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HOW MUCH LIKE ENGINEERING IS "GENETIC ENGINEERING"?

HAROLD ARMSTRONG*

Introduction

Every now and then one reads or hears something about "genetic engineering." Rather extravagant promises are made; such as, prevention or cure of certain diseases or changes in men and animals in ways which are supposed to be beneficial.

Such manipulation is often viewed with alarm. Rarely is it pointed out that what can be done in this way is at the present limited, and that there is no guarantee that much more will be possible in the near future.

However, in 1971, two authors have pointed out that some restraint is in order in talking about medical uses of such techniques. There are only a few genetic troubles which it seems feasible to consider curing by genetic manipulation; and, there is always the possibility that such manipulation might have undesirable side-effects. S. M. Fox and J. W. Littlefield concluded:

The promises offered by the proponents of gene therapy largely ignore its limitations and hazards. To mislead the public in this regard risks another period of disappointment and reaction. . . . Let us not do to ourselves what we have done to our environment. Let us now seek public support for research toward a better understanding of normal and abnormal human biology, rather than promise quick glamorous cures.¹

Authors of a more recent article likewise urge caution.² They point out that benefits to be expected from gene therapy are limited, and that it is not at all certain what side-effects there might be.

When I started to write about this matter, my first inclination was to dismiss most of what is written about "genetic engineering" as wildly extravagant, and to insist that, whatever it may be, it is not engineering. However, a friend pointed out that I could not ignore that, call it engineering or what you will, plant-breeders (and also animal-breeders) certainly have substantial

accomplishments to their credit. At the same time it occurred to me that often there are two stages to engineering, and that the plant-breeder's work, for instance, might quite fairly be compared with one of the stages.

Two Stages of Engineering

Two stages of engineering show up especially well in electronics. Some engineers design and make the components: transistors, and so on, for instance. Other engineers take these components and assemble them into what we might call systems; a radio receiver, in this sense, would be a system. It is true that recently the introduction of integrated circuits has, in some cases, blurred the distinction between the two stages; but the illustration will still serve our purpose.

In view of this distinction, will it not be agreed that the genetic engineering which is actually done, in plant-breeding for instance, corresponds to the second stage of engineering? There are physical features of plants, desirable or otherwise, which it is known can be inherited; these are the components. The breeder, by crosses, assembles the desired features into the "system," the hybrid plant which is produced.

Among roses, for instance, which have been bred very extensively, the components might be such things as glossiness of the foliage, a certain color, a certain shape of bud, and resistance to diseases. Desirable and undesirable features are likely, at first, to be found together; the breeder tries to eliminate the undesirable ones and keep the desirable.^{3, 4}

Breeders Utilize "Components"

In all this, the breeder is just using the features—the "components"—which he can find in the various varieties of living plants. It may well be that some of those features arose from mutations. So it may be worth his while to bring about a great many mutations in a short time, and to see whether any of them are useful to him. Of course, this has been done.⁵

But still, this is hardly what we have called the first stage of engineering. It is more as if, during the assembling, one were for instance to heat

*Harold Armstrong is a faculty member of the Queen's University, Kingston, Ontario, Canada.

a component (as I have seen done), to change its characteristics somewhat.

But the plant-breeder does not propose to go beyond the features which occur, somewhere or other, in the plants with which he is working. He does not propose to produce roses with green petals, or with foliage like that of asparagus.

If it should become possible to "dig" into cells and to manipulate the chromosomes, or to alter things in some similar way, that would still not affect the truth of what has been said. It would still be a matter of assembling existing features; only the new method might be more efficient than the old. It still gives no way of introducing an entirely new feature—of producing a race of men with wings, for instance.

We have seen, then, that there is a solid record of success for plant-breeding and animal-breeding, but that there is no evidence to show that some of the exaggerated proposals made in the name of genetic engineering are or ever will be possible. What else is to be concluded?

As these matters apply to human beings, the question is one of eugenics. There have been many proposals, going back at least as far as Plato's *Republic*,⁶ for breeding a super-race. History shows clearly enough what becomes of such attempts.

In Plato's time, it was commonly believed that the best example of applied eugenics was to be found in Sparta. But Aristotle, writing about fifty years later, gave the verdict of history, when

he said that we must judge the Spartans, not by what they used to be, but by what they are now.⁷

Application to Evolution

These considerations can be useful also in discussing the question of evolution. The breeder can bring about limited changes, even within a few generations. Sometimes, special methods, such as back crossing, are needed to establish these changes. Certainly no breeder would undertake to breed roses into daisies, or something of that sort.

So since we find here that the kinds are "fixed," although variations within kinds are possible, is it not reasonable to conclude that there never were any changes across kind? And in that case the kinds must have been created separately; which, of course, is just what Scripture teaches.

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- ⁶See *The Republic* by Plato, in and around Book 5, in any edition.
- ⁷*Politics* by Aristotle, Book 8, Chapter 4.

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