Concept Clearance: New Common Fund Program

TITLE: Nutrition for Precision Health, powered by the All of Us Research Program

Objective: To provide the evidence base for individualized dietary/nutrition recommendations

Initiatives:
1. Data and Study Coordination
2. Clinical Centers
3. Data Generation Centers
4. Artificial Intelligence, Bioinformatics and Data Modeling Center
5. Biobank

Funds Available $155,900,00

Program Duration: 5 years

Council Action: Vote on support of Program
Nutrition for Precision Health, powered by the All of Us Research Program

Griffin P. Rodgers, M.D., M.A.C.P.
Director, National Institute of Diabetes and Digestive and Kidney Diseases

September 11, 2020
NIH Council of Councils
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Why precision nutrition?

• Poor diet is a leading cause of preventable death and disease and preventable healthcare costs in the US

• Current dietary recommendations provide a one-size-fits-all approach

• Interactions between dietary intake, microbiome ecology, metabolism, nutritional status, genetics, and the environment are still poorly understood
Why do we need a Common Fund Program?

• Nutrition research is a cross cutting issue at most NIH ICOs accounting for ~$1.8 billion in research expenditures per year

• A large harmonized effort to comprehensively analyze the metabolic status of a diverse population is needed before precision nutrition can be widely applied in clinical/public health settings

• The project requires expertise in a wide range of areas spread across NIH

• First ever Strategic Plan for NIH Nutrition Research emphasizes the importance of studying precision nutrition
Personalized Nutrition by Prediction of Glycemic Responses

- 800 individuals, representative of adult non-diabetic Israeli population
- Individual glycemic excursions in response to the same foods were highly variable
- Intervention study: personally tailored meals significantly improved postprandial glucose responses
- ~90% of predictive model came from microbiome compositional data
Challenges with Current Approach

• Problems with collection and analysis of self-reported dietary intake data

• Challenges with adherence to dietary prescriptions

• Need for accurate information about calorie expenditure

• Costs of -Omic Measures

• Models have employed selected, not comprehensive inputs

• Small precision nutrition studies with limited diversity of participants
Why now?

- Improvements in multi-omic data generation, throughputs, costs, and analysis methods
- Advances in analyzing and understanding microbiome ecology
- Advances in artificial intelligence and deep learning
- Development or refinement of digital health technologies for dietary assessment
- Emergence of the All of Us Research Program
Why All of Us?

- Large diverse cohort with commitment to inclusion
- Established infrastructure
- Existing data: genomics, electronic health records, digital health data, physical measurements, and surveys
- Data access and sharing policy, Researcher Workbench
- A precision nutrition program can add new data types to *All of Us* and provide high value information for participants
Leverage existing NIH investments - including the All of Us Study - and emerging technologies and tools to make the critical discoveries to steer nutrition research toward personalized approaches.

MODULE 1
Examine usual diet with continuous glucose monitoring, followed by a mixed meal challenge, and microbiome/metabolic phenotyping.

MODULE 2
Randomized dietary interventions done at home as a subset of Module 1.

MODULE 3
Randomized dietary interventions conducted in inpatient controlled feeding centers where precise nutritional intakes, microbiome ecology, and physio-metabolic data can be rigorously obtained.

LEVEL OF MICROBIOME, PHYSIO-METABOLIC AND DIET RESPONSE DATA AVAILABLE FROM PROPOSED MODULES
Stage 1 Deliverable: ALGORITHMS THAT PREDICT INDIVIDUAL RESPONSES TO DIETS
# Innovative Measures

<table>
<thead>
<tr>
<th>Programs</th>
<th>Genetics</th>
<th>Microbiome Ecology</th>
<th>Continuous Glucose Monitoring</th>
<th>Hormones/Proteome</th>
<th>Physio-sensors</th>
<th>Mixed Meal Testing</th>
<th>Diet</th>
<th>Nutritional Status</th>
<th>Metabolome</th>
<th>24 h Urine Omics</th>
<th>Exosome</th>
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GOAL: Provide administrative management and coordination across all sites and collect, curate, aggregate, store, distribute, and ensure quality control of all data.
**GOAL:** Recruit, consent and enroll *All of Us* participants into nutrition program. Assess usual diet, conduct mixed-meal challenges, and collect biospecimens in 10,000 participants (Module 1); conduct a series of controlled feeding studies in a subset of 1,500, free-living participants (Module 2); and conduct a series of controlled feeding studies in 500 domiciled participants (Module 3).
Initiatives – Data Generation Centers

**GOAL:** Perform epigenetic analyses and microbiome metagenomic and metatranscriptomic analyses on all participants.

**Metagenomics Center**
new solicitation

**GOAL:** Perform metabolic and proteomic analyses on biosamples from stool, urine, and plasma using targeted (e.g., metabolites and nutrients) and untargeted metabolomics.

**Metabolomics and Clinical Assay Center**
new solicitation

**GOAL:** Develop innovative approaches to address dietary assessment challenges by integrating and improving measurement error in mobile dietary assessment technologies using data from free-living and controlled feeding studies.

**Dietary Assessment Center**
new solicitation
Initiatives

4 Artificial Intelligence, Bioinformatics, and Data Modeling Center

**GOAL:** Integrate data-driven and mechanistic approaches, with mathematical and computational modeling, to develop comprehensive dietary intervention algorithms that can predict biological responses. Enhance visualization and accessibility of data for broader scientific community.

5 All of Us Biobank

**GOAL:** Receive, process, record, and store biosamples and metadata related to the samples from clinical centers

new solicitation

supplement to existing award
## Budget - numbers are ($1000s)

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Thank you