Governmental Policy and Poultry Research

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ABSTRACT *Primus interpares* – first among equals! Unexcelled. The USDA for a hundred years has not been excelled by any other Federal agency in the productivity of the research conducted in its laboratories nor the research it has supported in State Experiment Stations and in other cooperating institutions. This assertion is true of poultry research: *primus interpares.*

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INTRODUCTION

The US Department of Agriculture (USDA) has major responsibility for conducting and leading national agricultural research efforts. It provides initiative and leadership in: 1) research on broad regional and national problems; 2) research to support federal action and regulatory agencies; 3) expertise to meet national emergencies; 4) research support for international programs; 5) scientific resource to the Executive Branch and the Congress and to participate in a nation-side system of agricultural research planning and coordination between the states and the USDA and other public and private research funding and performing entities.

DISCUSSION

History. The USDA research policy was initiated at the Departments inception, in 1862, by statutes establishing USDA and the Land-Grant colleges to "collect and disseminate information useful to agriculture." Establishment of the Bureau of Animal Industry (BAI) in 1884 combined regulatory authorities for disease, control, research in animal and poultry diseases, and production. This policy of interrelated research, regulation, and state and industry cooperation has continued.

The BAI initiated poultry research in cooperation with the Maine Experiment Station where Raymond Pearle did basic research in poultry breeding. Poultry nutrition research in the BAI began about 1905, when Brown (1904) published results of ingenious digestion trials. Research at Beltsville began about 1910.

Basic genetic research with guinea pigs was initiated at Bethesda in 1906, and Sewall Wright (1922) continued it at Beltsville, where information was developed on inbreeding and crossbreeding, undergirding current poultry and large animal breeding systems used today.

Morley Jull came to Beltsville in 1924. For the next thirteen years he developed and supervised a highly productive research program. Under his leadership, the Regional Poultry Laboratory and the National Poultry Improvement Plan were initiated. In 1936, the poultry husbandry section at Beltsville was split. Poultry nutrition was shifted to a newly formed Nutrition Division. As a consequence, Morley Jull left the Department to become head of the University of Maryland Poultry Department; USDA and the poultry industry lost his national leadership. At Maryland he developed and maintained a highly effective research and graduate program.

The split at Beltsville did not last. Paul Howe, the distinguished nutritionist who headed the new Nutrition Division, joined the US Armed Forces, where he served for 7 years before returning to the USDA. Meanwhile, the Nutrition Division was returned to Animal Husbandry.

Poultry product research was increased with the establishment of the Western Utilization Research Laboratory in 1940 and continued there until about 1970, when such research was transferred to the then new Russell Laboratory in Athens, GA. Funds authorized by the Research and Marketing Act of 1946 were used to establish USDA-state regional projects

[1] Retired.

in poultry breeding and poultry products. The Southeast and South Central Poultry Laboratories were established in 1963.

Currently, CRIS (1983) printout identifies 72 ARS poultry projects at these and other locations – 20 locations in all.

Until 1953 basic research, applied research, and the application of research results in regulatory programs continued under the direction of the Chief of the BAI. The Agriculture Research Service (ARS) was created in 1953; the BAI and the other six old-line bureaus were abolished, and their authority was delegated to the administrator of ARS.

In 1960, production economics was transferred from ARS to an Economic Research Service (ERS) coequal in status with ARS. In 1972, research in ARS was reorganized into Northeastern, North Central, Southern, and Western Regions, each with a Director who reports to the ARS Administrator. The Administrator has a National Program Planning Staff at Beltsville under the Deputy Administrator, ARS.

Organizational changes are costly. Their principal benefit is to enable USDA administration to make better informed decisions on allocation of resources and management of their use. In the case of establishment of status for ERS in 1960, individuals and organization were benefited. In my opinion, the cost of separation of social science research from production and product research exceeds the benefits.

This brief historical sketch provides background for consideration of a major, and changing, policy problem: the organization and administration – management – of research.

Administrative Management. In a message to Congress in January 1937, President Franklin D. Roosevelt said: "The Administrative Management of the Government needs overhauling." (quoted by Wallace, 1938). Pursuant to this mandate, Secretary H. A. Wallace (1938) asked the USDA Graduate School to organize a 10-lecture series for USDA employees. In one of the lectures, W. B. Dunham (1938), Dean of the Harvard School of Business, defined administration as:

> . . . the determination and execution of policies involving actions. Such policies must be effected by human organization and such policies react on human beings. The fact is that no organization is healthy if it lacks a spontaneous social organization that never gets on the organization chart. (p. 95).

A second distinguished lecturer, Uhrbrock (1937), used as a model for effective administration the role of the "master craftsmen" in the historic guilds of Europe. Each master craftsman had a small group of apprentices and journeymen as members of his own household and for whose every act he was responsible. This model is analogous to the research professor-graduate and postdoctorate relationship at its best.

In discussing the limits of effective executive supervision, Uhrbrock cited as a "rule of thumb", three or seven. Fewer than three, the supervisor is likely to cease to supervise; more than seven, the supervisor's attention may be spread too thin. Uhrbrock (1937) commented:

> . . . he succeeds and must be judged by the degree to which he inspires those under his immediate direction to perform work that is praiseworthy. The nearest approach that we have to the ideal is among the scientifically trained personnel who work with singular devotion in the search for truth. (p. 18).

The current advocates of "big science" – critical mass, real-time communication, word processors, and computer simulation – might consider whether or not the sum of these can replace continuing, immediate, effective personal contacts between supervisor and supervised. In my opinion, the critical mass for research, especially for basic research, is still one. I cite an example: Kolata's (1983) report that on the solution of a mathematical "number problem" which had baffled mathematicians for 60 years. It has been solved recently by a young German mathematician, Gerd Faltings, of Wuppertal University. Kolata (1983) said: "It took, he recalls, eighteen months of work, mostly thinking, and tinkering with a pencil and paper." (p. 349).

Ruttan (1982) stated:

> The idea that all a research director needs to do is to lure good people and let them 'do their thing' has only minimal relevance at a time when the solution to many significant technical and social problems requires concerted research effort. (p. 49).

This statement is arguable. It is true that many problems require concerted effort by multi-disciplinary groups. Hiring good people and placing them together to solve a common problem may or may not benefit from direction, but formal direction by division of labor on a common project with flow charts, target dates, progress reports, does not assure productivity. As a dictum, consider: in the absence of achievement, an exemplary record of time and effort is essential.

The USDA science administrators have been scientists. Scientist-administrators learned by doing. Promotion generally involved assumption of increasing administrative duties. Opportunities for on-the-job administrative management – and details to universities for a year's education in this new science – increased during the 1960's. Now, periodic training in executive management for middle and higher research managers is customary.

During the late 1950's a few positions for scientists, *per se* were established under Public Law 85-313. These provided for remuneration according to administratively determined performance, up to the equivalent of the highest Civil Service grade. At about the same time, Pioneering Research Laboratories were designated for some scientists to explore, through basic research in their disciplines underlying a major problem area, under their own direction.

The traditional practice of promoting research scientists to administrative positions has cost poultry research some productive research scientists.

The 1966 Long-Range Study. A long-range study [USDA, National Association of State Universities and Land Grant Colleges (NASULGC), 1966] of the Federal-State agricultural research system, with a 10-year projection and priorities, was undertaken on the recommendation of the Senate Committee on Appropriations, by a task force consisting of research scientists and administrators designated by USDA and NASULGC. The task force categorized research according to nine research goals, recommending a total increase of more than 60% in Scientist Man-Years (SMY) with no decrease in any of the nine areas, from a base of about 10,000 SMY's. The actual increase in the total program by 1977 was small. Among the nine research goals four increased slightly; these were 1) resource conservation and use; 2) protection of forest crops and livestock; 3) efficient production of farm and forest products; and 8) raise the level of living of rural people. The SMY's for three of the research goals actually decreased: 4) product development and quality; 5) efficiency of the marketing system; and 6) expand export markets. Two research goals showed marked increases in SMY's, almost doubling that of 1966: 7) consumer health, nutrition, and well-being; and 9) improve community services and environment. The task force did not foresee that the federal funds for research would not keep up with inflation during 1967 to 1977. Nor did they foresee the pressures, insistent and persuasive, by consumers and environmental interest for increased research funds in those areas, trends that are currently continuing Ruttan, 1982; pp. 82-83).

Program Planning Budgeting. The heavy hand of program planning budgeting (PPB) was laid on in 1966. The long-range study provided convenient classification facilitating its application (Puterbaugh, 1971). The Current Research Information System (CRIS) was developed to expedite information storage and retrieval of person, location, project by object and funds in the USDA-state system. CRIS is a useful tool; however, the time lag in acquiring and collating information limits its usefulness. The correlation between statements in CRIS and what research is actually going on is less than perfect. Projects are declarations of intent; leads develop and hot pursuit follows naturally.

Schick (1971) made a conditional prediction, in fact, a prescient one:

> If budget making is to be oriented to the planning function, there probably will be a centralization of policy making, both within and among Departments. . . . It is possible that the mantle of central budgetary policy will be assumed by the Bureau of the Budget. (p. 286).

The Office of Management and Budget and the Office of Science and Technology Policy (OSTP) currently have major impact on USDA research planning and policy.

The National Research and Teaching Policy Act of 1977 (PL 95-113) amended (PL 89-106) to establish USDA as the lead agency in the federal government agricultural research (except for biomedical aspects of human nutrition), to provide further authority for competitive grants for education and research, and to provide for a Joint Council on Food and Agricultural Science to foster coordination of federal, state, and other public and private entities involved in food and agricultural sciences and for a National Research and Extension Users Advisory Board responsible for preparing independent advisory opinions. PL 89-106 was further amended in 1981 (Section 1414) to provide for an Assistant Secretary of

Agriculture for Research, Extension and Teaching and (Section 1415 (2) (0)) stating: "high priority research shall include (1) basic research aimed at the discovery of new scientific principles and techniques that may be applicable in agriculture and forestry."

Basic Research. Basic research is currently emphasized by G. A. Keyworth II (1983), the President's Science Advisor and Director of the White House Office of Science and Technology Policy, and in the USDA 1984 Budget Proposals Keyworth stated: ". . . the disciplines which present well-considered unified agendas for research have the best chance of getting support for their programs." (p. 1125).

Basic research is a term often used but less often explicitly defined. One explicit definition is stated by National Science Foundation (1982);

> Basic research is research to gain fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific application toward processes or products in mind.

Use of the term "basic research" in USDA stems from Title I of the Bankhead Jones Act of 1935. "The Secretary of Agriculture is authorized and directed to conduct research into laws and principles underlying basic problems of agriculture in its broadest sense." Title I, Section 4, provided for the establishment and maintenance of regional laboratories to conduct such research. The Regional Poultry Laboratory at East Lansing was one of those regional laboratories.

Basic research in USDA is mission oriented. Puterbaugh (1971) said: "ARS has no mission to conduct basic inquiries into the nature of scientific phenomena that cannot be visualized as having an ultimate application to the agricultural industry."

ARS Administrator Kinney (1983) stated:

> "Basic research in ARS programs is described as mission-oriented fundamental research that is precisely targeted to obtain the knowledge that does not now exist but is required to solve high priority problems related to ARS's mission.[2] ARS intends to invest about 50 percent of its resources to these mission-oriented fundamental research areas. (p. 34).

Peer judgments tend to rank people they recognize as engaged in basic research higher than those engaged in applied research and technology. Ruttan (1982; Table 10.4) cites analyses indicating a higher rate of return to technology oriented agricultural research than to science-oriented agricultural research. I support the ARS position that basic research in agriculture should be mission-oriented.

The NSF and ARS definitions are equivalent, respectively, to the two subdivisions of fundamental research, pure research (free fundamental research) and oriented fundamental research. Auger (1961) defines pure research (free fundamental research) as "research directed toward fuller understanding of nature and discovery of new fields of investigation, with no practical purpose in mind" and oriented fundamental research as "fundamental research focussed on a given theme, generally connected with a natural phenomenon of broad scope, and often directed towards a well-defined objective." (p.245).

Pure research, as defined by Auger, is generally the work of an individual, whereas oriented fundamental research is often team research. The purpose of all research is to obtain new knowledge and, finally, understanding. "Wisdom is the principal thing; therefore get wisdom; and with all thy getting, get understanding." (Proverbs 4:7).

The policies of the USDA to support basic research has resulted, among other achievements, in three firsts in poultry research. Three firsts recognized worldwide but given scant recognition by US academe and the White House are: 1) the first spontaneous parthenogenesis, which led to the survival of many parthenote male turkeys to maturity by Marlow Olsen (1973); 2) the first induced ovulation of hen's ova and subsequent elucidation of the interacting parameters resulting in normal ovulation by Richard Fraps and his colleagues (1942); 3) the discovery of the turkey herpes virus, innocuous for chickens, used to immunize them against Marek's disease – the first successful application of immunization against a neoplastic disease – by Purchase and Okasaki (Anonymous, 1973).

[2] "The mission of ARS research is to develop new knowledge and technology which will insure an abundance of the high quality agricultural commodities at reasonable prices to meet the increasing needs of an expanding economy and to provide for the continued improvement in the standard of living of all Americans." House Hearings Appropriations Subcommittee, 1983, part 3, p. 194.

Competitive Grants. It is arguable that the use of competitive grants assures funding of the best research. I am unaware of empirical studies objectively comparing quality of output from grant research compared to institutionally supported research. Nonetheless, we are a competitive society and most of us accept the assumption as reasonable.

The relative costs of competitive grants are high. The grant is usually made in the name of a principal investigator. The investigator named may in fact do the research. Or it may be done by technicians, graduate students, postdoctorates, and other colleagues under his "direction". The cost in time and effort for preparation of proposals, for their review by peer panels, and the waste and discouragement suffered by the competition losers and their institutions are substantial.

Competitive grants were recommended by the NRC Committee on Research Advisory to the USDA, the so-called Pound Committee, (NRC, 1973), and by the NAS *World Food and Nutritive Study: The Potential Contributions of Research* in 1977. The funds appropriated for 1978 were $15 million; proposed for 1984 are $15 million for plant science, $2 million for human nutrition, and $4.5 million for animal science. Funding authority was under Sec. 1414 of the National Agricultural Research Extension and Teaching Policy Act of 1977. CSRS Administrator Thomas stated before the House Subcommittee on Agricultural Appropriations Hearings: "The increased funding will permit initiation of a new animal science research program emphasizing fundamental research in such areas as animal reproduction and physiology." (p. 417).

Special Grants. Congress has also provided special grant funds that may be awarded competitively or administratively under authority of Sec. 2 of PL 98-106, as amended (USC 4501). Special grant funds earmarked for specific areas of research were $26,523,000 in fiscal 1983 and proposed $15,482,000 for 1984. Most of the reductions proposed in the 1984 Executive Budget were restored by the House and the Senate. Special grants may be discretionary or competitive. The special grants have not included funds earmarked for poultry research.

Poultry science has not yet benefited either from competitive or from special grant programs.

Peer Panels. The term "peer panels" is a euphemism for the tired and much maligned general term "committee". Like other committees, the proliferation of peer panels goes on exponentially without foreseeable asymptote other than infinity. Infinity is a proper term; it may be approached conceptually; like the horizon, it cannot be reached.

Peer panels came to Agriculture Research Service in the 1960's as a means of appraisal of scientists for promotion. As objective materials for their appraisal were the candidates' publications and current project – publish or perish. Byron Shaw looked in some depth as the relation between number and quality of publications; he found it to be positive. Peer panels are the fashion in project appraisal. They may be overwhelmed by the volume and complexity of the language and simulation models presented for their consideration. Famous names and institutions cannot fail to impress them – often favorably.

Committees and peer panels have two serious, sometimes fatal, flaws. 1) They distract the attention of their members from their own principal employment, profession, or vocation. 2). Their product is so often gratefully acknowledged, shelved, and forgotten as to merit the comment relative to questions referred to international conferences for consideration: as ". . . diverted to those wonderful devices for inaction, groups of wise men." (Muldoon, 1983; p. 1080).

A retrospective process of peer evaluation takes place by citations of published scientific articles in refereed journals. A tabulation of citations for 1981 for USDA personnel currently conducting research with poultry averaged 14.7 citations; the average for 177 other ARS scientists currently engaged in large animal research was 12.5 citations. (*Science Citation Index*, 1981).

The House reduced the amount for competitive research grants from $21.5 million in the 1984 budget estimates to $10 million dollars. The amount proposed for such grants in animal science was reduced from $4.5 to $2 million. The Senate restored the amount for competitive grant to $21.5 million, as proposed in the Budget estimates. The Senate Committee on Appropriations stated: "The Committee continues its commitment to this method of fostering and promoting increased levels of basic agricultural research in our Nation" (June 22, Report No. 98-160, p. 31).

Among other changes proposed by the Senate is $10 million to be administered by ARS for grants:

> to be made available to instructional programs at land-grant institutions and at other colleges and universities which have demonstrated the capacity to carry out agricultural and nutrition teaching and research. The purpose of this additional funding is to support the recruitment and training of students in specialty areas in which scientific and professional expertise is deficient.

The proposed $10 million would be in lieu of the ARS budget request for $500 thousand for postdoctoral fellowships.

Animal Welfare. The Federal Animal Welfare Act is administered by the USDA Animal and Plant Health Inspection Service (APHIS), which regulates and inspects research animal care and facilities. The current (1983) appropriation contains about $4.86 million for these purposes. The 1984 USDA budget proposed a reduction of about $3.3 million. Inspection would be limited to investigation of complaints and prosecution, if necessary. (Hamby, 1983). A similar reduction was proposed in the 1983 budget proposal, but Congress rejected it: the bills of both houses restored the amount to $4.86 million.

Hamby (1983), representing the Humane Societies, testified before the House Subcommittee on Agricultural Appropriations. She requested restoration of the proposed cut. She testified that private organizations and individuals are not permitted to inspect research animal facilities under the federal law.

The federal and state research institutions are all concerned with modulating environmental parameters to provide healthy, sanitary, comfortable conditions so that poultry flocks thrive. Research institutions have increased their vigilance and requirements for care and use of research poultry. Incidents of activist vandalism have occurred.

Among the CRIS current projects, eight were, in my opinion, directly relevant to assuring the welfare of research poultry. One of them specifically included animal welfare as a research objective.

Management. The Food and Agriculture Act of 1981 established by law an Assistant Secretary for Research, Extension and Teaching; presently, Orville Bentley.

Policy and Structure. An Assistant Secretary is a part of the policy developing and policy implementing of the Secretary. An Assistant Secretary can assure consideration of research needs and opportunities in the final stages of budgetary development by USDA. He may speak for the USDA before Congressional committees and before the Office of Management and Budget. Three Assistant Secretaries are responsible for research in 1) agricultural resources, production, products, food, and nutrition; 2) economics; and 3) forestry, respectively.

The Joint Council on Food and Agricultural Sciences is a principal coordinating body. The Joint Council elects a non-USDA member to serve with the Assistant Secretary as cochairmen of the Council.

Joint Council on Food and Agricultural Sciences. Established by the Food and Agriculture Act of 1977, the Joint Council on Food and Agricultural Sciences includes representatives of the USDA agencies, of cooperating state agencies, of the Office of Science and Technology Policy, and of the public. Its duties are to foster coordination of agricultural research, extension, and teaching activities of the Federal government, the States, and other public and private institutions and individuals. The Joint Council submits annual reports to the Secretary of Agriculture, including recommendations as to national, regional, or interstate agricultural research, extension, or reaching programs to be implemented during the following fiscal year. (P. L. 95113, Food and Agriculture Act of 1977 Section 1407).

The National Agricultural Research and Extension Users Advisory Board. Established pursuant to Section 1408(a) of the Food and Agriculture Act of 1977, the National Agricultural Research and Extension Users Advisory Board consists of 25 members appointed by the Secretary of Agriculture. Eight members represent producers from the various geographical regions of the USA. Other members represent consumers, suppliers, environmental interests, rural development, human nutrition, animal health, agricultural product domestic or export transportation, labor, and programs for the developing countries.

The Board has general responsibility for preparing independent advisory opinions on the food and agricultural sciences consistent with this responsibility. [Section 1408 (i)]. Board Chairman W. E. Marshall, appearing before the House Subcommittee on Agricultural Appropriations on March 21, 1983, presented data for the 1981 fiscal year showing that the total USDA funds for agricultural research amounted to $603.4 million, whereas 14 other Federal agencies provided $629.3 millions. State Agricultural Experiment Stations received only 15% of these non-USDA federal funds. Marshall proposed (House Hearings, part 7, p. 218) that an increase of $7 million proposed for basic plant science be transferred to USDA. He further urged more collaboration between ERS economists and ARS biologists to identify potential value of research to agriculture.

Postdoctoral Research Associates. The ARS announced the availability of 21 postdoctoral research associates positions in May 1983 (Kaniuka, 1983). This program was authorized by Section 1417(2) of the National Agricultural Research Extension and Teaching Policy Act of 1977: ". . . to attract highly promising investigators to research careers in the basic sciences related to agriculture." The positions offered were selected from 189 proposals. Fifteen of the openings were in basic plant sciences, two were in human nutrition, one in ruminant physiology, one in porcine physiopathology, one in ruminant viral immunology, and one in simulation modeling of sedimentation losses from cropped lands. Poultry? Zilch!

Colleges of 1890 and Tuskeegee. The USDA funds for agricultural research at the Land-Grant institutions and Tuskeegee began about 1966 under authority of P. L. 89-106. There has been about a 10-fold increase in dollar amounts since that time. Funds are distributed on a formula basis.

Sidney H. Webb, Director of Agricultural Research at North Carolina A & T, presented a statement to the House Agricultural Appropriations Subcommittee, on March 21, 1983, in behalf of the Colleges of 1890 and Tuskeegee. He stated that there are over 200 scientists engaged in research in the 17 institutions. Current and 1984 proposed funds in the USDA budget are for research $22,394,000 and for research facilities $10,000,000 at these institutions. The CRIS search disclosed 15 poultry research projects at nine colleges; two in genetics, four in nutrition, three in disease, three in managment systems, and three in product quality and safety.

Agricultural Research Service is Responsive to Regulatory Agency Needs. The segregation of research and regulation is theoretically preferable. Under current ARS policy, ARS is responsive to research needs of regulatory and action agencies, e.g., Animal and Plant Health and Inspection Service (APHIS), Soil Conservation Service (SCS), and Food Safety and Inspection Service (FSIS). *Campylobacter* now cause more poultry disease than *Salmonella*—both are unavoidable on raw poultry, but both can be destroyed by cooking. Food Safety and Inspection Service Administrator Houston (1983) sais: "The basic problem in normal living domestic animals has been submitted to the Agricultural Research Service for research in methods of control during rearing" (p. 32). Currently, relevant poultry projects include production of *Salmonella*-free chickens; assuring the microbiological safety of poultry products; and elimination of *Salmonella* from poultry feeds.

Policy on Research Funding. The USDA research funding policy has included a continuing commitment to fund research as essential to assure adequate supplies of food and other agricultural products and to assure efficient conservation use of resources used in agriculture; both of these objectives are to be pursued with minimal adverse effect on the environment.

Within budgetary constraints imposed by the President's budget for each year, research must compete with other programs, e.g., regulatory, food, and price support.

Within funds for research, poultry must compete with other commodities and with resource and human nutrition research. Needs and opportunities, industry recommendations, long range studies, advisory committee recommendations, and prior commitments are all considered.

Personnel policy is a constraining factor; the very small increases in the number of research scientists in the USDA during the past 20 years has caused vacancies due to retirement or resignation to lapse. A few positions have been abolished.

Poultry research has not benefited from the several external studies nor has poultry been targeted for criticism. The World Food and Nutrition study of the National Research Council (Brown, 1977) ignored poultry, as such, completely.

The ARS Program Plan. The Agricultural Research Service Program Plan (ARS, 1983)[3] incorporates inputs from about 500 scientists and members of the ARS National Program Staff.

The mission of the ARS is:

> to plan, develop, and implement research that is designed to produce the new knowledge and technology required to assure the continuing vitality of the Nation's food and agricultural enterprise. As a Federal agency, ARS 1) addresses problems that are of legitimate national concern, 2) conducts research that is appropriate for the Federal Government, and 3) exploits the unique capabilities of ARS scientists and the facilities they operate- -a combination that forms an integrated and coordinated rational resource that is not duplicated by others in the full U.S. agricultural research and development system. (Kinney, 1983, p. 9).

The ARS Program Plan is designed to develop the means for reaching six objectives: 1) managing and conserving the nation's soil and water resources; 2) maintaining and increasing the productivity and quality of crop plants; 3) increasing the productivity of animals and the quality of animal products; 4) achieving maximum domestic and export use of agricultural products; 5) promoting human health and well-being through improved nutrition and family resource management; 6) integrating production, processing, and marketing technology into systems that optimize resource management.

Poultry scientists will appreciate the single example cited as pay-off of long-term research.

> . . . research on Marek's disease. . . initiated in 1939. . . a vaccine license for national use in 1971. By 1974 the annual benefit from the vaccine was $180 million, at a total cost of $31 million in public research funds. (Kinney, 1983, p. 14).

[3]The ARS Program Plan is relevant to the National Agricultural Research, Extension, and Teaching Policy Act Amendments of 1981, Section 1405 (b) (11), calling for a long-term food, fiber, and forest needs assessment and research requirements necessary to meet the identified needs.

The program strategy is based on five stated policies. 1) The administrator will operate ARS as a managed activity coordinated by plan. He is responsible for overall coordination and execution of the program. This includes meeting research needs of other federal agencies and other users of agricultural research. 2) ARS research program will include full range of activities to meet the six objectives of the program. 3) The Deputy Administrator ARS is responsible for establishing priorities in the 6-year implementation plan and the derived budgets. 4) Regional ARS administrators are responsible for development and implementation of operational plans. 5) The Deputy Administrator ARS is responsible for review and evaluations of programs and progress.

The ARS Program Plan, the six-year implementation plan, assumes a constant $413 million ARS appropriation for each of the six years 1984 to 1990. Shifts of funds are: decreases of $29 million in plant productivity and $4 million in animal productivity research; increases $6 million on Soil and Water Conservation research; $10 million in Commodity Conversion research; $14 million in Human Nutrition research; and $4 million in Integrated Systems research. "Priorities will be set by the Deputy Administrator ARS after he weighs the availability of resources, needs of agriculture, scientific progress, and other criteria." (Anonymous 1983, p. 6).

We have discussed the human nutrition research increase relation to the dietary guidelines. Here we consider whether or not the proposed decreases in animal productivity research and the proposed increases in commodity conversion research may impact poultry research.

Animal productivity research funds show increases amounting to $7.3 million. The largest projected increase, $2.2 million, is for research in genetic disease resistance. This is an area in which regional poultry labs and state scientists have done and are doing highly productive basic research. Ten State stations are cooperating in regional project NE 00060, "Genetic bases for resistance to avian diseases."

Decreases totaling $11.3 million are spread over 14 areas.

Increases for Objective 4, commodity conversion and delivery (which I construe to cover new and improved products, processing technology, and packaging for domestic and foreign consumer markets) include research stimulation of basic plant and animal biological and biochemical processes that produce desirable product properties and suppress those that produce undesirable product properties, $10 million; for research on means for controlling such processes, $5 million; for research on extrinsic toxic factors affecting product safety, $3 million; for research on ways to reduce product loss from insects, $1.6 million; for research on microbes, $1.5 million; for research on deterioration, $2.5 million; and research on means for meeting quarantine and other requirements restricting domestic and export trade of products, $2 million. Each of these projected increases may present opportunities and needs for poultry research.

Decreases, $15.6 million in total, projected under Objective 4, would deemphasize applied research on product and process technology and product quality and composition.

Objective 5, adequate human nutrition, includes projected net increases of $8.2 million for nutritive requirements and $5 million for bioavailability, areas to which eggs and poultry meat and related poultry research are relevant.

Dietary Guidelines for Cholesterol. USDA and USDHEW (USDHHS) jointly issued *Nutrition and Your Health: Dietary Guidelines for Americans.* The document contained seven recommendations: 1) eat a variety of foods; 2) maintain ideal weight; 3) avoid too much fat, saturated fat, and cholesterol; 4) eat foods with adequate starch and fiber; 5) avoid too much sugar; 6) avoid too much sodium; and 7) if you drink alcohol, do so in moderation.

The document resulted in controversy, although the recommendations 1 and 7 seem to me to be unassailable. Research relevant to the other five recommendations may result in their modification. Recommendation 3 is particularly relevant to poultry. Egg yolks contain cholesterol. The guidelines state (p. 11): "Some people can consume diets high in saturated fats and cholesterol and still keep normal blood cholesterol levels. Other people, unfortunately, have high blood cholesterol levels even if they eat low-fat, low-cholesterol diets." Research on cholesterol in eggs and research on fat in meat poultry, in relation to human food use, is underway in many laboratories.

Current poultry research projects identified by CRIS included relevant projects in 14 states.

The ARS Program Plan (Anonymous, 1983, p. 16) projects an increase in funds for research on nutrient requirements for aging people from the current $5.8 million to $11 million. Such research is conducted at the Nutrition Centre at Tufts. The ARS Program Plan (p. 53) notes: "the etiologies of some chronic diseases and disabilities that are associated with aging are influenced by nutritional factors." I assume that this ambiguous statement includes the relationship, if any, of saturated and polyunsaturated fats to cancer and atherosclerosis.

Objective 6, Integration of systems, is an area in which social scientists, biologists and engineers have cooperated in poultry research. Indeed, poultry science and the poultry industry are leaders in this area. The ARS six-year implementation plan proposes a $3 million net increase under this objective.

Projected increases totaling $9 million would support research in quantification of interaction among factors affecting production and marketing of food and other agricultural products, development and validation of predictive models, and technology for use of remotely sensed data in resource models.

Twelve states are cooperating in regional project NE 00133, the Function, nutritive composition, quality, stability and efficient production of poultry meat and egg products.

Projected reduction of $6 million would deemphasize research on rural housing, small scale and organic farming, energy and tropical agriculture systems.

The ARS Program Plan does not identify projected fund shifts by commodity. One may, therefore, assume, as a null hypothesis, that the proposed reductions in animal productivity research and the projected increase in funds for product and product marketing technology may affect USDA poultry research.

Poultry has problems in international trade. It is not obvious whether or not research in the traditional fields of product technology and competitive pricing will be useful. Research in political science may be required.

Poultry research funding in the USDA during the 1972 to 1981 decade, for which CRIS collations are available, increased less than the total USDA research funds and less than non-USDA funds for poultry research. Total USDA research funds increased from about $342 million in 1972 to about $761 million in fiscal 1981, about 120% of 1972.

The USDA funds for poultry research did not keep pace with increases in total USDA research funds. From $12.6 million in 1972, poultry research funds increased to $19.8

million in 1981 fiscal, about 57% increase-only half the relative increase in total research funds. Non-USDA poultry research funds (at the state stations) increased more rapidly: from $12.2 million in 1972 to about $25 million in 1981, about 103%.

Why haven't poultry research funds fared better? Will they do better in the future? Has the outstandingly productive poultry research of the past and present solved all the problems? Of course not. But the next question is not so readily answered: have the poultry industry and the poultry scientists who serve them identified the problems and the research needed to solve them that are currently making poultry enterprises precarious?

Current research is relevant. It is of excellent quality; it is productive. Poultry science has been a leader in innovative research and the poultry industry a leader in implementation of new technology. What now?

Is the shift from commodity to discipline organization at Beltsville and the regionalization of ARS administration factors? The Beltsville Agricultural Research Center is said to be the largest such center in the World. Certainly the achievements of the scientists, and especially of the poultry scientists who have worked there have given the center front rank status in the opinion of agricultural scientists throughout the world.

I have long admired Ted Schultz. He won a Nobel Prize for his lucid and persuasive emphasis on the importance of social capital. He and his colleague (Grilichis led the way in elucidating the high return to society from expenditures on agricultural research and education. Public agricultural research and extension were stated to return 46 to 48% on funds invested for the period 1938 to 1960 (Schultz, 1971).

The same source contains Peterson's (1967) estimate that public poultry research returned a 21% return over the period 1915 to 1960. This estimate is below the 35% estimated lower limit for all public agricultural research. (Schultz, 1971, p. 117).

Schultz (1971) stated:

> A national agricultural research center (the Department of Agriculture plus the National Research Center at Beltsville, Md) that is not an integral part of a major research-oriented university is under present conditions, an inefficient location for such research. Here, too, the advances in science have made what was, formerly, a fairly efficient place into an obsolete location. (p. 119).

My emotions were not stilled by Schultz' further statement:

> Even the prestigious Rockefeller research enterprise (New York City) has found it necessary to transform itself into a university.

The apparent decrease in the perceived status of Beltsville during the past 10 years has been accentuated by recent proposals to sell part of the land for development purposes. I applaud the vigor with which Paul Putnam, current Director of Beltsville, has defended it.

In my opinion, increase in both real and perceived status of Beltsville is in the national and international interests of agriculture, of agricultural science, and of poultry science.

Are our present estimates of potential benefits from poultry research too low? The projections (about + 6% in energetic efficiency by 1993) reported by Bray (1983) in the July *PSA Newsletter* for gains in broiler production efficiency are, in my opinion, conservative. Life cycle energy cost of producing edible animal protein by broilers was estimated by Dickerson (1978) as only about one-third the cost of edible protein produced by beef or lamb. Dickerson estimated the potential for genetic reduction in carcass fat percentage in broilers down from the current 13 to 8%.

Surely we may anticipate continued increases in egg production from the new, innovative research in genetics, physiology, health, environment, management, and other researchable areas. Integrated systems are feasible that will result in the equitable sharing of benefits among producers, processors, suppliers, marketers, and last and most important, consumers.

May we anticipate pathogen-free poultry meat and eggs? The first adult homeothermic parthenotes were turkeys. Can we clone chickens and avoid the annual wastage of 300 million newly-hatched males?

Agricultural research policy for the future should emphasize the economic and social gains to be expected from poultry research and should support the research and education necessary to achieve them.

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