

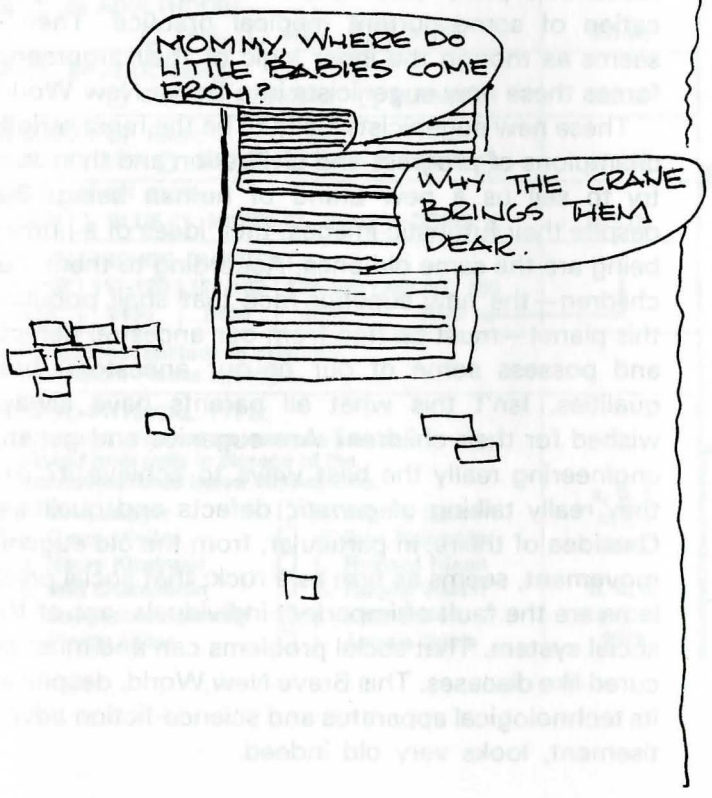
BRAVE NEW WORLD?

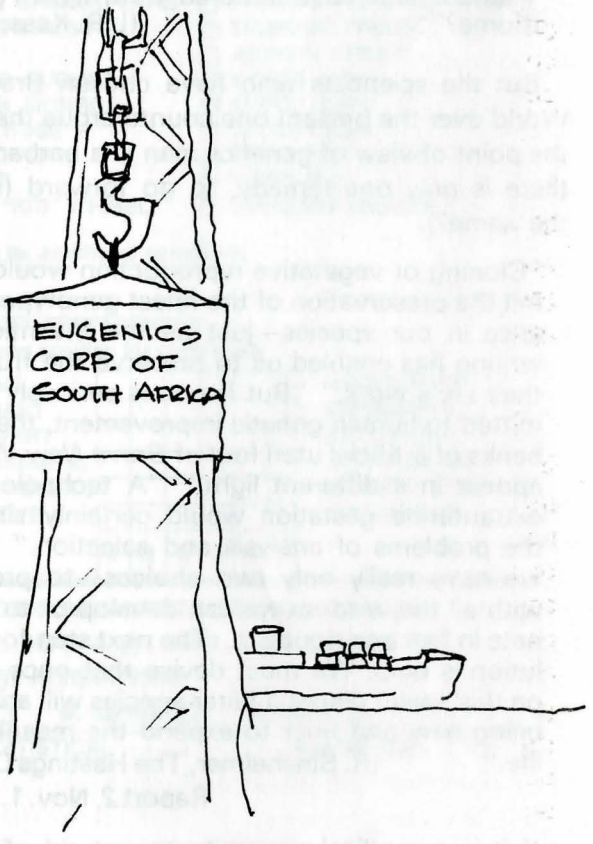
Scientific progress is currently propagandized as a major factor of civilization and increased human welfare, even though its immediate practical benefits may not be obvious. In the field of human reproduction, one possible long term goal is to relieve all women from the biological burden of pregnancy and child-birth. Another goal may be to liberate the human race from the biological chance of genetic defects. The supposed benefits to be expected from such progress must be discussed openly and in depth. If there are benefits, these must (1) not be limited to a small group of individuals and (2) must not be achieved at the expense of our present personal freedom and sense of ourselves. Therefore, the fulfillment of such goals would require not only scientific and technological progress, but also tremendous progress in our social relationships and political institutions.

Eugenicists—old and new—go farther in two respects. First, they want to create a "better" human race, assuming that we know already in which direction we want to go. Second, they want to start doing their things, without making sure that the technical and social conditions for real progress are available to all people. Many scientists take for granted—which is always a rather unscientific attitude—that some eugenic program, at least a limited one aimed to eliminate our "bad" genes, is desirable. To many, the urgency of such programs is reinforced by the presumed population crisis.

> "In a world where each pair must be limited on the average to two offspring and no more, the right that must become paramount is not the right to procreate, but rather the right of every child to be born with a sound physical and mental constitution, based on a sound genotype. No parents in that future time will have a right to burden society with a malformed or a mentally incompetent child. . . . He must produce a Man who can transcend his present nature."
>
> (B. Glass, 1971)

The obstacles to the adoption of eugenic programs are seen as mostly technical (more research is needed) and sometimes as psychological (ignorant and unreasonably fearful people must be convinced.)





"But if these obstacles are overcome I wonder whether such a eugenic program is not likely to emerge, aimed primarily at reducing the production of individuals whose genetic endowment would limit their ability to cope with a technologically complex environment. Would not such a program then seem simply like a preventive approach, supplementing the curative approach, to the humanitarian goal of minimizing human misery?" (B. D. Davis, 1970)

What is a genetic "defect"? Can a relative inability to cope with one's technological environment *in a given society*, be considered as a defect that the human race as a whole must be ridden of?

Some theologians and moral philosophers argue that the sanctity of human life is attacked by genetic engineers and the new eugenicists. They raise complex legal questions concerning the "right of the unborn". But they also ask straightfoward questions, like the following.

"It is probably as indisputed as it is ignored that the world suffers more from the morally and spiritually defective than from the genetically defective. After all, how many architects of the Vietnam War have suffered from Down's syndrome?"* (L.R. Kass, 1973)

But the scientists who have chosen Brave New World over the present one counterargue that "from the point of view of genetics man is a barbarian", so there is only one remedy, to go forward (more of the same?).

"Cloning or vegetative reproduction would permit the preservation of the finest genotypes that arise in our species—just as the invention of writing has enabled us to preserve the fruits of their life's work." "But if one is seriously committed to human genetic improvement, then the banks of artificial uteri (out of *Brave New World*) appear in a different light." "A technology of extrauterine gestation would certainly simplify the problems of analysis and selection." "And we have really only two choices—to proceed with all the wisdom we can develop or to stagnate in fear and doubt. . . . The next step for evolution is ours. We must devise that once again on this sweet planet a fairer species will arise—a being new and finer to expand the meaning of life." (R. Sinsheimer, The Hastings Center Report *2*, Nov. 1, 1972)

If it is a medical necessity to get rid of genetic defects, why not get rid of low I.Q. and other undesirable characters? If it is socially desirable to clone the finest individuals that arise naturally, then why not to try to fabricate the kind of human beings that they need, like obedient slaves to do their dirty jobs?

"It is entirely possible, given our present increasing pollution of the human gene pool through uncontrolled sexual reproduction, that we might have to replicate healthy people to compensate for the spread of genetic diseases and to elevate the plus factors available in ordinary reproduction from unidentified cell sourcess. . . ."
"If the greatest good of the greatest numbers (i.e., the social good) were served by it, it would be justifiable not only to specialize the capacities of people by cloning or by constructive genetic engineering, but also to bio-engineer or biodesign parahumans or "modified" men—as chimeras (part animal) or cyborg-androids (part-prosthetes). I would vote for cloning top-grade soldiers and scientists, or for supplying them through other genetic means, if they were needed to offset an elitist or tyrannical power plot by other cloners—a truly science-fictional situation, but imaginable." (J. Fletcher, 1971)

So much for genetic engineering and its supposed benefits. It all starts with some limited and apparently reasonable plan, which sounds like just an amplification of some current medical practice. Then it seems as though the inner logic of their arguments forces these new eugenicists into Brave New World.

These new eugenicists claim to be the most serious champions of progress and civilization and then they try to sell us a new brand of human being. But despite their futuristic images, their ideas of a human being are the same old ones. According to them, our children—the new superior race that shall populate this planet—must be free from our ancestral defects and possess some of our or our ancestors' best qualities. Isn't this what all parents have always wished for their children? Are eugenics and genetic engineering really the best ways to achieve it? Are they really talking of *genetic* defects and qualities? One idea of theirs, in particular, from the old eugenic movement, seems as firm as a rock: that social problems are the fault of imperfect individuals, not of the social system. That social problems can and must be cured like diseases. This Brave New World, despite all its technological apparatus and science-fiction advertisement, looks very old indeed.

CLONE ORDER FORM

PACIFIC INSTITUTE OF TECHNOLOGY
MEDICAL SCHOOL
8444 WILSHIRE BLVD., BEVERLY HILLS, CALIFORNIA 90211

TO PROSPECTIVE PARENTS:

April 22, 1983

Congratulations on your decision to become a parent. We are sending this order form for your clone in response to your inquiry.

We are indeed fortunate to live in the Nineteen Eighties for, through science, we are no longer at the mercy of mother nature when it comes to acquiring children. There was a time — many of you may remember — when to produce an offspring we were limited to sexual reproduction.

In ordering your child (clone) fill in the spaces below with careful consideration. Submit this form in triplicate to the biogenetics culture laboratories of Pacific Institute of Technology's medical school along with (a) The U.S. Department of Genetic and Cloning Control Certificate of Permission for Parenthood, and (b) a sample of epidermal cells of each prospective parent. (If there is to be one parent only one sample of cells are necessary. Of course if there are to be two, three or more parents of the clone, a sample from each for the proper genetic combination is necessary.) Your family physician can take these samples in a simple office consultation.

We will endeavor to provide you with the combination in genetic make-up most closely matching your specifications as set forth below. You should receive your clone after the normal nine month in-vitro fertilization and extra-utero gestation period.

James R. Kemp, M.D.
Institute Director

UNAUTHORIZED CLONING IS A FEDERAL OFFENSE

PARENT(S) NAME(S) last first init.	SEX M	SEX F	other
1st			
2nd			
3rd			

The following are characteristics you desire in your child (clone). Check appropriate boxes. Please type or use pen.

		RATE
SEX	☐ MALE ☐ FEMALE ☐ COMB.	$73.00
HT. IN ADULTHOOD:	☐ TALL ☐ MED ☐ SHORT	$61.00
WT. IN ADULTHOOD	☐ OBESE ☐ NORM ☐ SLENDER	$52.00
COLOR OF HAIR:	BLK ☐ BRN ☐ BLOND ☐ RED ☐ COMB. ☐	$71.00
COLOR OF EYES:	BRN ☐ BLUE ☐ HAZEL ☐ BLK ☐ COMB. ☐	$72.00

INTELLIGENCE QUOTIENT:

100-110	111-120	121-130	131-140	ABOVE 140
$320	$400	$480	$560	$620

Exceptional aptitude in selected profession. Please specify:

GENO-PHYSICAL TYPE:
If desired, physical appearance can be cloned from cells in storage of the individuals listed below. Check one.

☐ a. Mick Jagger	☐ b. Johnny Carson	a, b, f, h, i, l $415
☐ c. Orson Welles	☐ d. Burt Reynolds	
☐ e. Henry Kissinger	☐ f. Richard Nixon	
☐ g. Wilt Chamberlin	☐ h. Raquel Welch	c, d, e, g, j, k $375
☐ i. Jacqueline Kennedy	☐ j. Kate Smith	
☐ k. Phyllis Diller	☐ l. Angela Davis	

GENO-CEREBRAL TYPE:
If desired, special talent and professional characteristics are available from cells in storage of the following individuals. Check one. Prices available on request.*

☐ ALBERT EINSTEIN	☐ MOHAMMED ALI
☐ EMILIA EARHART	☐ LEONARD BERNSTEIN
☐ WILLIAM SHAKESPEARE	☐ FRANCIS FORD COPPOLA
☑ PABLO PICASSO	☐ SIGMUND FREUD
☐ PLATO	☐ ADOLPH HITLER
☐ HOWARD HUGHES	☐ GOLDA MEIR
☐ MARILYN MONROE	☐ MARIE CURIE
☐ TOKYO ROSE	☐ BETSY ROSS
☐ AMENHOTEP II	☐ POPE PIUS (I - XII)
☐ MOZART	☐ YOKO ONO
☐ NOBLE "KID" CHISEL	☐ DOODLES WEAVER

*Inquire for additional selections

PERSONALITY PREFERENCES:
check one position for each scale

PASSIVE							AGGRESSIVE
DOMINANT							SUBMISSIVE
INTROVERT							EXTROVERT
HYPERKINETIC							HYPOKINETIC
AFFECTIONATE							NONAFFECTIONATE
SENSITIVE							INSENSITIVE
	1	2	3	4	5	6	

FOR GOVERNMENT USE ONLY (43-67-J8)

APPROVAL: DEPT. A ☐ DEPT. B ☐ DEPT. C ☐

SUGGESTED ALTERATIONS:

A. XM-21 ☐ B. J5R-VB ☐ C. U90-1 ☐

STATISTICAL STATISTICAL

Today and tomorrow

WHAT MIGHT HAPPEN

Although many scientists openly support or are ready to accept a government sponsored eugenic policy, such policy is not likely to be enacted at the present time in this country. Strong resistance might be expected from the lower classes and the non-white against any program aimed to control population by limiting the number of their children. Such resistance could threaten also the funding of the limited indirect eugenic programs (screening and counselling) which are already under way and of other developments of the biological revolution (see below).

We might expect the first moves toward a genetically controlled society to be rather subtle. For example, every day, in hospitals around the country, decisions are being made about the genetic worth of prospective human beings. As amniocentesis is available, some parents have the opportunity to choose whether or not to abort a fetus with a genetic "defect." Clearly, this technique will save many parents from grief.

As the number of disorders that can be diagnosed by amniocentesis increases, more and more fetuses will be aborted on the basis of a particular doctor's and particular parent's judgements. Where do these judgements come from? They will undoubtedly reflect the dominant medical attitudes of the time and the attitudes of the dominant classes of society. (It won't be the lower classes who are writing in the medical journals and publishing the information for genetic counselling.) From recommending abortion for clearly defined defects (like Down's syndrome) they might move to hazier ones (like schizophrenia) and finally to low IQ.

Since these judgements about the genetic worth of the fetus will primarily be "individual" decisions, the "society at large" will not have a chance to take part in the decision. There will be no public debate about the whole issue. Nevertheless, the *sum* of these individual decisions will form new social values about the genetic worth of people. Since each new technique is likely to be heralded as an important new medical advance for the benefit of mankind, there will be little reason to criticize the whole trend. The change will be gradual. The new social values may never be put into law, but they will allow newer and more powerful eugenic techniques.

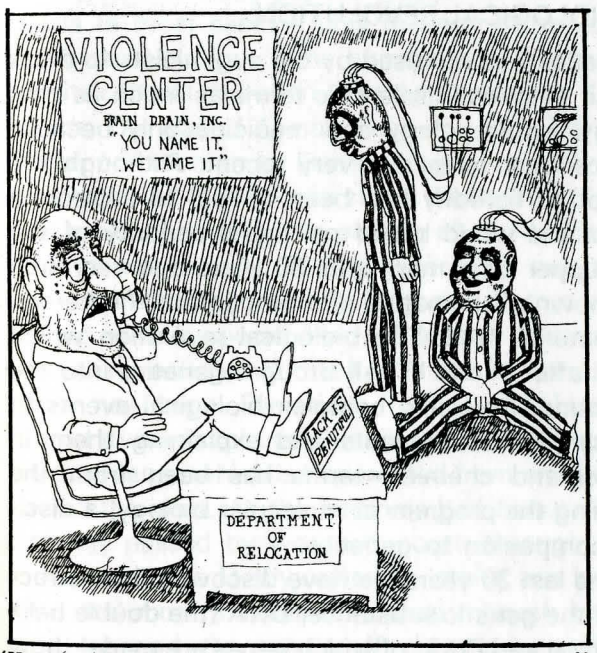
While the public will be led gradually to accept anything the new technologies may have to offer, the eugenicists will keep up the pressure. They will remind discontented workers that they could be replaced by semi-human cooperative morons. They will urge that welfare mothers be sterilized and perhaps be used for a salary to bear and deliver the babies of the upper classes. Or they will promise the warmongers the "perfect" ethnic weapon: like viruses or chemicals capable of attacking only non-white people (Larson, 1970). Technical advances will allow more control, more precision and more efficiency in doing more of the same things. Which things should be done and for what purpose, will never be discussed, except in small circles of scientific and political experts. So far those experts are the same persons who have been making the decisions that affect everybody's life.

BLAMING THE VICTIMS.

In the last 10 or 15 years there has been an increasing outcry against the inequalities of our political-economic system. From civil rights marches to ghetto uprisings to welfare protests and Indian occupations, more and more of the poor and op-

pressed have raised demands for a fairer distribution of goods and power in our society. Half-way measures taken by the government to correct these inequalities have been unsuccessful.

Meanwhile, in the last five years, there has been an increase in government funding for studies which show that individual "problems" are the cause of social problems. Not surprisingly, there has been an increasing number of scientists who have begun to explain away our problems as the fault of biological or genetic defects in individuals or classes of people. For example, Doctors Vernon Mark and William Sweet work with the Neuro-Research Foundation, which has as its purpose, "the diagnosis and treatment of persons with poor control of dangerous impulses." After the 1967 Detroit rebellions, the two doctors wrote a letter to the *Journal of the American Medical Association* which said the rioters were the kind of people who are unable "to resist the temptations of unrestrained violence." Their idea is to treat such people "with a low threshhold for impulsive violence" by operating on their brains (psychosurgery). Their approach hs been funded with $100,000 by the U.S. Justice Department.



"Hello, central casting?...about that zombie movie..."

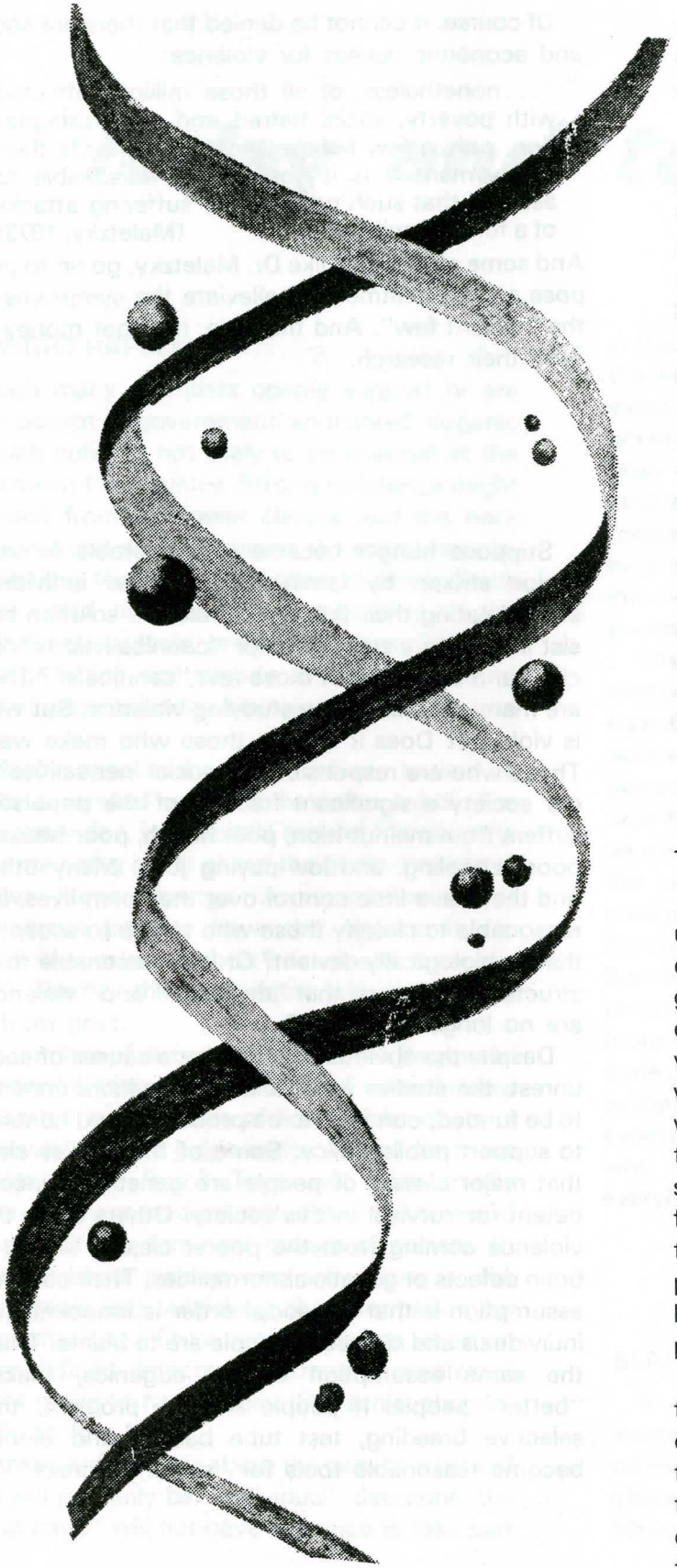
Of course, it cannot be denied that there are social and economic causes for violence:

> "...nonetheless, of all those millions afflicted with poverty, social hatred and urban stagnation, only a few behave violently towards their fellow man....Is it not entirely reasonable to assume that such patients are suffering attacks of a form of epilepsy." (Maletzky, 1973)

And some physicians, like Dr. Maletzky, go on to propose a drug treatment to alleviate the symptoms of the "violent few". And they too, may get money to fund their research.

Suppose hunger became so intolerable in some region striken by famine, that a few individuals started eating their fellows. Would the solution consist in finding a treatment for "cannibalistic tendencies" and using it with those few "cannibals"? There are many scientists now studying violence. But what is violence? Does it include those who make wars? Those who are responsible for social inequalities? In our society a significant fraction of the population suffers from malnutrition, poor health, poor housing, poor schooling, and low-paying jobs. Many others find they have little control over their own lives. Is it reasonable to classify those who refuse to accept all that as biologically deviant? Or is it reasonable to restructure society so that "deviance" and "violence" are no longer produced?

Despite the obvious and legitimate causes of social unrest, the studies which blame the victim continue to be funded, continue to be produced, and continue to support public policy. Some of the studies claim that major classes of people are genetically incompetent for survival in this society. Others claim that violence coming from the poorer classes is due to brain defects or genetic abnormalities. Their common assumption is that the social order is innocent, that individuals and classes of people are to blame. This is the same assumption behind eugenics, making "better" people. If people are the problem, then selective breeding, test tube babies, and cloning become reasonable tools for "social progress."



THE BIOLOGICAL REVOLUTION.

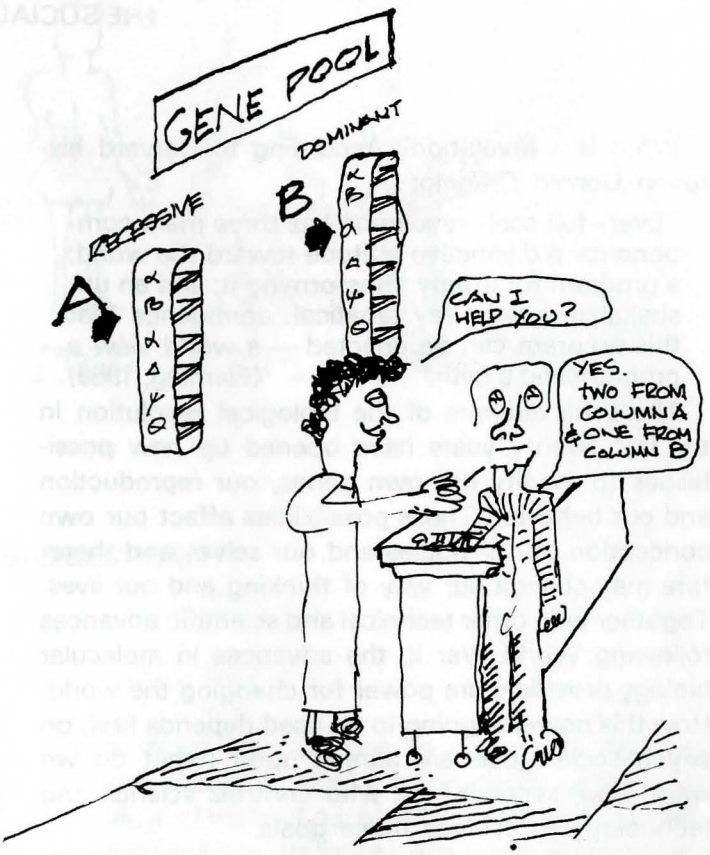
Genetics was not used by old eugenicists to dress up their theories in scientific terms as much as psychology, anthropology and medicine only because genetics as a science is very recent. Although the concept of heredity has been crucial to support a view of the world based on the superiority of the white upper class man, until 30 years ago very little was known of the nature and function of the hereditary material itself. The biological revolution which started after World War II brought genetics into the foreground. Reducing complex biological events to their simpler components and explaining them in physical and chemical terms has been from the beginning the program of molecular biology, a discipline companion to genetics.

In the last 30 years we have discovered the structure of the genetic substance, DNA (the double helix of Watson and Crick, of which genes are made), how to achieve its perfect replication in viruses and how this substance *codes* for other substances in all the cells of each living organism. We have learned to fuse together cells of the most diverse vertebrate species

and how to transplant the nucleus from one cell into another, as well as the general strategy for *transplanting organs* from one animal into another. We have learned how to induce egg-cells to start multiplying, how to transplant them and how to keep an embryo growing for some time outside the body. We have discovered hormonal contraceptives and the principle for designing such contraceptives for *both sexes.* We have discovered many *psychoactive drugs,* which reproduce the symptoms of many diseases and so we are learning to modify at will our mood and our behavior both by taking these drugs and by electrical stimulation of the brain.

Molecular biologists tell us what they can do and what they plan doing and then they generally stop there. If pressed, most will agree that their work can be used for good or evil, but they believe that the balance is for good.

But at the same time, just as molecular biology attempts to explain life as physics and chemistry, the trend is to go on to attempt to explain society and history as life. Many popular books—written by biologists in most cases—have recently portrayed the biological evolution of the human race as one thing with its cultural evolution. (*On Aggression* by Konrad Lorenz, *The Naked Ape* by Desmond Morris and *The Descent of Woman* by Elaine Morgan, are only a few examples.) All these books stress the fact that "man" is an animal and set up to explain all the major problems in our society by the legacy of our animal instincts. What is generally forgotten is that we are dealing with a special kind of animal and what is special is precisely that the key factor in human evolution has been liberation from direct biological control through culture. Culture is the knowlege and the experience which is transmitted from one generation to the next. At the beginning of history it was probably passed by word of mouth through individuals within the family, whereas later it has become more and more a social enterprise through schools, literature and the media. If culture is artificially scratched from the picture, then biology is all that remains. Biology is destiny, according to these writers, because we cannot change the laws of physics, chemistry and genetics.



In this way, while molecular biologists provide the new "scientific" world view, they also lend their authority, directly or indirectly, to the old eugenic dream. Here is how Nobel prize winner Salvador Luria reminds us of the vision of the future of another pioneer geneticist, Herman Muller (the first proponent of sperm banks):

> "Muller held forth to mankind the vision of a happier future: a future in which man, experimenting with himself and his progeny in an enlightened spirit of scientific inquiry and social justice, would by choice create better, more cooperative and more rational generations of man." (Luria, 1970)

Many molecular biologists share this vision, although they may not share Muller's unshakable optimism, conscious as they are of the past misuses and abuses of science. They only endorse the program with cautious and limited faith, unlike their colleagues who believe in Brave New World. But perhaps the biological revolutionaries have something in common. They dismiss our social problems and their social causes and they disregard the role of science as part of the problem. Perhaps we cannot change the world with this biological revolution.

What is a revolution? According to Harvard historian Donald Fleming:

> "Every full-scale revolution has three main components: a distinctive attitude toward the world; a program for utterly transforming it; and an unshakable, not to say fanatical, confidence that this program can be enacted — a world view a program and a faith." (Fleming, 1969)

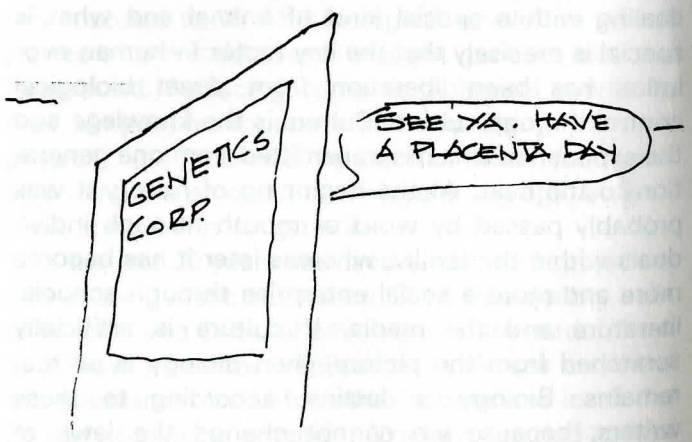
The achievements of the biological revolution in the last twenty years have opened up new possibilities to modify our own genes, our reproduction and our behavior. These possibilities affect our own conception of our bodies and our selves and therefore may change our way of thinking and our lives. Together with other technical and scientific advances following World War II, the advances in molecular biology provide more power for changing the world. How this power is going to be used depends first, on which social goals are agreed upon (what do we want) and, secondly, on who controls science and technology to achieve those goals.

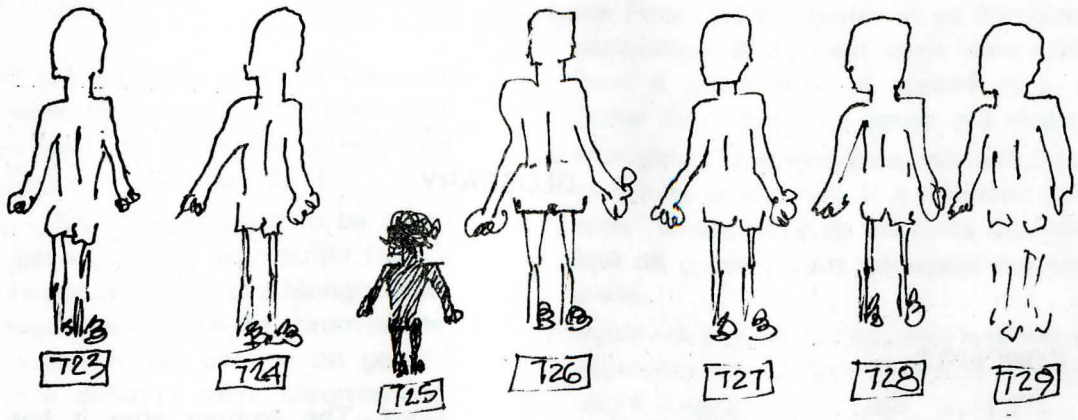
In the U.S. over half of all government research and development is paid for by the military and most of the non-military research is paid for by large corporations. The obvious goals—from the point of view of those who control society—are to increase and protect private profit, to monopolize the markets and to maintain peace at the workplace. Those who make the decisions on which goals are to be achieved are the same group that controls the funding of science and technology.

Science is not done in a vacuum, separate from the rest of the world. How scientific achievements get used depends on the social and political environment. The structure of society also determines what kind of scientific work gets done. One of the best known examples of this is the development of the atomic bomb. Under the pressure of World War II, the U.S. instituted a huge crash-program, the Manhattan Project, to apply the most advanced theories of physics to making the bomb. The same sort of thing happened during the Vietnam War to develop sensing devices. Wars are not the only time this happens. Many innovations in industry have appeared following a strike—to make the companies less dependent on labor. Recently, farmworker strikes have led to the development of new plant breeds and picking machines. Recently students' unrest, ghetto rebellions and the antiwar movement have brought the attention of the public and of the experts on violence. New devices have been developed for controlling dissent at home and for fighting a war abroad, which the American people have neither wanted nor declared.

We have examined the world view of the biological revolutionaries, the program of the eugenicists, the faith of the genetic engineers. We have come to the conclusion that their Brave New World is just a projection of the prejudices, the fears and the greed for power of the dominant classes in this society. Science can do much both to justify the policies and the beliefs of some small powerful minority and to satisfy *their* needs, to cure *their* diseases and to fight *their* wars. However, science cannot replace the will of the people. The Vietnam war has demonstrated that U.S. technology by itself could not conquer a small peasant country.

The Vietnamese people, instead, while resisting the French and the American invaders, have also succeeded in transforming their society by using modern science and technology. When the people in this country decide that they want justice, freedom and happiness for all, science can then become a powerful tool in their hands to change the world.





CLASSROOM SUGGESTIONS

1. Contact a hospital in your area to find out about genetic counselling. For what diseases are screening and counselling available? How well-defined are the diseases? How extensive is the counselling? Are several views presented? How expensive are the various tests and the counselling?

2. Are there any circumstances, imagining any kind of ideal society, where the genetic technologies or some of them would not be misused?

3. What are some examples of social control? What methods of control are used where you or your parents work? Are all of them necessary? Why do they exist? Could genetic engineering be used for social control?

4. In some places organizations like the Medical Committee for Human Rights and prison reform groups have started campaigns against practices like psychosurgery and behavior modification. What is going on in your area in terms of these experiments on people? What in terms of reforms? What do you think of it?

5. What can be done to make sure that scientific research give priority to problems which concern a large number of people? That technical advances (for example, in medicine) are available to everybody? That the people decide what is to be done?

6. Are I.Q. tests given in your present school? Have they been given to you previously? How are the results used? Do you know anybody who has been sent to a special school as a result of an I.Q. test? (talk to counsellors and teachers)

7. The Chicago Bar Association has introduced in 1973 a bill before the Illinois legislature. The bill would provide that the State Public Health Director issue a marriage license, only "after he has determined that such marriage may be consummated without serious danger to the health of either party to the proposed marriage or to any issue (i.e. children) of such marriage." Is it proper that the state determine whether or not people can live together? Do you think that the purpose for marriage is essentially to have children? For this purpose, could one consider artificial insemination or some other alternative? Could one consider adoption?

GLOSSARY

A. SOCIAL CONCEPTS

Caste System—A social system in which people are born into clearly defined groups which they stay in their whole lives. People are considered superior or inferior according to which caste they are in.

Conditioning—A process in which an individual is trained to react in certain ways and not in other ways by rewarding the way she or he is being trained to act, and punishing her or him when she or he acts another way.

Deviant—An individual who is different from what is considered "usual" or "normal". Often used to mean there is something wrong with the individual for being different.

Hereditarian—In the argument about whether people's behavior and mental make-up can be explained by inherited traits, or by the influence of the environment, those thinking inheritance is the only or the most important factor are called hereditarians.

Patent—If a person invents a new product or process he can buy a patent or guarantee from the government that nobody else can make or sell his idea without his permission.

B. REPRODUCTION (see also chapter on cloning)

Embryo—A newly formed organism in its first stages of growth. In mammals these stages include the multiplication and differentiation of the fertilized egg-cell after it is implanted, until blood circulation is established between the new organism (by now a few million cells) and the maternal body.

Fallopian Tubes—The tubes connecting the ovaries to the uterus. Eggs are produced in the ovaries, move into the fallopian tubes where they may be fertilized, and then after fertilization, go to the uterus, where they develop into an embryo.

Fetus—The embryo after it has grown for two months in the uterus. At this time the blood circulation between mother and fetus is established and the general design (anatomy) of the future baby is formed.

Implantation—The attachment of the fertilized egg-cell to the inner wall of the mother's uterus. This is the beginning of pregnancy.

In Vitro—Something happening outside the body, in a lab (such as an experiment in which cells from an animal are grown in a test tube). The word means literally "in glass". If cells are studied right in the organism, they are studied *"in vivo"*, or "in life".

Mammal—A class of animals including people, cats, dogs, rabbits, deer, etc. Characteristics include having babies develop in a uterus inside the mother, breasts for feeding babies, warm body temperature, & other traits.

Ovaries—The female reproductive organ, where eggs are produced.

Ovulation—The movement of the mature egg-cell in the female from the ovary to the uterus. During this period the egg-cell can be fertilized by sperm and then become implanted.

Placenta—The organ, similar to plant roots, by which the fetus is attached to the uterus and draws blood with oxygen and nutrients from the maternal body.

Sterilization—Making someone sterile, or unable to have children. Usually done in women by removing the ovaries surgically or tying the fallopian tubes, and in men (a much simpler operation) by tying the channels which connect the testis (where the sperm is produced) to the penis.

Uterus—The organ in women in which the fertilized egg grows into an embryo and then a fetus.

C. GENES AND HEREDITY

Diploid—A diploid cell contains pairs of chromosomes. Each pair contains one set of chromosomes from the mother and one from the father. The word means "double". (see "haploid")

Down's Syndrome—This disease used to be called "Mongoloidism", because those who suffer from it (all races) look like the caricature of a Mongol child. It is due to the presence of an extra-chromosome: like the XYY syndrome (see section on genetic counselling), but a different extra chromosome. The patients are frequently ill with all sorts of infections, they often get leukemia and they are physically and mentally retarded. They usually die before thirty.

Galactosemia—A one gene-defect. The patient from birth cannot utilize milk-sugar, so that food containing this substance is poisonous. If babies with this disease are recognized at birth or before, they may grow normally with a milk-free diet.

Gene Pool—All the genes of all the individuals in a population; A concept used when talking about how a given gene is spread in a population, rather than about the genes of a single individual.

Genotype—The genotype of an individual is all the genes he or she has. It is different from "phenotype" which refers to the traits the individual has. Not all genes in the genotype are expressed as traits.

Haploid—A haploid cell has only one member of each chromosome pair from the mother and father. The word means "half". (see "diploid")

Mongoloid—See Down's Syndrome.

Schizophrenia—A mental disease which can be very severe or not. There are many causes which concur in producing the disease. *Some* of them are inherited, because of some defective gene or genes.

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FURTHER READING

1. Grossman, Edward, "The Obsolescent Mother. A Scenario." *The Atlantic Monthly,* May, 1971, p. 39.

In general terms, experiments on the physiology of reproduction are discussed, with particular emphasis on Edwards' work on test tube fertilization, and Chang's experiments on implantation* of test tube fertilized mammalian eggs. Reasons why the development of an artificial placenta* might become a national priority are presented. Grossman considers some aspects of the advantages and disadvantages of these experiments to society and concludes that implantation of human embryos cultivated in "test tubes" is inevitable.

2. Edwards, R.G., "Aspects of Human Reproduction." in *The Biological Revolution,* ed. W. Fuller, Doubleday Anchor Press, 1972, p. 129.

Edwards explains his experiments on test tube fertilization, the way subjects were solicited, his reasons for conducting the experiments, and his interpretation of his responsibilities in performing them.

3. Kass, I., "Babies by Means of *in vitro* Fertilization: Unethical Experiments on the Unborn?" *New England Journal of Medicine,* 285:1174, 1971.

Kass discusses the ethics of test tube fertilization and concludes that the experiments should not be continued because one cannot guarantee that the fetus will be developed without undue hazard.

4. Hook, E.B., "Behavioral Implications of the Human XYY Genotype." *Science* 179:138, 1973.

This article is a very interesting review of evidence for a link between the XYY genotype and antisocial behavior.

5. Rosenhan, D.L., "On Being Sane in Insane Places." *Science* 179:250, 1973.

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6. Chororer, S.L., "Big Brother and Psychtechnology." *Psychology Today,* Oct., 1973, p. 43.

"Psychosurgery, drug therapy, psychiatry and behavior modification have become totalitarian tools that allow us to repress social dissidence and deviance, while ignoring the faults in our social system."

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An excellent popular summary of the current revival of the "nature vs. nurture" conflict, its influence on social policy and of a number of criticisms of the arguments put forth by Jensen, Herrnstein, Eysenck, and Shockley.

8. Powledge, T., "The New Ghetto Hustle." *Saturday Review of Science,* Feb., 1973, p. 38.

A description of the sickle-cell controversy that poses questions about setting genetic standards for having children.

9. Zimmerman, et al, "Towards a Science for the People." Available from Science for the People, 9 Walden St., Boston 02130. 25¢

A good critique of the present uses of science. Lists many examples of anti-people science and explains why they are so prevalent in our society. Also discusses alternate work for scientists to get involved in.