DISCUSSION: IMPLICATIONS OF EMERGING BIOTECHNOLOGIES

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I will discuss the issues raised by Dr. Carter with specific reference to the role of the agricultural economist. Dr. Carter looks down the road 15-20 years for the impacts of emerging biotechnologies and presents the "futurists" views of the Agricultural Research Service, USDA. An alternative approach may be more useful. Contracts between land-grant universities and major industrial firms for developments in biotechnology must follow a more pragmatic approach. Indicative of this approach is the usual provision in contracts concerning biotechnology that states "TIME IS OF THE ESSENCE." In an effort to reconcile this approach and the view of Dr. Carter, the question is asked "Why is my concern of immediacy and her's a concern of the longer run?" A basis in science rather than philosophy is proposed for this reconciliation.

My experience has more to do with animals; Carter's presentation centers on plants. Consider a small amount of the biotechnology involved. Much of the work in plants involves the regeneration of an entire plant from a single transformed cell. These techniques are in the developmental stage and not fully perfected (Bull et al.). The animal equivalent of single cell regeneration is the process of conception and conception is rather fully developed science. Also, because of the emphasis upon human health, more is known about the biological response modification in animals than plants. For these basic scientific reasons, the impact of biotechnology in vertebrate animals is immediate.

A typical example of present biotechnology in vertebrates brings the issue into sharper, more immediate focus. Research into baculoviruses at Texas A & M University, for the purpose of developing a viral pesticide to selectively kill insects without residue, introduced (cloned) a gene for human interferon into the virus. This research resulted in the production of human interferon at levels 1,200 times any previous method. That interferon was identical to that formed in the human body. This quality had never been produced by any artificial method. (Interferon raises the body's natural defense mechanism against viral diseases—the most notorious of which is cancer.) Subsequent research indicated the discovery has applications in the production of interleukens (a potential cure for AIDS—acquired immune deficiency syndrome), a growth hormone that would be equally effective in treating kidney failure in humans and for increasing feed efficiency in livestock and biological response modifiers that range from growth hormones in humans to selective pesticides (Smith et al.).

My first point is that developments in biotechnology frequently have applications in both human medicine and food production. Eventually both population and food supply will rise from biotechnology.The role of the economist is to assure that scientific resources are allocated efficiently to coordinate this effort. Otherwise, the promise of this technology will be instability. A better system than the uncoordinated use of peer reviewed, investigator originated, competitive grants in the human health area, and state and federal formula efforts in agriculture must be developed. Present allocations of research grants in biotechnology have no overall direction.

My second point is that the agricultural economics profession has a major role to play in assignment and protection of property rights. Major developments in biotechnology involve a sizeable component of public funding. Funding sources are generally from some combination of National Science Foundation, National Institutes of Health, land-grant institutions, experiment stations, etc. Present law allows public institutions to patent these developments and all economic incentives are toward some form of exclusive licensing with private firms (McEowen, Saliwanchik).

The government maintains "march-in" rights but these are hardly adequate considering the nature of demand for biotechnology. It is a derived demand and patents preclude effective substitution. This is the classic inelastic demand where the firm seeks to operate on the elastic portion of the demand curve. The problem is not complex, but time is important if human

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health is not to suffer because of restriction of supply of what is (or was) a public good.

The argument for exclusive forms of licensing is-"if everyone owns it; no one owns it," but the immediate problem is the most fundamental property right—the right to live. The agricultural economics profession contains the acknowledged experts in inelastic demand and a tool in consumer and producer surplus directly applicable to an intelligent public policy.

My third point is that the issue of market structure is important because biotechnology is capital intensive despite what you have heard. The development of human interferon cost approximately $2 million to the stage of clinical trials, but it produces some 16 biological response modifiers (such as interferon) and the clinical trials alone for these interferons are estimated to cost more than $300 million for this small piece of technology. This capital intensity is shown by the fact that no small company has a big stake in biotechnology. For example, Upjohn was granted more patents in the area of biotechnology last year than the combined efforts of the three premier biotech firms—Genetech, Genex, and Cetus.

In addition, patenting and uncertainty open the door for extensive anti-trust activities. For example, if a firm obtains a monopoly through an improper patent, it has by definition obtained an illegal monopoly in vital areas. At the very minimum this raises questions of market power. As Senator Gore has recognized, time is a factor in the examination of public policy in this area.

My fourth point is that preparation of future agricultural economists for participation in the field of biotechnology is essential. It is impossible to impact this burgeoning field of biotechnology without a fundamental knowledge of the biological sciences. My career as an agricultural economist has been aided greatly by my farm background. In the future, a basic grasp of the biological sciences may replace farm background as desirable for an agricultural economist. The knowledge of biological scientists' resources are prerequisites for economists to participate in efficient allocation.

Students of social science must receive the same access to grants as biological scientists. In the interest of long-run optimization, reallocation of resources from the so-called "disease of the month" to training grants across all areas of science should be pursued. At present agricultural economists are, as a group, on the outside looking in where biotechnology is concerned. Many administrators view the profession as playing chamber music in the age of rock and roll. This cannot continue.

My fifth point is ethical implications. John Hopkin covered the matter of ethical issues in research in a masterful manner at the 1983 SAEA meeting. Carter mentioned the future may hold the ability to use micro-injection techniques for injecting genetic material into eggs. Scientists at Texas A & M University have a cow in her second trimester of pregnancy carrying a fetus altered in this manner. Essentially, an egg is injected with genetic material to change the genetic makeup. Growth hormones to increase size and feed efficiency are the present focus, but the scientists believe that they are close to engineering an animal which produces meat with a much lower level of cholesteral—which consumers demand (Mapletoft).

In this case, government funding has the potential to transform a troubled meat industry from a tax-shelter driven industry to a science driven, consumer oriented industry. But there is a problem. The question arises, "Can humans be so manipulated and engineered?" The answer is inescapably "yes." This does not mean they will be, but "TIME IS OF THE ESSENCE" in resolving or starting a public dialog to prevent scrapping of beneficial technology because it has the potential for undesirable use in humans. Many firms avoid this type of technology because they know that when they are perceived to be on the wrong side of a social issue it is not a question of whether they win or lose—it's how badly they will be whipped.

The time is now for a dialog, with social scientists taking the lead using logic and principles rather than emotion and scientific arrogance. If Carter's assessment is correct that the future of this technology lies 15-20 years hence, the agricultural economics profession can yet help assure its future meets its promise. Social scientists and, in particular, agricultural economists have major roles to play in this process.

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