

## Advanced Training in Artificial Intelligence for Precision Nutrition Science Research (AIPrN) - Institutional Research Training Program [T32]

### **Background**

During the NIH [Precision Nutrition Workshop](#) sponsored by the Office of Nutrition Research earlier this year, participants noted the precipitous rise in largescale complex datasets being made publicly available by NIH Institutes, Centers, and Offices (ICOs, e.g., *All of Us* Researchers Workbench, Biodata Catalyst, Common Fund Data Ecosystem, TOPMed, and other ICO Data Commons) and elsewhere along with the corresponding arrival of Big Data analytics. This has created a new landscape for health research enabling the vision of precision nutrition and the opportunity to make discoveries in diet-related chronic diseases that are beyond human intuition. It was noted that this vision and type of discovery science could only be realized if the complex interplay of factors influencing nutrition and diet-related disease outcomes are understood. The relevant factors are likely to be present at multiple levels of influence including but not limited to the more frequently considered “below the skin” inputs of OMICs, physiological responses to feeding, history of recent disease and disease status. These broader external environmental and behavioral factors include food and community environment, socioeconomic factors, stress, race and racism, nutrition/health and other disparities, food security, policy, culture, dietary habits, and physical activity. A recommended approach to this complexity is assembling teams of interdisciplinary scientists with a wide breadth and depth of expertise spanning across nutrition science, biomedical science, behavioral science, but also core competencies in computational methodology, data science, systems science, machine learning (ML), artificial intelligence (AI), and data infrastructure. However, the workshop participants noted that the cadre of scientists with these characteristics needs to be expanded and concluded that most current nutrition training programs were not meeting this need. Conversely, AI/ML, Big Data, computational and systems science training programs were not often focused on nutrition. The Advanced Training in Artificial Intelligence for Precision Nutrition Science Research (AIPrN) Institutional Research Training Program aims to build this scientific workforce. As part of our further consideration, we conducted a portfolio analysis and found that of 1809 NIH T32 training grants, none had a focus on AI or ML. Twenty were focused on some aspect of nutrition, and 28 of the 1809 were bioinformatics/data science related (of which only 2 were nutrition-related). This dearth of T32s in nutrition with a data science AI/ML focus reveals the urgent need to expand this type of training. Notably the proposed concept: (a) has been developed in conjunction with the Office of Nutrition Research (ONR) senior leadership and Strategic Plan for Nutrition Research Implementation Work Groups, (b) addresses opportunities and gaps from the [Precision Nutrition Workshop](#) and a corresponding [Request for Information](#), (c) aligns with multiple strategic objectives within the [Strategic Plan for NIH Nutrition Research](#), (d) is enthusiastically endorsed by multiple ICOs that hope to participate, and (e) is modeled after but expands upon an existing OBSSR T32 ([RFA-OD-19-011](#)) that seeks to advance computational and/or data science analytic approaches in behavioral systems science research. It also dovetails with the planned Common Fund project that will be generating such data– [Nutrition for Precision Health – powered by the \*All of Us\* research program](#).

### **Program Goal**

This program aims to build a future workforce that will be able to make pivotal discoveries using an increasingly complex landscape of Big Data and a wide array of data tools to tackle complex biomedical challenges in nutrition science and diet-related chronic diseases.

### **Key elements include:**

- 1) Trainees – The AIPrN program is intended for both pre- and postdoctoral trainees chosen for support and participation based on their need to apply AI/ML to a nutrition-relevant project.
- 2) Multiple Interdisciplinary Mentors and Team-based Science Training Team – Each institutional training program should include interdisciplinary faculty, e.g., with expertise in nutrition, bioinformatics, or biomedical sciences (focused on diet-related diseases of interest to participating Institutes), computational

and data sciences, computer engineering, and biostatistics/informatics, etc. Multiple mentors and team-based science is strongly encouraged. The intended FOA requires applicants to assemble an interdisciplinary team of scientific mentors to design and direct a training program matched to the applicant’s expertise and individual research activities. Applications must include mentors from both nutrition science and AI-related disciplines. Ideally, the trainees will have at least two primary mentors who have different areas of expertise to foster a truly cross-disciplinary training experience.

- 3) Cross-program Team Building – The Office of Nutrition Research will convene and facilitate annual cross-site exchanges among faculty and trainees.
- 4) Diversity in Trainees – Applicants will be asked to prioritize the training of a diverse workforce in nutrition science. Applicants should be able to explain the institutional success or strategy for increasing the diversity of trainees. For example, the applicant training program should either **be** or consider linking their proposed training programs to trainees and/or faculty of Historically Black Colleges and Universities (HBCUs) or other Minority Serving Institutions (MSIs). Applicants should consider trainees who are either enrolled in a RD-MS (or equivalent) or Ph.D. program or have obtained either of these degrees—as described in the NIH Strategic Plan for Nutrition Research. Programs should have flexibility to train those with AI/computational science expertise in biomedical (diet-related disease)/nutrition research or the converse.
- 5) Diversity and Research Topics – While projects selected for training across the translational spectrum of the sponsoring institutes are encouraged, ideally a number of those should aim to make discoveries from large datasets in order to reduce the rate of diet-related chronic diseases that disproportionately affect minorities and those with other disparities, reduce nutrition health disparities due to race, ethnicity, geographical location, income or educational attainment, and/or reduce food insecurity and hunger.
- 6) Plan to Ensure Success of Training Program and Trainees – The application must include a signed letter on institutional letterhead from a President, Provost, Dean, or key institutional leader that addresses 12 specific points describing the activities and resources provided by the institution that will ensure the success of the planned training program and its trainees (not to exceed 10 pages).

**Initiatives**

An institutional research training program [T32] for advanced training in artificial intelligence for precision nutrition science research (AIPrN)

**Deliverables**

- Development of a diverse research workforce with advanced competencies in AI including ML and data science analytics to apply to an increasingly complex landscape of Big Data from the molecular, to organismal, to community and societal scales related to nutrition and diet-related conditions
- Annual meetings coordinated by the ONR to evaluate progress and bring together trainees and PIs to build a research community, and to exchange scientific ideas and training approaches

**Budget**

Numbers are (\$1000s) to co-fund 8-12 programs contingent upon NIH appropriations.

Initiatives	FY2023	FY2024	FY2025	FY2026	FY2027	Total
AIPrN T32	\$4000	\$4000	\$4000	\$4000	\$4000	\$20,000