ever adopt a political program that is consciously genetic (though it should be repeatedly emphasized that all political programs are unconsciously genetic). He does, however, point to a possibility:

> It seems more likely, however, that the change will be precipitated more suddenly by something new in human history, a genetic crisis. The survivors of a nuclear holocaust might prove willing to adopt a thorough system of genetic control in order to minimize the horrifying effects of radiation on the next generations. Once the barriers inherent in the existing social organization of human life were thus broken, genetic control would probably persist because of the competitive power it would give to the societies that maintained it.

The other remarkable essay is by Paul Ramsey, Harrington Spear Paine Professor of Religion at Princeton University. "Moral and religious implications of genetic control," which takes up a third of the volume, views eugenic ideas from a standpoint that is novel to most scientists. The many essays of H. J. Muller are sympathetically and critically examined through the eyes of a man to whom the Bible is a living presence. The five billion nucleotides of a human cell are continuously being degraded by mutation, spontaneous or other. In a state of nature, natural selection just as continuously acts as a proofreader, keeping the genetic message reasonably close to its proper meaning. Tenderhearted man, in the role of the physician, tries his utmost to pinion the proofreader to the rack of benevolent desires. Somatic medicine steadily degrades our genetic ability to deal with the challenges of a simpler, more "natural" life.

Is this a legitimate cause for worry? Dobzhansky, in *Mankind Evolving*, has said no, pointing to comparable changes that have taken place in the domestication of laboratory rats: "Norway rats . . . have been kept in laboratories since some time before 1840 and 1850. . . . But it does not follow that laboratory rats are decadent and unfit; nor does it follow that the 'welfare state' is making man decadent and unfit—to live in a welfare state!" Ramsey, however, thinks there is more truth in Muller's view, which he identifies as a genetic Apocalypse. The accumulation of genetic defects now going on is inexorably fashioning a man of the future who will be kept going only by a burgeoning armamentarium of prosthetic devices: eyeglasses, hearing aids, allergy shots, tranquilizers, heart-pacers, insulin, and who knows what else. Tenderheartedly we refuse to press for the evolution of Superman, in favor of an evolution of Prostheticman. Dobzhansky, presumably, would say that in the Prosthetic State Prostheticman *is* Superman.

At this point Ramsey interjects a *Quis custodiet?* by suggesting that in such a world the genetic deterioriation of the medical men themselves might ultimately result in their being unable to deal with the genetic chaos they had created. The probable consequence, in a world that is not completely stable (will there ever be another?), would ultimately be a complete collapse. This, says Ramsey, is the eschatology that Muller offers us, the vision of a time when *there will be none like us to come after us.* "No philosophy since Bertrand Russell's youthful essay," says Ramsey, "has been so self-consciously built upon the firm foundations of an unyielding despair." Ramsey is comparing Muller's writings to Russell's classic essay, "A Free Man's Worship." He points out, however, an interesting contrast between the two men: "There is less posturing in Muller's despair, more in the optimism that floats over this despair, than in Russell."

Muller's optimism is connected with his schemes for improving the race by "germinal selection," that is, by parents' choosing other, and better, germplasm for the production of "their" children:

> [Muller's] language soars, the author aspires higher, he challenges his contemporaries to nobler acts of genetic self-formation and improvement, all the more because of the abyss below. The abyss sets up such powerful wind currents that mankind seems destined to be drawn into it no matter how high we fly. These are some of the consequences of the fact [that] when all hope is gone Muller hopes on *in despair.* An Abraham of genetic science, if one should arise, would be one who when all hope is gone hopes on *in faith,* and who therefore need neither fear the problem nor trust the solution of it too much.

Ramsey makes a thorough ethical examination of the proposals of Muller, as well as various counterproposals and criticisms by Crick, Lederberg, Dobzhansky, and Medawar. The discussions are too intricate for easy summary, especially since they are couched in a religious idiom that is unfamiliar to scientists. Some may doubt the relevancy of this idiom, but the intelligence and earnestness of the discussion are such that any scientist who finds himself periodically engaged in dialogues with laymen interested in the possibility of eugenic action can hardly afford not to read Ramsey's excellent essay.

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Explaining Consciousness

Of Molecules and Men. FRANCIS CRICK. University of Washington Press, Seattle, 1966. 115 pp. $3.95. John Danz Lecture Series.

The main purpose of this book is, apparently, to refute what the author calls "vitalism." However, in the course of this refutation, an interesting and at times brilliant exposition is presented of some recent results of biology in the development of which the author had a major share. This applies particularly to the second chapter of the book, where DNA replication is described with skill and clarity and the action, production, and function of enzymes, proteins, and RNA are also sketched—though with somewhat less clarity. The second section is, in the opinion of this reviewer, the heart of the book, and it alone makes it well worth reading.

The first section is largely polemic, and polemic often in sharp language: "Elsasser's book is a beautiful example of the confusion that can be brought about by ignorance." The author, magnanimously, attributes the *Gestaltslehre* to Polanyi but compensates for this by declaring that it is ridiculous. On the other hand, this reviewer considers the criticism leveled against one of his own articles to be entirely fair, even though he disagrees with it.

There are very few complexes of phenomena which have been adequately described in terms of concepts developed in the earlier study of a much more restricted set of phenomena. Light turned out not to be a stream of particles which move according to the laws of mechanics; the study of electromagnetism did necessitate the introduction of the concept of fields—revolutionary and entirely new at the time. Modern cosmology is based on the theory of general relativity, and the study of microscopic phenomena led to the concepts of quantum mechanics and its profound modification of our earlier concepts. All these ex-

amples render it at least very likely that consciousness and life will be better understood on the basis of new concepts, yet to be developed, than on the basis of "our ordinary notions of physics and chemistry." If the emergence of such new concepts is what the author calls "vitalism" (p. 16), then the vitalists' point of view has a very good chance to prevail. Incidentally, the spirit of "ordinary physics and chemistry," as the author understands it, is greatly at variance with that of quantum mechanics (as interpreted by its philosophers: Bohr, Heisenberg, and Born among others) which provides, also according to this author, the "solid foundation" for the aforementioned disciplines.

Titles such as "Of Molecules and Men" always tempt this reviewer to write a book on "Satellites and Suns." The motion and behavior of artificial satellites can be adequately explained by gravitational forces, and there is good evidence that this applies to a very large extent also to the moon and the planets. (A few snide remarks could be inserted here about the effect of the moon on romantic love to parallel Crick's remarks on religion, which he regards as the sole contender for the time which should be devoted in our classrooms to backing of the theory of natural selection). The events within the sun could be sketched at least as well in terms of the concepts of ordinary mechanics and gravitational forces as the functioning of man is sketched in this volume. The fact that the sun does seem to emit some radiation, that nuclear and electromagnetic phenomena profoundly influence its behavior, could be as easily disregarded over most of the book as the fact that we are conscious beings is disregarded throughout most of *Of Molecules and Men*. Surely, a continuous transition between satellites and suns could be as easily established as between soulless bacteria and men with consciousness. The reader will be glad to know that I have so far resisted the temptation to write such a book.

The preceding expression of disagreement with the author's views on what he considers to be "vitalism" should not obscure the fact that the little volume is interesting and written with spirit. Its content is also somewhat less dogmatic than the title might imply. Crick does mention consciousness several times, even though he seems to consider it a rather unimportant and uninteresting complication. It should be admitted, finally, that the usual path of the development of new concepts starts with a somewhat uncritical application of the old ones and leads to the development of new ones only when the recognition of the inadequacy of the old ones is virtually forced on the workers in the field.

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Tissue, Psyche, and Motive

Psychological Stress and the Coping Process. RICHARD S. LAZARUS. McGraw-Hill, New York, 1966. 480 pp., illus. $12.50.

Lazarus's volume essays to integrate within a theoretical framework a vast amount of research on (or related to) stress, particularly of human beings. The major work on stress to date has been that of Hans Selye, which has focused on the physiological reaction of laboratory animals to noxious stimulation and toxins. Lazarus's work invites comparison with Selye's because he contrasts Selye's attention to physiological stressors and stress reactions with his own presumably transcending concern with psychological stress, which he terms *threat*. It will be useful to consider later how convincingly Lazarus has developed Selye's notion of stress, with its emphasis on tissue damage, into a more refined version with focus on psychic damage.

While Lazarus does not claim to be exhaustive in coverage (and is not, though the bibliography is 27 pages long), his wide-ranging review of recent empirical work is distinctly valuable. I shall concentrate, however, for obvious reasons, on the theoretical framework used to select, order, and interpret these works.

Lazarus defines *threat*, the key concept, as the appraisal of expected psychological harm. *Appraisal* is a two-staged cognition. The first stage is an assessment of the properties of the situation of threat—the circumstances of its appearance, the recourses for avoiding harm, the imminence of harm, and the ambiguity of the threat. The second stage is the appraisal of *coping*, the behavioral resources the individual mounts for dealing with threat. *Psychological harm* is defined as the thwarting of a motive. For *motive*, I am not greatly surprised to find only the brief explanation that it is "defined as the psychological representation of goals and routes to goals rather than as tissue need" (p. 57).

This definition of motive demonstrates the author's devotion to cognitive principles of explanation in contrast to those of the "associationists" (who are on the "other side"). Lazarus gets in some good licks in an opening chapter which sets the stage for a recurrent contest with the associationists—whom we soon recognize as occupying the mainstream of thought and conception in experimental-animal-learning psychology.

> In order to have a general theory of psychological stress for all animals, one tends to eliminate categories which are prime theoretical tools for understanding the person. . . .
>
> Of course, it is possible and desirable ultimately to place even these human-centered phenomena and concepts within a general theory. The argument is not against general theory, but rather against ruling out the very distinctions that are useful in one species, the human, when developing such a theory [p. 15].

And indeed, experimentalists often have been guilty of perverse logic as regards how one proceeds from observation on animals to generalization about man. Presumably, one assumes that many, though not all, behavioral potentialities observed in lower ani-