GENETIC ENGINEERING — A WAY TO ARTIFICIAL LIFE?

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Unfortunately, the public's ideas of genetic engineering, its positive opportunities and its risks, are often far removed from reality. Not only journalists who are poorly informed or who are just after sensational headlines have contributed to this state of affairs but also the so-called experts. To illustrate this I will quote a few lines from the instruction manual of a commercial "genetic engineering kit" for young people. While the experiments to be carried out with this kit are reassuringly harmless, the philosophy it conveys is most certainly not. The genetic engineering experiments are presented as acts (creation of new life) otherwise reserved to the gods. If this description were justified, genetic engineering could actually be viewed as a method for creating new, artificial life.

To enable an objective approach to such an important area, I will try to confront this pathetic account with the sober, yet fascinating reality. Here I would like to show what the methods of genetic engineering can actually produce, while focussing in particular on the public's misconceptions of them. This leads to the assertion that genetic engineering can be used to deliberately change inheritable characteristics of living beings. Proceeding from here, I will discuss the question whether — and if so to what extent — these methods will be developed further in the future to create products that could legitimately be referred to as "artificial life". Living beings, which have been altered by means of today's genetic engineering methods, e.g., bacteria that produce a certain human protein for therapeutic purposes or the transmission of a functional gene from another organism for healing humans suffering from a hereditary disease (gene therapy), obviously do not merit such a designation. One cannot speak of artificial living beings in a narrower sense in view of the fact that the changes brought about could have also taken place naturally even if the necessary events (e.g., transfer of genes between various types or classes of living beings) seldomly take place in nature.

To seriously test whether artificial life can be produced by means of genetic engineering, we first have to clarify certain notions. Living beings could be understood as systems that are capable of storing information and passing it on to the following generations. These systems must be able to absorb matter or energy and to transform it in order to construct the structures and tools necessary for storing and passing on information (metabolism). Artificial creatures, in a narrower sense, would have to use other types of structures and building blocks as natural organisms, i.e., other information memories than nuclein acides and other catalyzers than proteins. These considerations show that artificial life in this sense cannot be created by means of genetic engineering. In a less restricted sense, we could speak of artificial life if it were possible to produce radically new types of living creatures by means of the same basic structures and mechanisms that are characteristic of natural living beings. Here the problem of delineation arises. Does a blue rose represent a completely new type of life or would a singing rose have to be produced to do justice to this definition? The creation of a blue rose does not involve any particular technical or principle problem in terms of genetic engineering, it is also nothing sensationally new. A singing rose, by contrast, could not always be created with such a technology. In purely hypothetical terms, it could be produced by means of genetic engineering only by transferring a greater number of genes from already existing living creatures or by transmitting artificial genes that are modelled after natural genes. It is thus questionable whether even such a utopian living being could legitimately be called artificial life.

A further option will be explored here: Could genetic engineering be used to create living beings from non-biological (anorganic or organic on the basis of chemical synthesis)

components and would such creatures fall under the category of "artificial life"? It must first be stressed that in view of the present state of technology such a goal would, no doubt, be viewed as utopian. Yet given our theoretical understanding of the "reconstruction" of the simplest forms of life, such as bacteria cells, such an endeavor could at least in principle be conceivable, even if the resources needed to carry out such an experiment will make it unfeasible even in the future. With our present know-how, such a project would also be conceivable for higher forms of life, yet its realization becomes even more unrealistic. The following considerations are thus nothing more than a thought experiment. Beginning with the pure reconstruction of existing forms of life which would not necessarily bring forth artificial life, one could, in principle, go on to alter living creatures. Realistically speaking, however, an almost unsurmountable barrier would arise: any alteration of living beings producing forms of life that are radically different from ours, would not be feasible given our present or near-future state of knowledge, since higher organisms in particular would be made inviable. In unicellular organisms, where the prospects would be better in view of the accessibility of greater numbers of cells and the possibility of using more effective selection mechanisms, such a strategy would not be so attractive. Similar cells could be created much easier on the basis of already existing unicellular organisms — but this does not imply artificial life. Even this option is, for a number of reasons, not really new. Even if one of these methods were to bring forth a spectacularly new living being, would the "inventor" of this creature be seen as a sort of "creator", as divine, as promised by the author of the instructions to the genetic engineering kit that I mentioned at the beginning of this paper? Even in this case, such an interpretation would be exaggerated. The producer of this living being would have only used these principles to exploit the amazing variations of what already exists in nature to add something truly odd. It would be a question of definition whether this could be seen as bringing forth "artificial life", but as such of hardly great relevance.

The realization of such a thought experiment is not an attractive goal for genetic engineering, since it is a) utopian and b) nothing fundamentally new. For the same reasons, our experiment is also not dangerous. The opportunities to be provided by genetic engineering and its risks do not have much to do with the subject of artificial life. The scientist who works seriously with such biological technologies hardly views himself as being God-like or a creator. Being much more aware of the complexity of life than a superficial observer, he will also be more amazed by the wonders of nature, even if he is able to explain most of them on the basis of molecules. His amazement will, for the most part, be independent of the fact whether he believes in a personal creator of life or whether he assumes life to have evolved spontaneously and by necessity on the basis of "eternal" laws of nature. The latter assumption is, or could be seen as an even greater wonder than creation by the "super-genetic engineer" God.