

USDA Agricultural Research Service

Retrospective Assessment of National Program 107:

FINAL REPORT

The Retrospective Review Panel NP-107 met in Beltsville, MD, on November 2-3, 2006, to conduct a review of USDA-ARS-NP-107 (Human Nutrition) research and progress since 2000. The members of the Review Panel were 7 scientists external to the ARS, with expertise in various aspects of human nutrition including obesity, nutrition, biochemistry, physiology, and public health. The Review Panel was provided with an accomplishment report that focused on 7 major components within the ARS program. Individual projects were not assessed, but this was an overall review of progress made with representative references from each component that were selected by the National Program leadership staff. The Review Panel was informed that the accomplishments of the National Program as a direct result of the research activities from 2000 to 2006 should be assessed against commitments and goals identified in the Action Plan created at the beginning of the National Program cycle. The criteria used to assess the impact of research activities included that:

- Research significantly advanced the knowledge of human nutrition
- Research was innovative and significantly influenced other researchers in the same or related fields or yielded important new directions for research
- Research was used to formulate national dietary recommendations, i.e., Dietary Reference Intakes for United States (DRIs) or the Dietary Guidelines for Americans
- Research contributed to the development and/or implementation of government or industry policy or regulations (contributed to reports forming the basis for policy)
- Research resulted in new or improved scientific methods, tools or technologies developed by ARS and adopted by others (customers, stakeholders, consumers and/or other scientists).
- Research resulted in technology transfer such as timely public releases of food composition and national dietary survey databases, research products that have stimulated new business growth, and/or technology that has been patented/licensed leading to commercialization

Each member of the Review Panel was assigned a primary and secondary Component of the program to evaluate and all Panel members participated in the discussion of each component. Members of the Panel wrote a document on their primary Component assignment and these were collated into a draft report by the Chair. The draft report was critiqued, edited, and approved by all members of the Panel before submission of the Final Report.

The Review Panel is very grateful to the National Program Leaders and members of the ARS staff including David Klurfield, Molly Kretsch, Marilyn Low, Nadine Kessler, Rosemary Callahan, and Joseph Spence for their expert and friendly assistance during the

preparation and write up of this report. These individuals provided information, advice, and their expertise, and they were outstanding in their efforts to help the members of the Review Panel assess the NP-107 program. The Panel particularly appreciated the individual attention to administrative matters and travel assistance by Marilyn Low and Rosemary Callahan. It should be noted that the National Program Leaders who were responsible for putting together the information presented to the Panel were not involved in the initial planning of the goals or collection of the data, so they and the other ARS staff made heroic efforts to obtain the necessary information to facilitate the Panel's review.

General Comments:

There were a number of general observations regarding the Research Report. The first was that the report is incomplete. The information provided to the panel was a summary of initiatives and projects that were selected to demonstrate progress towards the goals that were set in 2000. Since this was the first Retrospective Report, many of the data sets that might be expected had not been identified previously and the ARS staff had to try to collect them. For future reports, there is a need for better methods to capture information from the ARS sites with simple, efficient protocols that will allow conduct of research, simultaneous information collection, and easier reporting. Some of the data needed for future reports are a full report on publications, average impact factors, personnel information, percent efforts, funding information, a better method for capturing work that is not publication driven, and an quantitative assessment of how ARS work influenced other investigators (for example, how many papers cited a particular ARS observation or new assay).

The Panel felt that there was a tendency of some ARS sites to favor individual initiatives over the strategic plans of the ARS. All ARS programs should consider themselves as part of the USDA team, with requirements for oversight, coordinated planning and goals, and realistic reporting requirements that are as efficient as possible. Scientific freedom for individual investigators to pursue the projects of interest to them is very important, but scientists and institutions that accept USDA-ARS funding for their research must also accept the research plans and goals of the ARS and work within these constraints. In turn, the ARS has the responsibility to foster individual initiative as much as possible.

In setting USDA goals, it is critical to involve the Center Directors directly in the planning process to engage them with ownership in the outcomes, set specific goals and directions, and set milestones that will be noted. In turn, Center Directors should involve individual scientists in proposing projects and strategic directions. Failure to adhere to the plans, goals, and milestones should have recognition and consequences.

The Reviewers felt that there may be some blurring of lines between USDA and other agencies such as NIH and NSF regarding research into specific disease areas. USDA has a critical central role because it is responsible for foods and food research. The presence of excellent facilities, equipment, and resources make the USDA a collaborator on many types of research and it can play a very important role in all of the other agencies'

research. The USDA should seek to leverage its limited funds to achieve the maximum research output, not try to compete with the other agencies, particularly on disease oriented research. ARS receives funding from external industry sources and from the report it appears that this leads to commodity-driven research. The ARS should identify specific foods that need to be studied according to priority areas that will affect health the greatest, and as many industry groups as possible recruited to fund the research to achieve the greatest efficiency in both science and costs.

Some of the excellent investigators of the ARS have retired or are reaching retirement age. Care should be taken to replace these individuals with high quality investigators.

As noted below, some of the projects described in various components of the report are excellent, other are marginal or poor, and some are very good but have not taken advantage of their unique populations or resources and thus have been less productive than optimal. The next section provides evaluations of the Components with ratings and recommendations for continuation, re-evaluation, or cessation of the individual research areas.

Critiques of Individual Components:

Component 1 - Composition of Foods:

Quality of Research Accomplishments: High

Expected Outcomes:

The National Nutrient Data Laboratory produces, documents and disseminates the most comprehensive and highest quality food composition information in the world. The data are used by scientists across the world. In the United States, they make possible the monitoring of diets of the population as well as providing scientists, the food industry, commodity groups, advocates and consumers critical information about the composition of the foods we eat. This program component is critical to the goals and objectives of the Nutrition Program Action Plan and to the mission of ARS.

Summary:

The mission of the ARS Nutrient Data Laboratory is to develop authoritative food composition databases and state of the art methods to acquire, evaluate, compile and disseminate composition data on foods available in the United States. See <http://www.ars.usda.gov/Aboutus/docs.htm?docid=6253#J2006>. The USDA has borne the responsibility of characterizing the nutrient content of the U.S. national food supply for over 115 years. Today, the National Nutrient Data Bank is a repository of information for more than 130 nutrients for over 7,000 foods. It is made available in the principle database--the USDA National Nutrient Database for Standard Reference (SR)--on both the ARS Web site and on CD-ROM (information taken from <http://www.ars.usda.gov/Aboutus/docs.htm?docid=4441>).

Accurate and up-to-date food composition information is crucial to accurately evaluating the nation's health. Food nutrient composition is a critical piece of national nutrition monitoring. ARS is the main source of food composition information in the United States, as well as the foundation for many databases around the world. Maintaining, updating and improving the USDA National Nutrient Database for Standard Reference (SR) is a vital part of the ARS Nutrition Program as it is considered the "gold standard".

ARS scientists developed a number of new analytical methods that enhance the accurate and reliable measurement of the nutrient composition of foods. New methods include a technique to measure cobalamin, a rapid screening method for cyanocobalamin in fortified foods and supplements, several new methods for the quantification of folic acid and a method to measure niacin in infant formula and wheat flours. In addition ARS scientists developed and applied new analytical methods to measure the flavonoid, phenolic acid, proanthocyanidin, and anthocyanidin content of foods. Lastly, ARS scientists developed an analytical method for the determination of unbound, coded amino acids and non-coded amino acids

There is a growing need to expand the USDA SR beyond known essential nutrients to include new data on food components that are hypothesized to be linked with diet and health. Areas the Food Composition laboratory are developing include databases on choline, fluoride as well as other food components such as flavonoids, isoflavones, proanthocyanidins and antioxidant capacity.

Since 2001, ARS has instituted annual SR update releases. In 2006, the USDA Database for the Flavonoid Content of Selected Foods, Release 2 was made available on-line. See below:

The database contains values for 392 food items for five subclasses of flavonoids:

- FLAVONOLS: Quercetin, Kaempferol, Myricetin, Isorhamnetin
- FLAVONES: Luteolin, Apigenin
- FLAVANONES: Hesperetin, Naringenin, Eriodictyol
- FLAVAN-3-OLS: (+)-Catechin, (+)-Gallocatechin, (-)-Epicatechin, (-)-Epigallocatechin, (-)-Epicatechin 3-gallate, (-)-Epigallocatechin 3-gallate, Theaflavin, Theaflavin 3-gallate, Theaflavin 3'-gallate, Theaflavin 3,3' digallate, Thearubigin
- ANTHOCYANIDINS: Cyanidin, Delphinidin, Malvidin, Pelargonidin, Peonidin, Petunidin

Details can be found at <http://www.ars.usda.gov/Services/docs.htm?docid=6231>.

Since 2001, 700 foods have been added or updated in the SR database. Foods and nutrients appear to be selected that may be changing in composition over time (pork and beef) and are important for food labeling initiatives (sugars, *trans* fatty acids, folate).

ARS and the NIH Office of Dietary Supplements are collaborating on the development of a Dietary Supplement Ingredient Database (DSID) to include data on supplement

components and their analyzed amounts. This is a critical undertaking given that > 50 percent of the American public are exposed to dietary supplements and the public health impact is unknown. A summary of this activity follows -

"Several activities of the Office of Dietary Supplements (ODS) at the National Institutes of Health involve enhancement of dietary supplement databases. These include an initiative with USDA to develop an analytically substantiated dietary supplement ingredient database and collaboration with the National Center for Health Statistics to enhance the dietary supplement label database in the National Health and Nutrition Examination Survey (NHANES). The many challenges that must be dealt with in developing an analytically supported dietary supplement ingredient database include categorizing product types in the database, identifying nutrients and other components of public health interest in these products and prioritizing which will be entered in the database first. Additional tasks include developing methods and reference materials for quantifying the constituents, finding qualified laboratories to measure the constituents, developing appropriate sample handling procedures, and finally developing representative sampling plans. Developing the NHANES dietary supplement label database has other challenges such as collecting information on dietary supplement use from NHANES respondents, constant updating and refining of information obtained, developing default values that can be used if the respondent cannot supply the exact supplement or strength that was consumed, and developing a publicly available label database. Federal partners and the research community are assisting in making an analytically supported dietary supplement database a reality."

Quoted from Dwyer, J., Picciano, M., Betz, J., Leila, S., Holden, J.M., Andrews, K.W., Cuiwei, Z., Harnly, J.M., Wolf, W.R., Perry, C. 2006. Progress in development of an integrated dietary supplement ingredient database at the NIH Office of Dietary Supplements. *Journal of Food Composition and Analysis*. 19:S108-S114.)

The USDA National Nutrient Database for Standard Reference is available for use by the general public. The interface can be found at <http://www.nal.usda.gov/fnic/foodcomp/search/>. This website allows simple searches using key words. It is used by everyone from school students doing science projects to nutrition researchers.

The National Nutrient Database is the source of food composition information for the NHANES national survey "What We Eat in America". The database was used extensively in the development of the USDA and DHHS 2005 Dietary Guidelines for Americans, in establishing the new Dietary Reference Intakes and for the interactive MyPyramid.gov nutrition education tool. In addition, the USDA food assistance and education programs along with other federal agencies (FDA, CDC, DOD, EPA) rely on the database. Thus, it is not surprising that there is great interest among dietitians and nutrition scientists in maintaining, improving and expanding the database. An annual National Nutrient Databank Conference is held. In September 2006, the 30th annual conference titled "The role of food composition in improving dietetic practice" was held in Honolulu. The program addressed numerous areas of interest and can be found at

http://www.nal.usda.gov/fnic/foodcomp/conf/NDBC30/NDBC30_pgm.html. Dr. Suzanne Murphy, organizer of the 2006 conference, urged attendees to understand the importance of synergy between better dietary assessment methods and better food composition data resulting in greatly improved estimates of dietary intake.

Assessment:

The ARS scientists dedicated to the Nutrient Data Laboratory are highly regarded by their peers. The work they do is the backbone of nutrition monitoring and nutrition research not only in the United States but around the world. This is the type of work that only USDA/ARS will focus on and thus it is essential that it be fully supported.

The scientists associated with this component of NP 107 should be commended for their excellent performance. The laboratory released annual updates of SR (last in Sept 2006), developed specialized databases, developed new search tools and disseminated data via various modes to researchers and the public along with developing new analytical methods. This laboratory sets the gold standard for maintaining and developing food composition databases.

The panel concurs with the ARS approach of identifying foods that are changing in composition over time as priorities for reanalysis (such as beef and pork).

Much progress is being made in the development of the DSID but it is unclear when this complex database will become available for use by researchers and the public. In addition, it is unclear how the challenges of a constantly changing playing field of dietary supplements will be managed once the database is released.

The panel expressed concern that some of the very productive scientists in this group are nearing retirement age or have recently retired. Are they being replaced by scientists of similar quality and promise? Downsizing this operation is not recommended. Outsourcing is also not appealing given the demonstrated excellence of the centralized laboratory and program.

Recommendations:

This area is a high priority for resources and replacement of scientists as they retire.

There is concern that the food composition laboratory has been chronically under funded while the food supply has continued to grow and change dramatically. The food composition data tables by which we make all assumptions about nutrient intake in individuals and the population are the backbone of nutrition research.

The panel urges ARS to consider the important balance between maintaining the strength of the available data for critical essential nutrients as food composition changes and analytical methodology improves with the need to gain new knowledge about previously

unexamined food components. In other words, don't neglect the old familiar nutrients at the expense of new, potentially less important food components.

A desirable goal is to examine the multiple variables that may impact nutrient composition of foods including region of the country, type of soil, genetic modifications etc. Nutrition scientists need to know how much variation exists and whether or not the variations matter. The scientists in the food composition laboratory might partner with other USDA groups, industry and/or commodity groups to pursue this goal.

The panel urges the laboratory to be transparent about the timing of the release of the DSID as well as clear about how the ever-changing nature of the dietary supplement industry will be handled,

The panel urges ARS to work with the food industry and commodity groups to leverage public resources in this area. The food industry and commodity groups are anxious to provide up-to-date analytical data on their products. ARS could work with these groups and build a systematic approach to how information from industry and commodity groups could flow to USDA/ARS for inclusion in the SR database. USDA/ARS should set the necessary standards and laboratory procedures in order to assure that reliable, valid information is obtained.

Component 2 – Bioavailability of Nutrients and Food Components

Quality of Research Accomplishments: High

Bioavailability research is important as a means of linking knowledge of the nutrients present in the food supply to knowledge of the requirements for these nutrients in the human body. Component 2 is a logical and well-justified part of the USDA/ARS mission to improve human health through improved diet and better knowledge of human nutritional needs. Other governmental research programs do not have this as a priority and if ARS scientists do not carry out this mission in a productive manner, there will be a deficiency in predicting the nutritive value of foods and the supply.

ARS scientists working in this Component have made important advances. They have demonstrated collaborative efforts between centers and with researchers outside centers to accomplish missions within Component 2. There is significant documentation in the Accomplishment Report 2000-2006 of *impact* in terms of:

- benefits to USDA/ARS stakeholders;
- excellent research quality in the majority of areas;
- adequate productivity (although with the information provided we can only guess at output per investment);
- good integration with the other component of NP107.

As examples of ARS success, research on beta-carotene bioavailability has helped to clarify the wide range of bioavailability from natural foods, and the information has

received attention in publications, lectures, and awards. There has been a significant impact of this research on setting DRIs (Dietary Reference Intakes) for provitamin A components in the food supply. The work in this 5-year cycle is likely to be influential in the future as IOM/FNB recommendations for Micronutrient DRIs are reconsidered.

Research on vitamin K, which combines advances in analytical analysis with bioavailability studies in humans, using broccoli, collard greens, and oil-based supplements as tests, also provides fundamental information. The research has been conducted with state of the art technologies, and the results have had impact in terms of publications that have advanced over time and have been published in journals with wide readerships. This work has significantly benefited the advancement of understanding vitamin K as a micronutrient and its bioavailability from commonly consumed sources. Anthocyanin bioavailability represents novel research, supported by advances in technologies to measure these less well understood compounds.

The ARS scientists and collaborators have also contributed importantly to mineral bioavailability research, an area for which ARS has a strong, sustained reputation. Studies of minerals (iron, selenium, copper, zinc and others) from foods labeled intrinsically or by extrinsic labeling have been conducted in humans, and rat, swine and cell culture-based models. This research has helped to identify plant growth conditions that stimulate mineral incorporation into the edible parts of plants. ARS research has been important in identifying interactions of minerals and carbohydrates (prebiotics, inulin, phytate), and has been innovative in using cell models, such as CaCo-2 intestinal cells, as screening tools. ARS research has also had an impact on stakeholder/industries, exemplified by studies of the bioavailability of cadmium from confectionary-grade sunflower seeds, which is attributed to having provided the evidence needed to ward off EU importation restrictions on U.S. sunflower seeds. Overall, there have been significant advances in research on factors affecting the bioavailability of a number of minerals including calcium, iron, zinc and selenium. However, the progress on some other minerals has been less and, in some cases, the research is of relatively low priority. Particularly research on the bioavailability and function of minerals is not recognized as essential, or where no human dietary deficiency condition is a concern, seems less important.

New, novel techniques have been developed and applied to provide stable and radioactive food components for bioavailability studies and to construct methods to follow uptake and metabolism of these components. The use of isotopic methods for bioavailability studies, coupled with mathematical modeling for analysis of kinetics and biodistribution, illustrates a strength of ARS research. This type of research is well recognized by high quality peer-reviewed literature, and is well regarded by non-ARS peers. Studies of carotenoids, flavonoids, polyphenolics, and other isotopically-tagged phytochemicals represent important research that can be and has mostly been done directly in humans.

Despite the strengths, there are also a few weaknesses and notable gaps in this Component. 1) First, the research on bioavailability does not *appear* to have a strong rationale based on strategic planning, considering factors such as consumption patterns,

major foods consumed, and expected health benefits. The research appears to be highly investigator-driven, and somewhat spotty in terms of comprehensive coverage. As examples, first, given the many forms of folate in foods and the strong interest in folate and chronic disease prevention, it was surprising that more focus has not been given to its bioavailability. But overall, this comment is not targeted at folate but rather at what appears to be an unplanned/undirected strategy regarding what it is most important to analyze. Phenolics may be important, but the evidence is still slight, and the consumption patterns for blueberries, etc., may not justify the emphasis ARS research has given to them. 2) Secondly, the emphasis on soils, growing conditions and genetic traits of plants may be consistent with the NP107 5-year plan. Yet it seemed somewhat over-weighted in proportion to other efforts (two of four bullets on page 11), yet productivity from this was modest. It was not clear that the information gained from plant research was being applied to human nutrition studies or model systems. Overall, the work on identification of optimal soil and growing conditions to enhance nutritional value could be important but its impact in the 5-year cycle has been somewhat marginal. 3) Thirdly, bioavailability research appears to reside as a component of adult and aging research, with little emphasis on younger age groups, i.e., there was little research regarding children in Component 2, and only minor emphasis on macronutrient–micronutrient interactions that might affect bioavailability. The integration of Bioavailability with other major areas of USDA funded research, especially optimal child nutrition and obesity prevention, is an area of opportunity that should be considered.

Despite these comments on weaknesses, the overall program in Component 2 has been productive. It fits very well with what the nutrition research community perceives to be the mission and the strengths of ARS Human Nutrition Research. Component 2 could be better integrated, and it might be improved by evaluating, beforehand, the likely impact of its research agenda in terms of the quantitative and potential qualitative significance of the nutrients being tested.

The publications from Component 2 are generally strong and have simulated new research, and are likely to be useful for revising micronutrient recommendations. For some of the papers listed, the lead / senior author does not appear to be an ARS scientist (ref. 4, 18 as examples) and some citations are reviews. The selected nature of the publications makes it difficult (if not impossible) to assess the true output and the evenness or unevenness of the research in Component 2 and NP107 in general. However, there is compelling evidence that several of the scientists within ARS conducting Bioavailability research have achieved wide recognition and have been rightly recognized as outstanding leaders in this field.

Summary

Overall, the impact of the work in the Component 2, “Bioavailability,” is assessed to be of **High Quality**. Bioavailability fills an important position between understanding the component in foods (component 1), and meeting human nutrient requirements (component 4). It fits very well with other components of the Action Plan. It addresses core problems. The USDA/ARS has a strong reputation for addressing bioavailability.

There are few opportunities for funding of bioavailability research by DHHS/NIH, yet the problem is crucial and ARS scientists are well positioned to address it. The facilities available at several ARS Human Nutrition Research Centers are ideal for conducting the metabolic studies, dietary assessment, stable isotope analysis, and biokinetics modeling needed to assess bioavailability in human subjects. ARS facilities also provide infrastructure/resources in terms of greenhouses and metabolic units that are ideal for this research.

The past 5 year cycle has been of High Quality in terms of output and impact in the majority of research areas. Productivity has been adequate in terms of publications (although difficult to assess on a cost or FTE basis given the lack of information on this available in the Accomplishments Report). Not all aspects of the component were evaluated as equally high, and there is room for better focus in the future on the bioavailability of nutrients/food components of high impact. “Vetting” the impact to public health in advance of starting a research study may be a way to focus limited resources on high-impact problems. This may include more emphasis within mineral bioavailability on those minerals of greatest known public health significance and less emphasis, or attenuation of research programs, on micronutrients of unknown essentiality, or on minerals known to be essential but for which dietary deficiency or toxicity is not a prevalent problem. There may also be opportunities to examine how the bioavailability of minerals such as iron, calcium, magnesium, and manganese is affected by macronutrient changes (such as may occur if the recommendations to consume higher fiber or lower fat diets are followed). A focus on the “more major minerals,” such as those needed for bone health and anemia prevention, also could help also to fill gaps in DRIs where no ERA/RDA current exists, and to firm up other DRIs for which age-specific information is missing.

Overall, this 5-year cycle has been successful in meeting researchable goals and providing new information that has been, or very likely will be, important in setting nutrient intake recommendations and policy. This Component appears to have appropriate leadership in terms of established, well recognized investigators. ARS should make forward-looking plans to retain its strength in Bioavailability in the next NP107 cycle.

Component 3 – Nutrition Monitoring

Quality of Research Accomplishments: High

Expected Outcomes:

The expected outcomes for this component of NP 107 includes ongoing monitoring of diets and nutrient intakes in a nationally representative sample of Americans; regular release of data; continuous improvement of methodology for dietary assessment; development and dissemination of methodological tools for dietary assessment; consultation with other countries regarding dietary methods and monitoring. Data produced are fundamental to the development of the Dietary Guidelines for Americans,

policy formation for WIC and other federal food assistance programs, and development of the DRIs.

Summary:

The mission of the Food Surveys Research Group is to monitor and assess food consumption and related behavior of the U.S. population by conducting surveys and providing the resulting information for food and nutrition-related programs and public policy decisions. See <http://www.ars.usda.gov/AboutUs/AboutUs.htm?modecode=12-35-50-00>.

National nutrition monitoring activities are critical to the nation and play a key role in shaping a variety of policies including food safety, child nutrition, food assistance and dietary guidance. The United States has one of the most comprehensive nutrition monitoring programs in the world and the data collected for the National Health and Nutrition Examination Survey (NHANES) serves the needs of people in government, academia and the private sector.

According to the ARS website, "What We Eat in America" (WWEIA) is the dietary intake interview component of the National Health and Nutrition Examination Survey (NHANES). WWEIA is conducted as a partnership between the U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (DHHS). DHHS is responsible for the sample design and data collection, and USDA is responsible for the survey's dietary data collection methodology, maintenance of the databases used to code and process the data, and data review and processing." See <http://www.ars.usda.gov/Services/docs.htm?docid=13793>.

The Food Surveys Research Group should be congratulated for an excellent collaboration with DHHS. Prior to 2002, two sources of data were collected separately by DHHS and USDA; NHANES and the Continuing Survey of Food Intakes for Individuals or CSFII. When these two surveys integrated several benefits occurred. Most importantly, diet and nutrition information can be linked directly to extensive health data. In addition, data collection should occur on a continuous basis through the established NHANES mechanism rather than periodically as was the case with CSFII.

However, the integration has led to limitations as well. Much of the coordination and funding for dietary data collection in NHANES now seems to be through USDA/ARS/Dietary Survey Research Group. In 2002 USDA funded the collection of a second day of dietary recall data. However, these data were not publicly released because of confidentiality issues. The WWEIA, NHANES 2003-2004 public release has two days of dietary recall data. Two days of data are essential as this improves researchers' ability to estimate individual usual dietary intake.

Additionally when the two surveys were integrated, the Diet, Health and Knowledge Survey (DHKS) was eliminated. This was a component of the CSFII that measured attitudes and knowledge about diet and health among Americans. Fortunately, the panel learned from ARS staff that the DHKS has been taken over by the USDA/Economic Research Service and will be added back to NHANES.

The Food Surveys Research Group has been heavily involved in improving the validity of dietary intake data. The group should be congratulated for recognizing the serious and pervasive problem on underreporting in dietary surveys and for stepping up to the plate to develop solutions to this serious problem. They have diligently pursued the development and validation of the USDA Multiple-Pass Method (AMPM). The AMPM is a five-step computerized dietary recall instrument that can be administered in-person or by telephone. A massive and costly validation study was undertaken to validate the AMPM using doubly-labeled water measurements of total energy expenditure as the gold standard. The nutrition science community is anxiously awaiting the publication of the results of this trial.

The Food Surveys Research Group is heavily relied upon to provide information on Americans' dietary intake for the development of national nutrition policy. They have been called upon to assist with the development of the 2005 Dietary Guidelines for Americans, the Dietary Reference Intakes and the new interactive MyPyramid.Gov nutrition education tool. WWEIA has enormous reach and is also important to the EPA's estimates of the population's exposure to food contaminants as well as other toxic elements (FDA's Total Diet Study) and to establishing the impact of USDA's multi-billion dollar food assistance programs.

Some scientists with the Food Surveys Research Group publish analyses of the food survey data. One analysis comparing fast food consumers with non-fast food consumers' energy intakes, diet quality and overweight status received a great deal of attention. Overall the group is not prolific publishing in the peer-reviewed literature. That said, the data are publicly available and countless analyses of the NHANES data are published by scientists annually.

In closing, the FSRG is doing an excellent job of continually improving the quality of our nationwide food consumption survey data. Effective nutrition monitoring is necessary to provide the data for sound public health and policy decisions. The inclusion of a second day of dietary intake data is essential, the DHKS should be returned, and the outcome of the AMPM validation study needs to be disseminated in the peer-reviewed literature.

Assessment

The FSRG had some very significant accomplishments during this period. The development, refining and validation of the AMPM dietary recall method is highly important. Meshing the former CSFII and NHANES was a huge task and went smoothly producing a very good outcome. The group should be commended for this collaborative work with DHHS.

Food Link is a major accomplishment and service to academics and practitioners.

The FSRG's should be commended for their international reach. They work with Canada as well as many other countries.

Recommendations

FSRG partnerships with NIH and/or CDC on some initiatives could be encouraged to extend resources.

Replace key scientists as retirements occur.

This area should have high priority because of the wide variety of stakeholders and the excellent quality and importance of the data produced.

The panel urges the group to move the doubly labeled water validation study of the AMPM to publication. This was an expensive, massive study and the nutrition community is anxiously awaiting its publication. An abstract was presented on a subset of the work in 2003. The investigators should be strongly encouraged to proceed with publication of this important work.

Component 4 – Nutrient Requirements

Quality of Research Accomplishments: Medium

Overall Comments (Entire NP-107 program)

The Human Nutrition Program of the USDA Agricultural Research Service appears to be meeting its goals and delivering quality nutrition research outcomes that significantly advance the knowledge in human nutrition. The program is working on some key issues of importance to the field of nutrition and providing relevant data to answer significant questions. The program is doing some state of the art work and employing top caliber scientists. Although NP107 is doing work on some critical areas where information it is needed, it is difficult to see how all of these pieces of work fit together in to a cohesive strategic plan with predetermined goals. Each component of the plan should have a specific goal it is trying to achieve within a certain time frame, this would help bring some focus to the work being done and help in making decisions on work that should stop. It would be helpful to understand the criteria that are used to determine if an area of research is worth continuing or completed. Right now it appears to be a collection of various research projects (good projects) grouped under various component areas (e.g., nutrition monitoring, nutrient requirements, etc.). More clearly defined goals should be identified for those component areas (e.g., in 3 years we will define the impact of high protein intake on calcium absorption, retention, and bone mineral density), with the rationale for that goal.

This report should capture the investment in NP107 research other agencies, industry, trade groups, etc. This investment to support ARS research demonstrates that external

organizations value the skills and capabilities of ARS research. It also demonstrates value to taxpayers, as their investment is being well leveraged. The budget sheet reported funds that came from non-USDA sources, but this is not complete and does not indicate source.

Their “food based” approach is important to provide data to support dietary recommendations. The Committee believes that the food/nutrient intake monitoring is a critical component of this program. The data from this nationally representative sample is important for formulating meaningful dietary recommendations. Continued work on the Multiple-Pass Method (AMPM) is important. Work on AMPM should be given priority over work related to FFQ. Better tools than FFQ are needed. Continued work to demonstrate the accuracy of food intake measurements is important. The USDA National Nutrient Database for Standard References is the gold standard, yet processing techniques or product formulations change quite often and this could impact the quality of those data. The Committee would like to get an understanding of how ARS is working with the food industry in the development of this database. The food industry has to account for regular reformulations of its products and nutrient data they collect on their products for nutrition labeling requirements by the Food and Drug Administration (FDA), is there any exchange of this information with ARS? A systematic process to work with industry may enhance the quality of the data and potentially save money. The SR process that prioritizes updates based on commonly consumed foods and nutrients of public health significance, with a nationally representative sampling plan is a good addition to the program.

Research on genetic variation and diet is an area of research that should be of greater emphasis in the program. The public health approach of “one size fits all” dietary recommendations needs to be reconsidered and good data to direct recommendations with a more individualize approach are needed. Available data has demonstrated that giving broad population based guidelines may do some harm. These guidelines are based on mean values. However, response to dietary change is highly variable. As an example, work by Ron Krauss has shown that the restriction of fat/saturated fat may produce blood lipid responses (increases in small dense lipoproteins with conversion to a type B lipid profile associated with a 3x increase risk of myocardial infarction) that may increase risk for cardiovascular heart disease. In addition to basic research in this area, more applied work is need on how to communicate an individual approach to diet to the general population in a way that enhances the likelihood of causing no harm, with improving overall health.

Nutrient Requirements

The work being done in this area is scientifically very sound and some very important issues are being addressed. A concern of the Committee is that there seems to be a lack of focus and a clear delineation of specific goals to be achieved. The work should be focused on a few key areas so that they can be examined in more depth and produce the amount of data to effect meaningful recommendations in a more timely fashion. How does ARS prioritize its work?

The work related to nutrient requirements for bone health is outstanding. The work on the synergistic effect of dietary calcium and protein in enhancing bone health are key studies that have produced data that will significantly impact recommendations for intake of these nutrients. The work on high meat intakes is helping to resolve an important issue for which there has been some confusion due to incomplete data or misinterpreted research outcomes. Work related to vitamins D and K is also important as evidenced by the utilization of these data by the National Osteoporosis Foundation in the formulation of vitamin D intake recommendations. Certainly, their work on vitamin K will impact future recommendations for intake.

Results of ARS work in this area raises an important issue in that national campaigns to reduce obesity could have an inadvertent effect of increasing the incidence of osteopenia and osteoporosis. This relates to an earlier point of the need to do more work in the area of diet and genetic interactions and its impact on health outcomes. The subsequent translation of this work into individualized dietary recommendations will also be critical. The need to increase work on diet and genetics to better define nutrient requirements would require an increase in budget or a reallocation of resources. Because budget increases are unlikely, ARS NP107 should review its program of work and determine the key issues on which it will focus, as well as which work will be stopped. While work in the program is good there are too many different areas of work, thus resources are not allocated to optimize the success of the program. For example, the Committee would question whether work being conducted on boron and silicon in relation to bone health should be a priority area of work (this is stated with the assumption that if it is in the NP107 program of work, it is a priority to ARS). Work related to leptin and bone formation is interesting, how will ARS determine if this area of work is worth pursuing in a more aggressive fashion? Are there go/no go decision points in the NP107 plan of work? Because of the need to focus this program, the Committee raised the question of whether the work related to dietary copper is of high enough priority to continue. There seems to be a large allocation of resources to work related to copper. Relative to the many human nutrition issues this would seem to be an area of low priority.

The area of nutrient requirements related to physical activity and performance seems to be a “mish-mash” of work with no “end game” goal to accomplish. There is a need to get this research focused on a few key objectives. Defining the nutrition and exercise requirements to prevent age-related muscle loss would be a good area for focus considering the aging US population. The Committee agrees that NP107 research has helped to characterize the molecular landscape that controls skeletal muscle metabolism and that this is a priority area, but would like to see better defined goals.

A key question for this program is how to set dietary intake recommendations (or DRIs) for food components for which there is no human requirement, but which may provide some biological activity that results in a health benefit (or disease reduction). In addition, how do we view recommendations for nutrient intakes at levels beyond meeting basic nutrient needs or at levels beyond what the food supply can deliver to reduce chronic disease? These questions create a debate on when recommendations for intake of these

biologically active molecules are in the field of nutrition and when are they in the field of pharmacology?

Work being done in this area is good from a scientific point of view, as evidenced by the high number of quality publications in top tier journals. There is outstanding work being done, but the Committee would like to see better focus on work, by a priority system, with well defined research goals.

Component 5 – Health Promoting Properties of Plant and Animal Foods

Quality of Research Accomplishments: Medium

The four major facilities working in this problem area are at Beltsville, Tufts, Davis and Little Rock. This is a rather broad problem area that to some degree overlaps with several other Human Nutrition Component areas. The research projects within this Component do not demonstrate focused goals, are very diverse in their nature, and have had variable impact on human health. There does not appear to be “directed” efforts in a sense of purposeful planning to achieve the “goals” set forth in 2000. The concepts behind this aim aren’t well spelled out, and it is not evident that the objectives mentioned have been prioritized with respect to their health impact. There is an underlying sense that some work under Component 5 is significantly commodity driven, a bit of a fishing expedition. Overall, the projects and accomplishments in Component 5 lack strong cohesiveness and don’t project themselves as having a strong, well-explained rationale.

There were three “outputs/outcomes” proposed for this component. Each is reviewed below.

Determine effects of changes in agricultural conditions on nutrients in crops.

This outcome overlaps with Components 1 and 2 and is thus difficult to assess. There was fair to poor productivity for this area with only small advances in research on the effects of agricultural conditions on bioactive components in soybeans and broccoli. Considering the potential impact of these bioactives on health outcomes, more knowledge on the effects of common agricultural practices on total content and profile of bioactives should be achieved in the future.

Assess the influence of consuming barley, tea, berries, vitamin E, and probiotic bacteria on reducing the risk for common chronic diseases or for infections.

There was a significant amount of research activity in this outcome area. There was some overlap of this area with Component 6. It appears that the most impact was achieved with the studies with barley that led, in part, to FDA approval (May, 2006) of a health claim for barley based on its soluble fiber content. The publications related to blueberries and aging/cognition received a great deal of publicity and this work may in the long run be shown to impact health status of older Americans. There was also some

emphasis on tea, cherries, cinnamon and soy by ARS researchers. It is interesting that ‘Selected Accomplishments’ and ‘Impact’ are not very well aligned. Selected accomplishments mentioned the food group/commodities above, while Impact is more focused on minerals and bone health, probiotics, as well as cinnamon, antioxidants, and anthocyanins.

It is not clear whether an underlying goal of research projects is to identify natural products that could become pharmaceutical/nutraceutical products (e.g., blueberries in neural signaling in an Alzheimer model (ref. 6) or whether the goal is to improve the food supply across macronutrient and micronutrient groups to better match human nutrient requirements and positive health outcomes. It is the opinion of this panel that enhancing foods should be the goal.

While it is difficult to quantify, research outcomes that have associated consumption of these foods with positive health outcomes most likely has increased consumer education, interest and sales of these products. The ongoing, large randomized trial with infant feeding of breast milk, soy or cow’s milk formula at the Arkansas facility is very exciting, timely and important. It would be expected that the outcome of this work would have significant influence on public health recommendations for infant feeding in the future. Many research groups around the world are evaluating health of probiotic bacteria. ARS researchers have developed a neonatal swine model that is useful for these research teams.

Overall the achievements in the goal area were rated as very good.

Diet and risk of eye disease commonly associated with aging.

For some time, a group at Tufts has focused on nutrients and diseases of the eye, especially cataracts and age related macular degeneration (AMD). They will be involved with an NIH-funded multi-center AREDS 2 trial of lutein, zeaxanthin and omega-3 fatty acids and AMD. Because of the limited progress in this area in the last 5 years, the outcomes from this goal cannot be rated as high.

Summary

Overall the impact of the work in the “Health Promoting Properties of Plant and Animal Foods” is judged to be of **Medium Quality**. There have been some good project outcomes but this research has only had marginal impact on overall knowledge of human nutrition and upon formulation of national dietary recommendations. It is not apparent that any of the projects are producing important, “new leads” that would significantly redirect food consumption patterns. There was no obvious integration of this Component with food database research, agricultural economics, behavior sciences, or human nutrient requirements.

On the other hand, some new methods and tools have been developed from work under this Component that should be valuable for the entire research community. There should

be promising new data that will come forth from the infant formula work from Arkansas and AREND 2 from Tufts and other non-ARS facilities. A review of the “selected citations” from Component 5 indicates ARS scientists are publishing in very good to excellent journals. The ranking of two ARS scientist in the top five of “most highly cited authors” is commendable but is mostly attributed to adaptation of the ORAC assay by many laboratories.

The Action Plan and report leave the panel with a sense of lack of strategic planning and drift in Component 5. More emphasis in the future on the health implications of bioactive components of foods is warranted but should be carried out in a more systematic manner taking into account the agronomics, economics of production, consumer acceptability, and the consumer behavioral challenges necessary to change food consumption patterns to include these foods in the dietary. In the future, research focus on commodities should be in parallel with the primary goals of the program Component and if planned properly there should provide an opportunity to partner financially with commodity/industry groups and other federal agencies.

Component 6 – Prevention of Obesity and Disease: Relationship Between Diet, Genetics, and Lifestyle

Quality of Research Accomplishments: High

The relationship between specific nutrients and disease risk is often modified by a host of genetic differences among individuals and groups of individuals. Understanding these differences is an important step in development of improved diet recommendations aimed at reduction of disease risk. This component of NP107 is directed toward elucidation of these differences as well as further examination of the role of specific nutrients and physical activity in obesity and chronic disease risk. Examples of accomplishments within this component are quite impressive. The breadth of projects summarized and the fact that they represent only a small fraction of the projects involved in this Component make it difficult to review the totality of effort or its quality.

Comments on Sample Goals:

Goal 1: Identify the effects of genetic variation on response of various risk factors for chronic disease differences in diet.

The elucidation and examination of the importance of polymorphisms of perlipin is an example of a very important type of research that can have wide-spread implications in our understanding of susceptibility to obesity and, eventually, to its control. The combined contribution of folate analysis and work with gene mutations of enzymes involved in folate metabolism is impressive and a good example of a coordinated effort across disciplines within ARS. The effects of ApoA1 polymorphisms on HDL response to polyunsaturated fatty acids has provided the groundwork for an interesting approach to screening prior to diet intervention. This goal is rated high.

Goal 2: Determine how genetic factors affect development of obesity in children from an ethnic minority.

The study of Hispanic children is much needed and well designed to help collect data to help sort out potential genetic/environment interactions. The reference database for body composition for the various ethnicities will be a major contribution from this goal. This section was rated high.

Goal 3: Assess whether infant or childhood feeding practices alter brain development and function.

This goal was discussed in conjunction with Component 5.

Goal 4: Provide data that bear on whether selenium, vitamin A and other antioxidants reduce cancer risk or improve resistance to infection.

The accomplishments described have had a great impact on our understanding of the role of these antioxidant nutrients on cancer risk and resistance to infection. ARS researchers have been heavily involved in development of our understanding of the role of selenium in cancer risk. Human studies of the effects of selenium and vitamin E on viral infection in the elderly have demonstrated efficacy as well and implicating mechanisms for these changes. Similarly the role of β -carotene in altering cigarette smoke-induced oncogene activation and subsequent studies in cell culture have also added significantly to our understanding of the potential role of foods containing these antioxidants on cancer susceptibility.

Alterations of methylation of DNA, as discussed in this section, may provide an exciting new direction for future exploration of nutrient modification of genes. This section is rated high.

Goal 5: Understand whether changes in physical activity alter long-term food intake and maintenance of healthy weight.

Although the project mentioned in the accomplishments had great impact with the public in helping make comparisons of several popular weight reduction diets, it did not address the stated goal accurately. For this reason it is impossible to evaluate the overall goal. This goal is rated medium.

Other accomplishments: Several additional accomplishments that did not fit within the goals described were outlined in this section. These accomplishments are very interesting and demonstrate the diversity of interests within ARS. These accomplishments also demonstrate the need to reorganize to better focus research efforts across the Program.

Assessment and Recommendations:

The impact of the accomplishments in relation to this Component has been strong in past with significant contributions in several of the areas highlighted in the goals. Continued effort will be needed in the future to maintain this status by coordination of effort across and within Centers.

In addition our discussion of the ARS NP107 effort aimed at building a focused, coordinated, concentrated effort in obesity research provides another area under this Component that could significantly contribute to maintenance and development of a leadership role in research.

Overall this section seemed to lack focus. It was not clear if this problem was a result of the attempt to summarize the highlights of a large number of diverse projects or if the problem was systematic. It was the opinion of the panel that both factors contributed to this observation. In any case, discussion and planning need to be used to develop a well focused and well directed set of projects. Overall rating high with some reservations for some goal areas.

Component 7 – Health Promoting Intervention Strategies for Targeted Populations

Quality of Research Accomplishments: Medium

Expected Outcomes

Many of the major public health problems of the US population can only be addressed by improvements in dietary patterns. There are a number of programs (including USDA programs) and professional organizations that engage in nutrition and health education for the public and for specific subpopulations; yet dietary patterns remain suboptimal for the population as a whole and even worse for some subgroups. Pervasive attention to the recent rapid increases in prevalence of overweight and obesity, and the predictable consequences for morbidity, premature mortality and health care costs has increased the sense of urgency around issues of learning better how to change behavioral patterns in effective and sustainable ways for large numbers of people. Further, the nature of the problem opens opportunities for a paradigm shift with regard to dietary behavior, with a more “upstream” focus on physical and social environmental change through policy advocacy and program development and implementation, as well as more traditional “downstream” attention to information, education and communication. Thus research under this program component should have even higher priority than it did several years ago when this program component was first articulated. The ability of ARS to engage in long-term research is particularly appropriate for this program component, and the idea of targeted populations of particular nutritional vulnerability complements the national nutrition monitoring effort under Component 3.

Goals:

The sample goals articulated for this component during the period of review were three: 1) development of databases that can be used to identify diet practices to avoid obesity and other chronic health conditions; 2) show that an exercise program without intent to lose weight improves insulin sensitivity; and 3) identify, implement and test nutrition and physical activity interventions in low-income communities. The first and third goals are broad and can form the umbrellas for a number of specific research activities; the second is rather specific and apparently implies a single research project. Systematic planning for this program component should be undertaken to direct and prioritize future goals, specifically with regard to targeted populations.

Size of the Program Component:

It is difficult to judge productivity without a clear understanding of the human resources and budget committed to this program component. However, whatever assumptions are made this component is very small relative to the overall size of the Human Nutrition Program. Judging from the information available to the panel, this effort seems to comprise a) the Geisinger Rural Aging Study, affiliated to the HNRC/Tufts, b) the entire program of the Nutrition Intervention Research in the Mississippi Delta of AR, LA and MS; and c) some activities at the WHNRC/Davis, HNRC/Tufts, and at the CNRC/Baylor. Only one ARS-funded scientist position is attached to the Mississippi Delta project (and no postdoctoral positions). The Delta NIRA activity accounts for <2% of ARS-funded scientist positions and <5% of the overall Nutrition Program budget. The resources devoted to this component in the other centers are also small; one to three ARS scientists each at Houston, Tufts and Davis appear to be producing some publications in this area.

Accomplishments and impact:

The output of this program component in terms of publications has been very modest (slightly over one percent of all Nutrition Program publications during this period) but the publications listed (16 out of the 24 total) are without exception in excellent journals and do represent contributions to the field. A notable policy impact of the work is a change in Texas school food policy following publication of work from the CNRC documenting choices made by school children who had access to foods other than those in USDA-approved school meal programs. Policies on sales of foods and soft drinks in schools have now been changed or developed in a number of states. Research into the value of physical activity/exercise alone in improving metabolic control has been conducted with adult women who are chronic dieters at the WHNRC and with elderly adults at the HNRCA; the results form a beginning evidence base for the design of health promotion programs in the era of prevalent obesity and related disease.

Two large activities deserve specific discussion because a) they constitute resources that provide bases for substantial long-term work; b) they focus on subpopulations that are not adequately represented in national (NHANES) monitoring, and that are particularly vulnerable to nutrition-related health problems; and c) they require by their nature a fairly long period of time for substantive impact and productivity to be judged. Both are just

beginning to produce peer-reviewed publications. These are the Geisinger Rural Aging Study and the Lower Mississippi Delta Nutrition Intervention Research Initiative.

The Geisinger Rural Aging Study (GRAS) located in Danville PA, was begun in 1988 by the Geisinger Clinic and was supported in the mid-1990s by a modest grant from the Robert Wood Johnson Foundation. It was continued with ARS support through a cooperative agreement with Geisinger Health Systems beginning in 1998 and is an ongoing, longitudinal, observational study of nutrition, aging, health and functional status in a large cohort (>21,000) of largely rural elderly adults. Only one publication from this study is listed in the Accomplishment Report, but search of PubMed revealed three others. The project report to ARS for 2005 indicates substantial planning for ongoing work. This study should prove to be a rich resource and has the potential to be a rural, multi-endpoint “Framingham-type” study conducted in the contemporary environment of widely prevalent overweight. The cohort is very valuable, and would seem to be a candidate for producing competitive proposals to NIH and elsewhere in order to realize its potential.

The Lower Mississippi Delta Nutrition Intervention Research Initiative (Delta-NIRI) was begun about the same time, namely in the early to mid-1990s and focuses population-based, participatory intervention related research in one of the poorest and least healthy areas of the country, as well as one with a very large minority population. Begun with an ARS-catalyzed effort, a consortium of six universities in three states (Mississippi, Arkansas and Louisiana) was formed, including the 1890-land grant university in each state. There followed a number of planning activities and the opening of an ARS office in Little Rock, AR to provide ongoing leadership and to bring ARS expertise from established centers to bear on the needs and activities in the Delta.. The group has produced, collectively, a dozen or so (five are listed in the Accomplishments Report) peer-reviewed papers, a monograph, and several chapters and reviews. This output is minimal but must be considered in the context of the effort to start a focused nutrition research initiative essentially from scratch in a generally resource-poor environment. The work has focused on developing the database on food consumption patterns and food security required to plan interventions, and to develop the community liaisons and networks required for long-term, community-based participatory research. Dietary intake patterns have been documented, a regional food frequency questionnaire developed and tested, a methodological investigation conducted with regard to cell-phone dietary surveys in households without phones, prevalence and health correlates of food insecurity documented, and a small-scale pilot weight loss intervention tested.

Altogether, the output appears to be of good quality, but the quantity is disappointing given the potential for a great deal more. While the amount of funding dedicated to the Delta NIRI is not insignificant, its division among six institutions of higher learning and an ARS office means that the resources available for any particular investigator or project are not large. The original intent of the Mississippi Delta effort included substantial capacity-building in terms of human resources in nutrition for the area. While existing scientists and affiliated universities have made some progress, creative leadership will be required to accelerate progress if this particular effort is to realize its potential.

Both the Geisinger Rural Aging Study and the Lower Mississippi Delta NIRI have tremendous potential. They focus on specific target populations that are particularly vulnerable to nutrition-related ill health and for whom effective interventions can improve quality of life. They also offer the opportunity for creative methodological work to improve the design and evaluation of nutrition interventions for other populations. The model of sustained involvement in a community participatory model is one with great promise, and in other settings has demonstrated effectiveness. However, to realize their potential both of these activities need adequate resources and vigorous leadership. It is not clear that the leadership of the Delta NIRI is meeting the challenges effectively and the USDA should give careful attention to improving the productivity of this program.

Both the GRAS and the Delta NIRI populations would seem to be natural environments for the short-term and long-term research proposed under the new Obesity Prevention Research Initiative.

Component 7 Recommendations:

1. Given the importance of this program component topic in today's public health nutrition environment, resources allocated to this Program Component need to be deployed in carefully planned and prioritized activities, to maximize impact.
2. Scientists with relevant backgrounds in economics, policy, public health, education and behavioral science should be actively engaged by the Centers with responsibility in this program component, drawing on the resources of affiliated universities.
3. ARS should consider bringing together all the activities under this program component periodically for sharing of information and progress, and systematic planning. Work in all of the ARS Centers in this program component could be stimulated.
4. Both the Geisinger Rural Health Study and the Lower Mississippi Delta NIRI should be maintained, and sufficient resources assured that they can realize their potential for advancement of knowledge and improvement of health. Consideration should be given to developing NIH and other proposals utilizing the Geisinger cohort. A re-evaluation of the leadership of the Delta NIRI program may be indicated to improve productivity. Additionally, ARS Centers may consider developing work focusing on other target populations.
5. Consider utilizing the Geisinger Rural Health Study cohort and/or the Delta NIRI population in the planned multi-center studies under the new Obesity Prevention Research initiative. There are several advantages to considering this – closer involvement of these initiatives with the overall national program, the economy of utilizing existing populations and relationships, and contrasting age and cultural characteristics.

Overall Panel Recommendations: Potential Future Directions for ARS Research:

1. The Dietary Guidelines have been available and used for some time to make policy, but have never been adequately validated. This should be a priority.
2. Obesity prevention from the dietary/foods point of view: Physiology, biochemistry, exercise, and drugs questions are not necessarily USDA concerns and goals. USDA should work with other agencies, particularly NIH for optimal efficiency.
3. Epigenetics is a critical research area of the future. Nutrition is a major factor in the epigenetic expression of various health and disease states. A coordinated focus with other agencies is important so that food/nutritional factors can be identified and evaluated.
4. The Report notes differences in nutrients in foods due to region of country, types of fertilizer, climate changes, genetic modifications, and others. Research is needed on the variances in nutrients and factors the affecting them. This is a large task that needs to be coordinated with other components of the USDA and of the government. These factors may have significant roles in epigenetic phenomena as well.
5. Diet and genetic interactions with chronic disease: The ARS should focus on applied research, not necessarily basic science, to identify the whole animal consequences.
6. Nutrient requirements of children and elderly: There are gaps in the information base for these age groups. These areas need to have a careful, planned balance of macronutrient and micronutrient studies with priorities set by USDA, rather than being predominantly investigator-driven.

Panel Members:

Richard L. Atkinson, M.D., Chair
John W. Erdman, Ph.D.
Gail G. Harrison, Ph.D.
Rachel K Johnson, Ph.D., R.D.
Gregory D, Miller, Ph.D.
A. Catharine Ross, Ph.D.
Jon A. Story, Ph.D.