Teacher-to-Teacher

A New Course for a New Educational Niche

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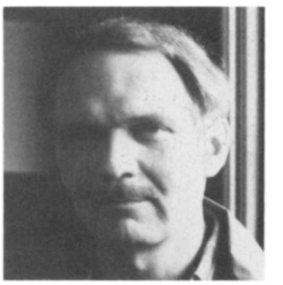

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Three years ago I developed a new course here in the Biology Department at Henry Ford Community College which appears to be one of the first of its type. Since then, partly because student support for the concept has been so enthusiastic, I've become convinced a great and growing educational niche exists for courses of this sort. In twenty years of college biology teaching, I've never known students to be so unanimously agreed about the value and necessity of a subject matter and so eagerly involved with a class. The course, it seems, relates to an educational direction whose time has come.

It is my intent here to describe the course and present a rationale for the development of similar courses elsewhere. In the process, I do not wish to suggest that my particular choice of topics or their arrangement represents an ideal package for others, but I do believe that the general concept makes such good educational sense that we will likely witness great proliferation of comparable courses within the next few years. The implications for growth of our biology departments are considerable.

The course is a comprehensive four-credit hour (semester) introduction to behavioral biology. There is no lab at present and deliberately no prerequisite since it is designed to stand alongside introductory courses in psychology, sociology, and anthropology as biology's contribution to the basic principles of behavioral science. It includes study of the genetic bases, the developmental sequences, and the proximate chemical and neuronal mechanisms of behavior, and gives special emphasis to selection-based, ultimate evolutionary explanation. Topics range (see outline) from the perspectives of classic ethology and the influences of the limbic system to the sociobiology of sexual behaviors and the evolution of reciprocal altruism. It is intended to provide a broad and sophisticated introduction to the fundamental principles and perspectives of the rapidly growing and enormously explanatory young science of behavioral biology.

At present the class is divided into four segments. the first part introduces the historical antecedents and the general premises of modern behavioral biology, but concentrates mainly upon the study of pertinent essentials of genetics and selection theory, with considerable related discussion of such critical questions as the level(s) at which selection operates and the nature of genetic-environmental interaction in producing behavior phenotypes. Furthermore, because it is unambiguously a *science* class, and because approaches to the study of behavior have often historically been quasi-scientific in attitude and methods, scientific analysis and logical exposition of cause-effect relationships are stressed from the start, and students are warned against cognitive blocks such as anthropomorphism, dichotomization (i.e., Nature *vs.* nuture), and teleological thinking, for example.

It has proven very helpful during this first segment also to include a brief unit to indicate "who's who" among the major animal groups and to describe some (mainly vertebrate) phylogenetic lineages, since few of the students have taken previous zoology classes or are aware of the value of comparative behavior study. In contrast with the dominant tradition of such social sciences as behavioral psychology, which assumes behavior (human at least) is essentially a consequence of "experience," behavioral biologists contend that it's not enough to study rats or pigeons or humans even if we wish only to comprehend rat, pigeon, or human behavior. They argue we cannot understand much about the behavior of *any* species unless we compare many related animals in order to identify common biological principles and patterns of homology. They insist that prevalent behaviors, much like structures, have evolved by the natural selection of genes and are related to the ecological circumstances and phylogenetic histories of specific groups of animals. So it is important that the students early in the course understand a few facts about primate history and that mammals evolved from reptiles and so on.

The second part of the course focuses largely upon the descrip-

OUTLINE OF MAJOR TOPICS

Part I

Premises of behavioral biology
Cognitive problems: Blocks to understanding
History & scope of study
Early & modern ethology
Selection theory
The evolutionary paradigm
The level(s) of selection
Genes as replicators
Genes & chromosomes
Alleles & gene pools
Survival machines & behavior
Speciation & taxonomy
Vertebrate phylogenies

Part II

Reflexes
Fixed action patterns & releasers
Instincts & motor programs
Motivation & drive
Rhythmic behaviors
Habituation & conditioning
Imprinting
Insight, reasoning, perceptual learning
Communication
Play
Evolutionarily stable strategies
Behavioral ecology
Sexual behaviors
Aggression
Territoriality
Hierarchy
Social behaviors: Principles

Part III

Inclusive fitness
Individual selection & inclusive fitness
Sensory and perceptual systems
Brain programs & neural mechanisms
Human brain & behavior
Neurotransmitters, hormones & drugs
Behavior genetics
Molecular ethology
Behavior ontogeny
Parental investment
Parental behavior
Parent-child conflict

Part IV

Male-female conflict
Evolution of behavior
Eusociality: Insects
Social behavior: Ungulates & carnivores
Primate behavior
Human sociobiology topics
Values, morals, aesthetics
Vestigial behaviors
Reciprocal altruism
Coevolution: The evolution of cooperation
The extended phenotype
Memes & cultural evolution
Behavior control & prediction

Texts:

The Selfish Gene, Richard Dawkins
Ethology, James Gould

tion of specific types of behavior, from reflexes and fixed-action patterns to imprinting and perceptual learning. The evolution and adaptive significance of these behaviors are considered within the context of Maynard Smith's concept of evolutionarily stable strategies (Smith 1975). Among other relevant contributions from contemporary evolutionary theory examined during this segment is Triver's concept of parental investment which has proven most valuable for understanding selection-based explanation for many behaviors related to male-female differences (Trivers 1971, 1972).

The third portion of the course continues the discussion of evolutionary mechanisms and concepts such as Hamilton's inclusive-fitness (kin-selection) theory with its vast applications for understanding behavior (Hamilton 1964). This portion also includes brief units on the basic methods and assumptions of the young sciences of behavior genetics and behavioral ontogeny. The main focus though is upon discussion of the *proximate* mechanisms or *"how"* questions about behavior: the actions, physiological processes, neural mechanisms, releasers, and other such parts of the developmental chains of immediate causation. How does testosterone mediate aggression? How does the right hemisphere influence behavior differently than the left? What do prenatal hormones have to do with sex role behaviors, and what do hypothalamic circuits have to do with "falling in love?" By the end of this section, students are able to discuss numerous behaviors from sleep to relative male promiscuity from both proximate and ultimate selection-based vantage points. The genetic "whats," the neural and physiological "hows," and the evolutionary "whys" have all been considered as legitimate parts of the explanation of behaviors. Astoundingly, *none* of these three levels of explanation has historically been given very much consideration by the mainstream approaches of psychology, sociology, and cultural anthropology! Genetic causation and evolutionary explanation have in fact been almost entirely ignored.

In the last segment of the class, several new topics are introduced, including the concept of reciprocal altruism and the theory of the extended phenotype. In general, this last part of the course ranges more freely through relatively uncharted territory than before and emphasis is

more deliberately placed upon asking questions and testing predictions than upon codifying answers. Are humans and social carnivores alike in some ways because of convergence due to similar ecological circumstances? Are human erotic preferences imprinted during early critical periods? Are honeybee and human society similarities explainable by many of the same principles of social evolution? Do humans have vestigial behaviors comparable to the circling of dogs before lying down? Human sociobiology is more specifically examined and the students are encouraged to apply what they've learned to better understand even such complex phenomena as courtship practices, team sports, and religion. Of course, nobody's saying we have specific genes for playing football or marching in Shriner's parades, but even such culturally shaped behaviors as these have some deep and important biological roots, according to behavioral biologists. They suggest that if we wish to understand very much about football, for example, we must study the R-complex, the limbic system and the evolution of male competition, intergroup hostility, group territoriality, and other such biological data and concepts.

Perhaps the most basic, distinctive, startling, and significant premise of behavioral biology is simply this: We are *animals* and subject to what that implies! Albeit clever and flexible and perhaps sometimes transcendent, because of our culture—itself on a genetic leash—we nonetheless are animals *behaviorally* as well as structurally. How could it be otherwise? We did not leave our genes behind when we acquired culture. Still, we've only just recently begun to recognize that behaviors, much like structures, are substantially products of biology, genetically influenced and shaped by natural selection.

Now as we at last have begun to apply the principles of genetics, ecology, and selection theory to the study of behavior in general, and Pope's "proper study of man" in particular, it seems a most portentious revolution in human self-knowledge has begun. Biology is dramatically redefining behavioral science and the nature of man, and the composite of sciences which comprise behavioral biology already, it may be argued, represents the methodologically strongest, most broadly explanatory, and most predictive of all of the academic approaches to the study of behavior. Though still adolescent, we have, thanks largely to its growth, probably gained more insight about animal behavior and human nature in the last twenty years than in the previous thousand.

One of the most important reasons for the dramatic recent success of behavioral biology relates to its extensive incorporation of selection theory. Like shots of growth hormone, application of the evolutionary paradigm has greatly stimulated its development, as witness the burgeoning growth of the subdisciplines of sociobiology and behavioral ecology. Interestingly though, the influence has not been unidirectional. An impressively productive feedback loop connects evolutionary science and behavior study these days. Not only is application of contemporary selection theory revolutionizing our comprehension of behavior, the study of behavior is producing brilliant expansion and refinement of selection theory as well!

Many biologists from Stephen J. Gould to Lynn Margulis have made impressive contributions to the new evolutionary synthesis which has emerged in recent years. John Maynard Smith's (1974, 1975) broadly applicable mathematical games-theory-spawned concept of evolutionarily stable strategies, for example, has vastly improved our understanding of selection and made evolutionary science much more predictive. It seems though that most of the scientists forging the new evolutionary synthesis from Richard Alexander (1979) to E. O. Wilson (1975, 1978) are *behavioral* biologists. From William Hamilton's (1964) profound inclusive-fitness resolution of apparent kin altruism embarrassments to Darwinian theory, to Richard Dawkin's (1976, 1982) tightly reasoned answer to "the fittest what?," the missing bricks and soaring turrets of the new evolutionary edifice are being cemented in place largely by visionary architects trained in behavioral biology.

Evidences of the great recent growth of behavioral biology are manifest everywhere in a swelling flood of scholarly research, articles and books, and significant expansion of behavior curricula in the biology departments of many of our most esteemed colleges, including Harvard, Cornell, and the Universities of Michigan and California. From the University of Florida to the University of Washington, there has been extensive planning and development of new courses and programs in neurobiology, behavior genetics, sociobiology, and so on.

Most of this curricular expansion, though, has been happening so far at upperclass and graduate levels. There are not yet many introductory courses suitable for the general student. The few which do exist are often too limited or specialized to serve general behavior education needs of most students in the way introductory courses in psychology and sociology have traditionally attempted to do. Most are not designed as general comprehensive introductions. More often they limit their focus largely to ethology or physiological mechanisms or seemingly reflect the

same "tabula rasa" assumptions which have dominated our thinking for decades by excluding much reference to human behavior. "Animal behavior" has de facto often implied "not human" behavior as though this topic were off limits to biology and belongs instead properly or exclusively to the social sciences. Besides, it seems that even those rare courses we offer which might otherwise serve as suitable general introductions usually require biology and/or zoology prerequisites which effectively insure they are not elected by many students other than biology majors. Unless we offer broadly basic freshman level courses without prerequisites as the social sciences have done, it's difficult to see how the biological sciences can contribute effectively to the general behavior education needs of most students. By default we've allowed nearly exclusive rights to the social scientists to teach the freshmen the basics about behavior. What a lamentably one-sided and woefully inadequate state of educational affairs! How can we possibly expect a student to understand much about behavior in general or human behavior specifically when the *only* courses generally available typically make little or no reference to genetic causation or biological mechanisms or selection theory? Few social scientists yet perceive that biology has much to do with human behavior and many forsake scientific inquiry altogether by arguing defensively that "deterministic" (biological) hypotheses should not even be considered because of what they (incorrectly I believe) foresee to be their dastardly *implications!* They have adopted something like the attitude of the wife of the Bishop of Worcester, who upon learning from her husband of Darwin's claims, supposedly said, "It couldn't possibly be true; but if it is, let us pray that it does not become generally known."

Among the students for whom the class is designed are of course the biology majors. We have traditionally offered classes in anatomy and physiology and so on, but not many in behavior. It seems clear though that it will be at least as important for biologists of the future to understand behavior as anatomy.

Since understanding of modern behavioral biology requires a quite sophisticated understanding of contemporary selection theory, one consequence for biology majors who take the behavior class is that they learn much more about evolutionary principles and processes than typically occurs in other introductory biology courses. This offers them great advantage, at least if one agrees with the philosophers of science who have stressed that the evolutionary paradigm represents the theoretical heart of biological explanation. Contemporary selection theory may well turn out to be the most broadly explanatory triumph in the history of science, offering the *only* scientific approach we have for providing satisfactory answers to ultimate "Why?" questions about biological reality. We should perhaps be offering more evolutionary principles courses for our biology majors, but until such courses might become more common, introductory courses in behavioral biology may offer the next best chance for freshman and sophomore biology majors to expand their understanding of selection theory and its applications.

There aren't many of them these days, but I developed this course too for students of philosophy and the humanities. As Dawkins points out in *The Selfish Gene* (Dawkins 1976), a brilliant exposition of contemporary selection theory and its applications to behavior study, philosophy and the humanities are still largely taught as though Darwin never existed, although evolutionary theory may well be the most philosophically significant contribution of our entire scientific tradition.

If only a small number of the basic premises of modern behavioral biology are valid, almost every classic question of interest to philosophers will need to be reexamined in the new light. If we have genetically based attractions and predilictions for certain stimuli and courses of actions, if pleasure and pain as biological adaptations represent crude value judgments, then how are we to think about our assessments of "good" and "bad," "right" and "wrong," and our philosophies of aesthetics, morals, and law? If there are programs in our brains as the neurobiologists insist which guide our actions and limit our perceptions, if we are more constrained genetically than we have realized, then what about "free will?" And if we are products of biological evolution, even if not "survival machines"* according to that growing perception, if our basic pancultural behaviors and even the roots of many of our value reactions are significantly products of the natural selection of genes, then the implications for students of philosophy and the humanities are so great as to boggle our imaginations for decades to come. According to important works by major theorists from Richard Alexander to E. O. Wilson, behavioral biology has so much to say in fact about the human condition and the "meaning of life" that it seems rather inevitable that the day will come soon when its study will be considered as essential to the education of students of phi-

*The rather revolutionary concept sweeping through biology that "survival of the fittest" should refer to genes—that genes, not individuals, are the units upon which selection operates—implies that individuals are phenotypic constructions or vehicles for the perpetuation of genes—hence "survival machines."

losophy and the humanities as is algebra for engineers.

The course attempts to serve a wide diversity of other students as well, but the students whose educational needs preoccupied me the most and prompted me to sit up late many nights wondering how to plan a suitable course were those who intend to major in the behavioral sciences, especially those who will concentrate in the traditional social sciences and might not have another academic opportunity to examine the basic principles of behavioral biology. For half a century most social science students have been taught that knowledge of biology is quite unimportant for understanding human behavior. Many social science educators, moreover, have strongly discouraged enquiry by arguing that to even *hypothesize* that genes are causally important implies reprehensible motivation: racist, sexist, Social Darwinist, capitalist, elitist, reductionist, hopeless, inflammatory doctrine!

What a sad state of behavior-education affairs. We are biological organisms by any rational assessment, genetically related to the other animals with essentially the same mammalian brains, made of much the same parts, with the same neurotransmitters and hormones mediating much the same general behaviors, using mostly the same muscles in response to much the same environmental stimuli, yet we've trained virtually all of our professional students of behavior almost without reference to biology! Most social science students have neither been required nor encouraged to study genetics or comparative zoology or behavioral ontogeny or neurobiology or endocrinology or selection theory. Their academic training has been largely limited to abiological perspectives. It's no wonder there is such widespread disagreement among social scientists about even the most elementary questions regarding human behavior. Without reference to genes and proximate biological mechanisms and natural selection, scientifically satisfactory answers to most of our questions are impossible, say the behavioral biologists. It's no wonder we've sat on so many couches with so little benefit and followed one guru after another without gaining much wisdom.

It's time we offered psychology and sociology majors and all students of behavior better opportunity than we have in the past. If they are ever to understand very much about behavior, they desperately need courses to learn about imprinting and territoriality and the evolution of sex role behaviors and such facts and principles of biology. If we value parsimonious explanation for even such elementary questions as, for example, why little boys the world over typically brag and fight more than little girls do, we might be well advised to teach our students why virtually *all other male mammals* behave much the same way. Intermale competition among deer and lions and walruses and ground squirrels is certainly not explainable in *their* cases by repressive fathers, uncaring mothers, or cultural deprivation. It just may be the case that the hundreds of human behaviors which so closely parallel those of the other mammals, from our similar submissive body lowering postures to our near universal wandering-male-eye attraction to *new* sexual partners, are not homologous at all, but rather are learned and have nothing to do with genes or evolution. It perhaps may be that we have independently culturally reinvented all those behaviors of ours which are similar to those of our mammal relatives from the discomfort crying of hungry babies to our constantly manifest territorial inclinations. But it's certainly not parsimonious to make such an assumption! It's not scientific thinking which denies the contributions of biological science. And it's not in the best educational interests of our students to perpetuate the abiological behavior education limitations of the past.

There are many potential Margaret Meads in our colleges eager to learn about behavior. Perhaps we can spare them the indignities her reputation is suffering now if we teach them that biology is part of the equation. Perhaps with a single class in behavioral biology (of course they didn't exist then), she might have recognized that her conclusions regarding sexual behaviors and aggression were so unparsimoniously inconsistent with primate and mammalian patterns as to be seriously suspect. With just a little training in sociobiological theory she might have been on guard to recognize the deception practiced by her subjects and the self deception which diminished the value of her contributions. If she'd had one behavioral biology mentor to counterbalance Fran Boaz's influence, perhaps she would have been able to avoid the *a priori* environmentally deterministic assumptions which so sadly and seriously limited her perspectives and which still characterize the education of most students of behavior.

It has not been my intent to single out social scientists for criticism. If I may be allowed a cliche, many of them are among my best friends. At least they were before I became so messianically involved with this territorial encroachment. Until quite recently, we biologists haven't realized the implications of our animal nature for understanding behavior either. Most of us were trained the same way. The social sciences deserve, and will I think maintain, a rich and legitimate territory. Still, if we wish to modify the abiological perspec-

tives which have so limited the progress of behavior study for so long, we must develop basic courses in behavioral biology.

We can hardly expect the psychologists to teach the students about limbic influences or territorial aggression, or expect the sociologists to discuss the concepts of mammalian bonding or vestigial behaviors. We biologists will have to do it—and we had best begin with the freshmen. There's some biological wisdom in the aphorism about teaching old dogs new tricks.

I must emphasize before ending this discussion that I certainly do not propose *biologically* deterministic resolutions to questions of Nature and nurture. Nor have any of the leading theorists in behavioral biology landed on the nature side of the old dichotomy! Several scholars, like E. O. Wilson have been seriously misunderstood and unfairly maligned. They are clearly not myopic determinists nor reductionists, as some critics have charged, but are rather among the most sophisticated, synthetic, non-dichotomizing, scientific thinkers of this century. They are challenging the environmental determinism which has limited us for so long by insisting that nurture and Nature must *both* be examined. They understand much better than most of us that all behavior results from an interaction of genes and environment. It's just that we've left out the genes! And most of the proximate mechanisms! And, more importantly perhaps, we've not realized the great explanatory value and predictive power of the evolutionary paradigm for understanding behavior.

Perhaps it's premature to make such an ambitious claim from my limited personal experience, but after only three years the course here feels so "right" and is so "necessary" (according to the students who have taken it), that it does not seem unreasonable to predict that development of introductory behavioral biology courses will be explosive within the next decade, and that most of our biology departments will consequently experience great expansion. It seems very likely that within a few years introductory courses in behavioral biology will be considered even more "basic" and will be even more widely elected and required than psychology or sociology presently are. If that becomes the case, it would mean our department at this community college would need to approximately double in size to meet the demand even without offering any advanced courses, such as human sociobiology or others which may be developed.

When Harvard's E. O. Wilson addressed the 1,200 students and scholars assembled for his acceptance of the Tanner Lecture Award given by the Philosophy Department at the University of Michigan, he suggested in his opening remarks that if we hope to understand very much about human behavior, we must stand farther back from ourselves than we have in the past. We've been much too close, he said, to realize that most of our general behaviors represent but a small subset of prevalent patterns characteristic of other animals. Wilson and the new generation of behavioral biologists offer unprecedented hope for our future understanding. They suggest that we stand back as far as we can, rather like dispassionate scientific observers from another planet. Only then can we see, startling as that may seem, that we are veritably primate, mammalian, vertebrate *animals*. They insist that if we're ever to understand much about human nature, we must first learn the facts of genetics and biological mechanisms, and the scientific principles which explain behavioral evolution in general.

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