VIEWPOINTS

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The Risk-Benefit Approach to Food

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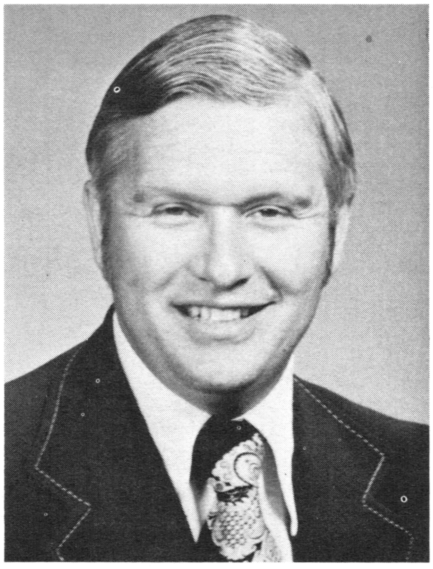
Human life from its beginning has included risk-benefit analysis. Simply stated, it means that, in any activity, risk is compared to perceived benefits. This assessment may be evaluated methodically but is often subconscious.

Twentieth-century living includes many activities which are quite risky. The use of an automobile carries with it the distinct possiblity of tragedy. Over 46,000 deaths and 1,800,000 nonfatal injuries from motor vehicle accidents were recorded in the U.S. in 1976. The risk-benefit approach to auto travel is something which all Americans use and presumbably understand. Other examples include participation in sports, childbirth, and overeating. We accept the risk-benefit approach to these human activities, doing so with little conscious thought involved.

Paradoxically, the thought of any risk, no matter how infinitesimal, is considered unacceptable in food. Americans are conditioned to the idea that they have the safest food supply on earth. In recent years, however, advances in analytical chemistry have greatly expanded detection limits for food contaminants. Most of these contaminants are probably of little consequence to food safety when compared with potential hazards of food poisoning and food infection. However, our present methods of food handling, processing, and quality control have greatly reduced the risk from pathogenic microorganisms and their toxins. More subtle hazards now occupy the attention of our regulatory and scientific community.

Consider the question of trace-level carcinogens found in food. Modern analytical techniques have the ability to detect minute quantities of these contaminants. However, the accepted means of testing carcinogens is to use high dose levels, and the current position of the Food and Drug Administration (FDA) assumes the nonexistence of a no-effect level. These positions negate the risk-benefit approach to carcinogens in our food supply.



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We thus have an interesting dichotomy in present day living which allows us to participate readily in high-risk activities such as auto travel, while expecting the activity of eating to be *risk-free* with regard to carcinogensis. The apparent explanation for this discrepancy is that food and eating are "gut" issues which escape the application of the same logic as other less emotional issues.

At the heart of the problem regarding dietary carcinogens is the 1958 Delaney Clause to the Federal Food, Drug, and Cosmetic Act. This clause clearly states that *no* carcinogens may be added to the food supply. This clause has only rarely been applied, nevertheless it carries with it dogmatic authority which has been responsible for much anxiety concerning the safety of many dietary components, including natural and added materials. Advances in analytical chemistry combined with anxiety resulting from fear of the unknown (cancer) have condemned as carcinogens or potential carcinogens some components of our food supply which were previously assumed safe. Examples include:

1. Nitrite in bacon.
2. Cyclamates and saccharin in soft drinks.
3. Aflatoxins in peanuts and grain.
4. Patulin in fruit and fruit juices.
5. Traces of diethylstilbesterol in meat.
6. Artificial colors such as red 2 and violet 1.

The effective level of detection for some chemical contaminants has improved 5 orders of magnitude in 20 years from 1 part in 10^7 or 0.1 part per *million* (ppm) to 1 part in 10^{12} or 1.0 part per *trillion* (ppt). Administrative guideline tolerances exist which limit the occurrence of *natural* carcinogenic contaminants such as aflatoxins to levels as low as 20 parts per billion (ppb) in peanut butter and 0.5 ppb in milk (which is at the very limit of detection and is obtainable only by the most sophisticated techniques).

A cursory evaluation of what has happened in analytical chemistry might suggest that we are approaching the limit for detecting trace contaminants. Actually, we are only beginning. Consider the ionic contaminant fluoride with molecular weight 19 at a level of 1 ppb in one mole (18 grams) of water. One mole of water contains Avogadro's number of molecules (6.0235 x 10^{23}); therefore, 570 trillion (5.7 x 10^{14}) ions of fluoride must be present in one mole of water in order to reach a minimum detection level of 1ppb. This simply means that a 1 ppb analysis of such a substance in water is only 1.7 x 10^{-13}% accurate. Practically, zero tolerance on the molecular or atomic level is meaningless.

Legislation such as the Delaney Clause has the laudible intent of insuring Americans a safe food supply. However, through implicit zero tolerance, it has created a climate where sensational results and headlines that contribute to public anxiety are easy to produce. Such investigations often involve "megadose–minute response" experiments wherein huge quantities of a suspected carcinogen are administered to test animals using whatever means researchers deem appropriate.

The Delaney Clause implies a denial of a no-effect level for carcinogens. While it is questionable if the level at which certain carcinogens might have

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no effect can be determined using existing laboratory methods, there is enough evidence to suggest that for certain substances a no-effect level must exist. For example, natural estrogens are carcinogenic in large quantities but they are also synthesized in man and animals. The trace element selenium is necessary in blood chemistry, but in sufficient quantities has been reported carcinogenic. Vitamin D, in fact, at high levels has been found carcinogenic. (Paradoxically, it is also required by law as a food additive in milk.) It is clear that research to establish methods of determining no-effect levels for carcinogens should be given extremely high priority.

In recent years, experimental results which even resemble carcinogenic responses produce quick decisive action by FDA and consumer activist groups. An excellent case in point is that of monosodium glutamate (MSG) which while not a carcinogen, was found by subcutaneous injection to cause brain damage in newborn mice. Analogies were quickly drawn from baby mice to baby humans and a demand for removal of MSG from baby food was issued by consumer activist groups. The material was quickly and voluntarily removed from processed baby food, which indeed *was* the obvious and correct action to take. Incorrect, however, was the panic reaction which developed around results of very limited experimentation.

A similar case developed around the artificial sweetener saccharin, which was shown to be a carcinogen in Canadian rat-feeding experiments. The Delaney Clause clearly mandated removal of saccharin from the food supply. In this case, the benefits of artificial sweeteners seemed obvious to many. Consumers and political leaders, along with many scientists, reacted with such vigor that a delay in the saccharin ban was sponsored by U.S. Representative James G. Martin (PhD, organic chemistry). Representative Martin and 200 of his colleagues responded to one of the most aggressive consumer reactions to food legislation of all time. The result has been an 18-month delay of the ban and the use of a label stating that saccharin contains a possible risk of cancer, as the search for more information continues.

Legislative proposals to replace the Delaney Clause are now being studied. Perhaps a risk-benefit approach to our food supply is now emerging.

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LETTERS

Professional Dilution and Horticulture

This letter is in reaction to Mr. Gogue's *viewpoints* article on "Professional Dilution and Horticulture" (*HortScience* 13:130-131; 1978). While I agree with his concern for excellence in horticulture, he left me with more questions than answers as well as complete disagreement on several points. Is he concerned about non-degree training, associate degree training, baccalaureate or graduate level education, or all levels? I'm also concerned by statements such as "the proliferation of courses designed for the non-horticulture major has in many cases done a great disservice to our discipline." How? The basic sciences which are so important to the applied science of horticulture *all* offer non-major courses in virtually every major educational institution I know of in the United States. If the mathematicians, physicists, biologists and chemists only taught their majors, the size of their faculties would be drastically smaller and the number of Teaching Assistant supported graduate students would be nonexistent. The largest teaching role for the basic sciences in most colleges is to provide instruction for the *non-majors*.

I also disagree with Mr. Gogue's implication that numbers of students, student/faculty ratios, etc., are games that adversely affect the horticultural program. In many states, (and the number is increasing) the university program is formula budgeted. These are not games. These are facts of life and while it would be nice to have unlimited funds for any agency, be it governmental or university, it's not the situation we have today. Education in the mid-1970's is not held in as high esteem with the American public as it was in the Sixties. And given the formula budgeting with which so many of us now have to live, we can still offer outstanding horticultural programs. It's another parameter within which we have to work, but it does not have to mean a denigration of the program. Positive thinking and gradual evolution of programs (yes, change!) carefully considered should improve horticultural programs, not destroy them.

The attitude portrayed that the only thing worthwhile in a horicultural program is educating your majors is, to me, an unfortunate one. Most colleges offering horticultural programs usually have multiple roles to perform. And most baccalaureate programs, be it English or horticulture, should have as their goals the preparation of well educated persons who can think critically in many diverse areas. A good introductory non-major or major course in horticulture would serve well as part of the general education requirement for many baccalaureate programs, especially those in the liberal arts. More and more faculties are doing this and students are electing such courses. In my estimation it should be fostered. This is educating the non-majors.

Richard H. Merritt
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Dr. Gogue's comment on "Professional Dilution and Horticulture" (*HortScience* 13:130-131; 1978) are long overdue. Horticulture's lack of professionalism is appalling. Rather than upgrade horticulture, horticulturists have chosen or been forced to degrade it by teaching fun courses – happy horticulture – at the expense of professional courses and professional instruction. At best horticulture instruction today is oriented in the back yard.

Due to the green plant boom, ornamental horticulture has suffered from dilution more than other sections. However, we've all suffered or will suffer. Many horticulturists have become green plant experts. The jogging craze has not forced dentists to treat bunions, likewise, some horticulturists should examine their actions. For years, the ornamental horticulture industry has been protesting the dilu-