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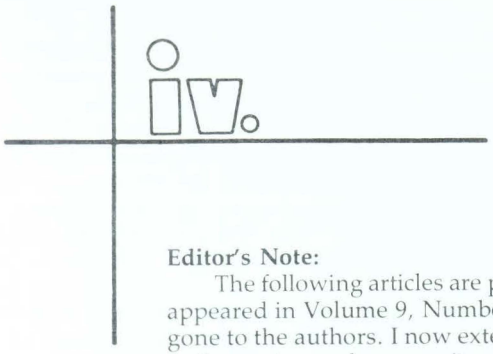

Editor's Note:

The following articles are printed here as they should have appeared in Volume 9, Number 3. My apologies have already gone to the authors. I now extend them to our patient readers. Both printer and compositor assure me that such errors as appeared earlier will not happen again.

G.F.E.

HUMANISTIC BIOLOGY: A GENERAL EDUCATION APPROACH

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INTRODUCTION

In modern man's attempt to understand human nature, two major modes of perceiving human experience, the humanistic and scientific, have often been in conflict. C.P. Snow labelled this dichotomy "the two cultures." As the power of science and accompanying technology have grown in the past forty years, the distance between the two cultures has widened. Reflecting concern about this cleavage, some scientists have attempted to incorporate humanistic perspectives and goals into science. In the area of biology, this humanistic concern is demonstrated by such groups as the Institute of Society, Ethics, and the Life Sciences (Hastings-on-Hudson) and its highly successful *Hastings Center Reports*. In addition, new journals such as the *Journal of Medical Ethics* indicate increasing concern with the problem of humanizing science. A plethora of books emphasizing ethical implications of applied biology include Taylor's *The Biological Time Bomb* (1968), Augenstein's *Come Let Us Play God* (1969), Potter's *Bioethics: Bridge to the Future*, (1971), Fletcher's *The Ethics of Genetic Control: Ending Reproductive Roulette*, (1974), and Goodfield's *Playing God: Genetic Engineering and the Manipulation of Life* (1977). However, as with many things which seem quite new, inspection shows that these books represent only a new awareness of concerns which have long been of interest to mankind. For example, Goodfield reports that in the 17th century, more than one-third of the papers of the Royal Society were about social problems and the relationship of science to them.[1]

Medical and nursing school curricula often include courses or units on ethics.[2] Humanistic approaches to biology have been incorporated into courses for undergraduates as well, both for the biology major [3] and the non-major.[4]

At Michigan State University some of the faculty teaching General Education Natural Science have developed a cluster of courses which address these humanistic concerns. These courses are briefly described in Table I.

TABLE I. HUMANISTIC BIOLOGY COURSES IN THE DEPARTMENT OF NATURAL SCIENCE AT MICHIGAN STATE UNIVERSITY

Biotechnology of Health deals with this issue: contemporary scientific insights have produced a technology with increasing power to alter the human system and may have the potential to completely redesign it. How can we learn to use this ability in a humanistic way?

Biological and Social Aspects of Human Reproduction focuses on the ways we are able to modify our reproductive processes. The problem of iatrogenesis, the ethics of developing new scientific knowledge, the criteria of humanhood, and the conflicts between social and individual rights are considered.

Bioecology of Health asks a pervasive human question: what is health? It suggests that biological science, particularly ecology and evolution helps us to answer this question. The course then considers the human implications of these answers.

Drugs and Society is concerned with the unique human characteristic of alteration of consciousness obtained by the use of certain chemical substances.

Biosocial Evolution of Man explores the fundamental question of what it means to be human. Principles of evolutionary biology are applied to the study of human behavior and to our relationship to other species.

The New Genetics and Society considers the social and ethical issues related to our increasing control of heredity.

Brain, Mind, and Culture studies the human brain from an evolutionary perspective and analyzes conflicts that arise from its history.

Chemicals, Health, and the Consumer provides an examination of the scientific basis for decisions affecting individual and public health. It emphasizes the use of scientific principles to make rational judgments in these areas.

CHARACTERISTICS OF HUMANISTIC BIOLOGY

Our humanistic biology courses address both broad philosophical and personal issues. Not all of our courses address all equally, but all courses stress some of the issues listed in Table II. Our classes stress that science, like all human activities, is rooted in and draws upon basic value judgments concerning ourselves and the world.[5] The Reverend Theodore M. Hesburgh has stated that:

> it is the value judgments that ultimately bring the social sciences to life and make them more meaningful in liberating those who study

them. The bursting knowledge of the [natural] sciences is really power to liberate mankind and the price of this liberation is value: The value to use the power of science for the humanization rather than the destruction of mankind.[6]

This quotation, in contrast to C.P. Snow's view, suggests to us that science and values are closely linked and that each is dependent upon the other for its impact. We are suggesting that general education science courses should emphasize the humanistic tradition, which places man and his accomplishments and ideals in a central position. For example, a humanistic biology course should concern itself with the life of man in socio-cultural and biological contexts. A humanistic approach is holistic and should explore specific characteristics and qualities of man that can be dealt with through science as well as those that transcend it (beliefs, faith, values, morals, and ethics). These cannot be empirically or statistically verified any more than the sense of beauty can be dealt with scientifically.

New developments in science continually force philosophers and theologians to reexamine the nature of man and morality. We believe that there is a fine line between science and philosophy and that the humanistic biologist can link biology and philosophy by probing the theological and ethical implications of scientific discoveries. Humanistic biology differs from specialized biology by its broad horizons, stressing the interrelatedness of science, art, religion, and literature. The inclusion of such humanistic emphasis in science courses might help to counteract the criticism leveled at science and scientists for being amoral.

TABLE II. HUMANISTIC BIOLOGY: CONCERNS AND GOALS

A. To Increase Perception, Knowledge and Understanding of:

1. Man as part of the natural world
2. Man as part of a continuum, beginning in the distant past and continuing into the indefinite future
3. Man as more than the sum of his parts - reductionism versus hierarchical organization
4. Man's genetic heritage
5. Man's environmental heritage (the ecosystem)
6. The interaction of man's genetics and environment - we are partially deterministic and partially indeterministic
7. Man's technology and how it modifies human existence
8. Self-understanding, awareness and the nature of humanness and personhood

B. To Use This Knowledge as a Basis for Examining Values and Making Decisions Regarding:

1. Personal health
2. Reproduction
3. Man's place in nature
4. Adaptation and coping with stress (lifestyles)

5. Technology as it modifies and creates human values
6. "Permissible" scientific activities
7. The meaning of humanness and personhood
8. Human social and political behavior

ISSUES IN HUMANISTIC BIOLOGY

Man's ever more successful pursuit of insights into his own nature and that of the world around him has given him ever greater power to intervene. While this capacity has solved some problems, it has also created new ones. In a finite system, alteration of one part produces sometimes unforeseen perturbations in other parts of the system. Exploration of the impact of human intervention based on scientific knowledge reveals several issues: iatrogenesis (unforeseen problems arising from well-intentioned use of technology), the tension between self and society, the frustrations of halfway technologies, the problems raised by our ability to change human nature itself, and the conflict between biological nature and cultural environment.

Iatrogenesis

The problem of iatrogenesis which confronts humanistic biology might be avoided or lessened if we could predict the effects of new technologies when introduced into biocultural systems. For example, the lowering of infant mortality, and the reduction of deaths from infectious diseases worldwide, have brought in their wake the population crisis which threatens the survival of the species. Humanitarian motives have also spurred great progress in the correction of birth defects, so that the afflicted can lead relatively normal lives, and bear children of their own. The iatrogenic effect is a threat to the quality of the human gene pool. Other examples include the development of cancers and birth defects as a consequence of the growth of modern industry. We must learn to innovate with minimal biological disruption.

Self and Society

Many of the tensions dealt with in our humanistic biology courses are really problems of self versus society. Should individuals have the right to produce offspring which will be malformed, even though this presents a burden to society and to the offspring themselves? Should one have the right to smoke, in spite of evidence that cancer may result with its disruptive consequences for society? Does society have the right to employ behavior control measures in the name of the common good? A cherished Western value is the freedom of the individual to choose his own course of action. On the other hand, in most species individual interests are typically subservient to those of the group; to be otherwise would be disruptive of group survival. Science can help illuminate self-society conflicts, and may show how and why they have arisen.

Halfway Technologies

Sometimes science presents us with partial solutions that, by becoming

entrenched as palliatives, actually interfere with the needed progress toward prevention or cure. Kidney dialysis and coronary by-pass surgery are examples of such halfway technologies, for they absorb such vast resources that little money and energy are left to pursue the greater goal of complete solutions.

Changing Ideas of Human Nature

Science has provided us with certain capabilities for altering our own evolutionary future. It has also given us enough insight to foresee some of the risks of using those powers, as well as the risks of not using them. Refusal to act when action is possible constitutes a decision in itself. Increasingly, biotechnologies such as genetic screening, drugs, life support systems, organ replacement, altered mechanisms of reproduction, and possibly the laboratory creation of human life, all have placed god-like power into human hands. However, we cannot find in science alone the wisdom we need to evaluate all the alternatives. This dilemma is one of the most important and one of the hardest to solve of all the problems faced in our courses.

Biological and Cultural Evolution

Although the precise course of evolution is indeterminate, evolution has been marked by a gradual increase in the complexity of living things, regarding both structure and function. One result of this trend has been the emergence of extra-somatic or cultural evolution, a process derived from the older biological evolution, but with properties unlike those of its parent. The innovations of cultural evolution have changed and accumulated much more rapidly than has been the case for the organic structures created through biological evolution. One consequence of this unevenness in evolutionary rates is that certain biologically evolved attributes of human nature seem to become dysfunctional, even disruptive, when they are placed in cultural environments. Several examples are addressed in our courses. Assuming that biologically derived behavior patterns such as aggression, pair-bonding and territoriality do exist, they may be maladaptive for modern societies. Also, those biological drives which lead to excess number of offspring served as a vital component of natural selection in our early evolutionary history, but now may be anachronistic in a modern society which has the power to save lives, no matter how detrimental to the species.

THE ROLE OF HUMANISTIC BIOLOGY IN THE UNIVERSITY

Scientific knowledge and its application have thrust upon each of us the necessity of making informed choices, thereby greatly enlarging our sphere of moral responsibility. Biology majors as well as non-majors can qualify for their degrees without ever being exposed to the social, legal, moral, and ethical issues which modern biology has created.[7] Abell speaks of the need for

> . . . restructuring undergraduate biology programs to meet the needs of a society which is looking increasingly to the academic community "for the kinds of knowledge that translate into practical decisions on social, political, environmental and economic matters, for the kind of technical and professional training that translates into meaningful vocations in a biosocial context and for a kind of

scientific literacy that translates into a more involved and responsible public."[8]

Humanistic biology courses can offer a valuable educational experience to all students and to concerned citizens in continuing education and extension programs. Though many colleges and universities have a course or two in this area,[9] we believe this cluster of humanistic biology courses for undergraduate education is unique.

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[1] June Goodfield, "Humanity in Science: "A Perspective and A Plea," *Science* 198 (November, 1977): 580-585.

[2] Robert M. Veatch and D. Fenner, "The Teaching of Medical Ethics in the United States of America," *Journal of Medical Ethics* 1 (July, 1975): 99-103.

[3] Sheldon F. Gottlieb, "Teaching Ethical Issues in Biology," *The American Biology Teacher* 38 (March, 1976): 148-149.

and

Betty B. Hoskins, "Raising Bioethical Consciousness in an Introductory Life Sciences Course," *The American Biology Teacher* 38 (December, 1976): 533-536, 541.

[4] Elof A. Carlson, "Biology: A Humanities Approach," *Journal of College Science Teaching* 3 (December, 1973): 139

and

Bruce Wallace, "An Overture: Biology and Society and Sociobiology," *The American Biology Teacher* 39 (January, 1977): 13.

[5] H. Tristram Englehardt, Jr., "The Roots of Science and Ethics," *Hastings Center Report* 6 (June, 1976): 35-38.

[6] Theodore M. Hesburgh, Rockefeller Foundation Illustrated Newsletter, 1973, 1: 8.

[7] Thomas R. Mertens, "Biology Instruction and Human Welfare," *The American Biology Teacher* 39 (March, 1977): 141

[8] Dana L. Abell, "The Other Biology," *BioScience* 25 (November, 1975:) 703.

[9] Joseph M. Dasbach, Office of Science Education, American Association for the Advancement of Science. *Ethics and Values in Science and Technology* (EVIST) *Resource Directory*, 1978. (Brentwood, MD: Stant Lithograph, Inc.).

*Lawrence C. Besaw, James Goatley, Michael Kamrin, Robert McDaniel, and John Mullins, of the Natural Science Department of Michigan State University, have contributed much to the cluster of humanistic biology courses described in this paper, and to the ideas presented here. We wish to thank Dr. Marvin Solomon for having encouraged the formation of a humanistic biology group in our department.