

Future Prospects

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ago. Now the point I would like to make really at the close though is to

put the research perhaps in proper prospect in the long run of things to come.

~~Now that~~ the genetic ^{code} language is known and it seems clear that most forms ^{of life on this planet} use the same language. I think that it may be eventually possible to communicate

directly with the cells in much the same way as one can prepare DNA from

certain strains of bacteria and add them to other strains of bacteria. A

certain proportion of ^{the} bacteria will take up the genetic message and incorporate

or stable it into their own DNA. This DNA will then be passed on to successive

generations. Now the technology for synthesizing DNA--this is chemically

synthesizing DNA of known base sequences is rather far advanced now. It is

quite difficult technically and would be a formidable job I think to synthesize

a piece of DNA corresponding to a small protein but I think it could be done.

I think it will be done almost surely within the next 10 years or something of

the sort. DNA, for example corresponding to insulin or something of this

nature or perhaps to a sRNA. Thus far the experiments that I have talked about

and just the work in molecular biology as a whole I think it has had very little

impact on mankind per se, primarily because there simply is not enough information

known to be able to apply the knowledge. Now knowledge can be used obviously

for good and it can be used for bad purposes as well, and Lurea Salvatore Luria

a very imminent microbiologist, stated the responsibility of the scientist very very elegantly and I'd like to read just a paragraph from Lurea's statement. Lurea says "The impact of science on human affairs imposes upon its practitioners an inescapable responsibility for the progress of science is so rapid that it creates an imbalance between the power it places in the hands of man and the social conditions in which this power is exerted. Then neither the warnings of scientists nor breadth of public information, nor wisdom of citizens may compensate for inadequacies of the institutional framework with which to cope with the new situations. The scientist should cultivate his own alertness to prospective developments that may suddenly add new powers to man. The scientific habits of skepticism and restraint, of curbing fancy and distrusting fancy; inhibit the scientist's effort to speculate on what the future may bring. He must, however, within the limited means at his disposal prepare the public to cope with the foreseeable consequences of the advances he anticipates. For example, during the 1930's the physicists realized that nuclear bombardment via a chain reaction would have certain consequences but they questioned the chances of harnessing it but they realized that it was theoretically possible. But when this power became a reality

society was unprepared both intellectually and institutionally to deal with it." Now that is really why I raise this question I think well in advance of the need to do so. Because I think nobody can say when because certainly if you were to take a poll of a dozen different investigators you would get a dozen different answers. But of one thing I am convinced -- I am absolutely sure that sequences of DNA will be made chemically, synthetically, and they will be used to program cells. First to program possible bacteria and when the techniques are worked out they will be used I think to program mammalian cells. Thus, man eventually --I don't know when--but eventually, will be in a position perhaps to control his own biologic evolution. I think that technically it may be feasible to do this far, far before it will be possible to know the consequences of doing this, obviously & so there will be an information lag and I bring this up to make one point and this is that when it is possible to do this man should exercise enough restraint so this does not really perform an uncontrolled experiment upon himself because I think there would be much pressure, for example, to use such power to cure genetic diseases and I think it would be very wrong to do so. I bring this up because I don't know the answers--all the answers-- but that this is something that we should perhaps think about and perhaps ^{we could} talk about during the next ~~day~~ ^{or} or so.

Thank you