



September 23, 1974

STANFORD UNIVERSITY SCHOOL OF MEDICINE

Department of Genetics

(415) 497-5052

Joshua Lederberg

### THE SCIENTIFIC ENTERPRISE

Some time ago I asked myself what I was doing spending so much time and effort in projects like ACME, DENDRAL, SUMEX so far from my home specialty of cellular genetics. (And I am sure that others have asked the same - perhaps almost as critically.)

It occurred to me that one way to answer that question was grounded in skepticism about the efficacy of the METHOD of science as practised today. (There is of course a substantial school of study of the philosophy of science concerned with similar issues, but hardly at all with ameliorative applications.) The DENDRAL project, for example, is directed at understanding and improving the process of abducing hypotheses, the fulcrum of the enormous effort of laboratory work. SUMEX in large part is directed at the more efficient communication of ideas and recipes in specific fields of work connected with medicine, to encourage the efficiencies embodied in the concept of "scientific community". Each of us is also involved in many different ways in the shaping of the scientific enterprise and the flow of social benefits and support, both in our own laboratory and in the guidance of policies of the university, of journals, of granting institutions and so on.

But I could think of no forum which mediated a collegial discussion of the method of science from the standpoint of measures to improve it. This lunch meeting was intended to start such a discussion; I had in mind a few figures for whose breadth of thinking and analytical acuity I had extraordinary respect to form the nucleus. We focus I think on the logical-speculative function and its mechanization on the computer; we might ask about augmentation with other areas.

Some questions I have in mind are:

1. How can we better integrate diverse sources of methodology for more effective theory formation and testing in science? I have the feeling that mathematical programming and operational analysis and some pure mathematics have reworked much of the same territory as Artificial Intelligence. And we are all well acquainted with the problems of exchanging complex algorithms once they are identified?

2. Can we identify other areas of science that are ripe for formalization, like organic chemistry for DENDRAL; or can we progress in the methods of formalization, the better to exploit AI approaches in the practice of those sciences?

3. Can we sharpen our meta-scientific model, the better to identify crucial points d'appui of approaches like these?

4. Should we incorporate value-oriented disciplines (economics, ethics) to help optimize our enterprise from the standpoint of social utility?

5. What further steps should we ourselves take in pursuit of these or other questions?