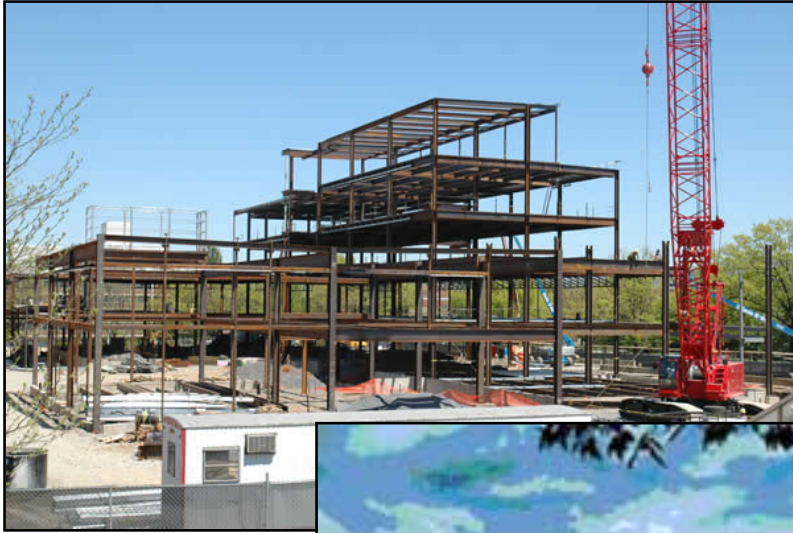


STRATEGIC PLAN FOR THE DEPARTMENT OF FOOD SCIENCE



JULY 1, 2005-JUNE 30, 2008

College of Agricultural Sciences
Penn State University

Preface

This plan continues a long history of successful strategic planning in the Department of Food Science. The present revision was prompted by the planning process at the College level. In Fall 2004, Dean Steele formed five groups (Animal Sciences, Plant Sciences, Social Sciences, Food Sciences, and Natural Resources) to study the ways the College should develop thematically over the next 20 years. John Coupland, Don Thompson and Greg Ziegler served on the Food Sciences study group, and Lynne Brown served on the Social Sciences group. These plans were integrated by a sixth study group (including Steve Knabel and Don Thompson) and their report was used by a group (co-chaired by John Floros) to develop a draft 3-year plan for the College. This draft was developed by the Dean's group into our final plan for the period July 1, 2005-June 30, 2008.

A radical departure for the College in this planning cycle was to view its mission in terms of three systems: the food and fiber system, ecosystems, and socioeconomic systems. The Department of Food Science welcomes this strategic change, and we have used this planning process to consider in particular how we can contribute to the College's efforts around the food system. The food system is traditionally drawn as a chain of material flow linking the farm field to the consumer through a series of processing steps. The Department is the point where the College's expertise most closely approaches the final consumer and we will lead the College in responding to consumer wants and needs. In particular we can help develop foods that will play a part in a diet supporting consumer health and wellness.

The strategic planning committee (SPC) was drawn from faculty members who had participated in the college process (Lynne Brown, John Coupland, Steve Knabel, Don Thompson, and Greg Ziegler) along with Donna Merrill (Manager of Departmental Operations) and Bonnie Ford (Creamery Laboratory Director). John Floros (Department Head) was invited to join the group. The SPC developed this plan in February-May 2005 with extensive consultation with the Department and external stakeholders.

The completion of the plan occurred within a month of the official groundbreaking of our new building. We hope the symbolism of change and renewal in that ceremony will inspire us to pursue the initiatives described in this plan.

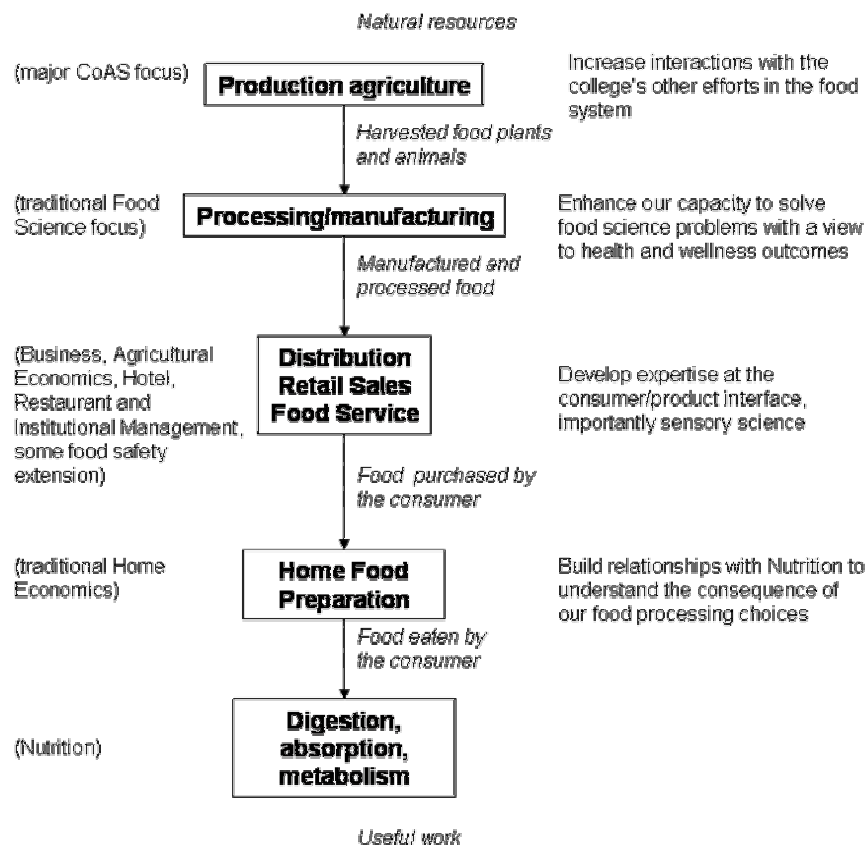
*Cover: Construction underway on the new Food Science building (5/10/05)
and the architect's rendering of the final building.*

Penn State Food Science Draft Strategic Plan

1. Executive Summary	4
2. Vision Statement	6
3. Mission Statement	6
4. Statement of Values	6
5. The Nature of the Department.....	6
6. Three Year Strategic Initiatives	8
 Initiative 1: Improve Consumer Health and Wellness	 8
Goal 1: Build on our expertise in the Material Nature of Foods	9
Goal 2: Focus on Systems Biology of Foodborne Pathogens.....	10
Goal 3: Acquire expertise at the Consumer-Product Interface	11
 Initiative 2: Enhance the Food Science undergraduate program(s).	 12
Goal 1. Revise the undergraduate curriculum in Food Science.....	12
Goal 2. Improve contact with food science students in the first two years of the food science program	13
Goal 3: Increase enrollment in the Food Science undergraduate program.....	13
Goal 4. Explore non-food science programs that might be led by the Department of Food Science.....	14
 Initiative 3: Coordinate our move into the new building to make the best use of our new resources and opportunities	 15
Goal 1: Physically move our programs to the new building.....	15
Goal 2: Promote Department programs	16
 Initiative 4: Ensure the atmosphere in the Department reflects our values.....	 17
Goal 1: Respect.....	17
Goal 2: Leadership.....	18
Goal 3: Scholarship.....	18
 7. Administrative Processes to Implement Plan.....	 19
1. Prioritizing resources for strategic initiatives	19
2. Assignment of responsibility and resources to action plans	21
3. Processes to report activity and progress towards planning goals.....	21
 Appendix 1: The Role of the Department of Food Science in the Food System.....	 22
Appendix 2: Benchmarking	27
Appendix 3: History of Strategic Planning in the Department of Food Science.....	39

1. Executive Summary

This plan is prepared at a time of dramatic change for the Department of Food Science. We have a unique opportunity to use the move to our new building to re-envision our missions in research, teaching and service. The College of Agricultural Sciences has moved to understand its missions in terms of three key systems, including the Food and Fiber System. A highly simplified representation focusing on the different sectors of the food system is shown below¹. On the left hand side of the Figure the academic units most closely associated with each sector are listed. Clearly the major focus of the College of Agricultural Sciences is on production agriculture – the foundation of the food system. While perhaps justified 150 years ago when the land-grant system began, currently this sector contains few of the economically important value-added processes² and is most distant from the consumer whose purchase decisions percolate up as the main driver of the whole system. The right hand side of the Figure shows ways we are using this plan to reposition the Department of Food Science in response to the economic and social realities of the food system by focusing directly on the needs of the consumer (especially consumer health and wellness).



¹ A more substantial discussion of food systems and their potential relationships to food science and to the department are provided in Appendix 1.

² For example, while production agriculture contributes approximately \$4 billion to the PA economy, food processing contributes \$20 billion.

Previous strategic plans have proposed strategic actions for all of the Department's core missions (teaching, research and service) as well as integrative activities. This plan is fundamentally different, focusing instead on a short, focused list of vital changes we must make over the next three years to transform the ways we meet our stakeholders' needs and maintain our position as one of the top food science programs in the nation. Therefore, many valued programs central to our missions do not appear on this list in order to prioritize our efforts and resources over the three years of this plan to focus on change.

Initiative 1: Improve consumer health and wellness. The physiological consequences of food choice will be largely studied in nutrition departments, with Food Science making important contributions in designing and manufacturing foods with enhanced nutritional properties. We will build on our expertise in the structure, composition and material nature of whole and manufactured food to strengthen our ability to develop products with the properties demanded by the consumer. However, even if nutritionists can specify the chemical composition desirable in a food and food scientists can produce it, the food will have no impact on health unless it is selected and eaten. We will therefore take the novel step of developing expertise at the consumer-product interface to help make this final connection. In addition, we will continue our work to reduce the burden of foodborne disease by focusing our existing strength in microbial food safety into the systems biology of foodborne pathogens.

Initiative 2: Enhance the Food Science undergraduate program(s). We are proud of our undergraduate program but recognize the need to make it both larger and stronger. We propose to increase our undergraduate enrollment by 10% a year each year of this plan and at the same time strengthen it by revising the curriculum and increasing contact with students in the first two years. We will also consider offering other major programs.

Initiative 3: Coordinate our move into the new building to make the best use of our new resources and opportunities. We must take action promptly to facilitate a smooth transition into the new building and take advantage of the many public relations opportunities offered. We will implement plans to move existing equipment safely and buy new equipment where necessary. We will also define the management of our new pilot plants to make the resources as available and effective as possible for all our stakeholders. We will form a Dedication Task Force to use events around the building opening to promote our programs.

Initiative 4: Ensure the atmosphere in the Department reflects our values. Attention to our values enables us to attract and retain the students, staff and faculty members essential to fulfilling our mission with integrity. To ensure our department reflects its values we have three strategic goals based around the selected values of respect, leadership and scholarship.

2. Vision Statement

The Department of Food Science will be a leader in the integration of teaching, research and service, recognized nationally for its preeminent undergraduate program and internationally for innovative research in the context of graduate education.

3. Mission Statement

The Department of Food Science provides science, education, and outreach contributing to an abundant supply of affordable, safe, nutritious, and appealing food.

4. Statement of Values

The department considers itself an intellectual community in which academic freedom and responsibility to the community are in harmony. The Department of Food Science endorses the core values in the College of Agricultural Sciences 2005-2008 Strategic Plan and in particular we value:

- An atmosphere of mutual respect that promotes open sharing and thoughtful consideration of opinions
- Creativity and innovation
- Cultural diversity
- Excellence and productivity in the scholarship of integration of education, research and service
- Leadership and teamwork
- Openness to change
- Research conducted in the context of graduate education
- The ability of food scientists to collaborate across disciplines and solve complex problems for the common good
- The competitiveness of the food industry
- The health and wellness of the population

5. The Nature of the Department

Penn State has a large, productive and comprehensive department of food science. Despite the recent significant cuts in our operating budget, we have increased productivity in all areas (see Appendix 2), and we are poised for even more dramatic growth as we move into our new facility – the largest food science building in the United States. Taking advantage of our new opportunities will require strategic change (described in Section 6 below). However it is worthwhile to first briefly reflect on the nature and quality of our existing and continuing programs.

Our undergraduate program is the largest in the eastern United States and is growing after a period of decline. Our students enrich their education through internships, international experiences (including new programs in Costa Rica and Ukraine), research (including several students publishing their work and presenting at national meetings) and through leadership opportunities in our active Food Science club. Our graduates report a high level of satisfaction with the program, and quickly and effectively transition to careers (largely in the food industry) or graduate school. We maintain strong connections with our alumni through the Food Industry Group (FIG) and the Advisory Board.

We effectively integrate our teaching and research missions around graduate education. We have redesigned and enhanced our graduate program in recent years. We have consolidated the course requirements at the graduate level and at the same time increased the breadth of optional courses available as well as increased the number of graduate students enrolled. Interestingly, the number of PhD students exceeded the number of MS students for the first time in 2004 suggesting an increased depth to our research efforts.

Our research efforts are structured around six impact groups. The cocoa, chocolate and confectionery; dairy foods manufacturing; and plant and mushroom products groups provide commodity related expertise in areas traditionally strong in Pennsylvania. The food safety and the ingredients as materials groups provide more basic science support while the family and community food systems group represents our efforts in community nutrition education. In addition, the Center for Food Manufacturing, based in the Department, is an industrially-sponsored research initiative with a vision of transforming the food industry from recipe-based to performance-based manufacturing. Both research funding and publication rates have increased in recent years.

Outreach activities connect the resources of the department with our stakeholders in Pennsylvania and beyond by offering current, accurate, and research-based food science information. Faculty members with extension appointments are the primary delivery sources for outreach programs. The food processing industry is offered regular workshops and shortcourses in dairy and ice cream manufacturing, meat and poultry HACCP, juice HACCP, principles of sanitation, food microbiology, and fundamentals of food science. Extension faculty members also create outreach publications, videos, and guidance documents that provide valuable information to both the food industry and consumers. Faculty members who do not have extension appointments also provide outreach leadership in shortcourses offered to the mushroom, canning, and chocolate and confectionary industries.

The University Creamery housed in our department is the largest facility of its type in the United States, and our teaching, research and extension/outreach programs benefit from our unique relationship. Our undergraduate students use the production-scale facility in several of their classes as well as enjoying the work experiences that a Creamery Internship can provide. Our graduate students use Creamery facilities to conduct practical research in a realistic manufacturing setting, and access to the facility and expertise allows us to offer great breadth and depth to our extension and outreach programs.

6. Three Year Strategic Initiatives

The SPC is proposing a plan that is fundamentally different than previous Food Science strategic plans, which addressed all the department's core missions of teaching, research and service as well as integrative activities (see Appendix 3 for a description of the history of strategic planning in the Department and the process used to develop this plan). Instead, we focus on a few critical strategic initiatives necessary to change the Department over the next three years and to lay the foundation of a long-term strategic path to meet stakeholders' needs and to maintain our position as one of the top food science programs in the nation. This approach does not downplay the continued importance and maintenance of the many other ongoing activities.

Initiative 1: Improve Consumer Health and Wellness

Food Science is classically defined as the application of engineering, chemistry and microbiology to the study of food and its manufacture from agricultural products. This Department also feels that the nutritional impact of the transformation of agricultural products into foods is an important aspect of food science as taught in undergraduate and graduate courses. In the past, the Department has focused more on aspects of food processing and manufacturing that are of most concern for industry profitability, with less emphasis placed on how these products affect the health and wellness of the ultimate consumer. Demographic and public health trends suggest this emphasis should change.

Scientists, individuals and public policy makers are growing more aware of the positive and negative consequences of dietary choices on their health and wellness. In the last ten years, obesity, both in adults and in children, has grown at an alarming rate. Now an estimated 64% of US adults are overweight or obese. An estimated 16% of children and adolescents are overweight and obese now compared to 11% in 1994. Additionally, rates of diabetes are climbing, especially the incidence of type 2 diabetes in adolescents. The publicized rise in obesity has sparked interest among adults in weight loss, of late through low or no carbohydrate diets. In addition, the attention of Congress is being focused on the contributions of fast food, fruit juice, sugar (take your pick) and advertising, particularly advertising to children, to the obesity epidemic.

In response to calls for more judicious food choices, smaller portions, and more exercise as well as publicized battles over items in school vending machines and lunches, health and nutrition are projected to lead food innovation in 2005 and beyond. Food Science can contribute to the prevailing emphasis on health and wellness by both the food industry and consumers. We currently have expertise in chemistry and engineering that can be applied to the function of specific ingredients or complex food mixtures needed in the development of products that will improve the health of consumers. In particular, many of our faculty members are interested in the material nature of foods, an area with great potential for multidisciplinary collaboration. Additionally, we have strong expertise in microbial food safety and security and in the positive dietary roles of microorganisms in

foods, with the objective of minimizing foodborne illness and benefiting human health, respectively. The crucial study of food product selection, involving expertise in the areas of sensory science, psychology and consumer marketing, is not currently studied specifically in the Department or elsewhere at PSU.

To build on and increase our ability to address health and wellness concerns, we propose three strategic goals. All of these will be met by reprioritizing our current research (particularly by awarding departmental assistantships in support of the initiative) and education (by stressing the health and wellness outcomes of food science) efforts, by building collaborative bridges to other academic units at Penn State and elsewhere, and by attracting new expertise to the department.

Goal 1: Build on our expertise in the Material Nature of Foods

The material nature of foods describes their physical, chemical and biological composition and structure. Control of these properties helps us develop foods appealing to consumers that provide healthful outcomes when incorporated into the diet. Our major approaches to controlling food properties are by selecting optimal ingredient combinations, processing operations and packaging materials.

The Department already has strength in these areas; for example, we maintain one of the most comprehensive facilities for the measurement and interrelation of food physical structure, chemical composition and sensory quality. We will build on our expertise in the material nature of foods with selected hires to strengthen our ability to design and/or produce products with attributes demanded by the consumer. From the point of view of health and wellness, these attributes can be characterized as sensory quality (as a determinant of food choice) and as the ways the food responds to the digestive system (as a determinant of its bioavailability and bioactivity). We will also collaborate with those involved in the Systems Biology of Foodborne Pathogens to better understand the role food structure plays in the control of foodborne illness.

Action Plans

- a. Seek additional faculty expertise in the Department (particularly in the areas of sensory science, bioavailability of nutrients and food materials process engineering).
- b. Develop contacts with expertise outside the Department in the Materials Research Institute, the Materials Science and Engineering Department, the Department of Nutritional Sciences, the Hershey Medical School and the Monell Chemical Sciences Center (<http://www.monell.org>) to understand the relationship of food structure to function and sensory properties. These relationships may include: (1) offering adjunct or courtesy faculty appointments for members of these groups, (2) inviting members of these groups to present in the departmental seminar series, and (3) developing a position description for submission to the Materials Research Institute.
- c. Develop staff support and administrative policies for the Food Materials Characterization Laboratory (see also Initiative 3, Goal 1).

Performance Indicators

- a. New faculty member expertise in the Department dedicated to this goal.
- b. Demonstrated increased contact and collaboration with members of relevant units inside and outside the university.
- c. Staff support and administrative policies for the Food Materials Characterization Laboratory.
- d. Departmental assistantships allocated in support of this goal.

Goal 2: Focus on Systems Biology of Foodborne Pathogens

The problems associated with rapid detection, tracking and control of foodborne pathogens are complex, and would thus benefit from a “Systems Biology” approach. Systems Biology is defined as “a multidisciplinary approach to investigating the interactions that control complex biological processes and visualizing emergent properties of a system that are not apparent from looking at its individual parts.” In addition to helping address problems in this area, a Center of Excellence in Systems Biology of Foodborne Pathogens would help us secure significant federal research grants.

Penn State has made a commitment to enhance its research effectiveness in the Life Sciences and in Health particularly through the Huck Institutes of the Life Sciences and the Department of Biochemistry and Molecular Biology. This includes many microbiologists with very basic research programs, especially in the areas of gene regulation and genomics. In this initiative we will seek to better link the Department with these efforts. However, we currently lack the necessary expertise in microbial ecology, molecular biology, genomics, bioinformatics and biosensors in our Department to take a true systems biology approach in this area. Establishing a Center of Excellence in Systems Biology of Foodborne Pathogens would result in greater collaboration with basic scientists at Penn State around intentional and unintentional microbial risks in food and methods to address bio-security issues. The approved Molecular Biology, Genomics and Bioinformatics position and a strategic hire in Microbial Ecology of Foodborne Pathogens will complement the applied research expertise that currently exists in our Department, while at the same time helping to bridge the gap between food science and very basic researchers inside and outside the University.

Action Plans

- a. Seek additional faculty expertise in the Department including molecular biology/genomics/bioinformatics and in the microbial ecology of foodborne pathogens.
- b. Develop contacts with external expertise in molecular biology, genomics, and bioinformatics located in the Huck Institutes of the Life Sciences in the Department of Biochemistry and Molecular Biology and in the USDA Eastern Regional Research Center. These relationships may include (1) offering adjunct or courtesy faculty appointments for members of these groups, (2) inviting members of these groups to present at the departmental seminar series and (3) developing a position description for submission to the Huck Institutes of the Life Sciences.

Performance Indicators

- a. New faculty member expertise in the Department dedicated to this goal.
- b. Demonstrated increased contact and collaboration with members of the Huck Institutes for the Life Sciences and other relevant units inside and outside the university.
- c. Departmental assistantships allocated in support of this goal.

Goal 3: Acquire expertise at the Consumer-Product Interface

Food scientists are experts at formulating and manufacturing foods, while nutritionists can describe a diet supportive of a healthy life. However, a food product formulated with a composition designed to support consumer health and wellness will only be effective if it were purchased and eaten. Control of the material nature of the products is important (see Goal 1), but not the sole basis for making the decision to eat (see Appendix 1). In this goal, we describe ways the Department can better approach some of the social science aspects of the consumer-product interface.

It is essential for the Department to maintain and expand its basic sensory science expertise, and to apply it in the laboratory and the community (especially directed at understanding flavor, texture and smell attributes that influence healthful food choices among various market segments). We must also interact well with expertise in food marketing especially in the importance of market segmentation, product modification and new product formulation around healthful food), and in behavioral psychology (especially food purchasing and the cues and cognitive processing used in decision making around healthful foods). In all of these studies, the importance of food packaging to convey a brand identity, to facilitate product use, and to modify the material properties of foods, is essential.

Action Plans

- a. Seek additional faculty expertise in the Department in sensory science.
- b. Develop contacts with expertise in behavioral psychology, food marketing and product development. This may include: (1) offering courtesy/adjunct appointments to members of the Department of Nutrition, the School of Hospitality Management, and the program in Food Marketing at St. Joseph's University (<http://cfm.sju.edu/>), (2) inviting members of these groups to present seminars at the departmental seminar series, and (3) developing a position description for the Children, Youth and Families Consortium.
- c. Contribute actively to University initiatives around childhood obesity.

Performance Indicators

- a. New faculty member expertise in the department dedicated to this goal.
- b. Demonstrated increased contact and collaboration with members of relevant units inside and outside the university.
- c. Departmental assistantships allocated in support of this goal.

Initiative 2: Enhance the Food Science undergraduate program(s).

The Department of Food Science takes pride in its undergraduate program and is willing to work hard to continue to improve it. If the program is going to continue as one of the top in the nation, then it must improve and provide educational opportunities that lead to a continued high level of student placement and the recognition that our students are successful. In this initiative we propose to revise the curriculum, improve contact with students at the start of our program, increase enrollment, and consider possible new majors from the department.

Goal 1. Revise the undergraduate curriculum in Food Science

It is important to assure the requirements for the undergraduate program in Food Science are up to date and relevant. In addition it is important to provide flexibility in the program in order to allow students to take advantage of various scheduling options to customize their individual academic program.

Action Plans

- a. Evaluate our curricular approach to food science education. We will first agree upon the expected outcomes for the complete FDSC undergraduate major, and then assure these are met by modifying our syllabus by writing performance objectives for each of the courses in Food Science, assuring the integration of required Food Science courses and the usefulness of non-Food Science required courses. In line with University recommendations, and in the context of this process, we will reduce the number of credits required for graduation.
- b. Expand the flexibility of the Food Science major by developing and implementing a variety of scheduling tracks to allow emphasis in business, science or pre-medicine. We will also implement a Nutrition double major scheduling track.
- c. Evaluate the need for supporting courses offered by the Department of Food Science.
- d. Assess the feasibility and advisability of permitting the substitution of a leadership course for the current undergraduate speech communication requirement for Food Science students and of including a seminar series “succeeding in the food industry” with extensive contributions from leaders in the food industry.

Performance Indicators

- a. A set of approved performance objectives and expected outcomes.
- b. Recommended scheduling tracks included in the Undergraduate Handbook.
- c. A plan for curricular revision submitted to the Faculty Senate.

Goal 2. Improve contact with Food Science students in the first two years of the Food Science program

The strengths of the Food Science program stressed in our recruitment materials include the real world nature of the subject and the close contact between faculty and students. The importance of this connection is seen in the improved ability of students to succeed, as well as in retention of students who have matriculated into our program. However, our current curriculum typically offers little in the first two years. We will change this.

Action Plans

- a. Develop and implement a Food Science first year seminar.
- b. Assure first and second year students have contact with the faculty and staff of the Department of Food Science in each of their first four semesters through course work, club activities and specific retention activities. We will seek to enhance the student experience by training the academic advisors through a series of advising workshops.
- c. Improve contact with non-University Park first and second year students using a variety of methods (e.g., newsletters, making phone contact once per semester, providing free tailgate tickets, interactions with the Food Science Club)

Performance Indicators

- a. A first year seminar in food science offered at least once per year.
- b. Enhanced retention of first year students.
- c. Evidence of faculty advising workshops

Goal 3: Increase enrollment in the Food Science undergraduate program

We have the capacity to educate more students without devaluing their educational experience or their “market value” on graduation. We propose to increase our enrollments by 10% a year over the three years of the plan. This goal will be met by enhancing recruitment and retention of students. We are committed to a diverse student body and we will seek to support this through our selection of recruitment and retention activities.

Action Plans

- a. Evaluate and expand our recruitment activities. Our current recruitment activities are effective, but the extent to which we can pursue them depends on the faculty and staff time available. Dairy and Animal Science and Poultry Science maintain instructors with significant recruitment responsibilities and we recommend a similar position in Food Science (see below). We also recognize that our current students are the best advocates of our program to high school and college students, and we will mobilize this resource effectively.
- b. Improve student contact throughout the recruitment process. It is essential that students are in regular contact with the Department as they move from

being a casual contact to an applicant to a paid-accept and through their early years at Penn State (at whichever campus they start) and their junior and senior years in our program. We handle the first and last part of this process well, but we struggle to maintain the contact in the intervening stages may consequently lose students. Part of this action plan falls under Goal 2 above, and we also propose to use information technology to track individuals through this process and maintain a regular and personalized system of contact.

- c. Enhance our website as a recruitment tool. Teenagers use the web as their research tool of choice, so it is essential we make the best possible use of our web space.

Performance indicators

- a. Dedicated resources in support of student recruitment and retention.
- b. Number of students enrolled in Food Science by semester standing.
- c. Records of how each student was recruited by the Department and of prospects not recruited by the department.
- d. Evaluations of recruitment activities.

Goal 4. Explore non-Food Science programs that might be led by the Department of Food Science

The College of Agricultural Sciences has plans to take a systems approach and focus particularly on the food system. The Department of Food Science is in a position to provide expertise to a large portion of the food system (see Appendix 1), and it seems likely that this would enable us to contribute to other programs beyond our successful FDSC major. These could include innovative combinations of physical and social sciences and combinations of science, business and engineering. In addition, we need to recognize that the relationship of the food science skill set to the manufacture of other important consumer products may provide additional opportunities.

Action Plans

- a. Develop criteria for evaluating the value of non-traditional programs to the department, college and university. These would allow us to fairly evaluate the potential costs, risks and benefits of any proposed new major.
- b. Explore the possibility of novel programs (e.g., “Food Studies”, “Food Packaging”, and “Personal Care Products Manufacturing”).

Performance Indicators

- a. Development of criteria for evaluating non-traditional programs.

Initiative 3: Coordinate our move into the new building to make the best use of our new resources and opportunities

By Fall 2006, half way through this planning cycle, the Department will be housed in a new building providing state-of-the-art facilities for teaching, research and outreach. The new Food Science Building also will help ensure that Penn State's Department of Food Science can remain strong by: recruiting and retaining the highest-caliber faculty, staff, and students; educating students through exposure to quality teaching and dynamic research; providing specialized research and technology transfer expertise for the food industry; and providing pilot plant facilities for small and medium sized food companies. However, it is our responsibility to make the most of the opportunities provided by this major investment in our future, and in this section of the plan we define several necessary activities.

Goal 1: Physically move our programs to the new building

The new Food Science Building is scheduled to be substantially complete in June of 2006. The transition and eventual occupancy of the building is scheduled for July and August of 2006. The commissioning of the dairy plant and certification of its equipment and laboratory is scheduled for April of 2006. The pilot plants and Creamery represent unique resources for the Department, and in order to maximize this advantage we need to develop strategic goals that integrate these facilities into our programs.

The Pilot Plant & Creamery Committees will develop a plan that addresses the actual transition of this Department to the new building. The task will be daunting on several levels, and we stress the time required for both the planning effort and the actual move. Awareness of this time commitment is key, and we caution the Department against thinking this move will be smooth and uneventful. We expect a “shakedown” period following the rigging, removal, and re-installation of the existing equipment. It is likely that some of the instruments and equipment will need re-adjusting or even replacement.

It is essential all members of the Department recognize the magnitude of this task, and prioritize time and resources promptly and appropriately.

Action Plans

- a. Identify equipment needs in pilot plants and the Creamery. Seek out sources of funding for equipment in pilot plants between now and the move-in date; acquire and install the equipment.
- b. Develop policies, procedures, and usage fees for use of these facilities. This is to include fees for internal charges, contract research, and consulting as well as use of the facilities for outreach programs.
- c. Seek a full time staff position as pilot plant coordinator and an instrument specialist for the pilot plants as well as laboratory instruments located through out the building.
- d. Prioritize time and resources to coordinate the move of other departmental functions (e.g., main office, research labs, common spaces).

Performance Indicators

- a. Working equipment installed in the pilot plants and the Creamery.
- b. Policies, procedures, and usage fees for use of pilot plant facilities and the instrumentation facilities and an administrative structure to collect and utilize these funds.
- c. Management and technical support staff for the pilot plant and other instrumentation.

Goal 2: Promote Department programs

The new building offers the Department a unique opportunity to promote its programs.

Action Plans:

- a. Prepare for the Building Dedication. We will form a Dedication Task Force from members of the department, college and FIG. This task force will work with existing departmental committees to (i) develop a consistent and appropriate message to be incorporated into departmental communications, (ii) plan and prioritize the printing and distribution of new publications (recruitment materials, brochures displays, etc.) with the new departmental message and information about the new building. Novel publications may include a video showcasing the new building and a dissemination of historical/archival information on Borland Lab, the Creamery and the new building.
- b. Dedication of the new building. In Fall '05 we will develop and implement a series of public relations activities in the run up to the opening of the new building. These may include: (i) activities surrounding the opening of the Borland Lab time capsule and the inclusion of items for the new time capsule (2006), (ii) a series of public lectures from distinguished speakers with food-related expertise, (iii) tours and demonstrations in the new building, (iv) local media outreach, (v) explore additional fund raising opportunities (e.g., auction of Borland stairwell knobs, last ice cream cone in Borland, first ice cream cone in new building, bricks, etc.), and (vi) a new ice cream flavor.
- c. After the dedication. Additional activities are recommended to continue the momentum generated by the building after the dedication. These may include: (i) building tours for uninvited audiences, (ii) social activities that include the public, (iii) work with Ag. Information & Communication Technologies to develop and disseminate quarterly press releases highlighting research conducted by FDSC faculty and graduate students to media outlets, (iv) recruitment activities with FDSC experiments outside the building, and (v) ongoing promotion of Food Science programs in the Creamery salesroom.

Performance Indicators.

- a. A consistent and appropriate message to be incorporated into departmental communications.
- b. Number of new publications prepared and distributed.
- c. Attendance at events associated with building dedication.
- d. Media response to building dedication and related events.
- e. A new ice cream flavor associated with the new building.

Initiative 4: Ensure the atmosphere in the Department reflects our values

Our strategic plan prominently features a statement of our shared values. We believe attention to our values will enable us to better attract and retain the students, staff and faculty members essential to fulfilling our mission with integrity. We have three strategic goals based around selected values.

Goal 1: Respect

At an inter-personal level, respect can be defined as a willingness to show consideration or appreciation, and it is in this context that faculty, staff and students deserve the right to be part of a “Culture of Consideration”. At the collective level the Department of Food Science should, through its actions, constantly endeavor to earn the respect of its faculty, staff and student body. The following actions are suggested as ways to support a climate of respect within the Department of Food Science.

Action Plans

- a. Participate in training offered by the college and university around values issues revealed by recent college and university surveys.
- b. A student recruited by the Department based on our promise of a friendly, small college atmosphere (see Initiative 2, Goal 3) may legitimately feel the lack of contact in the first two years of the program as a lack of respect. We will address this by increasing our contact in the first two years as described in Initiative 2, Goal 2.
- c. Devise and engage members of the Department in sessions (seminars, workshops) to clarify issues that undermine a climate of mutual respect.
- d. Encourage a respect for each other’s time and verbally acknowledge each other’s accomplishments.

Performance Indicators

- a. Participation at training events.
- b. Department-sponsored events designed to support morale and mutual respect.

Goal 2: Leadership

The Department of Food Science values leadership, and therefore the skills associated with effective leadership should be part of the career development process for faculty and staff as well as for students.

Action Plans:

- a. Encourage the Food Science Club to hold an annual weekend retreat to complete the HRDC professional development training on Leadership and Teambuilding.
- b. Organize a discussion series devoted to various faculty, staff, and student perspectives on leadership. Invite industry, university and government leaders to present seminars on the value of leadership skills.
- c. Assess the feasibility of permitting the substitution of a leadership course for the current undergraduate speech communication requirement for Food Science students. [see also Initiative 2, Goal 1]
- d. Encourage all supervisors to participate in formal HRDC and CoAS supervisory and leadership programs.

Performance Indicators

- a. Participation of Department members at events offering training or insight into leadership

Goal 3: Scholarship

As members of an academic community we strive to be scholars ourselves and to support scholarship in others.

Action Plans:

- a. Improve the Departmental seminar series. Our departmental seminar series offers us an opportunity to observe the practice of scholarship. By attracting excellent speakers from Penn State and elsewhere we teach by example, stay current in our approach, and promote Departmental programs. Attendance at seminar is perhaps the best orientation to the scholarly life that a graduate student could receive.
- b. Present public seminars around popular and topical food-related topics. See Initiative 3, Goal 2.
- c. Within the Department acknowledge outstanding publications and presentations at scientific meetings.

Performance Indicators:

- a. Attendance at seminars and scholarly engagement with the topics.
- b. Number of highly cited publications.
- c. Number of scientific achievement awards.

d.

7. Administrative Processes to Implement Plan

In our planning process we identified a short list of four critical initiatives essential to the development of the Department over the next three years (Section 6). As we completed our prioritization before writing the plan, all of the initiatives listed should be seen as “top priorities”. These initiatives are well-aligned with the college plan (see Table below) and also various University initiatives. The internal impact of the initiatives will be seen in our performance metrics (see Appendix 2), and we will communicate the impact of the initiatives and other ongoing programs to our various stakeholders, including members of the Department and College, the wider academic community, students, alumni and their families, state and federal government agencies, extension educators, the food industry and the consumers of food.

Initiative	College Goal	Relevant Departmental Metrics
1: Improve consumer health and wellness	B	Faculty and staff numbers. Funding and productivity. Graduate student numbers.
2: Enhance the Food Science undergraduate program(s).	A	Undergraduate learning, student numbers and the success of our alumni
3: Coordinate our move into the new building to make the best use of our new resources and opportunities	C	All aspects of departmental operations
4: Ensure the atmosphere in the Department reflects our values	D	

1. Prioritizing resources for strategic initiatives

Reprioritization of Existing Resources.

Initiative 1 represents a transformation of the way many of us approach the practice of food science and, if implemented in full, would mean a significant reallocation of our existing resources.

Initiative 2 will require the dedicated effort of members of the Undergraduate Program Committee over the three years of the plan.

Initiative 3 will demand the attention of all members of the Department and even more time from individuals charged with activities around the pilot plant and other shared facilities and members of the Dedication Taskforce. The extent to which new equipment

can be installed and new publications can be prepared will depend on the resources available.

Initiative 4 can be achieved by reprioritizing existing faculty and staff time.

Requirements for Additional Resources. Goals 2 and 3 of Initiative 2 (Recruitment and Retention of Undergraduate Students) will not be adequately implemented without support for the instructor position outlined below. If this support is not forthcoming we will drastically scale back our expectations in this section. Similarly, full implementation of Initiative 1 (Consumer Health and Wellness) requires additional faculty expertise within the Department as described below.

Staff positions required to support strategic initiatives

- **Instructor with Recruitment Responsibilities** to: (i) develop recruitment materials and present them to our target audiences, (ii) coordinate and support recruitment activities by other members of the department, (iii) track and maintain contact with prospects throughout the recruitment process and into the early years of the program, (iv) teach introductory course(s), and develop long-term contractual agreements with targeted industry clients, and (v) advise students.
- **Pilot plant coordinator.** The coordinator will support applied research and outreach activities to targeted industry groups around product and process development, workshops and training. In addition, the coordinator will be responsible for the maintenance of the pilot plant and its equipment, controlling access to the pilot plants, training and working with users, and charging appropriate fees.
- **Instrument specialist** for laboratory instruments located throughout the building. Responsible for the acquisition and maintenance of the laboratory equipment, controlling access, training and working with users, and charging appropriate fees.

Faculty positions required to support Initiative 1: Improve Consumer Health and Wellness

Goal 1

- **Materials engineering** to take a chemical/materials engineering approach to the manufacture, properties and/or packaging of healthful foods.
- **Food Science/Nutrition** with knowledge of or interest in bioavailability/bioactivity.

Goal 2

- **Molecular Biology/Genomics/Bioinformatics (Position Approved – search in progress)** – to conduct research in molecular biology and genomics of foodborne pathogens.
- **Food Microbial Ecologist** - to work on the microbial ecology of foodborne pathogens both in foods (outside the intestinal tract) and possibly in feces (inside the intestinal tract).

Goal 3

- **Sensory scientist** to conduct both classic (laboratory) and community based sensory experiments directed at understanding flavor, texture and smell attributes that influence healthful food choices among various market segments.

2. Assignment of responsibility and resources to action plans

During the summer and early fall of 2005, the Department Head will assign responsibility for the implementation of the strategic plan to members of the Department. Specific individuals will be charged to champion goals or groups of goals supported by a committee, either as a charge to one of the standing committees in the Department (for example Initiative 2 will be largely the responsibility of the Undergraduate Program Committee) or an ad-hoc task force formed for the purpose.

3. Processes to report activity and progress towards planning goals

It is the intention of the SPC that the strategic planning process will not end with completion of this document, but will continue over the next three years regular evaluation of our processes and feedback on our performance (quantitative and qualitative) toward meeting the goals set forth in this plan.

The individuals charged with championing individual goals will meet with the Department Head each semester to review their action plans and to report progress. All department members will report their contributions towards strategic initiatives as part of their annual review.

We will hold a Departmental retreat at the end of each Spring semester during the planning period to refine our goals and report progress toward the strategic initiatives. The Department Head will report progress towards our initiatives at subsequent meetings of the Advisory Board, and where possible to other stakeholder groups.

We will use the web to post ongoing progress towards goals and action plans.

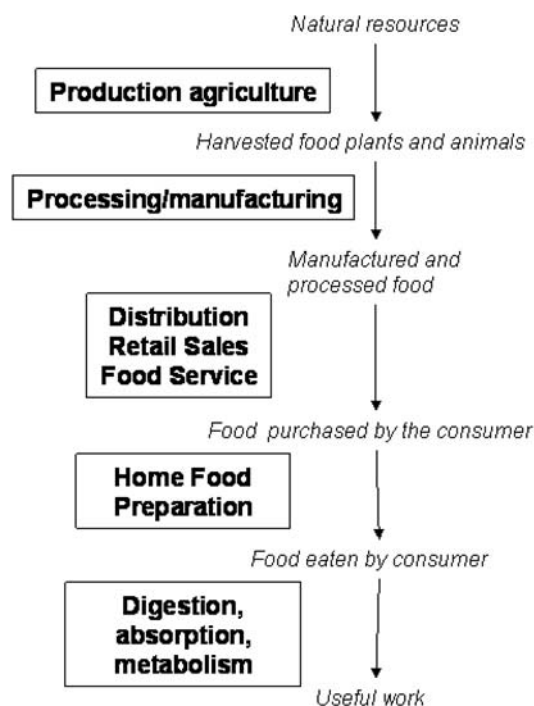
Appendix 1: The Role of the Department of Food Science in the Food System

1. What is "the" Food System?

The food system may be thought of in several complementary ways,

- As a system within the larger economic environment, as part of a “consumer culture.”
- As a segment of the economy. It includes all those activities contributing to the generation of food (meaning what the consumer eats).
- As a hierarchical set of systems: local, regional, national, or international.
- As a description of paths of information flow and its interpretation, especially from customer to provider.
- As a description of customer/provider relationships. In each relationship the provider must understand the desires of the customer, and ideally the relationship will take into account the desires of all customers beyond that up to the consumer.
- As a description of the paths of material flow toward consumer. As such, it can be useful for determining economic "value added."

In the context of this plan it is most helpful to focus on the last, “material flow” view of the system. A highly simplified figure summarizing some of the steps in this system is shown right³. Production agriculture is all of the processes of growing plants and animals and converting them to products not directly consumable. Food processing and manufacturing is all of the steps needed to convert these products to something that can be sold as food or a food ingredient, this might be as simple as a farmer washing apples for farm-gate sales but more likely involves some industrial operations at another site (e.g., processing the apples to make canned pie filling or pectin to sell to a jelly manufacturer). The next steps describe the diverse paths that these products may take before being purchased by the consumer; often this will involve a wholesale-retail chain but the food service path is increasingly important. The purchased food may be subject to further processing by the consumer in the home (i.e., cooking) but is finally



³ This is a simplified version of the Figure in the executive summary focusing on the nature of the system. The version in the executive summary includes this but also has additional annotations describing the current and proposed relationship between academic units and various sectors of the system.

eaten. The last stage of the process takes place inside the human body and describes the breakdown of food molecules and their biological use. This does not describe all of the food eaten but is probably valid for most of the typical American diet.

In a free market, the driver of material flow in this system is consumer preference as perceived by the suppliers (hence information flow in the reverse direction is crucial to understanding the above diagram). However, consumer preference may only be expressed in response to choices offered. Food companies will typically exert as much influence as possible to harness the power of consumer choice in the food system for economic gain. A food product is a brand which draws value from both its material properties and also from the psychological and sociocultural benefits it brings to the consumer. A food company seeking to increase its brand value may seek to use food science to improve the material properties of the product but will more often resort to marketing to influence the intangible aspects. In practice, working food scientists often report to a marketing department and this relationship reveals the fact that material properties are only one contribution to the overall brand value of the product. Importantly a consumer's *perception* of the product is likely to have huge influence on the purchase decision and hence the whole food system regardless of the actual material properties.

The food dollar is not equally spread over all sectors of the system and is concentrated approximately equally in the food service and food retail sectors, significantly less in the food processing/manufacturing sectors and much, much less in the production agriculture sectors. The College of Agricultural Sciences is skewed almost exclusively to the production side of the system and the Department of Food Science to the production and manufacturing sectors.

2. What is Food Science, and how does it relate to "the" Food System?

Food science is currently understood among its practitioners in the US as a group of disciplines (chemistry, microbiology, engineering, nutrition) brought to bear on scientific and technical questions concerning the material nature of food. Often the questions addressed by food science are related to practical problems associated with unit operations in food processing and manufacturing. Since industrial processes are designed based on engineering principles (even if based on recipe knowledge), answers to the science questions are often applied based on engineering-based analyses. There is no conceptual basis for excluding a scientific discipline from food science as long as it may be brought to bear on food-related questions. The traditional emphasis on certain disciplines is largely historical. Food science is not itself a discipline.

Scientific and technical questions concerning the material nature of food can occur at any stage of the food system. Typically these are focused in the processing and manufacturing sectors but may arise during distribution, in food retail and service sectors, during home preparation or even in the food as it passes through the human body.

Food science is important in transforming the economic value of agricultural produce as it contributes to the viability of the processing and manufacturing sectors, in particular the food industry. An important contribution of food scientists is to product development. Increasingly the recipe for new products is developed by culinary artists and marketers, and then transferred to food scientists/technologists to make it practical for mass manufacture and marketing. Marketers define a food product for the consumer; food scientists and technologists make it possible. Another major responsibility of the food scientist in industry is in trouble-shooting technical questions, sometimes in real time, in processing or manufacturing. The speed and volume of large-scale processing places a premium on the knowledge of a person who can quickly solve such problems. People of wide academic and non-academic backgrounds are involved in both of these problems and so there is again a premium on being able to work with people who see the problem from a different perspective. Communications skills are critical under any circumstances, but there is a special premium on them when working with a team under pressure.

Our treatment of the food system so far focuses on the transformation of materials and the consequent development of an economic system driven by consumer choice to which food science contributes. However the product choices made by the consumer and influenced by the contribution of food science to formulate products and influence their brand value constitute a diet, and diet constitutes a huge influence on health and wellness. Therefore consumer health and wellness is an important indirect outcome of the practice of food science not immediately obvious in the material transformation model proposed. How then can food science connect to nutrition?

Nutrition is generally considered as a component discipline of food science. However in practice the treatment of nutrition in Food Science curricula is often cursory (IFT requires only a single class) and academic collaborations between food scientists and nutritionists are limited. One useful, but conservative, application of nutrition in food science as a contribution to the "health and wellness" of consumers would be to study the classical food chemistry and microbiology-associated questions related to potential bioactive components in or added to foods. More aggressive application of nutrition would be to attempt to determine the nature of bioactivity of foods and their components or to study the effect of food components on host metabolism (nutrigenomics). In either case, it would seem that close collaboration with faculty members in nutrition programs would be appropriate. Food science expertise is also well suited to the study of food structure/functionality within the colon for example, an area about which little is known. Food microbiology might be reasonably expanded to include this milieu, and the nature of food ingredients which influence it, including prebiotics, would fit naturally as well.

Of course, the health and wellness outcomes are strongly coupled to commercial outcomes of food science, as many food companies maintain a strong interest in nutrition as a marketing tool. Importantly, the marketing value is driven by consumer belief in the health outcomes and only indirectly by scientific evidence which leads to potential ethical issues associated with the development and marketing of "healthy" foods. Ingredient

advertisements in trade journals often refer to what consumers think rather than the scientific evidence. Structure-function claims allow one avenue for nutrition/health marketing on the food label, and even a simple declarative statement (e.g., with x mg isoflavones) may be sufficient to influence consumer behavior. Both seem to be preferred over the insipid language of “qualified” health claims.

3. The PSU Department of Food Science and its relation to “the” Food System

The PSU Department of Food Science emphasizes the core disciplines of food chemistry and food microbiology in a traditional way. In food chemistry, a major emphasis is on “Ingredients as Materials.” This approach addresses ingredient technology from a “functional properties” perspective, but instead of characterizing functional properties by idiosyncratic empirical methodology (e.g., foaming capacity), it attempts to describe physical behavior in more fundamental terms. An attempt is made to relate chemical structure to physical function at scale levels from the molecular to the macroscopic. In food microbiology, the emphasis is on food safety, particularly microbial food safety. In addition to research concerning microbial food pathogens, strong outreach programs are in place for state and regional industry.

Food microbiology is a field of study that integrates and applies knowledge within the disciplines of Food Science and microbiology to preserve, process, package, and distribute foods that are wholesome and safe to eat. The Department has particular strength in destruction of foodborne pathogens (notably in meat, dairy foods and plant products) with a strong outreach focus. The growth of microorganisms in fermentations and as probiotics is also studied. Additional campus resources for students and faculty studying food microbiology are available through the Departments of Veterinary Science, Dairy and Animal Science, Poultry Science, Agricultural and Biological Engineering, Biology and Molecular Biology, and Microbiology.

Food engineering is limited in scope within the department per se. Additional capacity is available in the Agricultural and Biological Engineering department. The Center for Food Manufacturing is administered through the department and provides contact with numerous companies. Aspects of food engineering are evident in the departmental emphases on processing and manufacturing of foods of special importance to PA in particular mushrooms, dairy products, and confectionery. Although the nature of the pilot-scale processing facility in Borland Lab has been a historical weakness of the program, the planned pilot-processing facilities in the new building will change that, and offer an opportunity to enhance our engineering capabilities.

The University Creamery manufacturing facility and the Creamery salesroom are a unique resource administered through the Department of Food Science. The manufacturing facility provides opportunities for student internships and for demonstrating concepts in undergraduate coursework. This facility also provides, in a limited way, a mid-scale processing option for research. The Creamery is a major

contributor to many processing and manufacturing outreach programs through the department. Further integration of the Creamery manufacturing plant into departmental programs represents an important opportunity. The visibility of the University Creamery provides an opportunity to educate the University community about the food system and the role of Food Science in it.

Nutrition is currently represented in the department primarily as nutrition education, with a strong but diminishing cooperative extension emphasis. A large nutrition science program and a much larger nutrition education/dietetics program exists in the nutrition department. Nutrition elsewhere in the College of Agricultural Sciences focuses on animal nutrition. The increasing consumer interest in health and wellness through food argues that food scientists educated in our programs should be well grounded in nutrition.

Extension efforts tend to aim at providing technical support for small and mid-sized companies, not in a proprietary way but group-wise after identifying needs in common with industry sectors. A feature of our department is the number and breadth of the courses designed for industry specific industry segments.

The Department of Food Science has made relatively few contributions to aspects of the food system beyond the processing/manufacturing sector described above. Business questions tend to be addressed outside the department, within the College primarily through the agricultural economics department and the Agricultural Business Management (ABM) undergraduate program. A minor in food business is available but largely not used by Food Science undergraduates; on the other hand, many undergraduates take courses in this area as supporting courses. A once-co-listed product development course is now only offered as an ABM course, as the technical base in this course (open to students with no Food Science coursework) does not justify the FDSC (Food Science) designation. Most Food Science students do not take coursework concerning the food system or food marketing.

Aspects of the food system downstream of manufacturing are traditionally studied by the Hotel, Restaurant, and Institutional Management (HRIM, including food service) program in another college. It does not have a strong technical base, but is more business and hospitality oriented. The Department of Food Science interacts with HRIM primarily through outreach food safety programs oriented toward restaurants.

Appendix 2: Benchmarking

Benchmarking is the search for best practices that lead to superior performance. A benchmark is defined as a reference point or standard by which something can be measured or judged. The benchmarking strategy concentrates on both best practices and metrics. Best practices may be located in our own organization, in a competitor's organization or in a similar functional area of a non-competitor's organization.

Metrics are carefully selected measures of an institution's performance that help track change towards strategic goals. We are required to report metrics to the college as part of the strategic planning process. The Graduate School has for several years now evaluated graduate programs based on a select set of metrics. Our research and graduate program will soon be ranked for the first time against other "Food Science and Engineering" departments by the National Research Council, and we will be asked to report metrics as part of this process. We understand that those quantitative metrics most easily obtained generally give only a partial and somewhat distorted view of our performance. Therefore, we will continue to collect more qualitative assessments, such as that obtained via exit interviews, in addition to the metrics detailed in this plan.

Since the context of strategic planning is often important and the process may vary from institution to institution, we selected another academic department at Penn State, though not in the College of Agricultural Sciences, as our strategic planning process benchmark. We chose the 2002-2005 Strategic Plan of the Department of Chemical Engineering at Penn State as a model. We felt for both style and content that plan was exemplary. Furthermore, Chemical Engineering as both a department and a discipline is similar to Food Science, and so we felt the model was appropriate. Among the attributes of the 2002-2005 Strategic Plan of the Department of Chemical Engineering at Penn State that we emulated was its focus on a relatively small number (7) of well-defined goals for the three year period, and the extensive analysis of trends in the discipline and their department. We consider this benchmarking activity a starting point with the goal of identifying benchmark institutions from which we can obtain metrics in the future.

Benchmarking Overall Departmental Structure. There are currently 51 undergraduate programs in the U.S., Canada and Mexico approved by the Institute of Food Technologists (IFT). The IFT web site lists 48 graduate programs. The Committee selected 12 institutions that represent regional, national and international "competitors" for further investigation. To a large extent the selection of these schools was based on the Committee's assessment of those programs with which we compete for graduate students and research dollars. Table 1 lists those institutions the Strategic Planning Committee agreed to research. However, information was not equally available on all these institutions. Extension/Outreach programs were less of a consideration. As much as anything else, the programs we selected express our collective assessment of the "best" programs in the discipline and those departments we consider "peers." The list of ISI Most Highly Cited investigators in the discipline was also used as a metric for selection of benchmarking institutions.

Table 1. Peer institutions used as benchmarks.

Regional	National	International
Cornell	Purdue	ETH-Zurich (Switzerland)
North Carolina State	U. California-Davis	Guelph (Ontario)
Rutgers	U. of Wisconsin-Madison	Leeds (UK)
U. of Massachusetts	U. of Georgia	Wageningen (Netherlands)

The University of Massachusetts was selected because it had available a relatively recent strategic plan that included the results of a 2002 AQAD Review of the program. The preface of that review concluded that UMass Food Science is “a highly respected academic unit with a long and successful tradition as one of the leading centers of food science research in the world,” and “competes unusually well against other Department of Food Sciences for both federal and industrial grants and contracts.” UMass has established four “research centers of emphasis:” Food and Environmental Biotechnology, Physical-chemical Properties of Food, Food Safety, and Food, Health and Wellness.

Cornell and Rutgers are our closest competitors geographically, and have reputations for strong Department of Food Sciences, especially in graduate education. The Department of Food Sciences at North Carolina State and Purdue are comprehensive programs sharing much in common with our department, in particular a strong commitment to undergraduate education. The University of Wisconsin is perhaps our biggest competitor in the Big 10, notably in the areas of dairy and confectionery manufacturing. The University of Georgia has a strong microbial food safety program.

The Procter Department of Food Science at Leeds University (UK) is one of the leading Food Science departments in the world. Their excellent research record (only Food Science program to have been twice awarded the Government's 5* RAE research rating) means that many of the major food companies are involved in collaborations with Leeds. ETH in Zurich is reputed to have the premier food engineering program with an emphasis on material properties and processing. Wageningen is a comprehensive program with a strong dairy manufacturing emphasis and research reputation. Guelph is the premier undergraduate Food Science program in Canada, with a solid reputation in ice cream and food physics (food materials) research.

Benchmarking Undergraduate Education. Long-term trends in the degrees awarded in agricultural sciences are presented in Figure A2.1. Between 1966 and 2002, dramatic 20-year cycles can be observed in the number of baccalaureate degrees awarded, with the highs (~18,000) almost twice the lows (~8500). We appear to be currently on the downward trend after a peak in about 2000. Figure A2.2 provides similar data for B.S. degrees awarded in Food Science and related areas for the decade 1991-2002. It appears that similar to agricultural sciences in general, Food Science and related disciplines also peaked in the late '90s and are on a downward trend. This provides the general context in which we intend to increase our undergraduate enrollments.

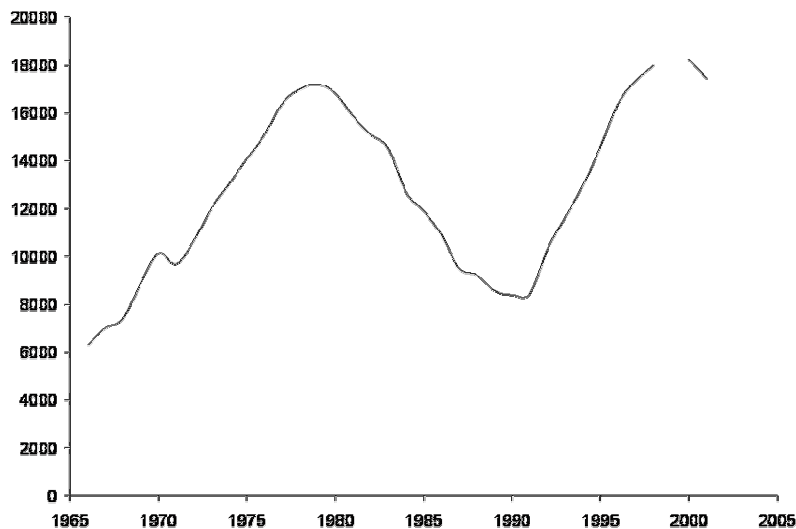


Figure A2.1. Agricultural Science B.S. degrees awarded 1966-2002 (NSF-SED).

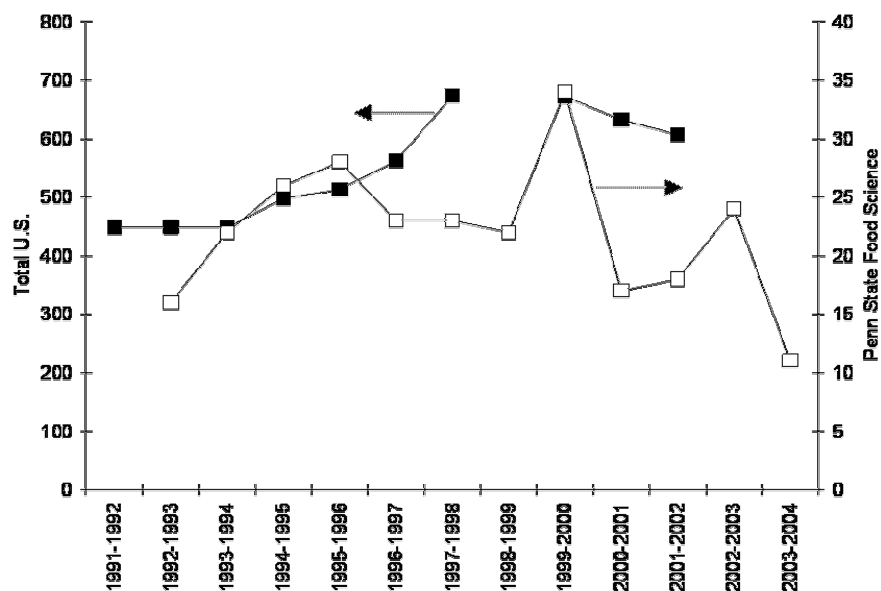


Figure A2.2. Degrees awarded in food science and technology (NSF data) shown alongside similar data for Penn State Food Science.

We are the largest Food Science undergraduate program in the Northeast and the second largest in the nation (Fig. A2.3). The department's renewed recruitment focus has had a positive impact in both the number and quality of students entering our program. As well as growing in size our program is effectively educating its graduates. In March of 2004, our undergraduate program was extensively reviewed and approved by the Institute of Food Technologists' Committee on Higher Education, nearly all of our undergraduate students benefit from internship experience, and we continue to have near 100% placement with competitive starting salaries. Enhancing and growing the Food Science undergraduate program is a continued strategic focus in our new plan.

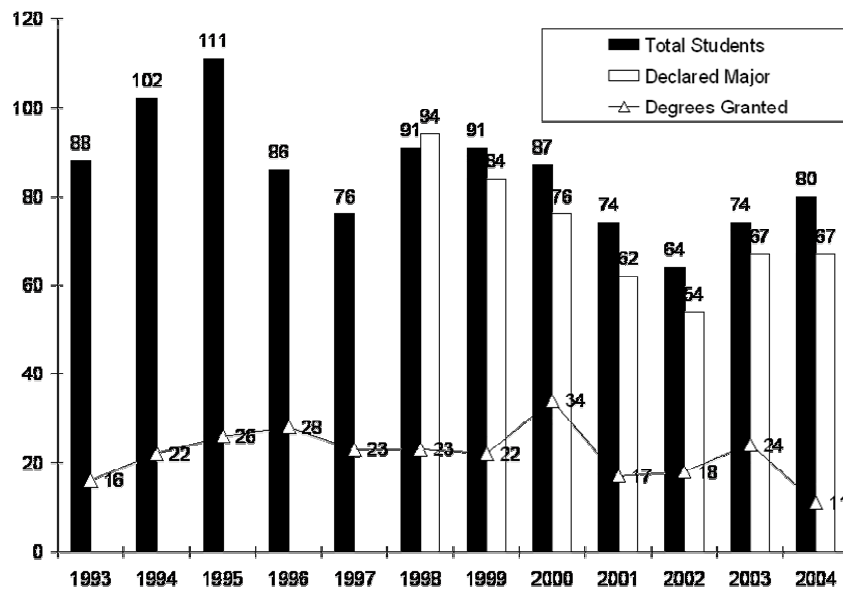


Figure A2.3. B.S enrollment and degrees granted from PS in Food Science, 1993-2004.

More recent national enrollment data is presented in Figure A2.4. In 2004, 909 students were reportedly enrolled in Food Science and Technology B.S. degree programs in the U.S. If we assume that the majority of those were enrolled at the 51 approved programs as listed by the IFT, this translates into an average enrollment of 18 students/institution. At a current enrollment of 80 undergraduates, the Penn State Department of Food Science is well above average.

As part of our efforts to increase enrollment, we intend to improve our current Food Science B.S. degree, but also consider possible new majors within the college that could be lead by our department. The programs offered by our benchmark institutions are listed in Table 2. Trends in some related majors are presented in Fig. A2.5.

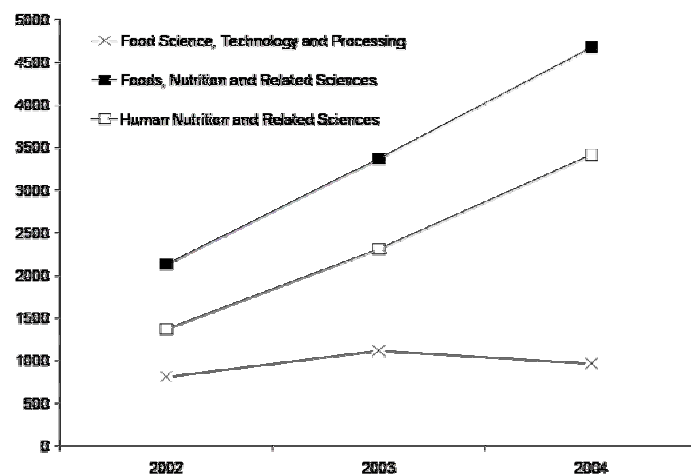
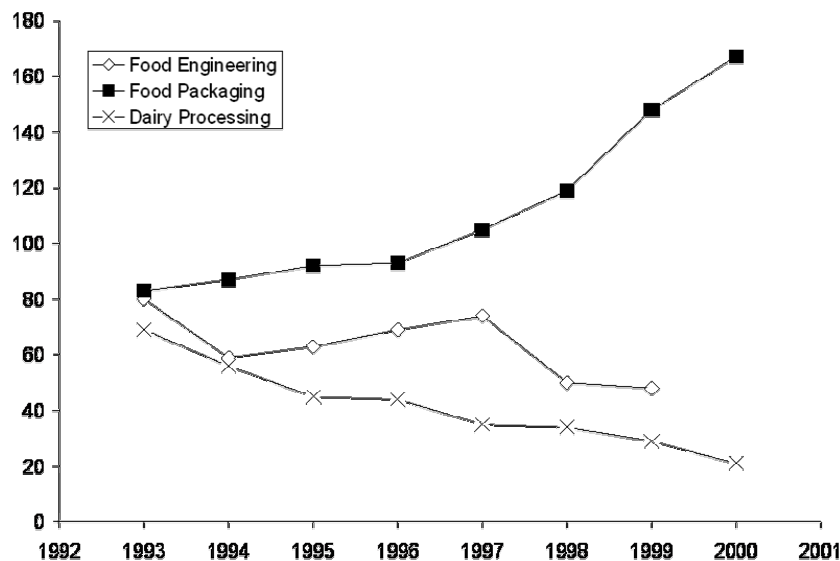


Figure A2.4. National trends in food science and related majors (Source: Ella Smith, FAEIS, CSREES). Data were consolidated from various CSREES categories.

Table 2. Degrees offered by benchmark institutions (obtained from web sites)

Institution	Undergraduate Degrees Offered	Graduate Degrees Offered
Cornell University	Food Science Food Operations & Management Food Biotechnology Enology/Viticulture	M.S. M.F.S. M.P.S. Ph.D. in Food Science & Technology
NCSU	Food Science	M.S./Ph.D.
Rutgers	Food Science Biological Tech.* Chemistry Operations/Management Science/Management	M.S. (thesis & non-thesis) Ph.D.
UMass	Food Science & Technology Food, Health & the Environment	M.S. (thesis & non-thesis) Ph.D.
U. Georgia	Food Science & Technology	M.S./Ph.D. M.F.T.
Purdue	Food Science Food Manufacturing	M.S./Ph.D. specializing in: Chemistry Microbiology Processing
U. Wisconsin-Madison	Food Science Food & Bioprocess Engineering	M.S./Ph.D.
U. California-Davis	Food Science Food Technology Business & Management Consumer Food Sci. Brewing Chemistry Biochemistry Biology/Microbiology	M.S./Ph.D.
Guelph	Food Science Functional Foods & Nutraceuticals	M.Sc./Ph.D. (research-based) M.Sc. Food Safety & QA (course-based)
Wageningen	Food Chemistry Food & Bioprocess Engineering Food Physics Food Microbiology	M.Sc. Food Technology M.Sc. Food Safety Ph.D.
Leeds	Food Science Food Biosciences Food Biochemistry & Health Food Production, Processing & Marketing	M.Sc. Food Science M.Sc. Food Biotechnology Food Quality Assurance Ph.D.
ETH	NA	NA

*Options under the general degree are indented.



Figures A2.5. Enrollments in related degree programs (Source: USDA-FAEIS).

Traditional degree programs like Dairy Processing have been losing enrollment steadily, as has Food Engineering, which has never been strong as a discipline nationally. While food science and technology seems to be holding its own, there appears to be growth in food packaging and health & wellness related studies. Among our proposed strategic goals is to *explore non-food science programs that might be led by the Department of Food Science*. In this regard we will assess potential alternatives using our benchmark institutions. We will seek information relative to the enrollments realized in non-traditional tracks and degrees and assess the potential for growth in “market share” vis-à-vis cannibalization of our current offering.

Benchmarking Research and Graduate Education. Figure A2.6 shows Ph.D. production in Food Science and technology from 1984-1999 (<http://www.reeis.usda.gov/> from NSF *Survey of Earned Doctorates*, 1999 most recent year break down by CIP available).

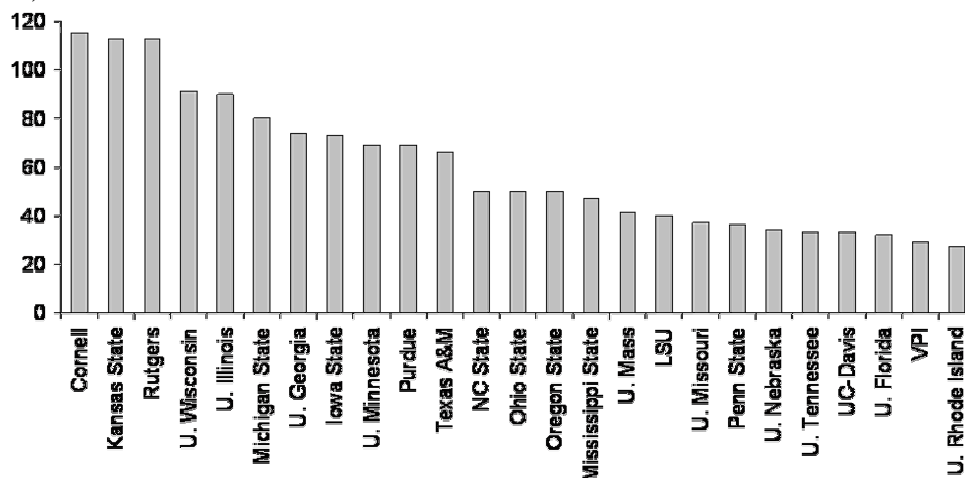


Figure A2.6. Food Science & Technology Ph.D. production by school, 1984-1999.

From this we can see that Penn State Food Science falls in the top 20 (#19) in Ph.D. production over the period 1984-1999. If no significant change has occurred in the last five years (the time period likely covered by an NRC review), we could reasonably expect that this will be our approximate ranking by the NRC, since it is heavily weighted to research and Ph.D. education. However, in the last five years we have shown improvement in Ph.D. enrollment and graduation rate (Figure A2.7).

The average number of Ph.D. degrees awarded in “Food Sciences” (NSF *Survey of Earned Doctorates 2003*) nationally per year was 145. Assuming there are 48 institutions awarding these degrees, then the average per institution would be 3/yr. Over roughly the same period (1996-2004) Penn State produced an average of 2.5 Ph.D.s/yr, slightly below average.

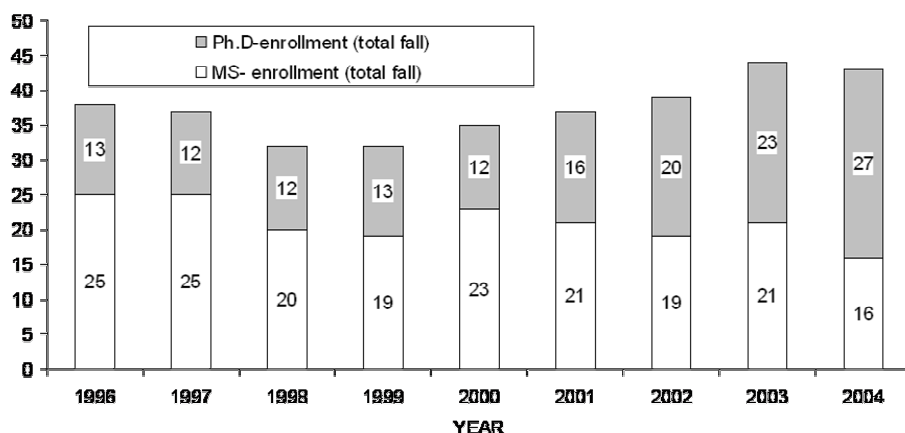


Figure A2.7. Graduate enrollment in Food Science 1996-2004.

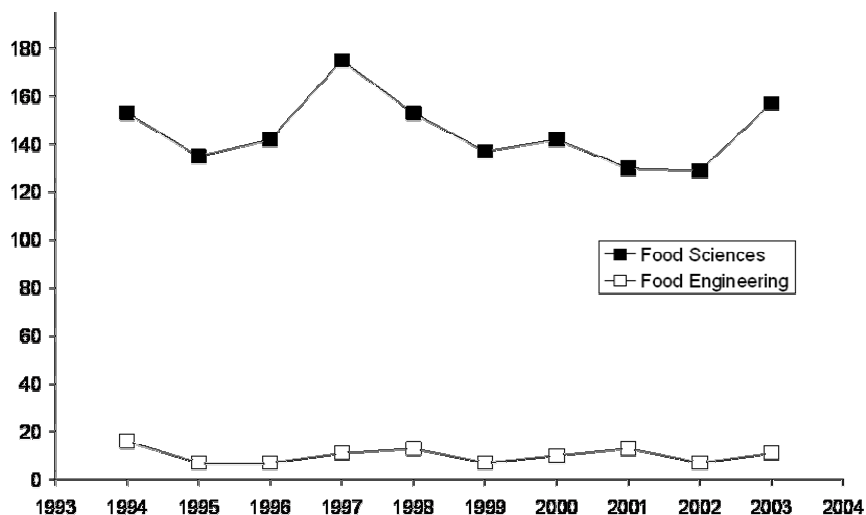


Figure A2.8. Ph.D.s in Food Science and Food Engineering, 1994-2003 (NSF).

In addition to attracting more Ph.D. students, we have remained very selective in our admissions, and we have achieved nearly 100% yield to our offers (Figure A2.9). Both indices indicate that higher quality students enter into our program. Finally, we have increased the total number of 500-level courses offered since the year 2000 from five to ten.

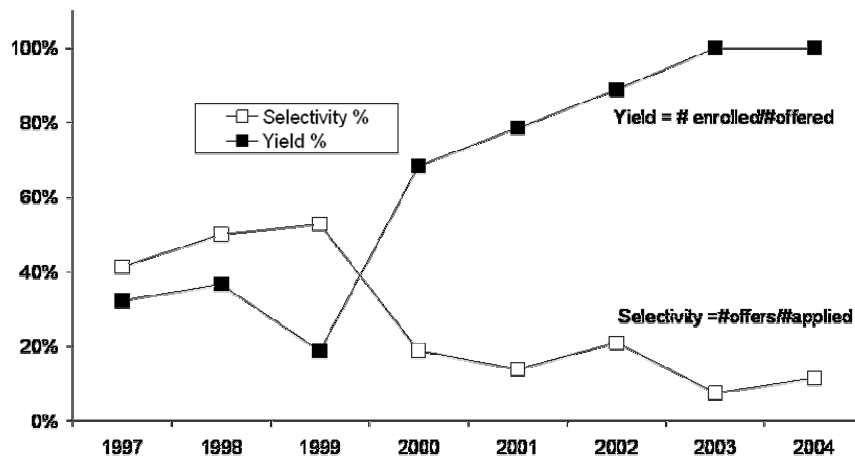


Figure A2.9. Selectivity and yield of graduate applicants, 1997-2004.

Penn State University ranks #7 nationally as the baccalaureate-origin institution for all doctoral degree recipients and #8 nationally for baccalaureate-origin of Ph.D. recipients in Agriculture (NSF-SED 2003). No data is available for Food Science separately. However, the data in Figure A2.10 may be helpful in graduate recruiting efforts. As would the NSF list of top “baccalaureate colleges” (liberals arts colleges) from which most Ph.D. recipients earn their baccalaureate degrees.

The picture that emerges is that Penn State Food Science, as we have generally assumed, has traditionally focused on undergraduate education. While we intend to maintain our reputation as such, we anticipate that the graduate program will grow with our progress on Initiative 1 of our proposed plan.

Relative to the goal of increasing the number of research programs receiving state, national, and international recognition, faculty have become increasingly competitive and continue to attract more external funds in support of their research activities (Figure A2.11). The department ranks second highest within the college when comparing \$ awarded per FTE. Another indicator of progress toward research goals is increased publications in peer-reviewed journals (Figure A2.12).

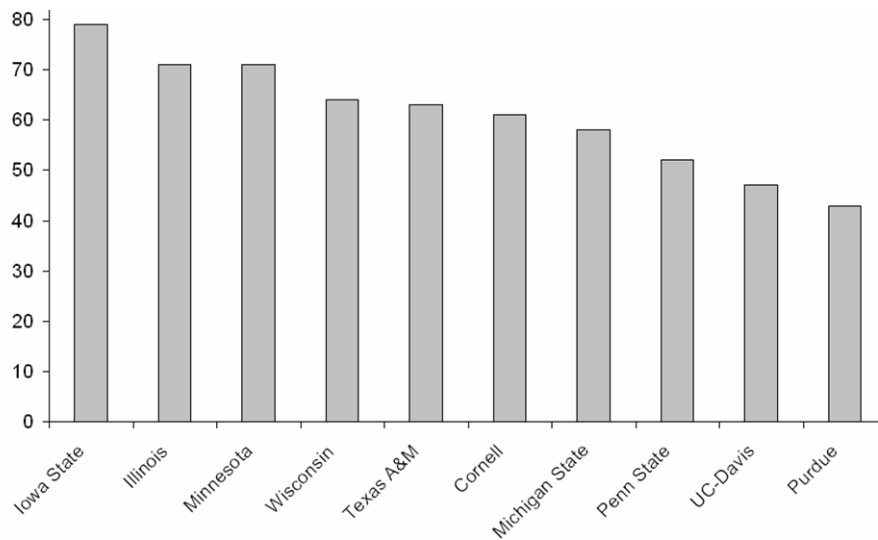


Figure A2.10. B.S. origin of Ph.D.s in agricultural sciences (NSF, 1991-5).

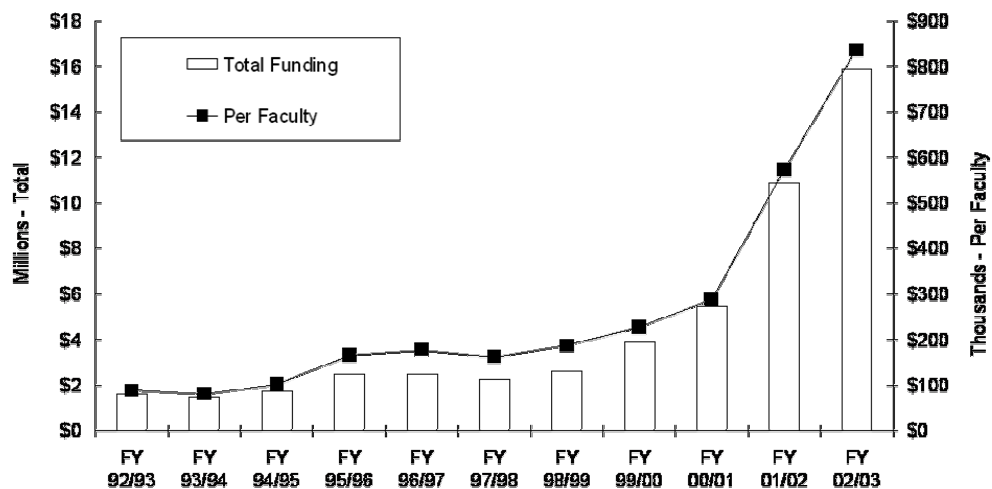


Figure A2.11. Research funding in the Department of Food Science

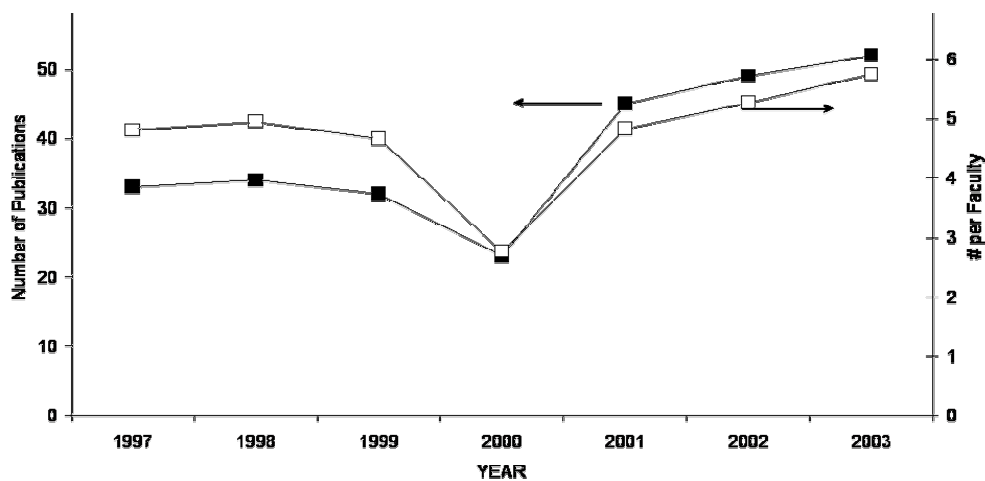


Figure A2.12. Publication rate in the Department of Food Science

Benchmarking Outreach Activities. A survey of Food Science web sites for the U.S. benchmark institutions was conducted. One problem with comparing our outreach efforts with others is a lack of consistency among the departments in presenting faculty outreach responsibilities. The Penn State web site lists all extension faculty members with percentages for teaching, research, and extension, but Cornell, Wisconsin, and UC Davis do not. Rutgers provides a general background of its one extension specialist and North Carolina has a page that lists several extension faculty and their interests. Actual workshops and other adult education activities are not summarized consistently either. We conclude that an accurate comparison of outreach activities in Department of Food Sciences would require an effort to contact each of the institutions, determine which faculty conduct outreach and/or have extension appointments, and talk to each to determine what are their current activities and future plans.

The Penn State Department of Food Science has made progress toward the goal to deliver outreach programs that are highly valued by the public and the food industry. Positive indicators are the increased number of program offerings and participation (Fig. A2.13). Grants and contract awards are also increasing (included in funding figure above). Food Science faculty's efforts are heavily tied to the college's Cooperation Extension Plans of Work. Dissemination of information through websites and publications is a major response to working with new and strengthening existing partnerships to benefit the Commonwealth and beyond. Our extension websites are extensively referenced by cooperative extension agents as well as the general public.

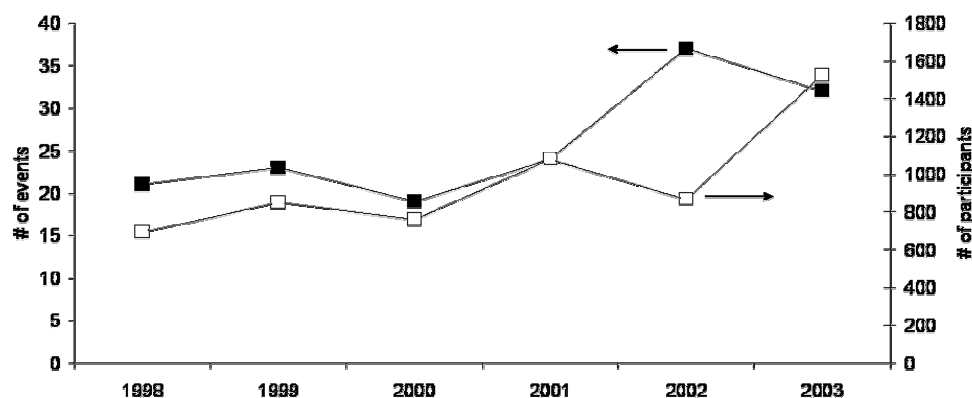


Figure A2.13. Outreach productivity in Food Science

Benchmarking facilities. Borland Lab is an outdated facility with numerous physical limitations. This ultimately led to the current construction of a new Food Science building, the planning of which occupied a central position in previous strategic plans. In this new plan we highlight the challenges and opportunities of moving into the new building during this next year. Compared to our benchmark institutions, we will have the largest and most modern Food Science building. Notably, the building will include the largest operating University-based Creamery in North America, which provides

opportunities for teaching and research unparalleled by any other institution. In addition, three specialized pilot plant facilities will open up new opportunities for teaching and outreach as well as collaborative research and development. However, the potential of these facilities may not be realized without proper equipment and staffing.

Among the new facilities is the pathogen pilot plant that will support our efforts in food safety through Initiative 1, by providing a test bed for technologies to control pathogens in food processing systems. Among our unique facilities is the Food Materials Characterization Lab that when combined with the analytical instrumentation in the flavor chemistry lab gives Penn State Food Science unmatched capabilities for the chemical and physical characterization of food materials. This was made possible by the consistent commitment of the funds from William and Lois Dietrich Endowment for instrument acquisition and maintenance. However, our superior position relative to our benchmark institutions in this regard is not assured without some continuing means to keep the facility upgraded. As with the pilot plants, proper staffing is necessary to take full advantage of these facilities.

Department Metrics

Performance indicators to strategic goals and initiatives as well as benchmarking metrics are shared within this strategic plan. The Department has historically tracked various metrics relevant to its teaching, research, and outreach programs for both internal and external evaluation purposes. In addition, this information is used in external reporting to stakeholders and to the college and University to meet strategic planning and other administrative reporting. Much of this information is also reported during third-party audits of our programs such as the IFT five-year undergraduate program review and the graduate program review. Maintaining such a broad base of metrics also ensures that as we devote resources toward our strategic initiatives, we are not eroding the progress of other ongoing initiatives that are also critical to the overall success of our Department.

Table 3 is a listing of the categories and types of data that are collected in each category. Information is recorded by academic year, calendar year, or fiscal year, depending on the source of the data.

Table 3. Department of Food Science metrics.

Category	Types of Data Collected for Category
Personnel (Faculty And Staff)	<ul style="list-style-type: none"> ▪ Faculty and staff numbers ▪ faculty % appointments, ▪ % by female, minority and international status ▪ # of awards (Faculty and staff)
Research	<ul style="list-style-type: none"> ▪ # publications ▪ # Non-refereed journals ▪ # patent applications ▪ # patents granted ▪ # of papers presented at scientific meetings
Outreach / Extension	<ul style="list-style-type: none"> ▪ # extension publications, ▪ # extension programs (shortcourses, workshops and training) ▪ # of participants (shortcourses, workshops and training)
Funding	<ul style="list-style-type: none"> ▪ # and \$ grant proposals, grant awards ▪ \$ generated from collaborative efforts ▪ R&D \$ from state, federal, and private sources, ▪ \$ contributions & gifts to research/extension ▪ endowment income ▪ sensory lab income
Undergraduate Student Program	<ul style="list-style-type: none"> ▪ enrollment- total & declared FD SC major (Fall semester) ▪ degrees granted ▪ # and \$ scholarship/awards ▪ % students supported ▪ average \$ supported per student ▪ # of revised courses by UPC ▪ % students female, minority, int'l
Graduate Student Program	<ul style="list-style-type: none"> ▪ enrollment- M.S. and Ph.D. and total (Fall) ▪ # of applications and # of offers ▪ # enrolled, selectivity and yield % ▪ # and \$ scholarship/awards/assistantships (total) ▪ % students supported, ▪ % female, minority, int'l, and underrepresented ▪ average GRE data ▪ JR/SR GPA data ▪ average time to degree, ▪ # university fellowships ▪ # graduate courses offered at least biannually

Appendix 3: History of Strategic Planning in the Department of Food Science

Food Science at Penn State began in 1966 when faculty members from the Dairy Science, Horticulture, Animal Science, and Poultry Science Departments initiated the Division of Food Science and Industry to administer an undergraduate program in Food Technology and a graduate program in Food Science. The first undergraduate and graduate degrees were awarded in 1968. In 1970, the name of the undergraduate program was changed to Food Science. In 1975 the Department of Food Science came into being, composed of faculty members from Dairy Science (9, from Dairy Manufacturing), Horticulture (3), Animal Science (2), and Poultry Science (2). The existence of the new department represented a decision to move away from vertical integration in the four commodity departments and to establish a new interdisciplinary unit. The considerable discussions concerning the rationale for initiating the Division, the programs, and the department will not be described here, even though these discussions were certainly strategic in nature. It is worth noting that the resources of the department at its inception were primarily the faculty positions, not technical support. In addition, the faculty members were spread over four locations: Borland Lab, the Horticultural Processing Lab, the Meats Lab, and the Poultry Processing Lab. Insight into the status of the incipient department may be gained from the September 1975 USDA Review of the program (by the time the report was received, the department had been formed). A subsequent USDA Review (of the research in both the Food Science and Nutrition programs) was conducted in March, 1979. These two reviews were research reviews, done by USDA to monitor the use of Hatch funds. While guidance from the review team is implicit in the reports, they cannot be considered to represent strategic planning by the department.

In 1982, College of Agriculture Dean Sam Smith requested that departments prioritize teaching, research, and extension programs. In December, the faculty discussed and approved three one-page reports, which were combined and transmitted by then-head Phil Keeney to Dean Smith. An April, 1985, document prepared by Phil Keeney for the 1985 CSRS Review Team included a two-page section on the mission and priorities of the department. The teaching and research priorities were verbatim from the 1982 reports.

In July of 1985, Associate Dean Jim Starling requested that each department develop plans to respond to a 20% increase or a 20% decrease in faculty numbers. On the basis of discussion at three Food Science faculty meetings, Phil Keeney prepared a report that was further reviewed by the Food Science faculty before it was transmitted. The following Fall the new department head, Lowell Satterlee, prepared a document titled "The Strategic Plan. Food Science One Year Later." From the title it is clear that this document implicitly considered the 1985 report to have been a strategic plan.

In 1990, Lowell Satterlee convened an *ad hoc* committee (Dimick, Kuhn, Maretzki, Thompson) to consider "the strategic plans for Food Science teaching, research and extension, how these plans relate to one another, and how they will eventually create the department's strategic plan." In September a four-page preliminary draft was sent by

Lowell Satterlee to Jim Starling, and in October Gerry Kuhn shared with the Food Science faculty a much-revised final document.

In November, 1991, at Lowell Satterlee's request, the Food Science Administrative Advisory Committee (Dimick, Knabel, Maretzki, Thompson, and Ziegler) initiated discussion about "how we can move forward to complete the strategic planning process for the department." At about this time, Lowell Satterlee announced he would step down as head as of April, 1992, and Gerry Kuhn agreed to serve as interim head. Discussion of strategic planning became very much a faculty-driven exercise. A two-day retreat was held February 29 and March 1, 1992 (planned and run jointly by Satterlee, Kuhn, Knabel, Thompson, and Ziegler), at which strategic issues for research, teaching, and extension were identified. In March, Lowell Satterlee appointed a Strategic Planning Committee (Ziegler, chair; Thompson, vice chair; Maretzki; and Beelman) to take over strategic planning from the Administrative Advisory Committee. The third in a series of subsequent departmental strategic planning meetings was held all day August 6 and continued August 10. Based on these three sessions, a draft document (dated August 24) was put together and circulated by Greg Ziegler in September to the faculty for comment (in academic year 1992/93 the Strategic Planning Committee was Kilara, chair; Beelman, Brown, Miller, and Ziegler).

While the department was working toward a grass-roots planning document under interim leadership, the University and the College were also engaged in an important strategic planning activity, referred to as the "Futuring Process." A College Future Committee (CFC) had been named, and by early October a draft with recommendations was produced. Because this document made several recommendations considered inimical to the interests of the Food Science faculty, the faculty immediately applied its strategic energies to responding to this document. The response communicated to the College drew upon the strategic thinking in the department to date. An unfortunate effect of the CFC activities and CFC report was that the departmental strategic plan never progressed past the draft stage. Although the faculty did not further formally consider the draft plan, a related strategic plan did appear in a Departmental Handbook in 1993, titled "Partial Strategic Plan Developed by the Food Science Faculty."

In November and December of 1993, incoming department head Don Thompson worked with the Strategic Planning Committee (Beelman, chair; Brown, Miller, Kilara) to draw up a thoroughly revised draft document to serve as the basis for a two-day retreat in January. By the end of January a completed plan was printed and distributed to the faculty, including five-year goals and one-year action plans. The plan was distributed among other college administrators, as well as to various interested external parties. (The responses from these individuals have been and continue to be taken into account in subsequent revisions.)

At the end of each calendar year since then, a two-day retreat has been organized by the Strategic Planning Committee to consider revisions to the five-year goals and to construct new action plans. Subsequent to the retreat the Strategic Planning Committee has worked closely with the departmental programmatic committees (Undergraduate Program,

Graduate Program and Admissions, and Outreach Program) to draft and revise portions of the document. In September 1996, a formal external review of the department was conducted. The review team was asked to make its primary objective a critique of the strategic plan. In its report, the team stated, "the department has developed a flexible, well thought-out strategic plan that appears to have broad faculty input and buy-in that will provide a flexible blueprint for charting the Department's future course."

The 1998 Strategic Plan took into account two important changes in the planning environment at Penn State in 1997: in March the College of Agricultural Sciences published a completely new Strategic Plan, and in September the University Planning Council distributed a wholly new University document, "Planning for the Twenty-First Century." In addition, Bob Steele, Dean of the College of Agricultural Sciences, visited a Department of Food Science faculty meeting in December 1997, to provide specific feedback on the 1997 departmental strategic plan. As a result of the changed planning environment, the revisions made that year were more extensive than in previous years.

Although the 1999 Strategic Plan continued to be a document revised yearly, but looking five years into the future, the 1999 Strategic Plan differed from previous plans in some fundamental ways. For the first time, Strategic Goals were written in terms of the desired outcomes of our efforts rather than as the efforts themselves. In other words, we stated goals in terms of what we hoped to accomplish rather than in terms of what activities would be performed. Consequently, the Action Plans became the statements of what would be done. These Action Plans were not limited to the calendar year encompassed by the plan, but also were considered over a five-year period.

In 1999 Performance Indicators were incorporated into the Strategic Plan for the first time. Performance Indicators were selected in relation to the Strategic Goals, but were not meant to be comprehensive indicators of whether a particular Strategic Goal was attained.

The 2000-2004 Plan was developed in the early weeks of 2000, and it was conceived as a rolling five-year plan for the period 2000-2004. Incoming department head John Floros participated in the January planning retreat, and this is the plan that was in effect when he joined the department that July. The plan remained in effect until the next planning effort was initiated early in 2002.

The process for the 2003-2007 Plan began in early 2002, with a February planning retreat attended by faculty, staff and students. The retreat dictated a substantial re-examination of the integration of departmental activities, and that re-examination naturally led to substantial changes in the strategic plan. As with previous strategic plans in the Department of Food Science, this version was a rolling five-year plan. The Strategic Goals were understood to be for the five-year period from July 1, 2002, through June 30, 2007. The Action Plans referred to those things that would be accomplished in the period from July 1, 2002, to June 30, 2003 and were intended to be revised each year based on progress. Much thought went into development of appropriate and useful Performance Indicators. The Performance Indicators relate most directly to the Strategic Goals, and

were selected to give us insight into our progress toward those goals. In addition to working with the department head, John Floros, the Strategic Planning Task Force (SPTF) (Don Thompson, chair, Swamy Anantheswaran, Audrey Maretzki, Donna Merrill, Tom Palchak, and Bob Roberts) worked with the Chairs of the Programmatic Committees and of the Impact Groups in an iterative manner as appropriate. Consequently the development of this Strategic Plan reflected extensive input from faculty and staff members.

The Current Planning Process. The Food Science strategic planning committee (SPC) was appointed in February 2005 by the department head, John Floros, and consisted of faculty and staff with responsibilities in teaching, research, outreach, administration, and creamery operations (John Coupland as Chair, Lynne Brown, Steve Knabel, Don Thompson, Greg Ziegler, Donna Merrill and Bonnie Ford). The faculty members on this committee served on one or more of the CoAS's focus study groups that played an integral part in the college's recent planning process. At the committee's request, the department head was also an active member of the committee.

The SPC employed a number of resources during its planning process including the College's 2005- 2008 strategic plan, the Department's previous plan, input from internal and external stakeholders, the CoAS Food Science Study Group's report, other units' strategic plans as well as information specific to other Food Science programs. Our External Advisory Board provided us useful feedback representative of some of our external stakeholders. The board consists of leaders in the food industry, government and academia and over the past two years has reviewed and provided feedback and guidance on the department's programs and previous strategic plan. The board discussed a draft of this plan at an all-day meeting on 4/29/05.

To address internal stakeholders, an all-day departmental retreat was held (2/25/05) to gain input from faculty, staff, and students on topics centered on department values and working environment, future research foci, the undergraduate program and future departmental hires. In addition, a number of open discussions were held during March and April 2005 on specific issues relating to the future direction of the department and to gain specific input on proposed goals for the plan. These meetings were organized and led by the SPC and by other groups within the department who were assigned specific topics and issues to address. The SPC and Committee chairs encouraged an ongoing electronic dialogue. Before final submission to the Dean's office, the Food Science strategic plan was presented in draft to department members at a second retreat (5/13/05) and to targeted external groups such as previous members of the Food Science Study Group, the Food Industry Group (FIG) and the Food Science External Advisory Board for final review and comments.