Improved Measures of Diet and Physical Activity Program

Genes, Environment, and Health Initiative (GEI)

Program Leads:

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National Cancer Institute

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National Heart Lung and Blood Institute People Science Health

U.S. Department of Health and Human Services
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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

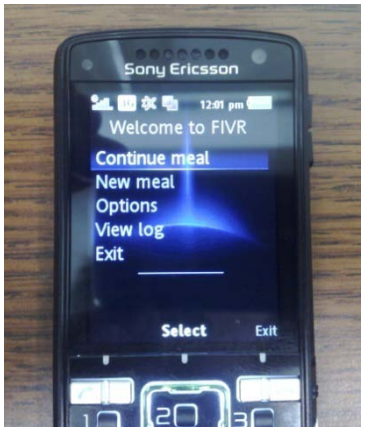
- Develop new or refine existing technologies to measure dietary intake or physical activity or both
  - Reliable and valid
  - Low respondent burden
  - Economically feasible for use in large studies of free-living, diverse populations
- Small-scale validation
- Prototype developed by FY10

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)



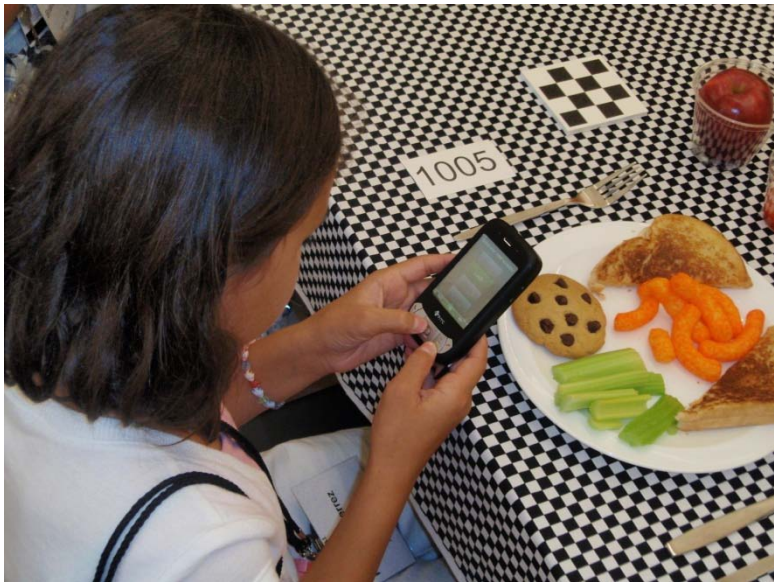
PI: Rick Weiss, Viocare, Inc.

- 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



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Food Intake Recording Software System, version 4 (FIRSSt4)

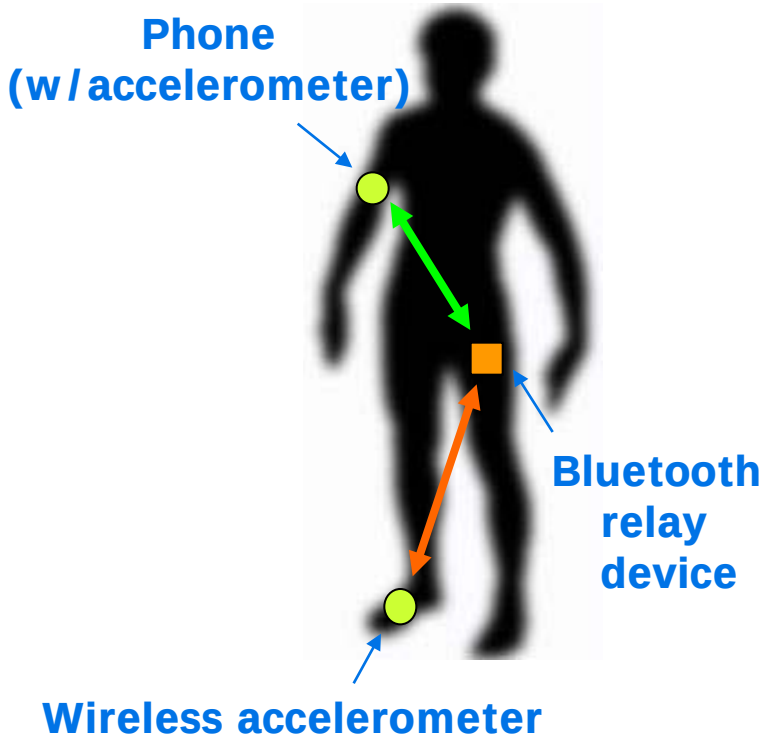
PI: Tom Baranowski, Baylor College of Medicine

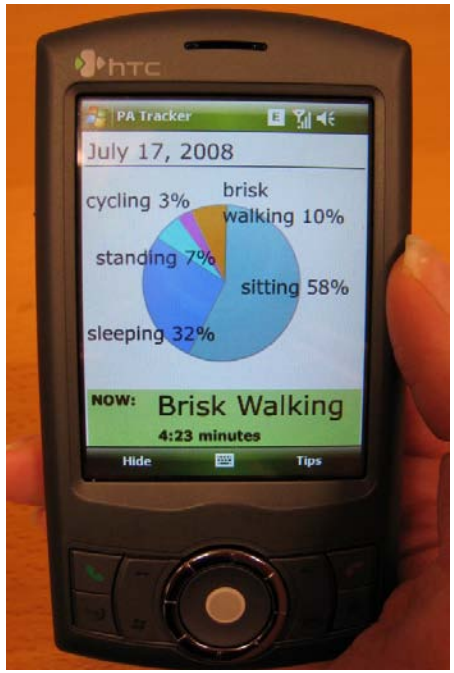
- Web-based, self-administered 24-hour recall for children
- Adapt NCI ASA24 to be child-friendly (~8-13 years)
- Formative research on child-computer interface
  - Optimal food search strategy?
  - Optimal screen size to accurately report portion size?
  - Does food picture size affect accuracy of portion 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





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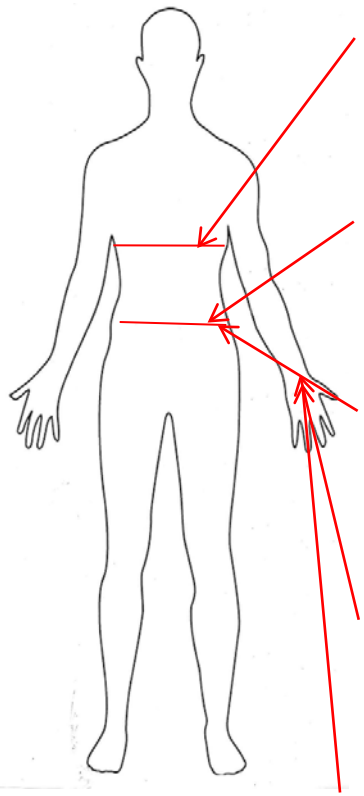
Development of an Integrated Measurement System to Assess Physical Activity

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



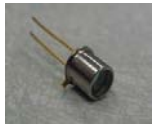
- **Ventilation Sensor**

- **Ventilation Sensor**

- **Accelerometer**

- **Accelerometer**

- **UV Light Sensor**



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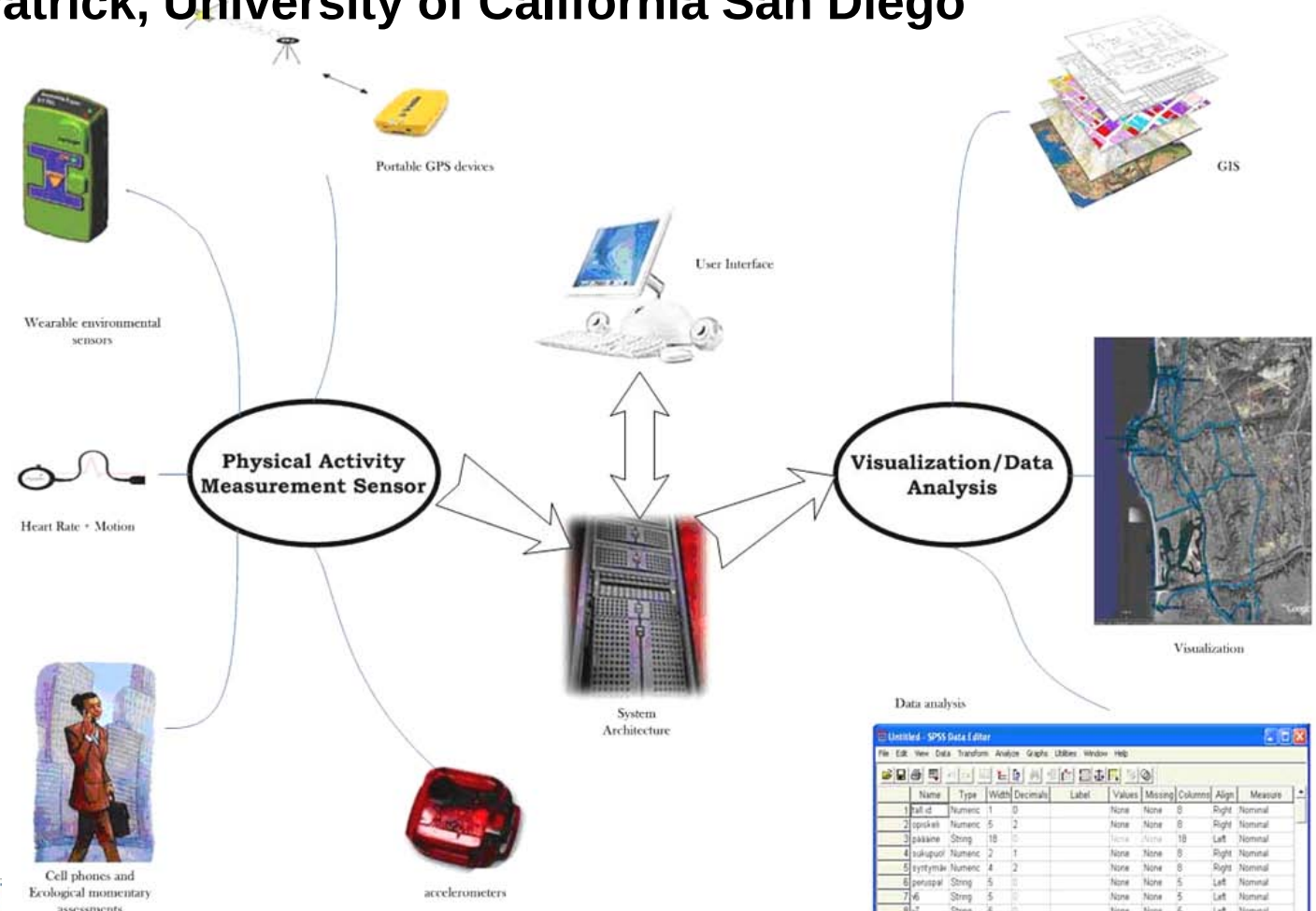
Physical Activity Location Measurement System (PALMS)

PI: Kevin Patrick, University of California San Diego

- Facilitates geospatial analyses
- Integrated hardware and software
- Real-time capture **and** analysis



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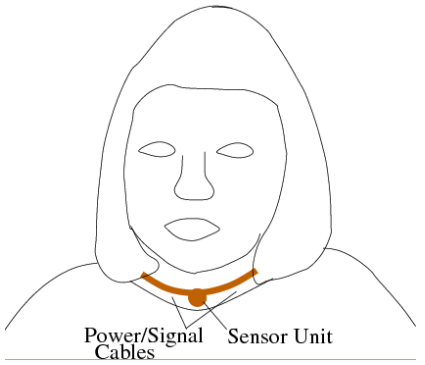
A Unified Sensor System for Ubiquitous Assessment of Diet and Physical Activity

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



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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