illustrate this. Unfortunately this control has seldom if ever been exercised for the common good of man. My thesis is that man is unique in being able to direct and control his own evolution. He has all too seldom exercised this option deliberately, and I agree with Yarnell that advancing knowledge makes this more feasible and at the same time more imperative for his survival and advancement in this nuclear and increasingly populous age.

Both Macinko and Beckwith point out the thorny nature of any discussion of the ancient pitfalls of free will. I referred to a concept of freedom stemming from our inability to know all that phylogenetic and individual past experience contributes to one's on-going behavior. We may or may not be entirely determined, and I suggested a pragmatic approach—that one may behave empirically as if one were free to make choices and thus justify responsibility, which I assume is socially desirable. An additional point in favor of freedom was derived from considerations of logical indeterminancy. This is a matter of definition of free will as I chose to use it in my discussion. Since we can have no final answer to the question of free will, one might ask, Which position is pragmatically better for society—the assumption that we are free or the assumption that we are not? What would be the social consequences if everyone were convinced that he was an automaton with no freedom to choose? It may be true that he is an automaton, although this contradicts our deepest convictions. In practice it seems to me that it would leave a society in a position in which people could not be held responsible for their acts. This conceivably might be a desirable state of affairs, but I do not think so.

Beckwith's point that "the doctrine that objective truth exists is metaphysical not ethical" seems to me irrelevant to the issue. I hold no brief for "absolute, unverifiable ethical principles." It is true that "principles of expediency verified by their utility" motivate much of science, but regardless of the metaphysics involved, when one compares the arrivals at conviction by the operational procedures of science with methods of myth, superstition, and prejudices that determine the beliefs of all too many people, the ethical significance of truth reached by science seems obvious. Scientific procedures extended more generally to the weighing and evaluation of evidence in relation to events in daily life, politics, and other human relations can have a very considerable ethical "fallout," in my opinion.

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## Scientists and Patents: A Lawyer Comments

An advertisement of the AAAS in your issue of 6 December (p. 1309) quotes this statement of a former AAAS president:

> I have sought . . . no patent for inventions and solicited no remuneration for my labors, but have freely given their results to the world. . . . The only reward I ever expected was the consciousness of advancing science and the pleasure of discovering new truths.

Elsewhere in the ad is the statement that AAAS is "an instrument for securing the benefits of science for human welfare." In the opinion of this reader, these statements are totally inconsistent. The use of the statement by AAAS is a representation of regrettable views of scientists about the patent system.

The picture conveyed is of the scientist cracking the door of his laboratory and throwing his invention out to the world. He then slams the door shut, returns to his bench, and revels in the warm feeling of having made his contribution to mankind. He gives no thought to the question who, if anyone, will transform his invention into a useful product or whether, in fact, his invention might be misapplied, to the detriment of his fellow man.

I do not propose that the social consciousness of the scientist should force him to abandon the bench and dabble in the dirty world of business. But if his attitude about patents is based on a desire to benefit the world, his mantle is soiled by abstinence rather than participation. Of course, many of the scientist's contributions are not patentable because they are not "useful" in the patent sense. They are, instead, the building blocks of future progress in the applied sciences. But scientists should nevertheless be aware of how patents, in proper cases, can increase the measure of their contributions. And those engaged in strictly fundamental research should reject the view that because the patent system may not operate for them it should be curtailed or abolished in areas where it does operate.

The philosophy of the patent system is to provide incentive for doing what must be done to the scientist's work before it can become a benefit to the public. Charles Kettering has said:

> . . . progress will not come through research, science, and invention alone. These are merely the loose strands of progress. They must be joined by cross-strands.

These cross-strands include the provision of an incentive to invest in uncertain developments in the hope that the temporary "monopoly" afforded by a patent will enable the investor to recover his costs and earn a profit. By exercising control through patents the scientist can better assure himself that his invention will do what he wants it to do in the world. He can license it freely to all worthy comers as though there were no patent at all, and he can refuse to license those whose competence or aims he distrusts. And there is no law requiring him to accept a profit in the process.

The *Science* ad refers to the author of the earlier statement as "a prime example of the spirit that has led eminent men of science for more than a century to seek the objectives of the AAAS." If this really represents the spirit of the scientist, we can only hope that one of the "new truths" he discovers is the availability of the patent system to help him fulfill the highest calling of his profession.

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## Consanguineous Marriage and Biological Selection

The exchange of letters between Victor McKusick and Cabot Briggs (*Science*, 10 Jan., p. 100) leaves the impression that the practice of marriage of close kin is on balance always biologically detrimental. But anthropologists are aware that marriage of close kin is a widespread practice among many primitive peoples who do not seem to show a high frequency of genetic defects, even at birth before selection has taken place. Probably the

reason is that these populations have become adjusted to inbreeding. One would, of course, expect that inbreeding beginning with a group of individuals each possessing a heavy load of deleterious recessive genes would lead initially to the increased appearance of homozygous defective offspring; but if such offspring were regularly eliminated from reproduction, the net effect in the long run should be a considerable reduction in the frequency of deleterious recessive genes in the gene pool. This reduction could be regarded as biologically functional. In such a population consanguineous marriages should be less likely to produce defective offspring than they would in a large population with free mating as its normal pattern.

I believe that most of the evidence for the dangerous effects of inbreeding in humans comes from instances where a small number of individuals arbitrarily drawn from a large outbreeding population have become the ancestors of a small, new inbreeding population which is extremely isolated by geography or society. The similarity of most animal inbreeding experiments to these human instances is apparent. It would be interesting to see the results of animal experiments in which the degree and duration of inbreeding approximated more closely the breeding pattern of many primitive societies, which tended to have enough inbreeding to eliminate harmful recessive mutations and enough outbreeding to restore beneficial genes lost through genetic drift.

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## Population Planning

The advances made in recent years in open dissemination of birth-control information is certainly encouraging, and your frequent reports on population planning ("News and Comment," 20 Dec. 1963, p. 1554) are of great interest to us in Scandinavia. It seems to me, however, that two aspects of the problem have been overlooked by most of those involved in the issue:

1) Current advances being made in agriculture, together with research in primary productivity of ecosystems, indicate that the world can support a much larger human population than it now supports. It seems likely, therefore, that the population problem will not be recognized as a problem by many people who are unknowingly the objects of birth-control projects, because they will be able to see more palatable short-range solutions than the one suggested. In this event, their cooperation in such projects may not be forthcoming. This possibility should be interpreted as indicating not that we should decelerate birth-control programs but that we should not readily become discouraged if, as in India, we see little result from our efforts after a few years.

2) The people who will first respond to the dissemination of this type of information will almost certainly be those who are most intelligent, most cooperative, and most concerned about social problems; in other words, the genetically elite. Indeed, from a eugenic point of view it may be suggested that the people who will be reached by birth-control programs ought not to be encouraged to practice birth control. Fortunately, the genetic bases of intelligence and of moral tendencies are sufficiently complex that simple individual selection cannot be expected to yield quick eugenic responses. Nevertheless, I consider this to be the more serious of the problems and one to which considerable thought and research could well be devoted.

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## Science and Poetry

Barzun's review (*Science*, 3 Jan., p. 33) of Huxley's essay, *Literature and Science*, begins as a half-hearted eulogy and ends as a diatribe. I agree with Barzun that the use of "popularized technicality" is "pretentious and false." I disagree, however, when he asserts that a poet cannot be expected to study science; he can—not to learn to use its terms, but to use its concepts, its philosophy, and the lessons it offers of human fallibility.

The poet can enrich his craft with insights from natural philosophy as readily as he can from history, psychology, or metaphysical philosophy. These insights are neither qualitatively different nor less amenable to poetic expression. Huxley himself makes ironic use of the hypothesis of the fetal ape in his novel, *After Many a Summer Dies the Swan.*

As to the hypothesis of the nightingale: The nightingale is *not* pouring out its soul in ecstasy or in love-sick anguish. It is establishing a territory, saying "Stay the hell away, unless you be female." The poet, the satirist of human foibles, could make a poem of this idea. The irony of man's eternally inflated anthropomorphism could begin here and extend even unto Deity in the hands of a poet.

Finally Barzun says, "We [scientific men?] can study birds, necessarily from the outside, till kingdom come, we shall never know *why* they sing. But as poets we know—none better—how their singing affects us." The scientist, to understand that bird fully, will not study it just as an object from the outside; he will try to get inside its skin and live, reproduce, sing, and die as it does. Then he will know that bird. And to *that* datum the poet may well listen, and react.

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## The Muse in the Laboratory

If the "Jargon of genetics (*Science*, 17 Jan., p. 195), why not the poetry?

*Sonnet*[1]

Let me not to the marriage of true minds
Admit impediments. Phage is not phage
Which alters when it alteration finds,
Or bends with the researcher to be sage.
O, no! it is an ever-fixéd mist
That looks on mutants and is never shaken;
It is the star to every scientist
Whose worth's unknown, although his paper's taken.
Phage's not Time's fool, though rosy heads and tails
Within his bending sickle's compass come;
Phage alters not with his brief hours and gales,
But bears it out even to the edge of doom.
If this be error and has me cagéd,
I never writ, nor no man ever phagéd.

*e. e. coli*[2]

i swear
by my cesium banding
by my microdensitometry
by my homologous pairing
i am e. coli
never fear

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1. With apologies to Wm. Shakespeare (see Sonnet CXVI).
2. With apologies to no one.