Emerging Food Processing Technologies as Viewed by a Food Scientist[a]

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Thank you for inviting me to be part of your panel discussion on emerging food processing technologies. Far too few of the food science and technology departments in academia have agricultural economists on the faculty or jointly appointed in such a manner as to promote integrated research and teaching, and to provide an environment that is conducive to professional growth, salary increases and promotions.

The goal of the food production, processing and marketing enterprise is to provide all people of this country with a safe, wholesome and adequate, if not abundant, supply of food, at a profit to the commercial participants. This definition is limited to the United States, but it must be expanded to include the world, at least in part.

Participants in this mammoth enterprise include those in education, in research, in service, on-farm producers, marketers, transporters, processors, packagers, quality control and regulatory officers, wholesalers and retailers, and importantly, consumers.

The food industry is characterized often as a single entity. It is anything but a monolithic giant; it is comprised of many small companies and relatively few very large companies. Acquisitions and mergers are commonplace, a recent example of which is the merger of RJR Industries and Nabisco, whose marriage resulted in a $19 billion corporation, $10 billion in the food area. The food industry is mature. There is little expansion, perhaps a percent or slightly more annually. There is little if any profit in primary processing, such as in converting live animals to fresh meat, cracking and extraction of oil seeds, milling of corn and wheat, and milk processing. Profit is generated by adding value to the products through additional processing of commodities into specialized food ingredients or food products, typified by the current lines of entree items and premium ice creams in the market place. Major emphasis by the processor is given to convenience, quality and safety.

The food industry needs a major input of integrated fundamental research information. Too often academia has provided small units of research information that is not utilizable by industry. In addition, the information may not be timely, or it may be a replay of previous efforts.

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A need exists for new processing technologies, illustrated by the following:

1. Knowledge of the fundamental properties of food ingredients is limited.
2. Few really new methods of food processing have been developed this century.
3. Preserving the original flavor and texture of products during processing is difficult if not impossible.
4. Assuming reasonable food safety is an expensive and unending effort.
5. The U.S. has built considerable dependence upon other countries for new innovations in food processing (Wedral, 1984) and for foods themselves. The data in Table 1 illustrate the rapid growth in food machinery imports compared with exports.

Table 1. Food processing machinery ($ Million)

	Year					
	1972	1977	1979	1981	1982	1983
Exports	103.8	270.5	365.5	508.3	459.6	322.0
Imports	65.7	248.6	324.2	432.0	534.4	439.2

Barrington, 1984

Similarly, improved food processing technology elsewhere, plus shortages in this country, have resulted in dramatic increases in the importation of selected food products by the United States (Table 2). By May, 1984, imports of orange juice essentially equalled those of the entire previous year.

Table 2. Imported concentrated orange juice ($ Millions)

	Year		
Origin	1973	1983	@5/84
Brazil	4.0	271	256
Mexico	2.4	20	19

Barrington, 1984

To complicate the U.S. trade balance even further, the increase in imports has occurred at a time when the U.S. dollar has gained strength on the world market thus imposing a negative effect on this country's ability to sell commodities and other goods on the world market (Table 3).

Table 3. Value of U.S. agricultural exports/imports ($ Billion)

	Year				
	1974	1977	1979	1981	1982
Exports	22	23	34	44	37
Imports	10	13	17	16.5	15.5

Barrington, 1984

Given the situation that the U.S. faces in world trade, the period of the mid-eighties would seem to be an ideal time to introduce innovative food processing technologies that would increase farm income, create more jobs, increase the tax base, and at the same time allow the U.S. to earn a more competitive position in the world market.

Unfortunately, there are existing constraints that limit the introduction of new technologies and prevent the situation from being turned around in the near future. Some of the factors involved are:

1. Lack of consensus on research needs. The U.S. has no agenda for research as regards food processing technologies. The Institute of Food Technologists (1984) launched an initiative in this direction by bringing together research leaders and decision makers from academia, government and industry to develop a major research agenda. This effort, if nurtured, can have a major impact on the productivity of the U.S. food industry and the health of the American public. However, nothing of major significance will happen unless the Federal government is willing to make a major investment in fundamental research in support of food processing technologies.

2. Lack of commitment by industry to fundamental research. The editors of Food Processing have published (1985) a survey of 100 top food companies, whose cumulative sales are $176.4 billion. Eighty-six percent reported that their R&D budget was 1% or less of sales (Table 4):

Table 4. What is your corporate R&D budget as a % of food sales?

	Year	
	1985	1984
Under 1/2%	39%	51%
1/2 - 1%	47	30
1 - 1 1/2%	6	17
1 1/2 - 2%	2	2
2 - 2 1/2%	0	0
Over 2 1/2%	6	0

Food Processing, 1985

And 45% of the respondents included quality assurance/quality control operations in their research budget.

Another important question asked of the companies was to estimate the distribution of research dollars to certain "research" activities. The respondents indicated that they spent 35% on new product development and 30% on reformation, process and package changes. Such a distribution of R&D activities does not favor major technological innovations.

Table 5. Approximately what portion of your budget is devoted to the following primary R&D activities?

	Median %	Range %
New Product Development	35	0-70
Profit Improvement (reformation, process, package changes)	30	10-70
Technical Service	20	0-70

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3. Relative lack of integrated research efforts by academia, industry and government. Although the United States currently has the most sophisticated food industry in the world, which is capable of providing this nation's population with an adequate supply of reasonably safe and wholesome food, it is well behind the Europeans and Japanese in coordinated research efforts. Improved coordination would increase the efficiency and productivity of the food research enterprise significantly.

4. Small, independent academic research units.

5. Lack of total research resources. Of the total federal research budget of $57 billion, only $900 million, or 1.58%, is committed to federally-supported agricultural research. And of that total, only about 20% goes to support the broad area of food processing or post-harvest technology research. Little wonder that the U.S. food industry is so dependent on technology from abroad. An investment each year in the development of innovative food processing technologies equivalent to one B-1 bomber would allow this nation to make enormous strides in supplying the growing food needs for a healthy America.

If academia, government and industry can act in concert on major research efforts, the following can be achieved by year 2000:

1. Comprehensive, rapid, non-destructive analytical procedures.
2. Use of new sensors and robotics.
3. New biotechnologies applied to food processing.
4. New mechanisms for controlling biological activity (e.g. slowing the degradation of fresh products).
5. New approaches for determining and controlling food safety.
6. Tailoring food composition and material properties to fit special nutrient needs of individuals.

Regarding the last point in this list, it is encouraging to note in the Food Processing survey, previously quoted, that companies are sensitive to the special nutrient needs of individuals and the associated market opportunity. The development of product lines with special characteristics is likely to continue.

Table 6. Rate the sensitivity of your product lines to the following ingredients or label references:

	High	Some	Little	None
Sodium/salt	32%	43%	13%	6%
Light/Calorie reduced	34	34	21	4
Sweeteners	32	30	21	9
Preservatives	30	36	19	9
Artificial Colors	30	26	21	13
Fats/Cholesterol	28	38	13	15
Artificial Flavors	26	26	28	11

Food Processing, 1985

In summary, the resources of the United States' food industry, plus those of the federal and state governments, are sufficient to lead to world-class accomplishments in food processing technologies provided there are decisions as to what needs to be done, how it shall be funded and who shall do it.

"What did you spend on R&D today? That's the question corporate directors should be asking, and that CEOs should frequently be asking their executives. That is, if they want profitable tomorrows (Forbes, 1985)."

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