Improved Measures of Diet and Physical Activity Program
Genes, Environment, and Health Initiative (GEI)

Program Leads:
Jill Reedy (NCI)
Cay Loria (NHLBI)
Amy Subar (NCI)
Heather Bowles (NCI)
Richard Troiano (NCI)
Genes, Environment, and Health Initiative (GEI)

- NIH-wide, 4 year program
- Aims to better understand the genetic and environmental contributions to health and disease
- $40M/y in FY07- FY10
- Components
  - Genetics – NHGRI led
  - Exposure Biology – NIEHS led
Exposure Biology Program Areas

- Chemical Exposures (NIEHS)
- Diet and Physical Activity (NCI/NHLBI)
- Psychosocial Stress and Addictive Substances (NIDA)
- Biological Response Indicators of Environmental Stress (NIEHS)
Challenges in Diet Assessment

• All self-report (24h recall, record, FFQ)
• Prone to measurement error (e.g., recall bias, observer bias)
• High respondent burden
• Costly processing (all but FFQ)
Challenges in Physical Activity Assessment

- Self-report still more widely used
- Objective methods (e.g., accelerometers)
  - Detect limited types of activities—may over- or under-estimate energy expended
  - Lack standardized analysis protocols
  - Behaviors are not measured
Goals of the Improved Measures of Diet and Physical Activity Program

• Develop new or refine existing technologies to measure dietary intake or physical activity or both
  – Reliable and valid
  – Low respondent burden
  – Economically feasible for use in large studies of free-living, diverse populations

• Small-scale validation

• Prototype developed by FY10
Improved Measures of Diet and Physical Activity Program

- 7 U01s (Cooperative agreements) funded

- Focus
  - 3 on diet
  - 3 on physical activity
  - 1 on both
Mobile Food Intake Visualization and Voice Recognizer (FIVR)

PI: Rick Weiss, Viocare, Inc.

• Uses a mobile phone as a food record
• Video and voice to record before/after eating
• Automatically identify foods and portion sizes to reduce participant burden
  • Computer vision techniques
  • Speech recognition software
  • Eating habits questionnaire
  • 3-D structure analysis to calculate volume (portion size)
• Calculates nutrient and food intake
Improving Dietary Assessment Methods Using the Cell Phone and Digital Imaging

PI: Carol Boushey, Purdue University

- Uses a mobile phone as a food record
  - 2-d pictures with digital camera
- Image processing to identify food in real time
  - Supplement with search list
  - Calculate volume to estimate portion
- Calculates nutrient and food intake
Food Intake Recording Software System, version 4 (FIRSSSt4)

PI: Tom Baranowski, Baylor College of Medicine

- Web-based, self-administered 24-hour recall for children
- Adapt NCI ASA24 to be child-friendly (~8-13 years)
- Formative research on child-computer interface
  - Optimal food search strategy?
  - Optimal screen size to accurately report portion size?
  - Does food picture size affect accuracy of portion size estimation?
- Compare to:
  - Observed school breakfast and lunch
  - Dietitian conducted recalls
Enabling Population-Scale Physical Activity Measurement on Common Mobile Phones

PI: Stephen Intille, Massachusetts Institute of Technology

- Detects type, intensity, and duration in real-time
  - Miniature, wireless accelerometers
  - Mobile phones
- Phone allows sampling
  - Self-reported data
  - Based on activity or location

Phone (w/ accelerometer)
Bluetooth relay device
Wireless accelerometer
Development of an Integrated Measurement System to Assess Physical Activity

PI: Patty Freedson, University of Massachusetts/Amherst

• Miniaturized unit to assess
  • body motion/acceleration
  • ventilation
  • environmental context

• Calibrate types/intensities of indoor/outdoor activities

• Develop statistical methods to
  • Combine the 3 data streams
  • Improve EE estimates

- Ventilation Sensor
- Accelerometer
- UV Light Sensor
Physical Activity Location Measurement System (PALMS)

PI: Kevin Patrick, University of California San Diego

• Facilitates geospatial analyses
• Integrated hardware and software
• Real-time capture and analysis
A Unified Sensor System for Ubiquitous Assessment of Diet and Physical Activity

PI: Mingui Sun, University of Pittsburgh

- Measures activity and diet (objectively)
  - Pendant or button with video camera
  - Takes pictures continuously while eating
  - Paired with accelerometer
- In-unit power supply/data storage
- Manually upload data to a computer
- Video and signal processing for event recognition
- Estimates food intake and physical activity
Collaborative Projects 2008

- **3G Workshop** (GPS, GIS, GEI)
- **Workshop**: Objective Measurement of Physical Activity: Best Practices and Future Directions
- Enhancing image recognition of food identification through user modeling
- Enhancing food volume estimation to improve assessment of dietary exposures
- Food image database collection and recognition algorithm evaluation