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STANFORD UNIVERSITY

OFFICE OF

Dr. Rather, Pathology

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Professor Joshua Lederberg
Department of Genetics

Dear Josh:

Perhaps you can clarify a few points about recent genetic theory which have puzzled me. They center around the current use of the terms "code" and "information". I can't help believing that there is something badly awry in the whole procedure, but you may be able to show me where I'm wrong.

Firstly, it seems to me that the meaning of a code (a written language, set of arbitrary symbols, or whatnot) is entirely independent of the material which embodies the meaning, i.e. it makes no difference whether we engrave the symbols in stone, put them on paper with ink, recode them in binary form in a computer, or whatever. There is always a perfectly clear distinction between the code itself and its infinitely variable material embodiment. But with the DNA code the situation seems quite otherwise. The paired units of the DNA molecule are supposed to be present in a number of sequences large enough to carry the necessary genetic information, I presume in the form of a binary code. The material components of the code cannot be altered to the slightest degree without confusing the meaning. In other words, the meaning of the DNA code cannot be separated from its material embodiment, as can the codes on which the analogy is based. Is this really meant to be an incomplete analogy, or is it merely a highly figurative way of speaking about genetic events?

A second place where I have difficulty is in my attempt to attach some clear-cut meaning to the use of the term "meaning" in this analogy. The meaning of "meaning" with respect to an ordinary code is clear enough. It has a meaning for us if we understand it, regardless of whether we do anything about it. For whom has the genetic code a meaning? It seems to me that this is of a piece with saying that "self" proteins "recognize" "not-self" proteins. I suppose anyone who chooses to can say that a key "recognizes" a lock, or vice-versa, but this would be a rather silly way to describe the facts.

Finally, about information. From the epigenetic point of view, as I see it, the fertilized ovum of a horse ought to contain enough information to specify a horse. But information about a horse is not a horse. I can conceive of an infinitely precise specification of a horse expressed in the form of a binary code, and as long as the meaning of the code remains separable from its material embodiment there is no difficulty. But it seems to me that current genetic theory somehow requires the information about the horse to be the horse and I can't make sense out of that.

Perhaps my difficulty is that I'm taking the analogy too seriously and looking for precise meaning in what is merely a rough and ready way of talking about the matter. - Have you any comment?

Sincerely yours,

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Professor of Pathology

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