WARREN WEAVER
SECOND HILL, R. F. D.
NEW MILFORD, CONNECTICUT 06776

June 16, 1964

Dr. F. H. C. Crick
Medical Research Council
Laboratory of Molecular Biology
University Postgraduate Medical School
Hills Road, Cambridge
England

Dear Francis:

About -- as you say -- biologists' biologists. I quite agree that the best molecular biologists do not forget that they are dealing with living organisms. But there are few of "the best"; and I think that a fair number of the not quite best do forget. This, however, is not our problem at our Institute; for we have only "the best."

You do agree that we have to move "toward whole cells, tissues, and organisms"; and you agree that the problem is "how to do it."

Here I suspect that you and I differ. For I do think that it would be useful to have around a person entirely capable of understanding even the most technical details of what the molecular biologists do, but a person whose orientating background is quite other. I mean a person who has a vast store of accurate and dependable knowledge about the whole living world, -- who is in a fine and serious and modern sense a student of natural history.

(I was about to write "a naturalist" rather than a "student of natural history." But the dictionary defines a naturalist as a person who "expands conceptions drawn from the natural sciences into a world view" and who holds that the "cause and effect laws (as of physics and chemistry) are adequate to account for all phenomena." In other words, you are a naturalist according to Webster's Third Edition. And "natural history," I find to my dismay, has now come to connote either an old-fashioned attitude towards nature or an amateurish interest in nature. Must I conclude that my enthusiasm for a biologist's biologist is as out-of-date as my vocabulary seems to be?)

Why do I think that it would be salutary for us to have

a colleague who has a first-hand knowledge of and experience with the whole world of animals and plants?

It is because I am skeptical as to whether physicists (even reformed physicists) can ever really abandon (or significantly generalize) the procedures that have served them so well in their own domain. For their successes have essentially depended upon the facts that, in the realm of inanimate nature, one can successfully

a) isolate a very small part of a great system, and then study that small part without taking any explicit account of the general system. Physics is the subject in which you can successfully separate variables.

b) restrict that study to the consideration of a very small number of variables (often two and hardly ever more than four). Physics is essentially not a complicated subject.

c) keep pushing the study to an ever smaller quantitative scale of length, time, and mass. The fun in physics occurs on a sub-microscopic level.

I do not propose to expand my argument, in this letter, to meet all possible objections to the statements just made; but to indicate that I have not overlooked some important activities that might possibly seem, at first blush, to run counter to my claim, may I simply state that I think these three points apply to the DNA structure problem (or for that matter to the general protein structure problem as it is attacked at present), and to cosmological research as well.

There are, of course, some physical problems whose gross features can successfully be analyzed statistically, because they involve not 4, but say 10^{40} variables.

A long time ago I wrote a very simple-minded paper with the title "Science and Complexity." If I were to rewrite it today I would alter some of the emphasis, but none of the main conclusions. I am sending you a copy herewith.

My net conclusion then is simply this -- that in the effort to work out ways of moving from molecules to man, I think we ought to have around a person who is aware of larger-scale, more complex, perhaps even more subtle, relations than can be captured by the small number

of variables that so magnificently handle the law of Newton, of Maxwell, of thermodynamics, of Einstein, of quantum theory....

Yours ever,

Warren

Enclosure

cc: Dr. Jonas Salk