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LAW AND BIOLOGY: THE NEW SYNTHESIS?

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To be human requires the study of structure . . . . The development of civilized thought can be described as the discovery of identities amid diversity.¹

For the last two thousand years, we have made remarkably little progress in moral philosophy, or its stepchild, jurisprudence, by attacking the field as a matter of a priori philosophy. Recently, a different approach has begun to be used, which is to treat morality as an empirical matter subject to scientific study. I am thinking of the work of Carol Gilligan,² or Jim Fishkin’s Beyond Subjective Morality,³ or Roger Masters’ Beyond Relativism,⁴ and some of the work in evolutionary psychology by people like Robin Wright⁵ and Matt Ridley.⁶ Much of this literature is summarized and extended in Frans de Waal’s recent book, Good Natured,⁷ on the evolutionary basis of morality. These works all look at what we previously thought of as abstract issues of moral philosophy as empirical issues of social science.

One subset of the movement to take a more empirical approach to the study of issues of morality and norms in law is called the “Law and Biology”

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¹ ALFRED NORTH WHITEHEAD, MODES OF THOUGHT 98 (1968).
² See generally CAROL GILLIGAN, IN A DIFFERENT VOICE: PSYCHOLOGICAL THEORY AND THE WOMEN’S MOVEMENT (1982).
⁴ See generally ROGER MASTERS, BEYOND RELATIVISM: SCIENCE AND HUMAN VALUES (1993).
The "Law and Biology" movement was founded by Margaret Gruter in the 1980s. Margaret had actually been working in this field since the 1970s, and published a number of interesting articles. However, beginning in the middle of the 1980s she began an organized effort to interest other lawyers in the approach.

Since that time, there has been a remarkable effort centered around an institution called the Gruter Institute for Law and Behavioral Research, which has trained over 250 law professors at annual summer conferences at Squaw Valley, and has engaged the time and talents of many of the leading evolutionary biologists including William Hamilton, Robert Trivers and Frans de Waal. This collaboration has produced numerous books and a substantial number of articles applying some of the principles of modern biological science to law. After a decade, it is time to take stock on both what the movement has accomplished, and whether its promise is either yet to be achieved or illusory.

I. WHAT "LAW AND BIOLOGY" IS NOT ABOUT

To describe what Law and Biology is about, I have to begin with a series of caveats. First, the term "biology" is probably not a particularly good one. (I can say that because I am the one who picked it.) We called it "Law and Biology" to emphasize its relation to "Law and Economics." The more precise term, though, would be "law and ethology." Ethology is a science which studies animal behavior in the environment and relates its observations to the

11. See infra notes 73, 78 & 82.
13. A database of numerous articles relating to Law and Biology is maintained by McGraw-Hill Primis, and are available to be combined in customized books of course materials.
14. Id.
15. What I am going to describe is a kind of progress report, because Law and Biology is definitely a work in progress. Also, it has clearly been a joint effort by many people in addition to Margaret Gruter: Roger Masters, the chairman of the government department at Dartmouth; Mike McGuire, an evolutionary psychologist at UCLA; Bill Rogers, a law professor at the University of Washington; Lionel Tiger, an anthropologist at Rutgers; Bob Frank, an economist at Cornell; and Gordon Getty, an independent scholar and philanthropist.
theoretical framework provided by evolutionary theory, as exemplified by the work of Konrad Lorenz. It is a strong academic discipline in Germany and there are a number of institutes that are studying ethology. The premise for ethology of law is that law is a particular type of animal behavior, and therefore that some of the same scientific tools that have been developed to study other forms of animal behavior can be adapted to studying the animal behavior that we call law.

However, we do not call the approach "Law and Ethology" much any more because many people don't know what "ethology" is (and confuse it with "ecology"). When Roger Masters and I offered the first course in "law and ethology" in an American law school in 1987 at Yale, it provoked a sarcastic remark in an article in the New York Times saying, "now they are teaching 'law and ethology' at Yale—what's next, 'law and a banana'?" We decided that we needed a term that more people could understand, so we picked "Law and Biology."

But there is a lot of baggage that comes with the term, "Biology." So let me make clear what Law and Biology is not about. It is not socio-biology. It is not the application of speculative evolutionary explanations to try to account for specific behaviors (which is what I take socio-biology to be). It is also not Social Darwinism; it is not a theory that the poor are poor because they are less fit, and it does not focus on issues of race or sex. It is not imperialistic; it does not purport that biology is the only factor determining human behavior - quite the contrary. Furthermore, it is also not deterministic because it does not posit that there is a unique, legal rule for every situation that ought to be adopted because of biology. Finally, the Law and Biology movement does not claim that the characteristics that biology builds into our species are somehow normatively privileged. The notion is not that the function of the law should somehow be to codify the behavioral tendencies that biology has built into the species.

Before I explain what Law and Biology is about, I have to "de-program" at least some of you to suspend what you think you know about evolutionary biology that turns out to be either false, or at least, a gross over-simplification. One of the difficulties we have in this field is that most of us come into law with a very simplistic, high-school notion of biology, which is often incorrect, particularly with regard to evolutionary biology.

19. For those of you who are interested in un-learning what-you-think-you-know about biology that turns out to be false, there is an excellent book by Tim Goldsmith, a colleague of mine in the biology department at Yale, called The Biological Roots of Human Nature. This book grows out of a course Tim has taught at Yale for undergraduates for a number of years,
Some of the important pre-conceptions about evolutionary biology that need to be corrected are the following:

A. The Genetic Determinism Fallacy

There is no claim in modern biology that all behaviors are dictated solely by our genetic makeup.20 On the contrary, much of the most interesting recent work in modern biology in recent years has focused on the evolution of behaviors, particularly the evolution of cooperation and altruistic behavior.21 Biologists have been quite active in developing models to explain the kinds of other-regarding behavior we call “altruism,” which is of particular interest in law.

The most we can say about the relationship between biology and behavior is that oftentimes our biological or genetic makeup creates a kind of predisposition toward certain behavioral tendencies in certain environments,22 because of the kind of physical structure that we have.

B. The Evolution of Behaviors Fallacy

The second important feature to clarify is that biological evolution does not operate directly on behaviors. There is no single gene for aggressive behavior, or intelligence. Behaviors are complex composites, which are influenced by a variety of biological structures and environmental factors. There is rarely a one-to-one correspondence between genetic structures on the one hand and behavioral structures on the other.23

C. The Adaptationist Fallacy

The third important point to clarify about evolutionary biology is that it is not deterministic. It does not posit a particular, unique solution to all evolutionary problems. In fact, biology is about variation. One would expect a great deal of variation—with the environment, but also variation within populations. Modern biologic theory—which is in many instances mathematical and empirical—focuses on the distribution of characteristics within populations, rather than positing that there would be one uniquely adaptive particular

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which is basically a de-programming of the myths about evolutionary biology that you learn in high school. TIMOTHY H. GOLDSMITH, THE BIOLOGICAL ROOTS OF HUMAN NATURE: FORGING LINKS BETWEEN EVOLUTION AND BEHAVIOR (1991).

20. Id.
23. The Human Genome, THE ECONOMIST 20, 21 (Sept. 14, 1996) ("It appears extremely rare that there is a single gene for anything—not even for most diseased, let alone for complex forms of behavior, such as aggression, or sexuality").
structure or feature.24

Modern evolutionary biology is therefore not really about "the survival of the fittest" (at least if "fittest" is understood to mean a single, most adaptive characteristic). The phrase "the survival of the fittest," which does not come from Darwin but Herbert Spencer,25 has probably created more misunderstanding than any other phrase in science. The core of the problem with this phrase is the implication of the term "fittest." In biology, it is very rare that there is only one unique solution that will survive. The standard for survival is usually much more like what Herbert Simon called "satisficing": good enough.26 Most of the time, when evolutionary pressures are relatively weak, "good enough" is not a very demanding constraint. There is a very broad range of characteristics that can survive and exist within the population.27

II. THE USES OF BIOLOGY IN UNDERSTANDING LAW

Having gone through those caveats about what Law and Biology is not about, what is it about? It essentially tries to use the insights of modern biology, particularly the features about the distribution and proliferation of characteristics within populations, and insights into behavioral factors like the evolution of cooperation, in studying law. There are essentially three ways in which these biological models and insights have been used in the Law and Biology movement to say things about how law works, and why it is the way that it is.

The first is the use of biological models to describe the dynamics of legal systems; how law works by analogy to other complex systems including biological systems. The second use of Law and Biology is to help us develop at least pieces of a natural law basis for law through a better understanding of how and why human beings are the way they are, particularly in comparison to other animals and particularly in terms of cooperative or aggressive behavior in groups. The third way that Law and Biology has been used is to give us some insight into how we can design legal systems more effectively. If we have a better understanding of human nature—of the raw materials that we are working with a legal system—then perhaps we can gain some insight into how to design laws to work more effectively.28

28. This third use has yielded the least fruit to date, but may be of increasing importance in the years ahead as our understanding of the brain and emotions increases.
A. Models of Legal System Dynamics

Let me turn first to the use of Law and Biology for understanding legal system dynamics. This is what I call the "bio-mimetic" view of law—the view that law imitates biology, or is a mimesis of the processes that take place in biological systems.\textsuperscript{29} This was really the first use of biological models to understand law. It was quite popular in the nineteenth century and it is the subject of the 1985 law review article that I wrote for the Columbia Law Review about the evolutionary tradition.\textsuperscript{30}

1. Evolutionary Models of Common Law

Oliver Wendell Holmes was a strong evolutionist and was knowledgeable about Darwin's theories. Holmes posited several theories regarding common law evolution by analogizing this evolution to that of biological systems.\textsuperscript{31} Elsewhere, I explored this issue of how the common law evolved and how it is similar to a biological system in some detail.\textsuperscript{32}

The basic notion is that law is an open system, influenced by interactions with its larger environment. The open system consists of an internal logic, which is what we call rules and doctrines, and that internal logic becomes a selection system that we use to store the results of past experience. We then use that "memory" to generate a proposed solution when we are confronted with a new problem. That is very similar to the way that biology uses the information stored in a genetic form to store the results of past experience. At a more general theoretical level, the claim is that any system that exhibits the three features of reproduction, variation and selection by the environment will evolve in the direction of greater fit with its environment. The "environment" for law is the larger community, the political culture and the values of the community in which the law takes place.

The critical, non-obvious part of this evolutionary model of common law was added in the late 1970s by my colleague at Yale George Priest and economist Paul Rubin, who developed what has come to be called the "selective re-litigation effect."\textsuperscript{33} This was the idea that, other things being

\textsuperscript{30}Id.
\textsuperscript{31}Oliver Wendell Holmes, Law in Science and Science in Law, 12 HARV. L. REV. 48 (1899).
\textsuperscript{33}Paul Rubin, Why Is the Common Law Efficient?, 6 J. LEGAL STUD. 51 (1977); George Priest, The Common Law Process and the Selection of Efficient Rules, 6 J. LEGAL STUD. 65 (1977). For critical discussions of the concept, see also Robert Cooter & Lewis Kornhauser, Can Litigation Improve the Law Without the Help of Judges?, 9 J. LEGAL STUD. 139 (1980); Robert Cooter et al., Liability Rules, Limited Information and the Role of Precedent, 10 BELL J.
equal, those legal doctrines that are out-of-step with the prevailing consensus within a community are more likely to be litigated because they are not acceptable to lawyers and clients. So if judges err—including because the internal selection system of legal doctrines is “wrong” at predicting what will be acceptable to the community—and the law errs, and creates a rule that is particularly inefficient, or does not make sense for some other reason, then people in the community are not going to be as likely to follow that law. Rather, the people are going to keep coming back to the courts to test that rule, and that rule is more likely to be modified or abandoned eventually. The principle is similar to that articulated by another colleague at Yale, Jan Deutsch, who once wrote that “no case is a precedent on the date that it’s decided.” Rather, it is “a claim to become a precedent as it is accepted and followed by other judges and lawyers in other cases.”

There is no inconsistency with the sort of systemic selection that is posited by the selective re-litigation effect, and the usual hypothesis that judges making conscious decisions as to what will fit the norms of the community. The two are not alternative explanations, but are quite compatible and complimentary. For example, legal theoreticians like Harry Wellington, former Dean of Yale Law School, have posited that judges should attempt to codify the conventional morality of their political culture. Judges might be consciously attempting to find a result that will be acceptable to the community. There is no inconsistency between the notion of learned behavior and unconscious selection both operating in the law. Both may operate simultaneously, and in ways that are complimentary and mutually reinforcing.

2. Models of Statutory Evolution

The same type of system dynamics that are analogous to biological evolu-
The principal problem in modeling statutory evolution is determining the analogy to precedent (or genetic reproduction): what causes a set of existing legal doctrines to be perpetuated? That is very similar to work that has been done on cultural evolution more generally, particularly by an academic named Cavalli-Sforza, who has done an enormous amount of work about the evolution of cultural artifacts. The basic notion is one of copying and transmission patterns. Human beings typically copy a particular cultural pattern or artifact from one area to another, and that process also frequently takes place in statutory law. We borrow one particular statutory pattern or device from one area and apply it to another. For example, the environmental impact statement was invented in 1969 in the National Environmental Policy Act. Within a few years, the new legal device of impact statements had been reproduced in many other statutes. That process of reproduction of new statutory forms is closely analogous to the way in which a new mutant develops and can be reproduced in biology if it has certain advantages. However, because the pressures of reproduce exact copies are much weaker in the statutory area than in common law or in biology, there is more opportunity for variation. Accordingly, one would expect that legislation would tend to change the law more quickly than does the common law, as in fact I think it does. Admittedly though, this would be difficult to measure objectively.

3. Models of Legal Sub-Systems

System dynamic modeling is available not only with regard to large systems like statutory systems or the common law as a whole, but it has also been applied to subsystems, or particular areas of law. For example, certain features of procedure, like the pre-trial conference under Rule 16, had changed functions; a particular legal structure existed, and then that structure was pressed into service for a new use. This is very similar to a phenomenon that is well-understood in evolutionary theory, and popularized by Stephen Jay Gould in

38. This is more difficult to see, but I have explored it in a 1985 article with Bruce Ackerman and John Millian in the Journal of Law, Economics and Organization about the evolution of environmental statutes. E. Donald Elliott et al., Toward a Theory of Statutory Evolution: The Federalization of Environmental Law, 1 J. L., ECON. & ORG. 313 (1985).


his book *The Panda's Thumb*,\(^{43}\) in which evolution adapts existing biological structures to perform new functions. But the new entity is usually not perfectly designed for the new function. The biological structure which is taking on new functions may bring with it certain features that are no longer adaptive in the new role; these are sometimes called "founders' effects," and result from the fact that an existing structure is being pressed into service to perform new functions.\(^{44}\) Columbia Law School Professor Mark Roe has recently described this phenomenon and its importance under the term "path dependence."\(^{45}\)

I discussed another example of "path dependence," or the Panda's Thumb effect, in a 1992 *Duke Law Journal* article describing the way in which the principal functions of notice-and-comment rulemaking had changed from public participation to building a record for judicial review as an existing structure was adapted to perform new functions.\(^{46}\)

To give another example, Bill Rogers at the University of Washington has written a wonderful series of articles about the role of deceit and deception and camouflage in law, particularly in statutory law.\(^{47}\) This is very much in the bio-mimetic tradition: using the way that deceit functions in animal communities, and then seeing how there is an analogous function in legal behavior. Another of Bill Rogers' bio-mimetic articles looks at cooperation versus exploitation in natural resources law as a function of whether a group has a continuing or only a nomadic interest in the area.\(^{48}\)

Some of my current work focuses on the use of biological knowledge about host-parasite relationships and symbiosis in understanding the "problem of the commons" in environmental law.\(^{49}\) The "problem of the commons" in

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\(^{44}\) Id. at 24.

\(^{45}\) Mark J. Roe, *Chaos and Evolution in Law and Economics*, 109 HARV. L. REV. 641, 643-44 (1996) (explaining "path dependence"). A classic example of "path dependence" is the QWERTY typewriter keyboard, which was introduced in the 1890's to prevent problem manual typewriter keys from jamming, but which continues to be used in word processors today despite its inefficiency. See Peter Passell, *Why the Best Doesn't Always Win*, N.Y. TIMES, May 5, 1996, (Magazine), at 60.


environmental law, which has become a central paradigm for understanding of environmental law, is isomorphic to the problem of why a parasite does not destroy its host. Why is the parasite not always better off by keeping the disease-bearing individual around? There is a lot of biologic theory about the conditions under which the parasite is better off forming a symbiotic relationship with the host. Some very interesting work on parasitology is being done by Amherst University Biology Professor Paul W. Ewald based on evidence about the spread of AIDS in a population. Basically, what it shows us is that as AIDS becomes more widespread in the population, it tends to evolve to become less virulent. It is in the evolutionary interest of the parasite to become less virulent to keep more of the host alive to spread the disease, and as the populations of the AIDS virus become more dense, those that adapt to become less virulent are more successful in reproducing and constitute a larger proportion of subsequent generations.

Another recent piece in environmental law which is influenced by Law and Biology is Richard Lazarus's recent work on the integration of environmental law and criminal law. Typical of many works that are influenced by Law and Biology, Lazarus's article is about law (rather than about biology, or about Law and Biology) but draws on an underlying understanding of legal system dynamics based on an analogy of biology.

4. Metaphor or Something More?

Is the use of evolutionary models in law more than a metaphor? The claim made by Law and Biology is that the analogy between the dynamics of biological systems and legal systems is more than a metaphor in an important way. The processes of system dynamics that take place in the law are asserted to be isomorphic, or similar in structural form, to what takes place in biology. The biological analogy is not simply taking an arbitrary metaphor, or grid, and imposing it over legal phenomena. Rather, the claim is that the proc-
esses of change in law can be better understood by comparison to another process which is structurally similar, but which is well-worked out and studied in greater depth. The advantage to legal scholars of this approach is the heuristic value. I have sometimes called this the "Pluto Effect." One of the great stories in the history of modern science was when astronomers knew that Pluto had to exist even though they could not yet see it on the telescopes because of the effect that it was exercising on the orbits of other planets.  

In the same way, if a structure in law is truly isomorphic to something that is well understood, like host-parasite relationships, one can utilize what is understood about those other relationships to go and look for things in law heuristically.

For example, with regard to host-parasite relationships, biology teaches that there is no single, dominant strategy in host-parasite relationships. It cannot be that it is always better for the parasite to kill the host, or not to kill the host. It depends. It depends on a variety of factors that are well-worked in the history of biology under the category of "R" strategies versus "K" strategies; whether or not the animal is better off producing lots of offspring and not investing in them, or whether it is better off taking care of those offspring and making investments in larger and more stable structures. The answer to that question depends upon how variable and unpredictable the environment is. By analogy, in environmental law one could ask those same kinds of questions about the conditions that may bear on when it makes sense to have sustainable development strategy—which is a symbiotic relationship between host and

57. WILLIAMS GRAVES HOYT, PLANETS X AND PLUTO 102-03 (1980). Pluto was where it was predicted to be because of the laws of Newtonian physics accurately predicted its gravitational effect on the orbits on other planets. Id.

58. Structural similarities between law and evolutionary biology result from the fact that both are "complex adaptive systems." ("Complex" in the sense that they are comprised of multiple elements which differ from one another; "systems" in that the elements are connected and the behavior of one influences the behavior of others; and "adaptive" in that they are open systems which are influenced by selection from their environments.) The general features of "complex adaptive systems" are being actively explored, particularly in work being done at the Sante Fe Institute. See generally THE MIND, THE BRAIN AND COMPLEX ADAPTIVE SYSTEMS (H. Morowitz & J. Singer eds., 1995) (Sante Fe Institute Studies in the Sciences of Complexity, vol. XXII).


60. Id. at 45-48.

61. Id.

62. WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, OUR COMMON FUTURE (Oxford, 1987) ("The Brundtland Commission Report"). For an explanation of the "sustainable development paradigm" and how it differs from other ways of thinking about environmental law, see E. Donald Elliott, Five Modes of Thought: Environmental Protection and the Development of Free Markets in Russia, in LAW AND DEMOCRACY IN THE NEW RUSSIA (Bruce L. R. Smith & Gennady M. Danilenko eds., 1993).
parasite—as opposed to a predatory relationship.

B. Biology and the Nature of Human Nature

The second major claim advanced by Law and Biology is that biology can give us some insight into features of human nature that are of concern to law. It is important to be very clear that in this area the claims of Law and Biology are remarkably modest, and even then, many of them have not yet been brought to fruition beyond generalities.

One of the early things that the Gruter Institute did to test whether biology had anything to contribute to law was to actually become involved in a legal issue, namely the “Baby M” surrogate mother case, in which a group of us filed an amicus brief. We gathered a group of scholars interested in the relationship of biology to law and discussed in the brief what modern biology had to say about the bonding process between the natural mother and the child. As we worked on that project, we came to the strong consensus that while scientists could tell the courts some things that might be of interest to the court about how the mother-infant relationship worked, there was no reason why the biological tendencies built into the species should necessarily be normatively privileged as a matter of law. At most biology should be followed or accepted as a rebuttable presumption, and that is what we said in the brief.

It may be that judges should understand what is built into the biology of the species because it is going to be more difficult, or take more social energy, for the law to go against what is built into us as a species. However, there is absolutely no reason beyond that why it should be a function of law to codify biology. In that sense, Law and Biology differs radically from what I call the bio-imperialistic view, represented for example by the work of John Beckstrom at Northwestern. Professor Beckstrom takes the view, in his book Evolutionary Jurisprudence, that what one ought to do in the area of intestate succession is simply figure out what biology would dictate, and then write that into the law. That is not what Law and Biology is about.

Instead, it is the limitations of biology that create the opportunity for law. This is not a new view. A similar point was made by Madison in the Federalist, that if men were angels, there would be no need for government and law.

64. For an account of the issues and deliberations among the scientists by one of the key participants, see Robin Fox, In the Matter of “Baby M”: Report from the Gruter Institute for Law and Behavioral Research, 7 POLITICS & LIFE SCIENCES 77 (1988).
65. Amicus Brief of the Gruter Institute, In Matter of Baby M., 537 A.2d 1227 (N.J. 1988) (“To avoid needless human suffering, rules of law should be framed in harmony with the rules that nature has built into the biology of our species, except where some clear ground of public policy dictates otherwise”).
or the point that Augustine and Aquinas made, that the reason that creates a need for the civil state is because of the fall of man.

Bioloogy can teach us about some of the characteristics of human beings that create the need for law. In a sense, it is the shortcomings of biology in adapting us to live in our current environment that are of the greatest interest for law; they create the niche in which law and many other social and cultural phenomenon take place. If we were perfectly adapted by biology to live in our current environments, there would be no need for law or other social cultural tools. This has led me to propose that law amounts to a kind of evolutionary prothesis—that is, that law is useful to societies precisely to compensate for those areas in which biology does not suit us to live in our current environment.

The primary phenomenon underlying this argument is what biologists call the "evolutionary lag" hypothesis. According to this thesis, biology moves relatively slowly. About ten thousand years ago, we were living as groups of hunter-gatherers, roaming the savannahs of Africa. Ten thousand years is like a minute in evolutionary time, according to the proponents of this hypothesis, and therefore we are still carrying around in our biology predispositions to behavior that may have been functional in our previous environment, but are no longer functional. The problem of law, culture and other evolutionary protheses is to try to modify the behavior of an animal which has adapted by biology to living in a different kind of environment but now lives in a quite different environment.

However, I think that the simple "evolutionary lag" story is a bit too simple. For one thing, in some instances, biological evolution can change certain physical structures quite quickly, certainly within a few generations. Moreover, human beings have evolved biologically in the way that they have over the last ten thousand years in part because of the development of culture, learning and other tools. We have adapted by using our brains, particularly our ability to envision and communicate about counter-factual states. Because of culture and learning, there is less pressure to accommodate new challenges through biological change. So rather than a pure evolutionary lag, the relationship

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70. LIONEL TIGER, THE MANUFACTURE OF EVIL (1988) (developing the evolutionary lag view with which I generally agree).
71. Margaret Gruter, *The Origins of Legal Behavior*, 2 J. SOCIAL BIOLOGICAL STRUCTURES 43, 45 (1979) ("Continuing to value a high birthrate, for example, is an emotional attachment to a belief which, in a changing environment, can be maladaptive and threaten the species survival").
between culture and biology is really a co-evolutionary process, not an inability of biology to change rapidly enough. Nonetheless, it certainly is the case that biological change generally proceeds more slowly than cultural change, and that individual learning can adapt behavior even more rapidly than cultural change. Biology, cultural and learning can be viewed as forming a nested hierarchy, like software and hardware in a computer.

What biology tells us about how human beings behave in groups bears on the niche or operational context in which law takes place. Often, it is the contrast between human institutions and how groups of animals deal with similar issues that is most important. The essential issues often involve mechanisms to coordinate behavioral expectations within groups, and much of the work in Law and Biology has focused on the problem of insufficient altruism to coordinate behavior in human societies without external aids.

One of the things that led both Bill Rogers and me to biology initially was the limitations of law and economics in explaining altruism. In the environmental area we see much altruistic behavior, and that was not well-accounted for by traditional law and economics models. By contrast, biology has much to say about altruism and why animals behave in an altruistic way. Oxford University Professor William Hamilton’s theory of inclusive fitness in 1964 has probably been the most important piece of work in evolutionary biology in the last generation. It had long been observed that in nature animals would sometimes sacrifice themselves to defend their kin. This was difficult to explain in terms of conventional evolutionary theory, until Hamilton began to focus on genetic-relatedness. In sacrificing oneself to protect the kin group, one may actually be maximizing ones own long-term reproductive success at the genetic level, particularly among closely-related kin,

Biological theory proposes to explain altruistic behavior as rational from an evolutionary standpoint at the genetic level, but initially the theory worked only for relatively small groups of closely-related kin. These are the types of small groups of closely related kin in which human beings lived until about ten thousand years ago, but Hamilton’s theory of inclusive fitness standing alone was not capable of explaining altruism in larger, more complex modern socie-

74. See, e.g., William Rodgers, Bringing People Back: Toward a Comprehensive Theory of Taking in Natural Resources Law, 10 ECOLOGY L. Q. 205 (1982).
75. See Hamilton, supra note 9.
76. For an accessible account of Hamilton’s theories, see RICHARD DAWKINS, THE SELFISH GENE (1976) (popular explanation of “inclusive fitness” theory).
ties. The next step was taken by Robert Trivers in 1971, who proposed the notion of “reciprocal altruism” - pair-wise exchanges of altruistic behavior among animals: “you scratch my back and I’ll scratch yours” - which are enforced by “moralistic aggression” when expectations of reciprocity are violated. These phenomena have been clearly demonstrated among other animals as well as humans. Trivers in turn was extended in 1981 by Axelrod and Hamilton, who proposed that pair-wise exchanges of altruism could explain the evolution of cooperation as a solution to more complex strategic situations such as two-person, repeat-play Prisoner’s Dilemma. The model of cooperation as a solution to repeat-play Prisoner’s Dilemma has a great deal of power in explaining phenomenon of interest in law, but it is difficult to model complex social interactions solely in terms of a series of pair-wise exchanges.

The next extension of the biological theory of cooperative behavior was by Robert Alexander, who proposed the theory of “indirect reciprocity,” the idea that norms and reputations develop as a solution to the problem of pair-wise exchanges. A number of contemporary biologists developed a thesis that many of our cultural, religious and legal institutions - for example, the golden rule to treat others as yourself—are ways to compensate for the fact that we are not programmed by biological evolution to behave cooperatively in large groups of non-kin. However, to maintain cohesion and predictability in larger societies, rather than in small kin-groups roaming the savannahs of Africa, human societies must give people reasons to act as if others in their nation-state were kin. This thesis parallels the claim by Sir Henry Maine, the founder of legal anthropology in the nineteenth century, who hypothesized that the state developed out of artificial kin-group relationships.

In any event, much of the work in this area by biologists has focused on issues like the Prisoner’s Dilemma, and ways in which law creates incentives to achieve more cooperative outcomes in groups of people when those people are not predisposed by biology to treat a harm to someone else as equivalent to a benefit to them. Many of the game theory explanations in modern law and economics take as a given the notion of actors externalizing part of the cost of what they do to other people. Externalities would not exist if we were actually willing to treat the golden rule as reality - that is, for example, if I regarded one

77. See Trivers, supra note 10.
78. See generally Frans de Waal, Food Sharing and Reciprocal Obligations Among Chimpanzees, 18 J. HUMAN EVOLUTION 433 (1989).
79. See Axelrod & Hamilton, supra note 21.
82. For a good summary and extension of this literature, see Frans de Waal’s recent book, GOOD NATURED, supra note 7.
83. See, e.g., Rogers, supra note 74.
dollar of benefit to me as truly equivalent to one dollar of harm to you, then there would be no need for a system of legal regulation to force me to internalize externalities.

One way to conceptualize the function of a legal system, at least in regulatory areas, in the biological view is that law gives us selfish reasons to act unselfishly. It uses our fear of punishment to get us to act in a way that in some sense is contrary to the way biology has built us, so that we can be better suited to live in our complex, modern environment. Thus, far from codifying what biology builds into our species, Law and Biology conceives of law and other cultural practices as a kind of "evolutionary prothesis," a tool to compensate for the fact that biological evolution has not adapted us perfectly to live in our current environmental conditions.

While the work in Law and Biology on the sources and limits to altruism may be of some interest, to date it has been of limited utility in actually changing the way that either scholars or practitioners conceive the legal enterprise. Law and Biology will be significant in this area only to the extent that it provides insights into the nature of human nature that either extend or differ significantly from the prevailing models of human behavior. To the extent that the differences are significant, and have implications for the design of legal systems, then Law and Biology may represent a significant advance, but that promise remains to be brought to fruition.

C. Biology as a Guide to Legal Design

The third area in which modern biology may be used is in helping society design more effective legal systems by increasing our understanding of the behavioral building blocks of human nature with which law is working.

There are many areas in which "Law and Biology" and "Law and Economics" overlap and would reach exactly the same results in analyzing human motivations. However, there are also some significant divergences which give Law and Biology its claim of particular power. One of these differences relates to preferences. Economists generally think about preferences or values as exogenously given. To the economist, people have preferences, and typically, those preferences are relatively fixed: people are either risk-preferring, or not risk-preferring. But to many legal scholars today, this seems really quite artificial and potentially misleading. One of the things that biology tells us about people is that their preferences are in fact setting-dependant. People do not


have fixed preferences, rather preferences change depending upon the particular context or environment. What a person is willing to do or how much of a particular activity a person will engage in is often dependant upon his or her perception about what others in the community are doing, or that person’s perceptions of his or her particular role or standing within the community.

For example, in my own area of environmental law, there have basically been two models of how to organize a recycling program. One is central a station and, in the middle of the night, people bring their trash and put it in a little igloo. The other is the curbside recycling system, where everybody takes their little blue bin and carts it out and puts it at the curbside. One of the things that we know about recycling, but have not been able to explain, is that when people are asked what percentage of their trash they recycle, their answer will be an inaccurate representation of what they actually do. But what has come to be understood is that they are very accurate in reporting what percentage of trash their neighbors recycle. Moreover, a person reporting that her neighbors recycle fifty percent of their trash actually recycles fifty percent of her own trash. So the best evidence of what somebody is actually recycling is the amount that person says his or her neighbor recycles.

The biologist would say that it may well be causal that the arrow runs in the opposite direction. People are recycling a certain percentage because that is the percentage they perceive their neighbor is recycling. The degree to which people in a community are willing to engage in cooperative behavior, like in the tit-for-tat strategy developed by Bob Axelrod in the Evolution of Cooperation, is dependant upon whether or not one perceives others in the community as playing by the same rules. I may be willing to restrain my predatory or exploitative behavior, but only if I perceive you as also playing a cooperative strategy. That is the essence of Axelrod’s tit-for-tat strategy. And if it is true, its implication is that the blue-bin strategy, which maximizes the perception by everyone in the community that everyone else in the community is doing their social duty, would be a much more effective strategy, as indeed it is.

Another practical implication of this suggests that one of the best things the IRS can do in order to maximize tax compliance is not simply hire more auditors, but to maximize the perception among the taxpaying public that most Americans pay their taxes voluntarily. As you have probably noticed, this message has been promoted through television ads and is placed on the front of every tax return. There are other examples, many of which are developed by Bob Frank in his book Passion Within Reason, which talks about how many of the human behavioral assumptions of economics are too simplistic and can be enriched by some of the knowledge learned from biology.

87. Robert H. Frank, Passions Within Reason: The Strategic Role of the
In addition to counseling how to design legal systems more effectively to promote voluntary compliance, in the future Law and Biology may also be able to advise lawmakers concerning the point in time and the type of legal interventions most effective to influence complex sequences of behaviors. However, this ambition has yet to be realized to any significant degree by the field.

III. LAW AND BIOLOGY: AN INTERIM ASSESSMENT

In closing, as Law and Biology enters its adolescence the accomplishments, promise and shortcomings of the field need to receive a sober assessment. Law and Biology has clearly engaged the attention of many of the leading researchers in biology and human behavior both here and abroad who believe their disciplines have many insights of great value to contribute to law. The reaction among legal scholars to date has been interested but more guarded, although articles which are clearly influenced by Law and Biology are beginning to appear in leading law reviews. Legal decisionmakers, such as federal judges, are only beginning to be exposed to Law and Biology.

The area where law and Biology has had the most influence to date is in providing models of the dynamics of legal change; the claims to provide useful insights into the nature of human nature, and to assist in the design of effective legal systems are still glimmers on the horizon, and may or may not come to fruition as the movement goes forward.

Unlike some of its predecessors, Law and Biology does not purport to be a complete, all-encompassing legal theory; on the contrary, it may be viewed as a corollary or corrective of some of the over-simplifications of other theories, such as law and economics.

The greatest danger facing Law and Biology is the Panglossian fallacy: to think that biology can explain everything. Voltaire created the imaginary character of Dr. Pangloss, who at one point pronounced that noses evolved for the purpose of holding up spectacles. We can employ this same logic in socio-biology, speculating on how particular behavior might be “adaptive.” This is a grave misuse of biology when it is merely speculative; and in the long run, these attempts to overuse biology are counter-productive and undermine the

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90. Voltaire captured this attitude best in his imaginary character Professor Pangloss, who assured his listeners, “Things cannot be other than they are . . . Everything is made for the best purpose. Our noses were made to carry spectacles, so we have spectacles. Legs were clearly intended for breeches, and we wear them.” Voltaire, Candide (1759).
credibility of biological explanations.

For example, there are some modern biologists who believe all human and animal behavior can be reduced to the issue of "reproductive success," which they define as increasing the percentage of a person's genes that are represented in the future generation one or two generations out.\textsuperscript{91} I believe this reductionistic approach is not helpful, but I acknowledge that there are some people who believe it.

I think a much better biological model for human behavior and legal behavior is the model of "paired characteristics." The concept of paired characteristics in biology is illustrated in the answer to the question of why a duck's feet are orange. Intuitively, it would seem that a duck with orange feet would be much easier prey to predators from below than one that had feet that were camouflaged. According to the prevailing biological theory, there is no advantage to the duck in having orange feet. Rather, it just turns out that the type of material that makes good webbed feet happens to be orange, and there is not a sufficient evolutionary disadvantage to orange feet to eliminate that characteristic.

"Paired characteristics" are similar to "founders' effects," and I think these concepts represent a much better way to think about human behavior and legal behavior than to imagine in a Panglossian way that everything we do maximizes our reproductive success. For example, I cannot come up with a very good explanation for why trekking all the way out here to Saint Louis and giving this lecture is likely to maximize my reproductive success\textsuperscript{92} I think this action may be better explained by a "paired characteristic" argument. For example, there are some evolutionary advantages to human beings to having the kinds of brains we have. Once we have the kinds of brains we have, some of us like to use them for delivering lectures on these kinds of speculative topics. That would be a paired characteristic argument, as opposed to a Panglossian fallacy argument.

In an excellent forward to the \textit{Notre Dame Law Review} in 1989, John Attanasio, now Dean here at Saint Louis University Law School, deplored the impoverished state of law and moral philosophy at that time.\textsuperscript{93} He was talking about the twin dangers of the formalism of law and economics on one hand, and the skepticism of legal realism, positivism and the legal process school on

\begin{enumerate}
\item See, e.g., Matt Ridley, \textit{supra} note 6, at 4 ("reproduction is the sole goal for which human beings are designed; everything else is a means to that end").
\item Ridley would, however, hypothesize that my appearing to deliver a lecture was a paradigmatic example of male "display behavior" intended to attract females for mating purposes. Indeed, Ridley proposes to explain much of human achievements, from BMWs to stock options, as ways to enhance reproductive success.
\end{enumerate}
the other.\textsuperscript{94} Law and Biology is potentially attractive because it offers the prospect for a kind of new synthesis that brings together the natural law tradition and the legal process tradition.

In 1982, Bill Rogers, one of the founders of Law and Biology, observed in his \textit{Bringing People Back} article\textsuperscript{95} that law and economics posited a very simplistic model of human behavior, and that if we are going to make further progress in understanding how law really works, we need to bring reality of human nature back into the picture. We need a much more realistic model of human nature. Law and Biology is one way - not the only way - to see human beings as they are.

Law and Biology is not new. For example, Oliver Wendell Holmes in his writing was very much influenced by biology.\textsuperscript{96} Much of Law and Biology is largely rediscovering insights about how law really works that have been known in the past, but were lost and need to be rediscovered in new words. It is not a panacea. Where true, it will not answer all issues.

Law and Biology is part of the evolution in legal scholarship, which in the future will focus far more on culture and the formation of preferences and moral norms.

\textsuperscript{94} Id.
\textsuperscript{95} See Rodgers, \textit{supra} note 74.
\textsuperscript{96} Supra note 31 and accompanying text.
APPENDIX

QUESTIONS

QUESTION: In the legal-cognitivist tradition, cognitive activity in the law is considered an expression of desire, and in the natural law tradition, it's understood as somehow descriptive of the good. What role or place does the cognitive activity of the law serve in Law and Biology?

ANSWER: There is a wonderful book by a Swedish Nobel Prize-winner named Ragnar Granit called The Purposive Brain in which he argues that there is a necessary isomorphic connection between learning, culture and biology. Granit suggests that these three systems be understood as essentially a nested hierarchy. For example, individual learning is the fastest of the three, so that is the one that will be used to try to adapt as quickly as possible. However, if individual learning will not do it, then the variations of individual learning are disciplined by culture, which is somewhat slower to change. And in turn culture, if it does not change sufficiently to adapt to the situation, will eventually be disciplined by biology. So the model that Law and Biology propounds that these three systems are not separate and unrelated, but that the logical structure of learning and of culture is in some sense an internal proxy which stores the results of the past record of evolutionary experience. In fact, there is some very interesting work about the structural similarities between learning and evolutionary biology. This is also developed in a less scientific and more poetic way by Gregory Bateson in his book, Mind and Nature: A Necessary Unity. The basic notion there is that we should not think of the natural order and the mind as being sort of two separate and unconnected realms. Rather, our minds develop in the way they do because we have biological and evolutionary advantages to thinking the way we think. So, the consequence of that, in specific answer to your question, is that one would expect that most of the time judges would be smart enough to get decisions right as a matter of conscious individual learning. In the relatively few cases where they don't, the evolutionary selective litigation effect is going to keep the cases coming back, and that will tell the judges to keep looking at the issue because they do not have it right yet. So that is the basic model where there really is not any inconsistency between learning and evolutionary biology, but rather a view that one is a kind of faster, simpler proxy for the other.

97. This appendix represents the questions and answers that followed E. Donald Elliott's Childress Lecture at Saint Louis University School of Law on February 29, 1996.
QUESTION: Do you see any implications in this movement that would change the way that law is taught?

ANSWER: Yes, I think that lawyers are woefully ignorant about the sciences that actually bear on human nature. I think we basically practice law today the way that people used to practice science before Francis Bacon—in a very non-empirical, non-observationalist way. One of the first things that we did in organizing Law and Biology was to start teaching courses in law schools where we would try to educate law students about some of the basic findings of biology regarding human behavior and their implications for the design of legal systems. Those courses in Law and Biology are now taught in at least ten law schools. We also conduct a teaching seminar for law professors every summer at Squaw Valley. We have had over 250 law professors around the country who have gone through week-long training in Law and Biology, and we bring in some of the major figures in the movement like Bill Hamilton,100 Robert Trivers,101 Lionel Tiger102 and others who believe it is important to share with lawyers and law professors what they view as the insights and implications of their discipline for the teaching of law. I think this approach will be very influential. For example, we often talk in law in terms of extreme relativism. We say, for example, “assume that people think it's fine to cook babies and eat them.” But of course, human beings do not in fact do that very often. Incorporating ideas from biology into legal education will help us to have a more refined understanding of the nature of the systems of human beings that we are attempting to regulate.

Having said that, the opposite end of the spectrum is that I do not believe that Law and Biology necessarily has implications for every legal question. I have not been able to figure out what the “last clear chance” doctrine in tort law103 should say as a matter of Law and Biology. It seems to me that this example is within the broad range of issues about which biology does not have anything to say because it is within the flexibility of the system to allow a great deal of variation. That is one reason that Law and Biology articles are different from law and economics articles. When you read a Law and Biology article, you may not even know it, because it is an article about law that draws on the insights of biology where they are applicable, and they are not applicable to everything. So it is really quite an opportunistic theory.

QUESTION: The claims that you make are very large, particularly when you said that Law and Biology represents an effort to reconcile positivism and

100. See Hamilton, supra note 9.
102. See Tiger & Fox, supra note 22.
103. RESTATEMENT (SECOND) OF TORTS § 479 (1963).
natural law, or an effort to put forward a new, sort of humanistic version of natural law which is empirically based. So much hinges on that empiricism, and I am happy to see that the claims are modest because there could be tremendous implications if the empiricism is wrong—if it turns out that the biological explanation is really cultural—and we have fashioned legal systems based on an incorrect empiricism.

First, how do you distinguish “Law and Biology” from “Law and Anthropology,” which is another movement that has tried to grapple with some of these things? Second, how do you distinguish “Law and Biology” from “law and psychology” or “law and psychiatry,” in the sense that both of these movements tries to make predictions about human behavior, one from a cultural view, the other from a more individuated order of social psychology?

ANSWER: Let me talk about the first part of your comment, the dangers of incorrect empiricism and the implications if what one thought was a biological factor was in fact a cultural one. I am not sure I agree with you that the dangers there are as great as perhaps you have indicated. Of course, anytime one posits that there is an error, it forms a basis for replicating other errors if it turns out the original prognosis was wrong. But I think the implicit premise of your question, at least as I understood it, was the notion that somehow law ought to codify these biological absolutes. That is a position that others such as John Beckstrom have taken, but it is one which I specifically deny. To me, it really does not matter very much whether something is a cultural phenomenon or a biological phenomenon; those characteristics that are biological are not, in my view, entitled to any special priority. In any event, I basically see a kind of dynamic unity between biology and culture.

I think the advantage here is in understanding what the law is really doing, what the function of law is. For example, consider the work of Guido Calabresi, an avowed instrumentalist; one of the problems with his work is the question of where his goals come from? Was it Archimedes who said, “Give me a lever and a place to stand and I’ll move the world?” Well, where is the place to stand? What is the goal of the instrumentalist?

What Law and Biology helps one to do is to construct a sense of what the goals of law and culture are, so that the instrumentalists’ debate about how to get to whatever those goals are starts from a premise that is stronger than the premise, “if we could get something that we all agreed on.” This is possible in the Law and Biology movement because Law and Biology relies on those

goals and functions as not being simply a matter of an arbitrary consensus, but takes the view that the moral norms that a society holds are in fact an understandable product of its environmental situation.107

In terms of the way in which Law and Biology is different from law and anthropology, or law and psychology, I think Law and Biology is a sub-set of both, or perhaps a cross-cutting sub-set of both. There are biological anthropologists, there are biological psychologists; there is a very broad set of disciplines that are brought to bear on biology, and I think the reason anthropology and biological psychiatry have advantages over some other portions of those fields is essentially the point I made about isomorphism as opposed to a pure metaphor.108 Utilizing a model which has the strength of describing the actual underlying process provides potential advantages over collecting data based on an entirely arbitrary grid.

But again, I would not say the only thing that a law professor ought to have in his or her arsenal for thinking about law is knowledge about biology. Law and Biology does not contain this sort of "know-nothingism" that would hold that if there are other empirical insights about human nature that come from social scientists and not biologists, we ought to ignore them. For example, there is some social science evidence that people find procedures more legitimate if they have an opportunity to participate in them.109 As a legal scholar, I would assimilate that information and consider it quite important in terms of how we design a legal system. But as far as I know that theory does not have any biological underpinnings. I would not exclude something that I believe is true about human nature just because I do not have a biological theory to explain why that is part of human nature.

I think that we as lawyers need to develop a more refined model of human nature to be able to understand how law works, and I think that one of the difficulties with law and economics, and also its great strength, is that the model of human behavior that it posits is so simplistic that one quickly runs up to the limits of the model. I would not say, however, that we should only think of those things about human nature that biology teaches.

QUESTION: Do you see a cross between law and economics and Law and Biology in the future? For instance, when a court wants to value distributive rights, it will evaluate based on biology—one dollar for one person may be five dollars for everyone else?

108. Supra note 56-62 and accompanying text.
ANSWER: I do see a developing synthesis between Law and Biology and law and economics. Many of the people who are early participants from the Law and Biology movement are in fact economists. People like Bob Cooter and Robert Frank, who are some of the leading economists working in the field of law and economics, understand very well the limitations on the model of human nature that is posited by law and economics. In fact, Richard Posner has been a participant in some of our conferences, Guido Calabresi wrote the introduction to Margaret Gruter's book, and I think both Posner and Calabresi have made some statements about how biology is very helpful in essentially transcending some of the limitations of law and economics, particularly in the area of understanding where preferences arise. For example, if you read Calabresi's book *Ideals, Beliefs, Attitudes and the Law*, he is clearly groping at the limits of his discipline, saying, "Look, the key question here is not the engineering question, how can we maximize our social preferences, but rather where do those social preferences come from?" I think that biology, or at least ethology, has a lot to say about where the shared values of communities come from. But I do not think it is the only thing that speaks to that. I think anthropology and social psychology also have important things to say about where shared values come from.

QUESTION: Is there a universalism to this so that, for example, Law and Biology American-style is not Law and Biology Russian-style?

ANSWER: Yes, there has been a lot of interest and joint activity in this with scholars from other countries. For example, we had a joint conference talking about Law and Biology at Brookings several years ago with some Russian legal scholars. Also, Law and Biology is probably farther developed in Germany. Because there is a very strong tradition of ethology in Germany, they readily understand what we are doing. In fact, almost all German law professors incorporate ethological insights as a matter of course into their thinking about law. So there is a universalist appeal to Law and Biology, although I should be careful about what I mean by that.

We do not mean, as was the search in an earlier era, that Law and Biology represents a search for cultural absolutes. In fact, modern biology predicts quite the contrary. Because of differences in environments, and also because of the notion that there is a diversity of strategies which are being played in any population, one would not expect the same thing that works in a particular culture to work in another context. This is both because of the environmental differences, and as modern biology teaches us, because there is not a single

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112. See generally id.
adaptive strategy. This is illustrated by the problem one finds if all of the seeds for corn are exactly the same; the corn is very vulnerable to a pest that can come in and defeat the seed’s genetic makeup. A distribution of strategies is much more evolutionarily stable. So what one would expect to see, and what one does in fact see, is a variety of different societies playing a variety of different strategies on such things as, for example, security and risk. The United States has a social structure which does not protect workers to the same degree that the German social structure does, or the Japanese social structure does. You can understand these differences in social organizations as different societies playing different strategies, each having different advantages or disadvantages in particular types of environments. So there is absolutely no reason to believe there is going to be a sort of single, universal approach. But it is helpful, I think, in a comparative way, to understand what the different functions are.

QUESTION: It seems to me that the Law and Biology movement shares something with the anthropologists, who are also concerned with defining or explaining in an empirical fashion the function of law in society, and perhaps from there extrapolating certain empirically-based attributes as to a functionally-based or an empirically-based definition of law. I take it you do not want to go that far, that you do not want to bridge this gap between formalism or conceptualism, and empiricism. Am I right?

ANSWER: I feel a little like Justice Brandeis, who once said: “I follow you right up to the ‘therefore.’” I thought I was with you until you said that I did not want to bridge this gap, and I think I do. Let me go back, and perhaps this will help clarify. I do see Law and Biology as a special sub-set of law and anthropology. It is a particular kind of anthropology, so it is not necessarily subsumed by law and anthropology—economics and other things get involved. But a lot of what Law and Biology is about is similar to what law and anthropology is about. On the other hand, if I did say "the function" of law, and I probably did, it is an oversimplification. Because in fact, law has lots of different functions. The same point I was making about the diversity of strategies also applies here. In different societies or in different contexts, law or particular laws perform many different functions. One of the difficulties or complexities that we encounter when we begin doing cross-cultural work is that there is absolutely no reason to believe that the function that law or a particular law is performing in the United States performs the same function in another society.

One of the things you often find is that the same social function may be performed by different institutions in different societies. For example, DeTocqueville’s account of the role of law in the United States was that because Americans do not have a strong, shared culture or religion, they have more so-
cial business in the "law-box" than many other countries do. So I tend to view law as a cultural tool, as one of a range of cultural or evolutionary protheses that is available to the society to do the things that society needs to do.

But that does not necessarily mean that one cannot usefully posit the primary function of particular laws. Law in our society, or at least regulatory law, deals a lot with the problem of insufficient altruism. But there are other societies that deal with that in quite different ways, such as through their culture or shared religious traditions, so that their system of state-imposed moralistic aggression (which is one useful formal definition of law) need not be devoted to the same degree to promoting a greater degree of altruistic behavior in the community.

QUESTION: I am curious about the predictive ability of Law and Biology. You mentioned its isomorphic ability, and yet you also mentioned that it is somewhat opportunistic, and that it does not apply in every situation. I am curious if there has been some formula, some reason to decide whether biology applies to a particular area of law, and if so, whether the model is like the parasite as opposed to some other relationship in biology.

ANSWER: There is a lot of work in Law and Biology that I have not spoken about today such as looking at how our brains are organized, and a lot of that work is focused on the nature of pattern-recognition. I think the anchor and adjust heuristic is often the basis for thinking creatively. In the same way, what we are talking about here is essentially pattern-recognition. When we look at how a particular system or sub-system behaves, if we know a good deal about how other systems behave in biology, we may be able to recognize an isomorphism. And then when we get three or four points of contact, we can develop a theoretical understanding that the system represents an instance of this particular biological phenomenon. Then we can begin to say, for example, that if the tragedy of the commons really is the problem of host-parasite relationships, then we should learn what we can about parasite-host relationships and look for places where knowledge about host-parasite relationships gives us some leverage to say something that is counterintuitive about law.

I can use the example of parasite-host relationships to illustrate this process. There is a consensus (and it is the politically-correct thing to believe) that sustainable development, or a cooperative relationship between host and parasite, is always a good thing and maximizes a development. But biology would counsel that that cannot be true. It is demonstrable that there are situa-

113. ALEXIS DE TOCQUEVILLE, DEMOCRACY IN AMERICA 48-49 (1841).
tions or environments in which parasites do better by playing an exploitative strategy than by playing a more cooperative strategy. Understanding the conditions under which the cooperative or sustainable development strategy does actually maximize gains, and when it does not, may be important in understanding why we have some difficulty getting certain societies to behave in a way that we would like to see them behave, and also in understanding as an academic matter why the sustainable development movement comes at the time that it does. There are some obvious examples, such as population density, but it also has to do with wealth. There is some good work by the World Health Organization that is very troubling to environmentalists that begins to show that people’s preferences to preserve the environment begin to go up when they reach a certain annual income per capita.\textsuperscript{115} Up to that point they do not care very much about preserving the environment.

Gordon Getty has also done some work developing a biological theory of how we discount future effects, which has major implications for the obligations to future generations issue, an issue important in environmental law as well as a lot of other areas. Biological theory basically counsels that human beings have relatively limited time horizons, and instead of applying a linear time discount, they are going to apply a time discount that will fall off rather rapidly beyond two generations. If that turns out to be true, and I think there are plenty of reasons to believe that it is true, it has major implications for how we go about designing systems. One of the things that becomes important is that systems that are designed to be true to something for longer than two generations probably cannot be grounded on selfish motivations, but rather something much more like a religion, where you have internal proxies for the long-term concerns.

This is just one illustration. I think you start with the pattern-recognition problem, then when you think you have the right model, you look for the things that are predicted by the model. In that sense, it is a lot like Pluto: they went and looked for Pluto because they thought it would probably be there.\textsuperscript{116}

\textbf{QUESTION:} Do you believe that as the empirical aspect of the Law and Biology movement strengthens, it will contribute to the movement’s credibility in legal scholarship in the same way empiricism did for law and economics?

\textbf{ANSWER:} Yes, I do believe that Law and Biology will become more empirical. But I do not agree with the premise of your question, that law and economics has been empirically validated. I gave an unjustly obscure lecture at Rutgers in 1989 in which I looked at the empirical support for some of the


\textsuperscript{116} \textit{Hoyt, supra} note 57 and accompanying text.
economic theories of tort law, and concluded that it was a remarkably weak body of empirical evidence upon which to build a major public policy decision.\footnote{117} So, I think the empirical basis for law and economics is remarkably weak examined more carefully.

But I have become a great believer in empiricism, and I have attempted to do several types of work tying together concepts in Law and Biology that I would call empirical. I would call the article that Ackerman and I did on the evolution of the Clean Air Act empirical in the sense of a case study, that is, trying to apply theoretical constructs in a particular case.\footnote{118} That is a weak form of empiricism—in the sense that data is the plural of anecdote. But at least it is a case study. And then the work I did on \textit{Chevron} with Peter Schuck is much more a statistical kind of work.\footnote{119} Lots of the work that others in the movement are doing is even more empirical. Frans de Waal, who works with bonobos and chimpanzees, has done a lot of interesting empirical work,\footnote{120} as has Roger Masters, a political scientist who has done fascinating work on political phenomenon based on things like the facial expressions of political figures on the television.\footnote{121} Mike McGuire, who is a biological psychiatrist at UCLA and who also works with primates, has also done a great deal of exciting empirical work.\footnote{122}

So I think that one of the big advantages of both law and economics and Law and Biology is, and this is where I agree with you, its potential to develop into a sustained, shared legal theory. For many years, it seems to me, legal scholarship was like Sisyphus trying to push the same stone up the same hill. Every legal scholar would re-invent the wheel, but with his or her own terminology, and therefore there was no real collective or cumulative effect. Law and economics, however, was a collective movement with a shared framework which allowed people to build on each others’ insights by attempting to validate or falsify the insights. With Law and Biology, we also have a real movement with a shared conceptual framework.

I remember visiting Chicago in 1985 back when I was first getting into this


\footnotesize{118. Elliott, \textit{Statutory Evolution}, supra note 38.}


\footnotesize{120. See generally FRANS DE WAAL, \textit{PEACEMAKING AMONG PRIMATES} (1989); DE WAAL, supra note 78.}


\footnotesize{122. See generally Michael T. McGuire, \textit{Biochemical Screening to Predict Behavior}, 65 S. CAL. L. REV. 565 (1991).}
movement, and having a great conversation with Richard Posner about whether biology could play the same role for me that economics had played for him. He basically said, “Well Don, you know, you’re doing this Law and Biology stuff, but when I started with Law and Economics, I had a framework.” And I said, “Well look, there is a framework among biologists too, you just don’t know what it is, here it is, and here’s how it’s different.”

Biological theory gives the advantage of a shared language and a comprehensive, theoretical framework around which lots of people are doing work. For example, everybody in the movement will know what I mean by the term “paired characteristics,”123 or what Mark Roe means by “path dependence.”124 These are all well-understood terms that have been worked out and validated, and I think that gives a tremendous advantage over conceptual systems which are more metaphorical than isomorphic. Metaphorical systems impose an arbitrary map, or grid, on behavior. So I do think that empiricism is important and that the study of Law and Biology is becoming more empirical.

123. Supra Part III.
124. Supra note 45 and accompanying text.