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Biotechnology and the Law: Social Responsibility or Freedom of Scientific Inquiry?

by George P. Smith, II*

I. SCIENTIFIC FREEDOMS V. SOCIAL RESPONSIBILITIES

At American University in Washington, D.C., on November 20, 1973, Julius Stone presented the tenth annual Mooers Lecture, entitled, "Knowledge, Survival, and the Duties of Science."1 The central question and thesis that he propounded could and, indeed, should be raised anew today; they form the very core of the province and function of law, science, and medicine. In our brave new world they point to the leeways of choice and patterns of discourse that exist in grappling with the central issue of social responsibility in scientific inquiry. Perhaps they will assist in forging a consensus opinion for a subsequent course of action. The task of this Article, then, is to test, to probe anew, and to thereby critically analyze the modern significance of Dr. Stone's thesis regarding the social responsibility of scientific inquiry.

Quoting from Sir Gustav Nossal's 1971 address before the Australian and New Zealand Association for the Advancement of Science, Dr. Stone admonished us to be aware of the 'genetic revolution' in which people would be created in test tubes and molecular 'monsters' would be released

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into the atmosphere. He proceeded to caution that "the liberty to extend knowledge is not absolute," but, rather, must be limited when it is in conflict with other values. He posited the central question of his inquiry as being a study of the extent to which scientists "have a moral duty to consider, along with others of competent knowledge, whether a line of inquiry should be desisted from as soon as it becomes clear that it is likely to bring about a mankind-endangering situation, which no one has any foreseeable capacity to handle . . . ."

Although debatable whether it is impossible to reverse the process of discovery, Professor Stone suggested that particular scientists might well have a moral duty "not to contribute by [their] work to the certainty or speed of its arrival." He acknowledged that the essential role of the scientist is to advance knowledge and that compromises which limit their inherent or fundamental freedom to act should not be freely undertaken, and, further, "that whether knowledge is put to good or evil use is a matter for society generally, and not for scientists."

From this, Dr. Stone shaped his thesis to state that "scientists have a duty to exercise self-restraint in pressing further those scientific activities which manifest" a likelihood that they will result in "limit-situations" or, in other words, "dangers of cataclysmic physical or psychological proportions for mankind as a whole." Self-restraint is specifically warranted when the scientist in question is actually "aware of this likelihood as a proximate outcome" of his own work. He stressed the point that the scientific duty of restraint should only be imposed when the scientist is "clearly able to foresee that the particular line of work is leading to a scale of dangers" that would constitute a 'limit-situation'.

Thus, Dr. Stone delimits the scope of scientific inquiry to a very narrow, but admittedly crucial, range. He observed that his essential inquiry is "not whether scientists should cease all activity which might lead to any dangers, much less that they should always be able to foresee all . . . ."

2. Id. at 232.
3. Id. at 235.
4. Id.
5. Id. at 234.
6. Id. at 237.
7. Id. at 240.
8. Id.
9. Id.
10. Id.
11. Id.
12. Id.
13. Id.
14. Id.
15. Id. at 241.
consequences.”16 Rather, the inquiry is tied to “whether they should not desist from activities likely to lead to dangers cataclysmic for mankind, and against which no protection seems possible, from the moment at which they can already foresee these dangers.”17 Professor Stone noted with pride that many groups of scientists in Britain and one scientist in Sydney adopted and codified ‘as a basic constitutional principle’ the substance of his thesis under the name, “Social Responsibility in Science.”18

He admitted that the criteria that he submitted for determining restraints on scientific inquiry lacked precision, but he explained that “the indeterminacies leaned in favor of the traditional scientific freedom of investigation”19 and that no duty of restraint arose unless the scientist was able to foresee the magnitude of the dangers of his research. He contended further that even though elements of indeterminacy were present within the criteria that he postulated, they give guidance to all concerned in that they not only indicate “the relevant orders of magnitude and imminence but also the nature of the substantive values threatened.”20 More specifically, Professor Stone was concerned with two orders of these values: the first embraces the limits of physical integrity and the sanctity of human life together with mankind’s survival in general; and the second concerns the dangers arising from “scientific advances to human individuality, in the sense of the autonomy of the human will and sensibilities presupposed by our notions of freedom.”21

Dr. Stone expressed his grave reservation about the feasibility of in vitro fertilization as well as genetic surgery and engineering.22 Although he recognized barren marriages could be resolved by the new noncoital techniques for reproduction and further, that genetic engineering could alleviate genetic-borne disease and disability, he “would not admit that relief afforded for such cases (admirable in itself though it might be) could even begin to tip the scales against the formidable dangers to a liberty-based society to which test-tube birth or any analogue of this would open the way.”23

16. Id. at 246 (emphasis in original).
17. Id. (emphasis in original).
18. Id. at 249.
19. Id. at 258-59.
20. Id. at 259.
21. Id.
22. Id. at 258.
A. Human Rights and The New Technology

Among the sophisticated countries of Australia, Europe, and America, the pervasive attitude has been, until quite recently, quite supportive of scientific inquiry and discovery. Many believed that this action was not only of overwhelming benefit to society, but was an essential attribute of human achievement and progress in the brave new world. Reflecting on the horrors of World War I and World War II, as well as the frequent limited conflicts since 1945, combined with overly emotional concerns regarding the potential for nuclear, bacteriological, and chemical warfare, and their real potential for annihilating mankind, scientists have witnessed a new and increasingly pessimistic temperament concerning scientific advancement. Indeed, one commentator has recognized that "not all science is good for humanity."

Initial efforts at the United Nations in the 1960's underscored the importance of the recognition of human rights in the era of the 'New Biology.' Before that activity, however, the 1948 Universal Declaration of Human Rights' guarantees of 'human dignity' written in Articles 1, 5, 6, and 29(1) established eloquent reminders of the need for the advances of biotechnology and genetic engineering to be tied to a basic understanding of and respect for fundamental human rights. Indeed, what is needed now is a new human rights debate among not only the legal community, but among scientists and technologists—a debate that would specifically, can Art. 16(1) of the Universal Declaration, with its guarantee that men and women of full age have a right to marry and 'to found a family' provide support for a claim to in vitro fertilization, embryo transplantation, artificial insemination, surrogate parenting and womb leasing, transplantation and the like? Is the guarantee of special care and assistance for motherhood and childhood in Art. 25(2) relevant to the new procedures available to overcome infertility? Is the guarantee of adequate health and medical care in Art. 25(1) the basis for a claim of access without limitation to these expensive new techniques?

consider anew the extent to which the plethora of medical, legal, scientific, and technological considerations of the brave new world challenge or complement the traditional and the redefined rights of humanity. As Mr. Justice Michael D. Kirby has succinctly summarized the issue: "If lawyers are to continue to play a relevant part in the human rights debate of the future, they must become more aware of scientific and technological advances. Otherwise, they will increasingly lack understanding of the questions to be asked, let alone answers to be given."

Often, the law has responded or reacted to, rather than directed, an agenda for social needs and demands. Indeed, Chief Justice Warren E. Burger has observed: "Law does not search out as do science and medicine; it reacts to social needs and demands." Law, science, and medicine must become full, unlimited partners. They must march in unison as they approach the task of assuring the primary goal of society: that all citizens have an equal opportunity to achieve their maximum potential within the economic marketplace, and to have their physical suffering minimized and spiritual tranquility assured.

II. Sociobiology's Challenge and Opportunity

A new and exciting debate is beginning to focus renewed interest and momentum in structuring a modern discipline that portends vast increases in attaining a higher level of understanding about genetic response mechanisms. The debate also presents a perfect example of the much needed full partnership of law, science, and medicine to which I have just referred.

The sociobiology debate has been described "as the continuance of the historic conflict created in the social sciences and humanities by the mechanistic examination of human nature through the instruments of conventional biology." Strictly as a discipline, rather than a theory, sociobiology is defined classically as, "[t]he systematic study of the biological basis of all social behavior," with human sociobiology being but one aspect of the whole study of the biological basis of social behavior. Stated otherwise, sociobiology is the study of "the evolutionary roots of social

29. See supra note 24, at 181.
30. Burger, Reflections on Law and Experimental Medicine, in 1 Ethical, Legal and Social Challenges to a Brave New World 211 (G. Smith, II ed. 1982).
32. Wilson, Foreword to The Sociobiology Debate at xi (A. Caplan ed. 1978).
34. Id.
behavior. Evolutionary sociobiology's goal should be not only to reconstruct the history of primates and identify their course of adaptation over time, but to monitor the genetic basis of current models of social behavior. As Edward O. Wilson, the modern progenitor of sociobiology has stated: "Contemporary general sociobiology might at best explain a tiny fraction of human social behavior in a novel manner. Its full applicability will be settled only by a great deal more imaginative research by both evolutionary biologists and social scientists. In this sense the true creative debate has just begun."

Darwin's basic evolutionary theory is that all living organisms are related by common inheritance. In 1865, Francis Galton, relying extensively on this theory, determined that his task was to encourage the use of positive eugenics, the application of the science of genetics to man in order to improve the species in a biological sense, to breed the better, stronger elements of the populace, and, accordingly, to discourage the breeding of the lower socio-economic classes. Galton's eugenic movement resulted in the passage of eugenic sterilization laws in most of the states and essentially ended in 1932. Later, environment was a more significant force in shaping personal qualities than transmissible genes.

Environmentalists constantly challenge gene sovereignty or biological determinism, asserting that, as to sociobiology, there is no genetic variation in the transmission of culture. Culture, noted Dobzhansky, is not inherited through genes, it is acquired by learning from other human beings. Boulding's theory of 'Ecodynamics' builds up a nonbiologic process in which each generation of humans learns culture from the preceding generation rather than through the inheritance of biologically predetermined genes.

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36. See supra note 32, at xiii, xiv.
40. See supra note 37, at 225. See also C. Blacker, Eugenics: Galton and After (1952).
44. K. Boulding, Ecodynamics: A New Theory of Societal Evolution (1978). Other attacks on Darwin's principle of organic evolution have been made. See, e.g., S. Stanley,
Sociobiologists' assertions that sociobiology allows for an opportunity to explain previously unexplainable behavioral phenomena within a restructured framework of contemporary Darwinian evolutionary theory have rekindled a strong biological interest in the sociobiology discipline. There has been substantial criticism about what is perceived as the illegitimate use of biological analogy in analyzing social systems and about the inherent weakness of sociobiologists' nonverifiable assertion that human social structures exist because of a superior adaptive value. Nevertheless, the efficacy and relevance of the theory of sociobiology for the study of both human behavior and human nature is of unique significance because it "stands as an instance of a rarely observed intellectual phenomenon: the attempt to produce and legitimize a new scientific discipline."

Evolution may be regarded as "a competition for survival among genes." The survival depends in large part upon regeneration of the species. This, in turn, will be tied to a standard of evolutionary behavior that will mandate, all things being equal, a form of altruistic conduct promotive of this regeneration. One commentator has noted:

The evolutionary theories of sociobiologists show that beings who considered only their own interests would leave fewer descendants than beings who also considered the interests of their kin. So there is a good reason to believe that we do not all act solely in our own interests. Genes promoting strictly selfish behavior in individual animals would be less likely to survive than genes which do not.

Relying upon the principle of reciprocity, sociobiologists suggest two forms of altruism are at work in the process of natural selection and propagation of the gene: Kin altruism and reciprocal altruism. Both forms are, in an ultimate sense, promotive of the 'Selfish Gene's' best interests of survival and propagation.

Kin altruism is a genetically based tendency to assist one's relatives
and should extend beyond immediate family to include cousins, as well as nieces and nephews. In the animal kingdom, kin altruism as a theory merely posits that animals may be expected to act as if they are aware of genetic relationships, with no direct knowledge of the degree of relationship being acknowledged. While reciprocal altruism should be regarded ideally as the source of attitudes of moral approval and disapproval, as well as ideas of fairness, gratitude, retribution, and cheating, it appears not to be altruism at all, but merely "enlightened self-interest." Concern for one's own interests, plus the knowledge that exchanges of assistance are likely to be in the long-term interests of both partners, is all that is needed.

The effect of biological evolution upon the development of law has been studied and evaluated for quite some time. Indeed, the legal roots of sociobiology are found in the writings of Maine, Corbin, Wigmore, and Holmes, and, of course, one must add Stone and Pound. Holmes structured the very theory of legal evolution when he observed that:

The life of the law has not been logic: it has been experience. The felt necessities of the time, the prevalent moral and political theories, intuitions of public policy, avowed or unconscious, even the prejudices which judges share with their fellow-men, have had a good deal more to do than the syllogism in determining the rules by which men should be governed.

Continuing further, he stated that, "The truth is, that the law is always approaching, and never reaching consistency. It is forever adopting new principles from life at one end, and it always retains old ones from history at the other . . . . It will become entirely consistent only when it ceases to grow."

Modern efforts are being undertaken to postulate a theory of sociobiology for aid-giving actions that have legal consequences, and more especially intestate wealth transfers, general property rights,
privacy, and the doctrine of nuisance. Although biological theory may offer no unquestioned answers of why certain legal outcomes result from genetic alignments, some proffer important partial explanations. Others disagree, however, and are quick to note that evolution has had little effect on the law.

A. Human Application

Theoretically, the core of sociobiology is that evolutionary biology has programmed us to be predisposed, either at a conscious or unconscious level, to aid other humans in such a manner “that the genes or genetic material we each carry are likely to be ultimately benefited in the sense of being proliferated through reproduction.” Followed to a reasonable level of application, this theory may project varying (and sometimes startling) implications pertinent to one’s predisposition to aid either a direct offspring, a parent, niece, or even a stranger. Interacting with environment and culture, these predispositions vary in intensity. They make the task of the behavioral scientist a truly formidable one as he seeks to predict the levels of cooperative behavior or, in other words, the “nuances of aid-giving” likely to happen within different environments and cultures.

The law often finds it necessary to engage in predictions or speculations that actually involve aid-giving inclinations. The average, ordinary, reasonable person’s reactions to a given situation are tested repeatedly in order to reach a standard of fairness for judicial decision making or legislative design. The enhanced opportunities for more accurate prediction


67. Rodgers, Bringing People Back: Toward a Comprehensive Theory of Taking in Natural Resources Law, supra note 65, at 218.
68. Id. at 221.
70. J. Beckstrom, supra note 54, at 2. The sociobiologist, being a pragmatic biologist who has been trained in both physiology and evolutionary history, posits that the emotional control centers in the hypothalamus and limbic system of the brain both constrain and shape self-knowledge; and furthermore that these two centers flood the consciousness with all the emotions, including love, guilt, fear and hate. E. Wilson, supra note 33, at 3.
72. Id.
73. Id.
74. Id.
75. Id. at 3.
or speculation are realized when the behavioral scientists are allowed to join forces with legal decisionmakers in an attempt to determine how the somewhat mythical average person with a defined set of characteristics is most likely to follow a particular behavioral pattern when an issue of aid-giving is present.76 "Even those judges or legislators who are jealous of their decisionmaking prerogatives and suspicious of 'mechanical' approaches based upon scientific information should be receptive to advice from scientists regarding such questions."

Marked differences of opinion abound within the discipline of sociobiology, thus its essential underpinnings are in a state of flux.78 Basing sociobiology's efficacy in genetics and evolutionary learning is indeed conceptually difficult. Obviously, until the theory of sociobiology becomes more settled and empirically verifiable, it cannot be used as a basis for law making. On the other hand, "the potential for immediate mutually beneficial joint research projects between lawyers and scientists appears to exist . . . . Thus, it is not too early for lawyers and sociobiologists to become more aware of each other."79

B. Expectations

If one of the most important ideals or tasks for a contemporary society is to devise a system of laws in which man-made laws complement the laws of nature, then sociobiology holds the hope and the promise of such a normative coalescence. Even though science is not capable of solving normative problems, it can serve a valuable role in assisting the evaluation of the means as well as the consequences of reaching various goals. Thus, together with individual value judgments, these analyses can contribute directly to a final selection of goals. Surely, scientific insights into human nature are equally important to the task of formulating ethical and legal systems. Since biological evolution has, by predetermination, imposed broad behavioral constraints on individual development, cultural evolution must endeavor to chart a course between these borders.80 Perhaps the time has come to seriously consider temporarily taking ethics from the philosophers and giving it to the scientists to be "biologized."81 Indeed, sociobiology should be recognized as affording a basis for a new

76. Id.
77. Id.
78. Id.
79. Id.
and enhanced understanding of ethics. Sociobiology enables a fresh comprehension of ethics as "a mode of human reasoning which develops in a group context, building on more limited biologically based forms of altruism."82

Because the extent of biology's gift to future lawmaking efforts is clouded, perhaps it is better to test or evaluate the absorptive capacities of law.83 The extent to which law receives or at least listens to what sociobiology is revealing depends in large part upon the willingness of lawmakers, judges, and legal scholars to welcome scientific knowledge as a bridge to present levels of ignorance and professional rigidity.84 By endeavoring to explain norm-forming processes, sociobiology and other behavioral sciences may have an important contribution to make in forming broad legal policies,85 specifically by arranging interactions in order to facilitate dispute resolution and promote norm-forming action.86

III. THE NEW BIOLOGY IN AMERICA

Today, scientific work is less a basic expression of the 'ancient aristocratic ethos of the love of knowledge' than a mere job to be done by entrepreneurs, employees, or others who have independent funding.87 Genentech, a San Francisco based biotechnology company, recently issued shares on the over-the-counter stock market. Among its products are: A hormone capable of stimulating human growth; mass produced human insulin that would allow a substantial reduction in the cost of the treatment of diabetes; and interferon, which may prove to be the long awaited 'miracle' drug to combat cancer. The price of Genentech stock increased dramatically during the first day of trading, and some brokers even suggested that Genentech may well be the next Polaroid or Xerox.88

82. P. SINGER, supra note 46, at 149. Accordingly, the sociobiological perceptive analysis of ethics should be regarded as being on the same level as either anthropological or sociological accounts of ethics. Id. at 81 & ch. 3. See generally Rosen, Classical Sociology and The Law, 5 Ox. J. Legal Stud. 61 (1985); Hyde, The Concept of Legitimation in the Sociology of Law, 1983 Wis. L. Rev. 379.


84. Id. at 326.

85. Id. at 332.

86. Id.


88. Investors Dream of Genes, TIME, Oct. 20, 1980, at 72. The potential profits derived from manipulating the genetic code, either to create new forms of life sufficient to clean up toxic chemical wastes or to produce anti-cancer agents on grand scale, spurred President Derek Bok of Harvard University to suggest that the university start its own genetic engineering firm. Strong faculty opposition, however, forced him to give up these plans. A Firm
Commentators have asserted that patenting new forms of life, as sanctioned by the United States Supreme Court,\(^89\) will be guided by short term profit motives rather than sound philosophical principles.\(^90\) Scientific knowledge is not, however, an absolute end. The thrust and purpose of patenting new life forms are basically technological, and are essentially political. Because the etiology of new life forms is political, both its costs and its benefits are of public interest and concern.\(^91\)

Pure scientific inquiry does not produce an economic exploitation of nature, only man's use of the truths of scientific inquiry does. With the methodological style of nature, science seeks to demonstrate causal relations among events. Thus, the laws of science state that whenever X occurs or varies in a particular way, Y will similarly occur or vary. This phenomenon aptly has been termed "a formula for action."\(^92\) Practical application awaits only an individual's decision that it might be economically advantageous to try to mobilize X's to produce Y's.\(^93\) Science promises truth, not peace of mind.\(^94\) Yet, liberty to extend knowledge is never to be regarded as absolute, but rather, as has been seen, it undergoes limitation when it conflicts with other values.\(^95\)

I now proceed to focus the spirit of inquiry and analysis on the additional parameters of the scientific imperative to explore truth. The United States patent laws and administrative interpretations, and more specifically, the United States Supreme Court in its momentous holding allowing patents on new forms of life created in a laboratory shape the scope of this inquiry.\(^96\) The ultimate purpose of this investigation is to refute the arrogance of power theory expressed in the current studies of the vast potential for the positive achievement of good through harnessing the "New Biology." I intend to demonstrate that what has been dismissed as a magnificent obsession for power, profits, and immortality has, in truth, a far more intrinsic potential for good and reward for the scientific community and the greater world community.

Improvement of man's genetic endowment by striving for positive propagation of those with a superior genetic make-up or conversely, de-

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\(^89\) See Compton, supra note 87, at 37.


\(^93\) Id.

\(^94\) Id.

\(^95\) Id.

limitation of those with negative genetic inheritance has always been a primary concern in the field of genetics.\textsuperscript{97} If the use of law as it relates to genetics may improve or advance the quality of life, then the application must be undertaken. No longer does the Dostoevskian quest to give life meaning through suffering become an inescapable given. By and through new scientific advances in the field of genetics and successes with \textit{in vitro} fertilization, the real potential exists to prevent, in large measure, much human suffering \textit{before} it manifests itself in or through life.

\textbf{A. Altering Human Evolution}

Today, man is in a position not only to alter the social and environmental conditions of the universe, but also to change his very essence.\textsuperscript{98} The mythology of the Minotaur and the Centaur, half man and half animal, may well become the reality of the twenty-first century. Indeed, modern medicine is presently not only attempting to create man-animal combinations, but also man-machine combinations or cyborgs.\textsuperscript{99} Plastic arteries, artificial hearts, electrically controlled artificial limbs, and pacemakers highlight the achievements of modern science to replace diseased or worn-out parts of the human body.\textsuperscript{100}

Efforts to construct or engineer biologically functional bacterial plasmids \textit{in vitro} exemplify the relatively new technology of recombinant DNA.\textsuperscript{101} Regarded as the most significant step in the field of genetics since 1953, research in this technology will facilitate identification of every one of the 100,000 genes in the human cell. Armed with this information, scientists could direct efforts toward replacing defective genes with healthy ones. Thus, the hope is that by making these replacements, genetic diseases such as hemophilia and sickle cell anemia could be conquered.\textsuperscript{102} Indeed, the plenitude of new products of nature that could

\textsuperscript{97} See G. Smith, \textit{supra} note 39, at 1.


\textsuperscript{100} See generally A. Toynbee, \textit{Surviving the Future} (1971), and \textit{The Prospects of Western Civilization} (1949).

\textsuperscript{101} DNA is the basic genetic material that transmits inherited characteristics.

substantially improve the human condition is staggering to the imagination.

The National Institute of Health ("NIH") has taken a conservative view of the limits of safety review required by those institutions receiving federal grant monies to experiment with DNA. In 1980, two hundred representatives from the scientific community called upon NIH to loosen the restriction on gene-splitting experiments conducted in the United States. The scientists expressed the growing agreement that DNA research carries with it fewer risks than had once been thought.

The central question that arises in relation to the current scientific advances is whether genetic engineering should be promoted and encouraged as a basic recognition of the freedom of scientific inquiry and right of privacy. Significant potential dangers are present in conjunction with the almost limitless opportunity for scientific advancement within the technology of recombinant DNA, commonly referred to as genetic engineering. The fear that the proverbial 'mad scientist,' working independently or with an enemy foreign power, could isolate and then proceed to duplicate a cancer organism and place it, possibly, in public water supplies, is not easily dismissed. Acts of thoughtless negligence in a laboratory could result in the 'escape' of a deadly microbe that in turn could give rise to a 'parade of horribles.' Chance occurrences are always inherent in any scientific intervention. When the chance of harmful accident is calculated, the primary consideration is whether the merit of the intervention justifies beginning or continuing the experiment.

Viewed as an instrument to revolutionize, genetic engineering limits the effect of natural selection and replaces it with programmed decision making. Programmed decision making serves to facilitate rather than impede rational thinking. Is it shameful to acknowledge that man has the capability to be in control of himself? The lack of control over the years has spawned a type of 'evolutionary wisdom' that resulted in the bubonic plague, smallpox, yellow fever, typhoid, diabetes, and cancer. Today, the

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104. Id.
105. Id. But see, Fields, Bizarre Circumstances Surround Chance Cloning of Banner Virus, CHRONICLE OF HIGHER EDUCATION, Aug. 25, 1980, at 1, col. 1 (in violation of federal guidelines that bar genetic copying, a researcher at the University of California at San Diego cloned a virus); Holtzman, Patenting Certain Forms of Life: A Moral Justification, HASTINGS CENTER REP., June 1979, at 9.
quest for maximum efficient use of biological and medical knowledge represents one of the tenets of the so-called evolutionary wisdom.\textsuperscript{108}

A number of post-Darwinians in the scientific community assert that there is no wisdom in evolution, only chance occurrence. Few, if any, would be willing to accept unconditionally all that nature bestows, particularly disease. Consequently, science finds itself in the position of trying to influence and, in many cases, control the process of evolution. Some even suggest that dangerous knowledge is never half as dangerous as dangerous ignorance.\textsuperscript{109}

Compelling state interest may alter the sanctity of creation and the fundamental right of privacy in procreation, which is an acknowledged basic or fundamental freedom.\textsuperscript{110} Is there a more compelling state interest than the desire to stop a 'chromosomal lottery' that saddles the economy each year with four million Americans born with diabetes or fifty thousand born with discernible genetic diseases?\textsuperscript{111} State interests in minimizing human suffering and maximizing the social good should be properly validated.\textsuperscript{112}

Opponents of unrestricted genetic research specifically attack its proponents as being both scientifically and socially irresponsible, and ultimate promoters of a serious environmental disaster.\textsuperscript{113} They suggest that nature has developed strong barriers against genetic interchanges between species and that extreme caution ought to be used during experimentation in this area.\textsuperscript{114} Others argue that mankind's genetic inheritance is its greatest and most indispensable treasure that must be protected and

\textsuperscript{108} Fletcher, \textit{Ethics and Recombinant DNA Research}, 51 S. Cal. L. Rev. 1131, 1139 (1978). Fletcher observes that there is nothing fundamentally unnatural or intrinsically wrong, or hazardous for the species, in the ambition that drives man to develop the technology to understand himself. It would, in fact, seem more offensive to fail to use and develop man's natural curiosity and talent for asking questions or worse to try to suppress it. “This is the greater danger of our species, to try to pretend that we are another kind of animal \ldots and that the human mind can rise above its ignorance by simply asserting that there are things it has no need to know.” Thomas, \textit{Notes of a Biology Watcher: The Hazards of Science}, 296 New Eng. J. Med. 211, 228 (1977).


\textsuperscript{112} See G. Smith, \textit{supra} note 39, at 2.


guaranteed at any cost. These opponents submit that the evolutionary wisdom of the ages must not be irreversibly threatened or abridged in order to satisfy the ambition and professional curiosity of some members of the scientific community.

Autonomy, self-determination, and a basic sense of freedom must be tempered by logic, objectivity, and a disinterested search for knowledge that may result in the minimizing of human suffering and maximizing of social good. But what is the social good in this question? It is suggested that the social good, within this context, could be equated with an economic policy that lessens the financial burden on citizens and supports and maintains genetically defective citizens. The wisest policy is one that promotes a good—social, economic or otherwise—for the greatest number. Thus, human need and well being shape the degree of positive good resulting from one policy as opposed to another. Alternatively, a determination could be made in order to structure what is right or wrong, good or evil, according to whether the consequences of an act or public policy add to or detract from the aggregate human well being.

Ultimately, the decision for or against a policy is going to be tied to development and maintenance of an a priori standard of ethics (when, in theory, a balancing occurred before the standard was set). The decision may also be tied to a situation ethic by which the consequences, pro and con, equities or inequities, of each proposed action will be carefully weighed, and a conclusion with an ethical posture or structure of a standard of modus operandi will be reached.

B. Encouraging Experimentation

Recognizing that a sustained level of progress for society would depend upon a continuing standard of technological evolution and individual technological contributions of exceptional merit and benefit, the Founding Fathers endeavored to codify this attitude within the United States Constitution. A structured system of checks and balances within the Constitution would promote both perspectives. The grant of limited monopolization as authorized by the Patent Clause could promote these truly exceptional contributions. The grant of limited monopolization, however, was intended to be consistent with the guarantees of the fifth and the fourteenth amendments, which recognize the right of all citizens to de-
velop their individual skills in pursuit of a trade or calling.\textsuperscript{120}

The recorded history of efforts to legitimize monopolies for patents of unworthy inventions is long. The United States Supreme Court has thwarted these efforts and has recognized and enforced the constitutional mandate to allow the unfettered growth and natural evolution of technology.\textsuperscript{121}

On June 16, 1980, by a five to four vote, the Supreme Court decided that new forms of laboratory life were eligible for patents.\textsuperscript{122} One may regard this decision as a ratification of some accomplishments of the 'biological revolution' that has allowed a broader understanding of life and promoted a greater ability to manipulate various forms. Both the majority opinion and the dissent, however, stressed that they addressed only the question of whether the current patent laws evinced a congressional intent to deny patents to those inventions determined to be alive.\textsuperscript{123} More particularly, the Court chose to tie itself to the United States Code section that provides: "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."\textsuperscript{124} Out of this statute emerged the issue of whether a manufactured microorganism constituted a manufacture or composition of matter within the meaning of the statute.\textsuperscript{125}

Dr. Ananda M. Chakrabarty, a General Electric Corporation microbiologist, engaged in research in which he succeeded in manufacturing a new microorganism not found in nature that is effective in breaking up oil spills. This genetically engineered strain of \textit{pseudomonas} is made by com-

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\textsuperscript{121} See \textit{Sakraida v. AgPro, Inc.}, 425 U.S. 273, 279 (1976); \textit{Graham v. John Deere Co.}, 383 U.S. 1, 5-6 (1966); \textit{Atlantic Works v. Brady}, 107 U.S. 192, 200 (1882). Interestingly, about 65-70\% of litigated patents are invalidated. T. \textsc{Beauchamp} \& L. \textsc{Walters}, \textit{supra} note 119.


\textsuperscript{123} Justice Brennan, writing in dissent, surveyed the Patent Act of 1793, as reenacted in 1952, the Plant Patent Act of 1920, and the Plant Variety Protection Act of 1970, and concluded that there existed a strong congressional limitation against patenting bacteria. "It is the role of Congress, not this Court, to broaden or narrow the reach of the patent laws. This is especially true where, as here, the composition sought to be patented uniquely implicates matters of public concern." \textit{Id.} at 322. For those who have followed Justice Brennan's judicial philosophy, this position, which called for judicial restraint, is most interesting and unusual. In the past, he has been the judicial activist and Chief Justice Burger the apostle of judicial restraint. In \textit{Chakrabarty}, the roles were reversed.

\textsuperscript{124} \textsc{35 U.S.C.} § 101 (1976).

\textsuperscript{125} 447 U.S. at 307.
\end{quote}
bining (or cross breeding) four strains of oil eating bacteria into one man-made scavenging microorganism that combines the beneficial properties of each of its four parent bacteria. Each of the four strains digests particular hydrocarbons in a mixture of oil and water, as found in petroleum spills. Useful by-products of water, carbon dioxide, and a bacterial protein that is nutritious to inhabitants of the ocean, remain. Dr. Chakrabarty demonstrated that this manufactured superstrain is much more efficient in digesting oil than a mixture of the four individual bacteria. Another advantage is that this microorganism, if it escaped, would not be able to thrive in gas tanks or in the oil fields of the earth and wreak uncontrolled environmental havoc on the ecosphere. Britain, following several European nations in recognizing both plants and animals as patentable, had already granted a patent for the Chakrabarty bacterium.

The patent application of Chakrabarty and General Electric was for a manufactured microorganism product not found in nature and a process of using the microorganism to digest oil spilled in water. The United States Patent Office rejected the product claim, but allowed a portion of the process claim. The rationale for rejection of the product claim was that a living organism, a naturally occurring product of nature, was not within the classes of subject matter which are patentable. The patent office reached this conclusion because there was no mention of this type class in the controlling statute or in the statute's legislative history. The Patent Office Board of Appeals upheld this decision, but the United States Court of Customs and Patent Appeals reversed, and the Patent and Trademark Office appealed to the Supreme Court.

In the past, the Patent Office has included living things within the statutory subject matter. For example, in 1873, the Patent Office issued United States Patent No. 141,072 to Louis Pasteur. Claim two of the patent application reads: "Yeast, free from organic germs of disease, as an article of manufacture." In other patents there are examples of claims granted for viruses and cultures.

128. 447 U.S. at 306.
129. Id.
Today, there are more than one hundred patent applications related to products of genetic engineering.\textsuperscript{133} \textit{Chakrabarty} sets the pace for a wide variety of new man-made organisms that can facilitate socially desirable processes such as growing wheat in arid lands, leeching ores to assist mining companies in reaching remote parts of the earth, and producing a ‘bug’ that will ferment corn starch or corn syrup into ethanol, an alcohol used in both whiskey and gasohol. There is also a patent application for a bacterium that metabolizes ethylene into ethylene glycol (antifreeze).\textsuperscript{134}

As noted previously, the major thrust of the Supreme Court’s decision in \textit{Chakrabarty} is tied to the interpretation of the term ‘manufacture’ as it appears in the federal patent code.\textsuperscript{135} Writing for the majority, Chief Justice Burger observed that Thomas Jefferson’s Patent Act of 1793 stressed its coverage to “any new and useful art, machine, manufacture, or composition of matter, or any new or useful improvement [thereof].”\textsuperscript{136} Chief Justice Burger defined manufacture as “the production of articles for use from raw materials or prepared materials by giving to these new materials new forms, qualities, properties, or combinations, whether by hand-labor or by machinery.”\textsuperscript{137} The Chief Justice cited approvingly precedent that defined composition of matter as including “all compositions of two or more substances . . . all composite articles, whether they be the results of chemical union, or of mechanical mixture, or whether they be gases, fluids, powders or solids,” and concluded that the Chakrabarty microorganism qualified as patentable subject matter.\textsuperscript{138} The claim is particularly forceful since it is for a product of human ingenuity that is non-natural in its occurrence.\textsuperscript{139}

In response to the argument that microorganisms cannot be patentable without express congressional authorization, the Chief Justice declared that Congress had already defined what was patentable subject matter in section 101 of the Act, and that it was for the courts to define that provision. Chief Justice Burger found no ambiguity in the statutory provisions and, stressing the broad constitutional and statutory goal of promoting “the Progress of Science and the useful Arts,” he adhered to his position

\textsuperscript{135} See Nelkin, \textit{Threats and Promises: Negotiating the Control of Research}, 107 \textit{Daedalus} 191 (1978).
\textsuperscript{136} \textit{Id.}
\textsuperscript{137} \textit{Id.}
\textsuperscript{138} \textit{Id.}
\textsuperscript{139} \textit{Id.} at 310. See generally Delgado & Miller, \textit{God, Galileo and Government: Toward Constitutional Protection for Scientific Inquiry}, in \textit{Ethical, Legal and Social Challenges to a Brave New World} 231 (G. Smith, II ed. 1982).
that the definition the Court gave to section 101 was consistent with the goals of the Act.\textsuperscript{140}

The Court declined to acknowledge the grave risks or the 'gruesome parade of horribles' that the Patent Office argued that the Court should weigh in deciding whether the Chakrabarty invention was patentable.\textsuperscript{141} The Court acknowledged that "genetic research and related technological developments may spread pollution and disease, that it may result in a loss of genetic diversity, and that its practices may tend to deprecate the value of life."\textsuperscript{142} The Court concluded, however, that neither the grant nor the denial of patents on microorganisms would end advancement in genetic research nor "deter the scientific mind from probing into the unknown any more than Canute could command the tides."\textsuperscript{143} The Court stated unequivocally that scientific arguments against advancements in this field are matters of high policy that the legislative process, which balances and places in proper perspective the various competing values and interests of all interested parties, should consider.\textsuperscript{144} The Chief Justice concluded that if the Court had misconstrued the provisions of section 101, all that Congress needed to do was to amend the statute to exclude from the protection of the patent laws organisms that genetic engineering produces.\textsuperscript{145}

Despite the Court's disclaimer that its action was purely constructive in nature, merely an interpretation of a statutory mandate, it did attempt to validate a new national policy. While invoking the Jeffersonian concept of ingenuity in patent creativeness, the Court came down four-square on a policy encouraging experimentation into the New Biology despite the possible risk to mankind. Thus, while disclaiming the application of a balancing test, the Court, in effect, performed one. The Court correctly decided that the utility of good that will flow from research and experimentation into the varied fields of the New Biology far outweighs the potential harm accruing as a consequence of this undertaking. This is an eminently fair and reasonable position.

C. A Further Innovative Application

In May, 1987 the United States Patent and Trademark Office announced that it "considers non-naturally occurring nonhuman multi-cellular living organisms, including animals, to be patentable subject mat-
ter."146 Although viewed by the Patent Office as but an effort to keep pace with the startling new advances in biotechnology, and thereby encourage innovation without determining the ethical implications, others, such as animal rights advocates, were concerned that animals were being considered as products and not sentient beings.147 Some also feared that the new policy would enable a select number of biotechnology companies to dominate the livestock industry. Domination by these companies would eliminate small independent breeders. The enforcement of this policy would eliminate genetic diversity among farm animals,148 because with patents the central issue becomes who either owns or is in control of breeding livestock.149

Theologians quarrelled with the Patent Office policy because it not only equated heavenly made creatures with manufactured goods of the market place, but took a giant step on the slippery slope that would lead to the patenting of genetically altered human beings and man’s full assumption of God-like powers. The clear specification of the policy that its application was only for ‘nonhuman life’ was of no assurance here.150

Informed members of the scientific community saw the Patent Office as merely continuing the reasonable exploitation of nature. As a director of Ohio University’s Animal Biotechnology Center in Athens, Ohio, said succinctly: “A pig is a pig, and a cow is a cow. You merely enhance certain aspects of it [sic].”151

It is expected that the near future of biotechnology will give rise to work in laboratories in the United States in which virus and bacteria genes will be transferred to plants in an effort to enable them to produce their own particular insecticides or fertilizers. After field testing, farmers will use these ‘transgenic’ plants in the place of conventional crop varieties.152 Further successful research that manipulates the primordial cells producing sperm and eggs will enable breeders to determine the sex and other preferred characteristics of their animals, and gene transplants from one species to another will be accomplished routinely.153

Already the Federal Department of Agriculture, operating from its research center in Beltsville, Maryland, has produced a brown or rust-colored transgenic pig that was bred with the growth hormone of a cow.

147. Id.
148. Id.
149. Id.
150. Id.
151. Id.
153. Id.
Engineered with the idea of achieving less fat, the pig has met this scientific purpose. Sadly, however, it also suffers from severe arthritis, has difficulty walking, and has crossed eyes as well. Against the efforts of the government, the Foundation of Economic Trends, a policy group opposing genetic engineering, together with the Humane Society, unsuccessfully maintained a legal action to halt the research that produced this particular boar's father. The essence of their claim was that research of this nature not only was cruel and violated animal dignities, but would also have very significant social and economic repercussions because the more expensive animals would, in turn, cause severe market dislocations in the farm economy.

As discussed previously, the Chakrabarty decision raised these and similar concerns over patenting life. Since no catastrophic events have followed in the aftermath of Chakrabarty, and none are expected from the United States Patent and Trademark Office's new policy, the ongoing debates over the long range effects of genetic engineering and its ethical constraints will be of little value in halting the momentum of scientific inquiry, experimentation, and advancement of biotechnology. As the director of the New York Hastings Center, an organization devoted to the continuing ethical study of the advances of the new biological technologies on society, stated, "It's very hard to sustain a great deal of worry about these things when, after 10 years of pretty constant interest and attention, there have been no untoward events."

IV. TOWARD A STANDARD OF REASONABLENESS

The Supreme Court's actions in Chakrabarty and the recent Patent and Trademark policy on the patentability of nonhuman life give private corporations the incentive to invest in further research in the fields of biochemistry, genetics, and eugenics. This incentive and the anticipated results satisfy the constitutional objective of early disclosure that, in turn, expands the public domain of knowledge in these fields. There can be little doubt that patentability of microorganisms and nonhuman life forms is 'Progress of the Useful Arts.'

Man's dehumanization and depersonalization will not be fostered as a
consequence of the continued quest for mastery of the genetic code. Attendant to the freedom to undertake research into the exciting and fertile frontiers of the New Biology is a coexistent responsibility to pursue the work in a reasonable, rational manner. Pursuing the New Biology in such a manner requires adequate attention to the safety factor in all aspects of the experimentation.\textsuperscript{160} The undesirable elements of a Brave New World can be tempered only when knowledge is pursued with the purpose of establishing the truth and integrity of the question, issue, or process.\textsuperscript{161} The vast potential for advancing society and ridding it of a verisimilitude of its present ills is an obvious good that we must pursue. Little sustained harm can result from a reasonable pursuit of truth and knowledge; indeed, truth and knowledge are the basic interstices in any balancing test. If actions are undertaken and performed with the goal of minimizing human suffering and maximizing the social good, then the noble integrity of evolution and genetic progress will be preserved.

There can be little quarrel with Dr. Stone's idea of social responsibility in scientific inquiry and investigation. I find myself, however, in respectful dissent to his concern regarding the dangers of research into the fields of the noncoital reproductive sciences. Indeed, so long as procreation continues to remain the central driving force in a marital relationship, and the family the very core of a progressive society, efforts will be undertaken to expand the period of fecundity and combat infertility. Genetic planning and eugenic programming are more rational and humane alternatives to population regulation than death by famine and war.

Man must endeavor, to be sure, to execute his investigatory and manipulative or creative powers within the scientific laboratory with a rational purpose and in a spirit of humanism. Then one should seek to minimize human suffering, thereby contributing to the social goal of allowing each member of society an equal opportunity to achieve their maximum output within the economic marketplace and to maintain personal integrity and seek spiritual tranquility. Man must use genetic engineering that contributes to the social good. There can be no real doubt that genetic manipulation provides a perilous opportunity that may either threaten freedom or enhance it, depending upon the balance struck between its use for individual need satisfaction and societal good.\textsuperscript{162}

\begin{thebibliography}{99}
\bibitem{162} See Kirby, \textit{Bioethical Decisions and Opportunity Costs}, 2 J. Contemp. Health L. \& Pol'y 7 (1986).
\end{thebibliography}
Restraining scientific inquiry, then, should be limited only to action taken to be *unreasonable*. Accordingly, an undertaking would be regarded as unreasonable when the long and short term costs of its effects would outweigh the enduring benefits that would derive from its study and implementation. Viewed as being not only an aid to the tragedy of infertility in family planning, but as a tool for enhancing the health of a nation’s citizens, vital scientific research must continue in the new reproductive technologies and in efforts to engineer man’s genetic weaknesses out of the line of inheritance. Healthier and genetically sound individuals have a much better opportunity for pursuing and achieving the ‘good life’ and in turn they make a significant contribution to society’s greater well being.