The Biotechnology Revolution and Its Regulatory Evolution

Part 2

by

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cies, but [would] operate solely in an advisory capacity.[288]

The BSCC would not have the supervisory powers or reviewing authority of the BSB but would instead coordinate interagency activities. Thus, the BSCC was to be a less powerful body than the BSB.

VI. Regulation Since 1986

Between 1984 and 1986 the EPA, the USDA, and the FDA also received comments on their proposed policies in the coordinated framework. With a few minor exceptions, no new relevant regulations were promulgated by the agencies during that time.

On June 26, 1986, the OSTP published the final version of the Coordinated Framework for Regulation of Biotechnology.[289] The final framework contained policy statements not only from the FDA, the EPA, and the USDA, but also from the OSHA, the NIH, and the newly established BSCC. The document included a substantial amount of new information not provided in the initial version. Of most significance were "two new USDA regulatory programs, additional elements of EPA's TSCA and FIFRA programs, and a controversial set of definitions issued by the BSCC."[290] The BSCC statement included definitions of two classes of organisms considered appropriate for regulation: pathogens and "intergeneric" organisms.[291] The definitions were adopted by the various regulatory agencies consistent with their authorizing legislation but were, and continue to be, controversial because they exempt certain organisms, considered to fall outside the definition of pathogens and intergeneric organisms, from any regulatory scrutiny.[292]

A. *EPA Regulation Since 1986*

In its 1986 policy statement, the EPA abandoned its 1984 "process-based" approach to regulating genetically engineered organisms under

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288. Note, *Rutabaga*, *supra* note 15, at 1542.

289. *Coordinated Framework for Regulation of Biotechnology*, 51 Fed. Reg. 23,302 (1986).

290. Novick, *supra* note 3, at § 18.03[7][a].

291. *Coordinated Framework for Regulation of Biotechnology*, 51 Fed. Reg. 23,306 (1986). Pathogens were defined as viruses or microorganisms that have the ability to cause disease in other living organisms. Intergeneric organisms were those deliberately formed to contain genetic material from source organisms in different genera. *Id.* at 23,307.

292. Exempt from the definition of pathogen are organisms belonging to "generally-recognized non-pathogenic strains of species commonly used for laboratory research or commercial purposes." Exempt from both the definition of pathogen and intergeneric organism are "engineered organisms that are created by the transfer from . . . source organisms of only well characterized, non-coding regulatory sequences such as origins of replication, ribosome binding sites, promoters, operators and terminators." Novick, *supra* note 3, at § 18.03[7][a]. Thus, exempt from the definitions are those organisms formed by "deletion or rearrangement of an organism's own genetic material, or by transfer to recipient organisms of genetic material from sources from within the same genera." *Id.*

FIFRA and established a two-level review system under which microbial pesticides that pose less risk to the environment receive an abbreviated review and may be field tested without an experimental use permit.[293] Specifically, under the two-tier review, if the pesticide is "intergeneric" and nonpathogenic, it need only comply with Level I reporting requirements. These requirements include submission of information regarding the identity of the organism, its natural habitat and environmental competitiveness, the methods used to genetically engineer the organism, and the proposed testing program.[294] If the EPA determines, from the information submitted, that the organisms may present a risk to human health or the environment, the applicant must apply for an EUP or comply with the more stringent Level II reporting requirements.[295] Level II requirements also apply to organisms that are intergeneric—*i.e.*, those containing genetic material from dissimilar source organisms—and those that are "pathogenic."

In its 1986 policy statement, the EPA also clarified the applicability of TSCA to genetically engineered organisms, stating that the law would not apply to genetically altered plants or animals nor to organisms that are foods, food additives, drugs, cosmetics, medical devices, or pesticides. In addition, the EPA took a new and different approach to the definition of "new chemical substance." The statement defined new chemical substances as those that "through deliberate human intervention contain genetic material from dissimilar source organisms."[296] Organisms are considered dissimilar "if they are from different genera."[297] However, organisms created by certain intergeneric combinations—those in which the "genetic material added to the recipient microorganisms consists only of well characterized, non-coding regulatory regions"—were exempted from PMN requirements.[298] The basis for this exclusion was that the resulting organisms "do not possess new combinations of traits but rather exhibit quantitative changes in preexisting traits."[299] Intrageneric and non-engineered microbes were considered naturally occurring.

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293. SUBCOMM. REPORT, *supra* note 14, at 12.

294. *Statement of Policy: Microbic Products Subject to the Federal Insecticide, Fungicide, Rodenticide Act and the Toxic Substances Control Act*, 51 Fed. Reg. 23,321 (1986).

295. The Level II requirements provide that an applicant must submit all the data required under Level I, plus information concerning the means by which the organism is to be contained at the test site and the means of controlling the organism if it escapes from the test site. *Id.* at 23,321-22.

296. *Id.* at 23,325.

297. *Id.*

298. This exclusion only applies if the producer of the microorganism can document "three elements: i) the exact nucleotide base sequences of the regulatory region and any inserted flanking nucleotides; ii) the regulatory region and any inserted flanking nucleotides do not code for protein, peptide, or functional RNA molecules; iii) the regulatory region solely controls the activity of other regions that code for protein or peptide molecules or act as recognition sites for the initiation of nucleic acid or protein synthesis." *Id.* at 23,332 (1986).

299. *Id.*

The 1986 policy statement also reiterated that the standard PMN form would not be applicable to microbial products. Instead, the applicant and the EPA would discuss the "level and types of information appropriate for the notice during pre-notice consultations."[300] Although the EPA is following a case-by-case approach to the specific information it will require in a PMN, the policy statement set forth the types of information the EPA expects to see in a PMN on a new microorganism. This includes identifying information—*e.g.*, taxonomy, source, reproductive cycle, and capacity for genetic transfer—methods used to manipulate source organisms genetically to obtain the resulting product and the special functions obtained, and risk assessment information. The risk assessment information should include production processes, workplace exposure, worker practices, provisions for containment, and releases. Additional information is required for small scale field tests, such as numbers of microorganisms and methods of application, site of application and surroundings, containment, mitigation measures and monitoring procedures, and data on "environmental fate and effects."[301]

Finally, the 1986 policy statement reconfirmed the EPA's earlier intent to: (1) eliminate the small quantity PMN exemption for research and development using genetically engineered microorganisms, (2) issue a SNUR for organisms falling outside of the PMN requirement that could pose a risk to public health or the environment—specifically for pathogens, and (3) impose additional reporting requirements under section 8(a) on companies that release microorganisms into the environment without review under the PMN or SNUR procedures. As of November 1989, however, the EPA had not promulgated rules implementing any of these policy objectives and continued to request that companies voluntarily comply with the EPA's policy guidelines in these areas.[302]

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300. *Id.* at 23,326.

301. In a "Points to Consider" document, the EPA stated that submitters of a PMN for such organisms should "describe the microorganism's growth characteristics in simulated environments; the environmental conditions that would affect survival; the physical or biological containment features present at the site; contact of engineered organisms with other populations; and possible undesirable effects." J. GIBBS, *supra* note 77, at 49. Information about the source organism and the method by which the organism has been altered would also be requested. In addition, the agency may request "data regarding the human health and environmental effects of release, *e.g.*, pathogenicity, and effects on competitors and prey." *Id.*

302. Karny, *Regulation of the Environmental Application of Biotechnology*, 7 BIOTECH. L. REP. 328, 342 (July-Aug. 1988). In May of 1988 the EPA distributed proposed rules addressing some of these issues for interagency review but as of November 1989 they had not been published for public review. Comments on the proposed rules reveal that they vary considerably from those contemplated by the EPA in its 1986 policy statement.

On the legislative front, Representative Fuqua introduced a bill in 1986 that would have amended TSCA to "prohibit the use of a genetically-engineered organism in commerce, manufacturing, or the environment without a permit." *See* J. GIBBS, *supra* note 77, at 57 (summarizing H.R. 4452, 99th Cong., 2d Sess. (1986)). The bill did not achieve significant progress in Congress and new legislation does not appear forthcoming. *Id.* Although it is not anticipated

In February 1987 the EPA's Office of Toxic Substances received the first PMN for a genetically engineered microorganism. Biotechnica International informed the EPA that it planned to field test a genetically altered bacterium for use in improving nitrogen fixation in alfalfa. In March 1988 the EPA approved the PMN, and in the summer of 1988 Biotechnica International began to conduct its field test in Pepin County, Wisconsin. As of May 1988 the EPA had received a total of sixteen PMNs for biotechnology products. These included twelve for testing of genetically engineered microorganisms in the environment and four for closed system uses. Four of those received for environmental testing and three of the four proposed for closed system testing were permitted to proceed with restrictions. All those reviewed required additional information. All four of those approved for environmental release agreed to proceed on the basis of a section 5(e) consent order. No application was denied.[303]

Realizing the need for some assistance in its review of biotechnology-derived substances under TSCA and FIFRA, in 1986 the EPA also stated that it was establishing a science advisory committee for biotechnology.[304] The committee's primary function would be to "provide peer review of specific product submissions under TSCA, FIFRA, and other EPA statutes and scientific oversight of the Agency's biotechnology programs."[305] The committee, formed in 1987, consists of ten independent scientists and members of the lay public. The committee first met in April 1987. It continues to meet on a regular basis to review biotechnology related proposals for agency approval.

Recently, the EPA has proposed to decentralize its review process concerning the release of genetically engineered organisms into the environment by creating "institutional-level environmental biosafety committees (EBCs) patterned after the IBCs created by the NIH Guidelines."[306] Such EBCs, rather than the EPA, would review field tests involving low-risk microorganisms.[307] The EPA is currently setting up model EBCs in certain areas of the country.

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that it will gain significant support, Representative Baucus of Montana has drafted the Novel and Exotic Organism Release Act. The Act, which was introduced in Congress in the fall of 1988, preempts APHIS and FIFRA regulation of environmental releases, placing all EPA responsibility for such regulation under the Toxic Substances Control Act. *See* Association of Biotechnology Companies, *Summary of Congressional Activities Impacting Biotechnology Industry*, 7 BIOTECH. L. REP. 244 (May-June 1988).

303. Statement of John A. Moore, Assistant Administrator for Pesticides and Toxic Substances, EPA, *Hearings before the Comm. on Science, Space and Technology, Subcomm. on Natural Resources, Agriculture and the Environment* (May 5, 1988).

304. *Statement of Policy: Microbic Products Subject to the Federal Insecticide, Fungicide, Rodenticide Act and the Toxic Substances Control Act*, 51 Fed. Reg. 23,318 (1986).

305. *Id.*

306. Karny, *Regulation of the Environmental Application of Biotechnology*, *supra* note 302, at 343.

307. *Id.*

B. *FDA Regulation Since 1986*

In its 1986 policy statement, the FDA maintained its position that no new regulations or administrative procedures were necessary to "deal with generic concerns about biotechnology."[308] However, the FDA did attempt to respond to some of the comments it received and to clarify its position on several issues. For example, the FDA received a number of comments regarding its general requirements for approving biotechnology products that were animal drugs, human foods, or food additives. In response, the FDA added a new section concerning its policies on human foods and food additives and clarified its policies with regard to animal drugs. In its new food section, the FDA suggests that a new food additive petition may not be necessary when a previously approved product covered by an existing food additive regulation is subsequently produced using R-DNA techniques. Although in general the FDA stated that new marketing applications will be required for most products manufactured using new biotechnology, in some instances "complete new applications may not be required" and "[a]s a general rule, the extent of testing required on a food product produced by biotechnology will depend upon many factors, including the novelty of the substances used to produce the food, the purity of the resulting product, and the estimated consumption of the product."[309] With respect to GRAS substances subsequently produced via biotechnology, however, the FDA clearly stated that a GRAS substance could lose its GRAS status "solely because it was produced or modified by new technology."[310]

The FDA also responded to the question of whether an original application for a biotechnology product identical to an approved animal drug would be necessary. The FDA responded that the "Center for Veterinary Medicine has determined that, when the new substance produced by biotechnology is identical or virtually identical to an approved substance produced by conventional technology, only a supplemental application is necessary" if the sponsor of the biotechnology product is also the sponsor of the conventionally produced product. In all other cases an original application is necessary.[311]

As regards new human drugs developed via biotechnology, the FDA's 1986 policy statement did little more than reiterate that in evaluating these drugs it would use the general process it adheres to in the regulation of all new drugs. Yet in other documents, called "Points to Consider" documents, the FDA has taken the position that new drug applications will be necessary for all R-DNA-derived products.[312] Although the FDA "has indicated that

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308. *FDA Policy Statement*, 51 Fed. Reg. 23,309 (1986).

309. *Id.* at 23,313.

310. *Id.*

311. *Id.* at 23,311.

312. *Points to Consider in the Production and Testing of New Drugs and Biologicals Produced by Recombinant DNA Technology*, 49 Fed. Reg. 1138 (1984) (revised and updated

the contents of these documents are not guidelines but represent something less developed and less certain than guidelines,"[313] their practical effect is to require companies to submit a complete new drug application on all R-DNA-derived drugs in virtually all cases. The FDA argues that the length of the NDA and the number of tests required can vary significantly and, in some cases, will in effect be comparable to an abbreviated submission.[314]

Since 1986 new questions regarding the regulation of biotechnology-derived foods and drugs have arisen. For example, the use of the "may render" and "ordinarily render" standards to regulate foods produced by biotechnology has come under scrutiny. At least one author has suggested that the agency consider using an approach similar to the one it uses for unavoidable contaminants. For such contaminants the FDA "has determined administratively what level of contamination renders a food adulterated based on a scientific evaluation of the health risks posed by the contaminant."[315] Such an approach makes sense, as the "question of whether a substance in food is added or naturally occurring *per se* is not as significant as whether it is present at levels that might be considered in some sense abnormal."[316]

Others have questioned how the FDA, under the adulteration provision, will be able to determine whether a genetically engineered food product constitutes a health risk.[317] The potential hazards of genetically engineered foods include the following: (1) the technique may introduce a new toxicant into the food; (2) it may increase the toxicant naturally present in insignificant quantities in the food; and (3) it may cause the food to lack certain valuable nutrients on which consumers rely.[318] Some have asserted that the FDA does not have good baseline toxicant data for many conventional foods and that, as a result of this data gap, the "FDA could have trouble establishing that a toxicant is new, is present in abnormally large quantities, or is possibly dangerous."[319]

Apr. 10, 1985); U.S. DEP'T OF HEALTH & HUMAN SERVS, FOOD & DRUG ADMIN., TALK PAPER (Pub. No. T83-2) (Jan. 7, 1983).

313. Note, *An Overview of FDA Regulation*, *supra* note 170, at 523.

314. Telephone interview with Dr. Henry Miller, Special Assistant to the FDA Commissioner for Biotechnology, in Rockville, Md. (July 7, 1988).

315. Jones, *Food Safety*, *supra* note 187, at 359.

316. *Id.*

317. In its 1986 policy statement, the FDA stated that when determining the safety of food produced by R-DNA techniques, the agency will take into consideration whether:

> 1. The cloned DNA as well as the vector used are properly identified; 2. The details of the construction of the production organism are available; 3. There is information documenting that the inserted DNA is well characterized and free from sequences that code for harmful products; and 4. The food produced is purified, characterized, and standardized.

FDA Policy Statement, 51 Fed. Reg. 23,313 (1986).

318. Comment, *Regulation of Genetically Engineered Foods Under the Federal Food, Drug, and Cosmetic Act*, *supra* note 170, at 911.

319. Gibbs & Kahan, *supra* note 184, at 18. A further problem involved in the use of the

Questions regarding the application of the misbranding provisions of FDCA to genetically engineered products have also been raised. Generally, a product is considered misbranded if "its labeling is false or misleading in any particular"[320] or if it is a food governed by a standard of identity[321] and it does not conform to the standard.[322] The labeling requirements for genetically engineered foods may present one of the most challenging regulatory issues for the FDA.[323] The problem lies in determining when an organism has been "altered sufficiently so that it can no longer accurately be identified by the same name as the species from which it derived the bulk of its genes."[324] For example, will a tomato less one tomato gene still be a tomato?

> As biotechnology advances, new tomatoes may not be anatomically or morphologically classifiable as new species, but may still differ from ordinary tomatoes in one or more essential attributes. Identifying the point(s) at which genetically modified products might need new or supplementary names to avoid misleading consumers has received little attention.[325]

Another potential problem is jurisdictional. According to one author, some aspects of gene transfer in animals may bear a resemblance to both animal drugs and food additives. Some gene products are capable of affecting both the functions of the food producing animal (the identifying characteristic of a drug) and the quality or nature of the resulting food product (the characteristic of a food additive). Because animal drugs are regulated by the FDA while food additives used in meats and poultry are regulated by the USDA, some mechanism will be required to determine which agency has primary regulatory authority in such cases.[326]

Another jurisdictional controversy involves the regulation of human gene therapy. The FDA "has stated that DNA used for human gene therapy trials will be considered a biological drug and subject to FDA requirements

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adulteration provision is that it focuses on the addition of substances to a food when an omission could also result in adulteration. Thus, a food that is produced via the deletion of a certain gene might be adulterated if, for example, the deletion resulted in a reduction in the nutritional value of the food. This was the case in a tomato that was developed to aid mechanical harvesting. The tomato had approximately fifteen percent less vitamin C than conventional tomatoes. *See id.* at 19. Whether a food product produced by gene deletion would be considered one with an "added substance" is open to debate. Because the process of gene deletion consists of removing and then reinserting a gene from the original food or plant, however, one could argue that it is actually an added substance.

320. 21 U.S.C. § 343(a)(1) (1982).

321. FDA has promulgated standards of identity which set forth the composition of certain food products. For example, a product cannot be called milk if it does not contain a certain percentage of fat.

322. *See* Gibbs & Kahan, *supra* note 184, at 15.

323. *Id.*

324. *Id.* at 20.

325. *Id.*

326. *See* Jones, *Food Safety*, *supra* note 187, at 353-54.

even if [also] reviewed by the NIH's RAC."[327] According to one author, "[t]his may cause an overlap of jurisdiction between the FDA and the NIH, and a power struggle over which agency will regulate human gene therapy."[328] In most cases, however, the issue will probably depend on whether the reviewee is an industry or an NIH grantee.

C. *USDA Regulation Since 1986*

Until 1986 the USDA steadfastly maintained that its existing regulatory framework, combined with the NIH *Guidelines*, was "adequate and appropriate for regulating research, development, testing and evaluation, production and application" of biotechnology products.[329] This position evoked significant criticism on the part of the public and Congress.[330] In addition, the General Accounting Office issued a study which strongly criticized the USDA's regulatory system for biotechnology.[331] As a result, in 1986 the USDA issued a policy statement detailing two new regulatory programs for bioengineered organisms. One program would regulate such organisms under the Plant Pest Act. The other would cover organisms used in research.[332]

Under the jurisdiction of the Plant Pest Act, the USDA proposed Regulations on the Introduction of Organisms and Products Altered or Produced Through Genetic Engineering Which Are Plant Pests or Which There Is Reason to Believe are Plant Pests.[333] The regulations, adopted in June 1987, allow APHIS to regulate an organism under the Act if there is *reason to believe* that it is a plant pest.[334] The regulations thus significantly stretch the statutory "can injure" test. The USDA believes the "reason to believe" standard "is necessary to regulate genetically engineered organisms where the plant pest status is unknown because traits conferred by genetic engineering may be new to the organism or to the environment into which it is released."[335] Industry and environmental group representatives have criticized the new definition as overly broad.[336] According to one source, this

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327. Jaffe, *Inadequacies in the Federal Regulation of Biotechnology*, 11 HARV. ENVTL. L. REV. 491, 518 (1987).

328. Culliton, *New Biotech Review Board Planned*, 229 SCIENCE 736-37 (1985).

329. *See Statement of Policy for Regulations, Biotechnology Processes and Products*, 49 Fed. Reg. 50,898 (1984).

330. *See* Fogleman, *supra* note 42, at 246.

331. The study considered the USDA's regulatory procedures poorly coordinated and confusing, particularly those concerning direct release experiments, and the agency's emphasis on biotechnology's benefits lacking in sensitivity to potential risks. The study noted that continuing battles with the EPA over regulation were also a cause for concern. *Id.*

332. Novick, *supra* note 3, at § 18.03[7][d].

333. *Coordinated Framework for Regulation of Biotechnology*, 51 Fed. Reg. 23,352 (1986).

334. *See* 52 Fed. Reg. 22,892 (1987).

335. J. GIBBS, *supra* note 77, at 96.

336. *Id.*

effort to regulate genetically engineered organisms under the Plant Pest Act "is a bold attempt to fashion a biotechnology regulatory program from the elements of a statute clearly intended for other purposes," and the expansion of the definition of "plant pest" to include organisms that have not manifested themselves as plant pests is an interpretation that "severely strains the jurisdictional limits of the . . . Act."[337]

In order to strengthen its regulatory capability under the FPPA, APHIS also established the Biotechnology Environmental Coordination Staff (BECS). The BECS is intended to ensure that an environmental assessment is prepared prior to the issuance of a plant pest permit for the deliberate release of a biotechnology derived plant pest. This effort has been criticized by the regulated community, which sees the requirement as duplicative of the review of deliberate release experiments involving R-DNA conducted historically by the ARRC and more recently by the Agricultural Biotechnology Research Advisory Committee (ABRAC).

Also in 1986 VSTA was amended by the Food Security Act[338] to allow the USDA to regulate products which are shipped intrastate or imported, and to regulate the exportation of animal biologics.[339] The 1986 policy statement included a brief discussion about proposed regulations implementing the provisions of the amendments. As Gibbs pointed out, the amendments will have "significant implications for the field testing of new animal biologics, since field testing often involves only *intrastate* shipment."[340] Furthermore, Gibbs noted that the amendments would prevent manufacturers of animal biologics from avoiding the restrictions of VSTA by exporting their products for testing abroad. Theoretically, at least, manufacturers who attempted to conduct field tests of their domestically produced animal biologics abroad would be subject to VSTA.

In 1986 APHIS awarded the first license to produce and sell a genetically engineered vaccine to Biologics Corporation. The vaccine, called Omnivac, was to combat a pseudorabies virus. The review process under VSTA, however, was fraught with problems. Initially, APHIS did not classify the product as derived from R-DNA technology and reviewed the product as if it were a conventionally derived vaccine. Subsequently, the vaccine was reclassified as recombinant and additional tests specific to R-DNA-derived organisms were required.[341]

The Omnivac case also raised the question of whether compliance with the NIH *Guidelines* would be a prerequisite to receipt of a license under VSTA. Although APHIS did not require compliance with the *Guidelines* nor preparation of an EA or EIS prior to issuing the license, subsequent

337. Novick, *supra* note 3, at § 18.03[7][d].
338. 21 U.S.C. § 154a (Supp. IV 1986).
339. J. GIBBS, *supra* note 77, at 91.
340. *Id.*
341. *Id.* at 92.

criticisms led the agency to suspend the license while it prepared a formal EA. The major issue in the environmental review was whether the testing of the vaccine would result in a "release" into the environment. The agency concluded that it would not and found that its action in licensing the vaccine "would not have a significant impact on the environment."[342] Shortly thereafter, APHIS lifted its suspension of the license and Biologics Corporation was permitted to proceed with the sale and marketing of Omnivac.

D. *The USDA Research Program*

The new regulatory program for research activities set forth in the 1986 policy statement consisted of several components. These included the establishment of the Agriculture Biotechnology Research Advisory Committee (ABRAC) and of two new biotechnology offices: the Office of Agriculture Biotechnology (OAB) and the Committee on Biotechnology in Agriculture (CBA).[343]

The ABRAC was modeled after NIH's RAC and was to take the place of the existing ARRC. As initially envisioned it was to oversee "research projects on genetically engineered agricultural organisms and the evaluation of the adequacy of draft environmental assessments for these research projects."[344] More recently, however, a charter for the ABRAC was drafted which significantly expanded the committee's tasks. In addition to its initial function, the committee will also be responsible for "recommending additions and alterations to research guidelines and protocols as necessary; providing advice to other federal and state agencies on agriculture related research projects; and providing information to and maintaining cognizance of the Institutional Biosafety Committee to assure the availability of essential personnel to carry out oversight of agricultural related biotechnology functions."[345]

The OAB was established to "coordinate oversight over all facets of agricultural biotechnology" within the USDA,[346] while the CBA was established to serve as a link between the research and regulatory agencies within the USDA and to provide the agencies with advice on biotechnology issues and policy matters.[347] The roles of the two offices vis-a-vis one another have

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342. *Id.* at 93.

343. In-house biotechnology research is primarily conducted by the Agricultural Research Service (ARS) and grants for external biotechnology research are administered by the Cooperative State Research Service (CSRS) and the Office of Grants and Program Systems. Each of these services reports to the Assistant Secretary for Science and Education, who is responsible "for coordination and oversight of all matters relating to research in biotechnology" within the USDA. J. GIBBS, *supra* note 77, at 81-82.

344. *Id.* at 83.

345. *See* ABRAC Charter, USDA Dept. Reg. 1042-87 (Mar. 29, 1988).

346. J. GIBBS, *supra* note 77, at 83.

347. *Id.* at 85.

not been clearly set forth in writing. According to one source, however, the CBA is a policy-making body, while the OAB is responsible for implementing and coordinating the "policies established by the CBA and by agencies within the Department."[348]

In addition to the establishment of these new offices in 1986, the USDA stated its intent to issue its own set of guidelines for biotechnology research involving agricultural products under the authority of the Food Security Act.[349] The guidelines are being modeled after NIH's *Guidelines*, but also include containment provisions for non-microscopic animals.[350] As initially envisioned, the scope of the guidelines was to be somewhat broader than those of NIH, extending to "agricultural research on plants, animals, and microorgansims, and provid[ing] guidance for laboratory research and field testing of organisms derived from recombinant DNA, specific molecular gene vectors, cell fusion, or other nonclassical genetic manipulation of organisms conducted at the cellular or molecular level."[351] A more recent version of the guidelines, however, limits their application to research outside the laboratory. Like the NIH *Guidelines*, the USDA guidelines will not be binding on private industry and will only apply to USDA in-house research and USDA-funded research.[352]

Thus far, the USDA's new regulatory programs have not functioned as well as the regulated community hoped that they would. For example, the OAB has been only partially successful in coordinating oversight of USDA biotechnology activities. Although the OAB has been able to oversee the review of requests for research and deliberate release approvals, its ability to oversee requests for licenses, permits, or approvals for products falling under the jurisdiction of USDA agencies has been undermined by agencies such as APHIS that have established their own internal office for coordinating the regulation of biotechnology products. As a result, if a manufacturer seeks approval of both APHIS and ABRAC, a dual submission may be nec-

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348. *Id.*

349. The Food Security Act, 7 U.S.C. § 3121 (1988), amended the National Agricultural Research, Extension, and Teaching Policy Act and gave the Secretary of Agriculture the authority to establish "appropriate controls with respect to the development and use of the application of *biotechnology* to agriculture." *Id.* (emphasis added). This was the first and is the only federal statute to expressly mention biotechnology. The language of the statute would appear to give the agency broad authority to regulate biotechnology activities in the agricultural area and even to create a new regulatory structure. The agency, however, has not yet made full use of the significant regulatory potential of the statute.

350. J. GIBBS, *supra* note 77, at 86.

351. *Id.*

352. In its 1986 policy statement, the USDA also proposed the establishment of the National Biological Impact Assessment Program (NBIAP). Under the program the ABRAC will utilize scientists affiliated with state and federal agricultural research centers in its own review process. Where ABRAC review "is required by the USDA Guidelines, the ABRAC will request a scientific review from the NBIAP system before making its decision." *Id.*

essary, thus defeating the purpose of a coordinated review.[353]

E. *The OSHA Statement*

In a notice published in the April 12, 1985, Federal Register, OSHA (the agency) said that "it would consider promulgating specific regulations (aimed at protecting individuals who work in biotechnology research institutions or manufacturing plants) in the event that new biotechnology processes presented a significant hazard that could not be accommodated under present standards."[354] At the time, however, the agency did not believe such regulations were necessary. In 1986 the agency reiterated its earlier position that "no additional regulation of biotechnology workplaces is . . . needed because no hazards from biotechnology *per se* have been identified."[355]

F. *The NIH Statement*

In its 1986 policy statement, the NIH stated its intention to continue to revise and oversee its *Guidelines* "and to continue the NIH Recombinant DNA Advisory Committee (RAC) and the NIH Office of [R-DNA] Activities (ORDA)." In February 1987 the RAC adopted a proposal eliminating the NIH notification requirement for R-DNA experiments reviewed and approved by another federal agency.[356] Because many deliberate release experiments now require review either by the EPA or the USDA, the RAC currently reviews very few deliberate release proposals. Today, the RAC spends much of its time debating definitional issues, such as the meanings of "deliberate release" and "recombinant DNA," and making revisions to the *Guidelines*. In June 1988 the RAC considered proposed amendments to the *Guidelines* to cover certain transgenic animals that do not contain R-DNA and therefore were not covered under the *Guidelines*.[357] The RAC is also devoting its time to the development of public information documents regarding human gene therapy.

VII. Biotechnology and the Courts

While the federal agencies were formulating their policies regarding the regulation of biotechnology activities, the federal courts had several opportunities to comment upon and influence this policy development. Most of the judicial activity in this area has been under the rubric of NEPA. How-

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353. *See* J. Gibbs, *supra* note 77, at 84 for an expanded discusson of this problem.

354. Isakoff, *supra* note 42, at 25. *See also* 50 Fed. Reg. 14,483 (1985).

355. *Agency Guidelines on Biotechnology*, 51 Fed. Reg. 23,348 (1986) (emphasis added).

356. *See Recombinant DNA Research: Actions Under Guidelines*, 51 Fed. Reg. 45,650-51 (1986); *Recombinant DNA Research: Actions Under Guidelines*, 52 Fed. Reg. 31,848-50 (1987).

357. *Recombinant DNA Research: Proposed Action Under Guidelines*, 53 Fed. Reg. 12,752 (1988).

ever, a few other statutes have also been utilized to challenge federal agency action regarding biotechnology. In 1983 NEPA was used for the first time by the Foundation on Economic Trends, a public interest group headed by Jeremy Rifkin, to halt R-DNA field testing. The foundation sued the NIH for its failure to comply with NEPA when it amended its *Guidelines* in 1978 and when it approved several deliberate release experiments.[358] Specifically, the foundation asserted that the NIH should have prepared: (1) an EIS when it modified its *Guidelines* in 1978 to allow the deliberate release of genetically altered organisms into the environment on a case-by-case basis;[359] (2) a "programmatic" EIS in 1982 "when NIH began to generally review and approve deliberate release experiments";[360] and (3) an EA or an EIS when it approved a deliberate release experiment involving the application of genetically altered bacteria to a crop of potatoes to help make them frost resistant (the "ice minus" bacteria).

In 1984 the United States District Court for the District of Columbia preliminarily enjoined both experiments approved by the NIH and all future deliberate release experimentation until a final judgment on the merits of the alleged NEPA violations could be reached.[361]

On appeal the United States Court of Appeals for the District of Columbia Circuit upheld the injunction against the ice minus experiment, "but vacated the injunction against future NIH approval of any other deliberate releases as overly broad."[362] In upholding the injunction of the ice minus experiment, "the District of Columbia Circuit found the NIH's review of the possible environmental consequences of the experiment insufficient to satisfy the requirements of NEPA"[363] and severely criticized the NIH for "not having fully considered the environmental impact of possible dissemination of the ice-minus bacteria."[364]

NEPA has continued to be used, primarily by the Foundation on Economic Trends, as a vehicle to halt and delay biotechnology activities. In

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358. Foundation on Economic Trends v. Heckler, 756 F.2d 143 (D.C. Cir. 1985).

359. NIH had prepared an EA for the amendment but determined that the action would not pose a significant environmental impact and therefore preparation of an EIS was not necessary.

360. Note, *Foundation on Economic Trends v. Heckler: Genetic Engineering and NEPA's EIS Requirement*, 2 PACE ENVTL. L. REV. 138, 139 (1984) [hereinafter Note, *Foundation on Economic Trends v. Heckler*].

361. *Id.* at 144.

362. Note, *Rutabaga*, *supra* note 15, at 1539.

363. *Id.*

364. *See* J. GIBBS, *supra* note 77, at 142. As a result of the decision of the court of appeals, the NIH prepared a very detailed EA for the ice-minus experiment. Although notice of the availability of the EA was published by the NIH in the Federal Register, only fifteen comments were received, and only one comment, from the Foundation on Economic Trends, was negative. The NIH rejected the points made by the foundation and determined that the EA was adequate and that the preparation of an EIS was not necessary. *Id.*

spite of its success in *Heckler*, however, with the exception of a few cases,[365] the foundation has been unsuccessful in the other anti-biotechnology cases which it has brought. In *Foundation on Economic Trends v. Block*,[366] the foundation brought suit against the USDA claiming that an EIS should have been prepared prior to the agency's use of R-DNA techniques to exchange genetic material between species in order to enhance animal productivity.[367] The court determined that the USDA's animal research activities did not constitute a "major federal action" under NEPA and therefore neither an EIS nor an EA was required. Furthermore, the court concluded that, because the animals in the experiments were contained in a locked and guarded barn, there could be no significant environmental impact.[368]

The foundation also filed suit against the USDA, claiming that its approval of the Omnivac pseudorabies vaccine had violated the Virus-Serum-Toxin Act (VSTA) and NEPA.[369] The district court granted summary judgment in favor of the USDA. With respect to the NEPA claim, the court upheld the USDA review of the environmental issues and deferred to the agency's expertise. Specifically, the opinion states that "the Court is not in the same position as the agency in its review of the scientific data submitted, and cannot replace the agency's judgment with its own."[370] With respect to the VSTA claim, the court also found for the defendants holding that the plaintiffs lacked standing to challenge the issuance of the license under VSTA.

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365. *See, e.g.*, Foundation on Economic Trends v. Weinberger, 610 F. Supp. 829 (D.D.C. 1985). In *Weinberger* the foundation alleged that the Department of Defense intended to utilize a new facility in Dugway, Utah, to conduct R-DNA research related to biological warfare, and that an EIS was therefore needed. The Army denied that any work with pathogens was planned. Although the court ruled that "mere contemplation" of a future action did not trigger NEPA's requirements, the court found that NEPA had been violated for another reason: the EA that had been prepared was totally inadequate. *See* J. GIBBS, *supra* note 77, at 143. The court prohibited any further construction of the facility until an adequate EA had been completed. Subsequently, the Army "made a policy decision to prepare an EIS." *Id. See also* Foundation on Economic Trends v. Weinberger, No. 86-2436 (D.D.C., stipulation of dismissal filed 1987). In this case the plaintiff alleged that the Biological Defense Research Program of the Department of Defense was in violation of NEPA for failure to prepare an EIS. Prior to a court decision, the suit was settled. The Department of Defense agreed both to prepare an EIS and to conduct all activities under the program in compliance with the NIH *Guidelines*. J. GIBBS, *supra* note 77, at 144.

366. Foundation on Economic Trends v. Block, No. 84-3045, slip op. (D.D.C. April 29, 1986) (Memorandum Opinion).

367. The experiments involved the insertion of human growth hormone in pigs to make them larger and leaner. On similar grounds the foundation petitioned the Food and Drug Administration to prepare an EIS before approving bovine growth hormone, an R-DNA derived animal drug which increases animal size and productivity. The FDA rejected the petition. *See* J. GIBBS, *supra* note 77, at 144.

368. *Id.* at 88.

369. Foundation on Economic Trends v. Lyng, 680 F. Supp. 10 (D.D.C. 1988).

370. *Id.* at 16.

The foundation was also unsuccessful in *Foundation on Economic Trends v. Johnson.*[371] In that case the foundation brought suit alleging, first, that the definitions and exemptions proposed by the BSCC in the 1986 coordinated framework were "procedurally deficient because they appeared for the first time in the final framework and thus lacked notice and comment,"[372] and second, that "the environmental risk posed by the Framework was so substantial that an environmental impact statement was required prior to its implementation."[373] In December 1986 the federal district court dismissed the case for lack of a case or controversy and on the grounds that the plaintiffs lacked standing because they had no more than a " 'hypothetical interest' in the outcome of the litigation."[374] According to Gibbs,

> this decision may hamper lawsuits under NEPA resting on highly speculative allegations that agency action involving a specific biotechnology-derived product may cause environmental harm. Disagreement with the government's policy will not be enough. Future complaints will need to allege a more concrete causal link between the government's conduct and the asserted injury.[375]

In spite of these more recent decisions, *Heckler* made it clear to federal agencies that NEPA is not a statute to be ignored in preparing biotechnology regulations or approving biotechnology experiments.[376]

At least one author has questioned the appropriateness of applying NEPA to R-DNA research. According to Fogleman, NEPA was enacted to ensure full decision-making on the impact of technology on the environment, not on the conduct of scientific research.[377] She argues that at the scientific experimentation stage, "there are no guarantees that an approved experiment will even succeed, much less that it will evolve into a new technology that significantly affects the environment."[378] The court in *Heckler* disagreed with Fogleman's view, but just how far the courts will go in applying NEPA to scientific research remains to be seen.

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371. Foundation on Economic Trends v. Johnson, 661 F. Supp. 107 (D.D.C. 1986).

372. Novick, *supra* note 3, at § 18.03[7][a].

373. Foundation on Economic Trends v. Johnson, 661 F. Supp. at 108.

374. J. GIBBS, *supra* note 77, at 144.

375. *Id.* at 145. The suit, however, has not hampered the foundation's litigiousness. In December 1987 the foundation sued the NIH claiming that it violated NEPA by funding certain AIDS and cancer research projects. The case is still pending. Foundation on Economic Trends v. Bowen, No. 87-3393, slip op. (D.D.C. Dec. 28, 1987).

376. For a more detailed discussion of the Heckler case and application of NEPA to R-DNA research see McChesney & Adler, *supra* note 42, at 10371-73; Note, *Foundation on Economic Trends v. Heckler*, *supra* note 360, at 139; Comment, *Regulating the Environmental Release of Genetically Engineered Organisms: Foundation on Economic Trends v. Heckler*, 12 FLA. ST. U. L. REV. 891 (1985); Korwek & de la Cruz, *supra* note 42, at 316-28.

377. Gibbs also points out that there has been a "long-held belief by those in the research community that basic research is exempt from NEPA requirements." J. GIBBS, *supra* note 77, at 87.

378. Fogleman, *supra* note 42, at 218-19.

The foundation has also filed suit under FIFRA. In May of 1986 the foundation petitioned the EPA, seeking to force the agency to promulgate regulations under FIFRA establishing "minimum financial responsibility standards" for applicants for experimental use permits for microbial pesticides. The foundation stated that the risks posed by the release of genetically engineered pesticides "although still unquantified, are of potentially devastating proportions" and that financial responsibility standards are necessary because the EPA "currently does not have an adequate program for assessing, controlling, and assuring remedial actions and accountability for the environmental risks presented by the deliberate releases of recombinant organisms."[379] The EPA denied the petition on the grounds that it did not have the authority to issue such a regulation. The foundation then brought suit against the EPA, challenging its denial and seeking a court order requiring the agency to promulgate financial responsibility standards.[380] The Federal District Court for the District of Columbia denied the request for the order on the grounds that the foundation did not have standing to bring the suit. The merits of the issue were not addressed.

VIII. Regulation at the State and Local Level

The early vacuum in biotechnology regulation, and continued concerns about gaps in the federal regulatory system, have caused several state and local governments to enact ordinances and statutes regulating biotechnology research and commercialization within their borders. Between 1977 and 1982 approximately one dozen local governments passed such laws. One of the first localities to act was Cambridge, Massachusetts. In the summer of 1976, the Cambridge City Council imposed a three-week moratorium on all R-DNA research and began to draft an ordinance to regulate all DNA experimentation in the city.[381] The moratorium was targeted at research being conducted at Harvard and MIT.[382]

In February 1977, the city council passed the ordinance making the NIH *Guidelines* for government-sponsored research applicable to any projects conducted in the city.[383] The ordinance also imposed additional safety requirements and banned deliberate releases of genetically altered organisms as well as "BL4" experiments, "those involving dangerous or contagious organisms."[384]

Following the example of Cambridge, a number of other localities passed ordinances regulating R-DNA research: Princeton, New Jersey; Am-

379. Foundation on Economic Trends v. Thomas, 661 F. Supp. 713, 715 (D.D.C. 1986).

380. *Id.* at 714.

381. Rosenblatt, *The Regulation of Recombinant DNA Research: The Alternative of Local Control*, 10 Envtl. Aff. L. Rev. 37, 67 (1982).

382. *Id.* Harvard was planning to build a P3 lab for R-DNA experiments.

383. Huber, *Biotechnology and the Regulation Hydra*, Tech. Rev. 1957 (Nov.-Dec. 1987).

384. *Id.*

herst, Massachusetts; Waltham, Massachusetts; Berkeley, California; Emeryville, California; and Newton, Somerville, and Boston, Massachusetts.[385] For the most part these ordinances adopted the NIH *Guidelines* with a few modifications. Often, a license or permit was required to conduct R-DNA research. The ordinance adopted by Waltham, Massachusetts, was unique in that it was the only ordinance to restrict the use of R-DNA for other than biosafety reasons.[386] In addition to requiring adherence to the NIH *Guidelines*, the Waltham ordinance prohibited the use of humans as experimental subjects. According to Krimsky, the ban "resulted from concern of one member of the [city] Council that the cloning of people might be considered in the future."[387]

During the late 1970s two states—New York and Maryland—also enacted legislation regulating biotechnology. Both statutes made compliance with the NIH *Guidelines* mandatory for all research, public and private, conducted within the state. The Maryland statute was enacted in 1977 with a five-year sunset clause. Thus, the statute expired in 1982. No subsequent legislation has been enacted.

Between 1982 and 1985 there was little activity on the local level regarding R-DNA regulation.[388] With the move of R-DNA research from the laboratory to the field, however, communities targeted for deliberate releases took action to delay or prohibit the field tests. For example, in 1985 county officials in Monterey, California blocked experiments by Advanced Genetic Sciences to test its frost-suppressant bacteria,[389] and in June 1986 the Board of Supervisors of Modoc County, California, passed a resolution requesting that the University of California and Dr. Steven Lindow delay their research with ice minus bacteria in Tule Lake, California.[390] Also in 1986 city officials in St. Charles, Missouri, passed a resolution opposing efforts by Monsanto Corporation to test a microbial pesticide in a neighboring county.[391] More recently, two townships in New Jersey passed ordinances placing strict regulations on any outdoor testing of genetically engineered

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385. *See* S. KRIMSKY, A. BAECK & J. BOLDUC, MUNICIPAL AND STATE RECOMBINANT DNA LAWS: HISTORY AND ASSESSMENT (1982).

386. *Id.* at 26.

387. *Id.*

388. One exception was the passage by the California legislature of a resolution "to promote the biotechnology industry, while at the same time protecting public health and safety and the environment." Assembly Concurrent Res. 170. In response to the resolution a special interagency task force was established to evaluate the adequacy of federal and state regulation and to coordinate the development of state policies in this area. *See* J. GIBBS, *supra* note 77, at 169. In 1982 the California legislature passed the California R-DNA Safety Act, requiring that any research conducted under the auspices of a California state agency comply with the NIH *Guidelines*. The bill never became law, however, as it was vetoed by the governor.

389. Huber, *supra* note 383, at 60.

390. *See* J. GIBBS, *supra* note 77, at 161. The Modoc County resolution was not legally binding, however, as the local government did not have jurisdiction over the research site.

391. *Id.* at 162.

organisms within their boundaries.[392]

New Jersey is one of a handful of states that has considered legislation aimed at deliberate releases. Specifically, New Jersey has debated the establishment of a commission on the release of genetically engineered microorganisms which would monitor compliance with federal regulations and review the adequacy of existing state law.[393] A bill that would create such a commission passed the New Jersey Senate in 1986, but did not reach the floor of the State Assembly.[394] The Texas legislature has considered legislation similar to that proposed in New Jersey but has not taken any action on it. California has also considered a number of bills on this topic, but so far "the state legislature and a special task force have concluded that the existing matrix of environmental regulation suffices."[395]

The Wisconsin legislature recently passed a bill that requires companies and university researchers to notify a state agency of their plans for any deliberate release experiments and to submit to the state copies of all documents submitted to federal government agencies relating to the release. The bill was motivated by the release by Biotechnica International in Pepin County, Wisconsin, of three different genetically engineered varieties of *Rhizobium meliloti*, a bacterium intended to improve nitrogen fixation in alfalfa.

IX. The Regulatory Balance

As a recent GAO report pointed out, government regulators appear to be following a "step-by-step" approach to the regulation of biotechnology. These steps have paralleled the progression of the technology as it has moved from the laboratory to the field for testing. At each step regulators have started out with a cautious approach and fairly stringent standards. Then, as experience is gained, the rules are relaxed.

The first step in the regulation of biotechnology consisted of rules governing laboratory experimentation—the NIH *Guidelines*. Initially, these *Guidelines* called for very stringent review and containment procedures to be applied to work with R-DNA organisms in the laboratory. They prohibited any sort of deliberate release experiments. Not until the RAC was con-

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392. The New Jersey ordinances, passed by Estelle Manor and Shamong Townships, are virtually identical, and require any firm that wishes to conduct a deliberate release experiment within the towns to carry $5 million in liability insurance, prove the organism's safety to the town council, hold a public hearing, post a bond, obtain a permit, and agree to suspend any experiment if the township deems it unsafe. *See* Gladwell, *Towns Restricting Tests of Altered Organisms*, The Washington Post, Mar. 20, 1988, at H5, col. 1. The ordinances were not a response to any particular deliberate release proposal, but rather a response to a model town ordinance distributed by State Senator John Dorsey, who is also attempting to push a bill through the New Jersey legislature regulating deliberate releases on a state level. *Id.*

393. J. Gibbs, *supra* note 77, at 170.

394. *See id.*

395. *Id.* at 169. *See* discussion of California legislative activity, *supra* note 388.

vinced that laboratory experiments with these organisms did not pose a risk to workers or the general public were the *Guidelines* relaxed. As more experience was gained, the *Guidelines* reduced the review requirements and permitted deliberate release experiments on a case-by-case basis. Similarly, at the local level a number of ordinances restricting R-DNA research were passed at the early stages of the technology's development. This was followed by a period of inactivity as more experience was gained with R-DNA in the laboratory and no significant adverse consequences came to light.

Recently we have moved to the second step of the regulation of biotechnology. In the environmental and agricultural area, this second step consists of regulations governing small-scale deliberate release experiments. In this phase regulators started out cautiously, requiring significantly more data when reviewing these products than when reviewing other conventionally produced products and taking a case-by-case approach, rather than a categorical approach, to their review. Thus, data requirements and controls have been individually determined based on the potential risks of the activity. Similarly, communities have become active again in attempting to regulate or prevent deliberate release experiments in their back yards.

In the food and drug area, biotechnology has also moved out of the laboratory and into clinical trials and marketing. Additionally, clinical trials have moved from using microorganisms to using animals for the production of new drugs and foods. In this area the FDA and the USDA have also taken a cautious case-by-case approach to reviewing and regulating biotechnology-derived products.

More recently, however, the agencies have begun to relax their stringent standards ever so slightly. The USDA and the EPA, for example, have moved toward a modified categorical approach to regulating deliberate release experiments, setting levels of review on the basis of the biological features of the source organisms from which the genetically engineered organisms were made. The move, however, has been both applauded and criticized. Scientists and industry representatives have been highly critical of the government's case-by-case regulatory approach, arguing that it is overly burdensome and that it requires too much unnecessary information, especially in light of the benefits of the technology. The result, it is argued, may be "higher costs to the manufacturer and delays in bringing products to market."[396]

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396. GAO REPORT, *supra* note 5, at 37. As evidence of what some would describe as a ridiculously overcautious approach to the regulation of the release of a genetically engineered organism, Baskin cites the experience of Steven Lindow, one of the first researchers to seek approval for the release of a genetically engineered microorganism, who planned to spray potato plants with "ice minus" bacteria to make them resistant to frost. Lindow's proposals for a field study were subject to detailed and repetitive scrutiny over the course of five years. In addition, he endured two federal court suits and was required to prepare at least 1,300 pages of formal paperwork. "This included his original 98-page proposal to the National Institutes of Health Recombinant DNA Advisory Committee; an 80-page revision; a 67-page federal Envi-

Scientists point to the trouble-free results of the few small-scale tests that have been done to date as further evidence that the regulatory agencies are being overly cautious. At the First International Conference on the Release of Genetically Engineered Microorganisms held in Cardiff, Wales, in April 1988, there appeared to be a consensus that it is now reasonable to relax the stringency of the regulatory review process for deliberate release experiments. Edward Adelberg, a geneticist (from Yale University) who attended the meeting, provided evidence of the trend in scientific thinking on the subject:

> At some point we must rely on scientific principles to tell us whether we have enough data. Then, if the experiments suggest that most genetically engineered microorganisms won't compete [with native microbes] or won't do harm, the burden of proof is on the opponents of deliberate release to produce plausible scenarios of harm.[397]

According to Adelberg, "very few scenarios for harm are now plausible; hence, there should be a 'presumption of safety rather than of harm.' "[398]

In spite of this view, there are those who think that the regulatory program is not stringent enough and that at the very least it should not be relaxed. The recent GAO report on biotechnology reflects this view. The report concludes that the federal agencies should continue to pursue the "case-by-case" approach to regulating genetically engineered organisms that are intended for release, given our limited experience in the area. The report characterizes the approach as a preventive one which requires that permission be sought before field tests are conducted instead of allowing tests and dealing with the problems after the fact.[399]

The report was severely criticized by the Department of Health and Human Services for its "unsupportable conclusions and recommendations," but it was praised by the USDA for being "ambitious and comprehensive."[400] These comments reveal the different perspectives of the agencies themselves with regard to the risks and regulation of genetically engineered organisms.

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ronmental Assessment and Finding of No Significant Impact; a 312-page Environmental Use Permit (EUP) application to the Environmental Protection Agency; and a three volume, 725-page California Environmental Impact Report." Baskin, *Genetically Engineered Microbes: The Nation Is Not Ready*, 76 AMERICAN SCIENTIST 338 (1988). Furthermore, in order to obtain the EUP from the EPA, Lindow was required "to test ice-minus for pathogenicity on 75 species of plants, from buttercup to pigweed, in the greenhouse. He also had to test 67 species of plant to determine the range of possible hosts and run an extensive battery of 'product identity' tests to define the characteristics of his microbes." *Id.* at 338-39.

397. Fox, *supra* note 25, at 536.

398. *Id.*

399. GAO REPORT, *supra* note 5. The report specifically recommends that the EPA and the USDA discontinue their current policies subjecting certain genetically engineered organisms to no or little scrutiny.

400. *Id.* at 91, 97.

In all likelihood, regulators will continue to relax the regulations regarding the small-scale deliberate release of R-DNA organisms as more information is gained. However, as biotechnology moves into new phases—*i.e.*, large-scale field testing and application of R-DNA technology to higher animal life and humans—a new round of more stringent regulations can be anticipated. Because the stakes are higher and the potential harms greater, it may take a longer time for regulators to relax the relevant regulations.

In light of the controversy over the risks of biotechnology, it appears that the regulatory agencies have achieved the correct balance in regulating biotechnology research and product development. Although scientists resent the numerous and seemingly unnecessary data requests piled on them by the regulatory agencies, given the relative lack of experience in the area and the lack of data regarding the risks of the technology, it makes sense for the agencies to proceed slowly.[401] Existing regulations generally provide adequate coverage of health and safety risks, and newly enacted or proposed regulations are filling in the few gaps that do exist by allowing the agencies to gather the data necessary to assess the risks of the technology prior to proceeding to the next phase of experimentation.

Thus, the major problems with the regulatory process do not appear to lie with its ability to protect society from the current health, safety, or environmental risks of the technology. Rather, the problems include the confusion, duplication, and jurisdictional overlaps inherent in the system, the lack of focus on future uses and future regulatory needs, and the inattention to the social risks of the technology.

A 1987 article argues that the "gravest regulatory threat to the development of biotechnology lies not in the stringency of regulation, but in its ponderous disorder."[402] The article provides several examples of jurisdictional disputes and regulatory overlap that add to the delays in product and research approval:

> Genentech reportedly encountered needless delays and expenses while USDA and FDA argued for more than a year over which agency should regulate the company's new bovine interferon. The agencies were unable to decide whether the product was a "veterinary biologic" under USDA's jurisdiction or a "new animal drug" under FDA's control.
>
> Advanced Genetic Systems complied with all of NIH's testing requirements in order to inject a genetically engineered bacterium that would reduce the risk of frost into the bark of fruit trees . . . in Oakland, California only to find that EPA approval was required instead.
>
> After two years of review and field tests, USDA's Animal and Plant

401. According to the recent Harris poll on public perceptions of biotechnology, "more than three-fourths of the public (77 percent) say they agree with the statement that 'the potential danger from genetically altered cells and microbes is so great that strict regulations are necessary.'" OTA, REPORT ON PUBLIC PERCEPTIONS, *supra* note 31, at 81.

402. Huber, *supra* note 383.

> Health Inspection Service licensed Biologic Corp's pseudorabies swine vaccine for commercial use. Because the vaccine was not reviewed through the department's Recombinant Advisory Committee, however, its license was withdrawn and it required additional testing.[403]

Many of the jurisdictional differences can be attributed to the fact that the regulatory scheme relies on statutes that were enacted prior to the advent of recombinant DNA technology. Thus, none of the statutes were initially designed to address biotechnology. Moreover, the agencies that enforce these statutes have different missions and goals, which sometimes conflict. Furthermore, although each agency attempts to reduce risk, each has a different approach to risk assessment and risk management. Finally, agency inexperience in dealing with this new technology has caused delays in regulatory review.[404]

A second problem with the current regulatory system is its failure to anticipate future uses of biotechnology products and the need for corresponding new regulations. For example, researchers are now experimenting with using genetically engineered microbes to clean up toxic chemical spills. These microbes may create their own hazardous byproducts, yet the EPA has yet to consider policies or regulations to address this possibility. Transgenic animals are now being developed for purposes of drug and food production. These animals are currently being regulated under existing statutes focused on animal drugs and food products. Soon, however, scientists and industries may create transgenic animals that are not food producing—*e.g.*, pets, sport animals, and animals that produce hides, furs, or wool. Although these animals may be regulated by the FDA under the animal drug regulations,[405] the use of the drug regulations for this purpose is questionable. We may need additional regulations under FDCA, or we may need to use other statutes such as the Consumer Product Safety Act, to regulate the use of these transgenic animals.[406]

The third major shortcoming of the existing regulatory structure is its inattention to the perceived social risks of the technology. This is the area that is least adequately addressed. Yet, at the same time it is the area where the risks are perhaps of most concern to the general population. Although virtually every new technology imposes social risks—*i.e.*, has an effect on our social fabric and the way we live—biotechnology is unique in its ability to change our lives so directly, to modify animals, plants, and human beings

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403. *Id.*

404. *See* von Oehsen, *Regulating Genetic Engineering in an Era of Increased Judicial Deference: A Proper Balance of the Federal Powers*, 40 ADMIN. L. REV. 303 (1988), for further discussion of these problems.

405. The definition of drug includes "articles (other than food) *intended* to affect the structure or any function of the body of man or other animals." 21 U.S.C. § 321(g)(1) (1982).

406. Although the Consumer Product Safety Commission has interpreted the Act so that it does not apply to animals, this interpretation could be revised.

in ways that may be highly beneficial but at the same time pose troubling questions.

One of the most significant concerns in the social risk area concerns the ability of biotechnology to greatly expedite the evolutionary process and change its course. Historically species have evolved slowly, by a process of adaptation, in response to changes in the environment. Soon, we may be able to create plants and animals that can survive in extreme climates such as the desert or Antarctica. We also may be able to create animals that can survive in polluted waters and lands. Certainly there would be benefits to such adaptability, but on the other hand, this type of adaptive capability raises concerns. For example, it may lead to devoting resources to the creation of new species rather than to the clean up of the environment. How should we evaluate or think about this possibility? Is there a role for the legal or regulatory system here?

A second concern voiced by at least one author is the modification of animals in ways that may be harmful or cruel to them.[407] The author poses as an example the creation of a chicken that is an extremely efficient egg layer. Although this is not a bad outcome in and of itself, the genes that allow this result also produce a chicken that is legless, featherless, and wingless.[408] Is such a result justifiable?

The author suggests that, if we are worried about cruelty to animals, we simply create species with less brain function so that they will not be able to suffer or feel pain.[409] Is this the answer? The issue of creating animals with less brain function or of lesser intelligence is at least as socially troubling as the creation of animals with greater intelligence. Such a possibility elicits numerous fears.

An additional problem that we may have to confront in this area is the creation of animals that are closer and closer to humans in terms of intelligence and functional ability. How will we determine who is human and who is not?[410] Moreover, how should we deal with parents who want to use "gene therapy" or genetic engineering to create their ideal child? Reproduction

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407. *Tomorrow's Animals*, THE ECONOMIST 11 (Aug. 15, 1987).

408. The example is not far from reality. Scientists at the USDA have created a pig that will produce leaner meat. These pigs, however, develop arthritis at a very young age and are listless and inactive. *See* OFFICE OF TECHNOLOGY ASSESSMENT, FEDERAL REGULATION AND ANIMAL PATENTS STAFF PAPER, at 6 (Feb. 1988).

409. Alternatively, we could create animals or entities with no brain function at all. An example might be live tissue cultures from which we could continuously cut off steaks. Such an organism would be an extremely efficient food producer and would resolve the concern regarding cruelty to animals.

410. This issue may initially require resolution in the patent area where the patenting of higher animal forms has begun. The patent office has stated that "claims directed to or including within [their] scope a human being will not be considered to be patentable subject matter under [the patent law]" as "[t]he grant of a limited, but exclusive, property right in a human being is prohibited by the Constitution." The Patent Office has not defined what constitutes a human being, however.

and childrearing has been one of the few areas that has been protected by the constitutional right of privacy. But would this right protect the decision to engineer the type of child one will have? Even if the decision is protected, is there a legitimate state interest in preserving the gene pool that outweighs this right? One can imagine scenarios that would seriously threaten the existence of the human race. These might include the creation of a significant majority of female children as opposed to males (or vice versa), or the creation of intelligent, attractive children that are vulnerable to certain diseases or viruses.

Finally, the availability of this new technology will inevitably involve questions of accessibility. Who will have access to these special genes and at what cost? Will these be public goods or private ones? If private, will we exacerbate the rift between the haves and have nots by allowing those who can pay to have the most attractive and intelligent children at birth? If public, how will these genes be allocated?

X. Recommendations for Improvement

In order to address the problem of regulatory confusion, overlap, duplication, and delays there is a need for a mechanism and a body that has the authority to resolve disputes between existing agencies and has the mandate to anticipate new problems. It was the goal of the OSTP to meet this need via the Coordinated Framework and the BSCC. Neither, however, has thus far been successful at achieving this objective, nor are they likely to be.

The Coordinated Framework attempted to address the issue of overlapping jurisdiction by establishing a "lead agency" when two or more agencies have the task of regulating a single product and by establishing a "consolidated or coordinated review." Although in theory the coordinated review could work well, the Framework includes "no description of how the coordination will occur or how two independent agencies using different statutes could have an integrated review."[411] This shortcoming could easily be overcome by setting forth in detail protocols for coordinated review. However, the assignment of this task to the BSCC would be unwise for a number of reasons.

The BSCC has been fraught with problems since its inception. As initially envisioned, the BSCC was only to exist for two years—its charter included a "sunset" provision that automatically disbanded the organization in October 1987, unless the White House chose to extend its life.[412] During its early years, the BSCC's activities were shrouded by a Justice Department investigation of its director for an alleged conflict of interest, and much of

411. J. Gibbs, *supra* note 77, at 130.

412. *See* Crawford, *Wyngaarden to Chair Biotech Council*, 238 Science 1504, 1505 (Dec. 11, 1987).

its work was not completed.[413]

In the summer of 1987, the White House elected to extend the life of the BSCC, but there was controversy within the White House about whether the composition and duties of the committee should be expanded to include policy issues.[414] Ultimately, the White House decided not to expand the committee's responsibilities, but instead established the Life Sciences Committee (LSC) to handle interagency policy issues.[415]

It is unlikely that either the LSC or the BSCC will be able to adequately address the complaints of duplication and confusion that have been hurled at the biotechnology regulatory system. Neither the BSCC nor the LSC has the power to take away the authority of a regulatory agency to review an application for a license, permit, or other approval.

Furthermore, the composition of the BSCC is fatally flawed if the committee is to handle interagency conflicts. An organization composed totally of representatives from numerous agencies, each with its own mission and its own piece of the regulatory pie, with no one having a clear leadership role, is not likely to reach agreement on important issues. Even if it could reach a consensus, the fact that the committee cannot make binding decisions (only recommendations which can too easily be ignored) further limits its effectiveness.[416]

This problem could be addressed by legislation that gives the BSCC the authority to promulgate regulations that would be binding on the relevant agencies, or alternatively, by the creation of a new body, headed by someone

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413. During its lifetime the BSCC has devoted its attention to the following activities: developing definitions of terms common to the agencies regulating biotechnology, evaluating risk assessment methods used by the agencies that review biotechnology products, developing standards for greenhouse containment, and reviewing proposed regulations and guidelines put forth by the regulatory agencies. The committee has also established two task forces—one to develop a position paper on the scientific basis for submitting a paper description of patented items as an alternative to the deposit requirement under the United States patent laws and the other to review the adequacy of current regulations to address newly developed genetically engineered animals. Telephone interview with Janet Dorrigan, BSCC staff, in Washington, D.C. (July 7, 1988).

414. Crawford, *supra* note 412, at 1505.

415. The LSC will include most cabinet departments and key independent agencies—EPA, NASA, and NSF— as well as the Office of Management and Budget, the Office of Policy Development, the Council of Economic Advisors, the Council on Environmental Quality, and the Office of the United States Trade Representative. The LSC will be responsible for "all science and policy development issues related to life science." Fox, *OSTP Sets New Biology Panel: BSCC Reprieved*, 6 BIO/TECHNOLOGY 19 (Jan. 1988).

416. An example of the BSCC's inability to resolve differences among the different agencies involved in the regulation of biotechnology is its abandonment of its effort to define such terms as "deliberate release" and "containment." After several months of attempting to develop general definitions of these terms that would apply to all of the relevant regulatory agencies, the committee abandoned the effort when it was unable to produce a consensus among the agencies involved. Thus, it continues to be possible that different agencies may have different definitions of key regulatory terms.

who does not represent another agency, with authority to resolve agency disputes and select a "lead" agency when two or more agencies have authority to regulate an area of research or a new product. The new body need not have licensing and permitting authority, but must have clear authority to make binding decisions when interagency conflict arises. Regulatees would have access to the conflict resolution agency only when two agencies disagreed as to the appropriate regulatory requirements with which the regulatee had to comply. Such a body should also have as its charge the task of identifying areas where new regulations or legislation may be necessary and appointing the correct agency to begin working on those regulations or begin drafting legislation to be submitted to Congress.

Second, if biotechnology is an area that the government wants to promote, it could develop a separate agency with the sole purpose of assisting biotechnology researchers and product developers in obtaining the approvals and licenses necessary to proceed with their work. Such an assistance function could expedite the regulatory review process. By pointing researchers and developers to the correct doors, assisting them in the application process, and foreseeing potential jurisdictional conflicts, such an agency could serve an invaluable function. The service could be financed by fees from the researchers or companies, similar to the fees which are charged for processing licensing applications.

Both types of agencies would greatly contribute to reducing the confusion and delays that now characterize the regulatory system without creating another level of approvals.

The third major issue we must confront in developing a sound and supportable regulatory policy regarding biotechnology is the perceived social risks associated with the technology. Public perceptions of these risks will continue to delay developments in this area and continue to push regulators to impose stringent controls, perhaps more stringent than necessary, on the technology.

Although in general our regulatory system is not suited to dealing with highly controversial moral and ethical issues such as those associated with biotechnology, there are non-regulatory mechanisms the government can utilize to assist in improving the quality of the debate on these risks and in developing a greater consensus regarding them. The first and most important of these mechanisms is education. As Maxine Singer, a molecular biologist, pointed out in a recent speech entitled "Public Perception of Genetics," there is considerable distance between scientists' views of biotechnology and public perceptions:

> The disparity is troubling because the public is ultimately [the scientists'] source of support, both financial and intellectual. It is not only public money that is required to advance science. In our democratic society, it is also a common view of what is worth knowing and what are the

> relative social costs of knowing it . . . .[417]

Furthermore, "the general scientific ignorance of even our most highly educated citizens" and the "deep anti-intellectual strain in our population makes informed discussion about biotechnology extremely difficult."[418] Government can begin to combat this ignorance by developing or funding programs to educate citizens about biotechnology and its enormous potential benefits. These programs might consist of television documentaries, brochures and books that explain the technology in lay terms, museum exhibits, school programs for children, and adult education courses.

A second mechanism that government could utilize to improve the debate regarding the social risks of biotechnology would be to require the preparation of social impact reports (SIRs) by regulatory agencies that approve various biotechnology activities. These SIRs would be developed by the regulatory agencies, not the researchers or biotechnology companies. They would be generic in nature—*i.e.*, prepared for a certain class of activities rather than for each license granted—and would specify the potential social risks of a given activity. The public would be notified of the availability of these SIRs and have an opportunity to comment on them.[419] The preparation of these generic SIRs would not delay the issuance of any approvals or licenses but would require the agencies to consider the social, ethical, and moral issues that might arise as a result of their approval of a certain type of research or product.

A third recommendation for dealing with the perceived social risks of biotechnology is the creation of an overarching non-regulatory body that is provided funding to assess the potential social and ethical issues associated with new developments in biotechnology. The body would be composed of paid staff with expertise in the areas of economics, anthropology, psychology, law, philosophy, sociology, religion, ecology, and microbiology. The task of the body would be to solicit public opinion on the social and ethical issues that will arise as we begin to utilize biotechnology more fully, to prepare reports setting forth the risks and the benefits of the new technology, to solicit public comment on the reports, and to recommend the drafting of new regulations or legislation necessary to address the social risks of the technology. The advantages of such a body would be its outreach to the public and its broad focus: it would not have the narrow focus of existing regulatory bodies.

The idea is not a new one. In 1985 Congress created a Biomedical Ethics Board to advise it on ethical issues in the delivery of health care and

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417. *Biology Frontiers Pose Ethics Questions*, News Report (1988) at 20.

418. Id.

419. Such SIRs are not a totally new idea. Some states require social impact analyses in conjuction with an environmental impact analysis; *e.g.*, Massachusetts, under Mass. Gen. L. 21D, requires a socioeconomic impact report for the siting of hazardous waste treatment facilities. Similarly, the Wisconsin equivalent of NEPA requires such a socioeconomic impact report.

biomedical research, including human gene therapy.[420] The board was empowered to select an advisory committee whose members would be responsible for conducting studies, preparing reports, and holding public hearings. Due to political problems, the committee was not established until September 1988, and its continuing viability has been questioned.[421] The use of this committee or one similar to it to deal with the new ethical issues being introduced by biotechnology would provide society, regulators, and Congress with an understanding of the ethical conflicts inherent in the application of the technology.

Our society needs alternative mechanisms to deal with the controversial and value-laden issues posed by new technologies. Our regulatory system does not deal well with "highly technical questions of science and technology that also involve value judgments."[422] We need mechanisms that allow for education regarding technical issues, discussion of the values inherent in our regulatory programs, and the impact those value judgments will have on our society.

XI. Conclusion

There continues to be considerable controversy over the adequacy and onerousness of the current biotechnology regulatory system. For the most part, environmentalists and a small number of "antibiotechnologists" consider the system inadequate, while scientists and industry representatives have described the system as "scientifically indefensible," confusing, and fraught with jurisdictional conflicts and delays. Given this controversy and our relatively limited experience with biotechnology processes and products, the cautious approach being taken by the regulatory agencies with authority in the area seems warranted. The process can be improved, however, and the delays and conflicts addressed by creating an agency that has the authority to address interagency conflicts and to appoint a lead agency when two or more agencies have the responsibility for regulating the same process or product. Moreover, a non-regulatory agency assigned the task of assisting researchers and developers through the regulatory maze and identifying potential jurisdictional conflicts could significantly reduce delays in the regulatory system.

Of perhaps most concern from the point of view of the general public

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420. *A Once and Future Biomedical Ethics Board*, Hastings Center Report 2 (Apr.-May 1988).

421. Another, very successful, example of a similar committee was the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research. The commission published a series of books on ethical problems in medicine, including one volume entitled *The Social and Ethical Issues of Genetic Engineering with Human Beings*. *See* 42 U.S.C. § 300(v) (1982) for a description of the commission.

422. Ramo, *The Regulation of Technological Activities: A New Approach*, 67 A.B.A J. 1456 (1981).

are the moral and ethical issues created by the new biotechnology, *i.e.*, the technology's perceived social risks. The current regulatory system does not address these concerns, nor is it adequately equipped to do so. However, biotechnology researchers and developers will continue to encounter delays and a stringent regulatory climate unless and until some of these social risks are confronted. Several mechanisms are available to increase the quality of public debate regarding biotechnology processes and products. First and foremost is an educational program aimed at increasing the public's understanding of the science and the numerous current and potential benefits of the technology along with the difficult ethical issues that it invites. Second, regulatory agencies can assist in educating the public by preparing generic social impact reports on the possible ethical and moral issues raised by their approval or licensure of new biotechnology products. Third, there is a need for a separate, non-regulatory body that is assigned the responsibility of assessing the social impacts of biotechnology from a broader perspective than is possible within the limits of any of the existing agencies. This body should be required to gather public opinion on various social and ethical issues involved in the application of biotechnology, prepare reports on the topic, solicit public input on the reports, and propose new legislation for areas that require additional regulation.

Additional public input on these matters is essential for public acceptance of the applications of this new technology. The pace of scientific research must not preempt public debate and an outcome consistent with societal values.