

Transdisciplinary Research on Energetics and Cancer Update
TREC website: <https://cancercontrol.cancer.gov/brp/hbrb/trec/index.html>

Introduction

The relationships among overweight/obesity, physical activity, nutrition, and cancer risk are highly complex. For example, increased estrogens and testosterone levels have been shown to increase the risk of breast and endometrial cancers, and hyperinsulinemia and insulin resistance promote chronic inflammation and depressed immune function, leading to increased risk of colon, breast, and pancreatic cancers. The National Cancer Institute (NCI), in response to the growing public health concern with overweight and obesity in the United States, established the Transdisciplinary Research on Energetics and Cancer (TREC) Centers. The TREC initiative is designed to foster collaborative research across multiple disciplines assessing how body weight, diet, exercise, environment, and other factors affect physiologic systems and intracellular pathways to see whether and how they influence carcinogenesis. The Centers included scientists from multiple disciplines and encompass projects spanning the basic biology and genetics of behavioral, socio-cultural, and environmental influences on nutrition, physical activity, weight, energy balance, and energetics. In 2005, NCI funded through cooperative agreements the first four research centers and one coordinating center. The coordination center has facilitated interactions across the research center and between NCI.

TREC I Research Centers (2005 – 2010)

- **Case Western Reserve University (Principal Investigator, Nathan Berger, M.D.)**
This center concentrated on cellular mechanisms, using laboratory models and clinical research that focused on obesity, sleep and metabolic dysfunction, and colorectal cancer risk.
- **Fred Hutchinson Cancer Research Center (Principle Investigator, Anne McTiernan M.D., Ph.D.)**
This center concentrated on prevention of breast and colorectal cancers, with particular emphasis on diet and physical activity. The projects included an integrated research program that examined energy balance and its consequences in cells, animal models, and human subjects.
- **The University of Minnesota (Principle Investigator, Robert Jeffery, Ph.D.)**
This center focused on population studies that examined the causes of, and effective prevention strategies for, obesity in youth and families.
- **University of Southern California (Principle Investigator, Michael Goran, Ph.D.)**
This center explored the physiological, metabolic, genetic, behavioral, and environmental influences on obesity and cancer risk in minority children.

Scientific Update

In the first 5 years of funding in TREC I, 14 research projects and 119 developmental pilot projects were supported. Highlights include:

Population Sciences

Population-focused research that assesses the impact of sleep behavior and cancer risk, or the impact of the environment on dietary patterns in young adults.

- **Short Duration of Sleep Increases Risk of Colorectal Adenoma (CASE – PI: Cheryl Thompson, Ph.D.)**

- Informing Measurement Strategies to Assess Relevant Food Environments Among Young Adults (U of Minn – PI: Melissa Nelson Laska, Ph.D.)
- Influence of Built Environment on Obesity during Childhood (USC – PI: Michael Jerrett, Ph.D.)

Clinical Sciences

Clinical oriented research projects featured unique population groups and relevant biomarkers to understand how these compounds work in concert in the etiology of cancer.

- Investigating the Relationships between Obesity and Leukemia Relapse (USC – PI: Steve Mittleman, M.D.)
- Exercise and Diet: Biomarkers and Mechanisms in Humans (FHCRC – PI: Anne McTiernan, M.D., Ph.D.)
- Insulin Resistance Syndrome Pathway Factors and Colon Polyps (CASE – PI: Li Li, M.D., Ph.D.)

Basic Sciences

Basic biological discoveries from three exemplar projects in basic science and mechanisms research.

- Diet, Metabolism and Cancers in Mouse Models – PI: Joe Nadeau, Ph.D.)
- Plasma Biomarkers Mediate Effects on Exercise on Rat Mammary Carcinogenesis (FHCRC - PI: Henry Thompson, Ph.D.)
- Effects of Amino Acid Substitution (C to G) in the PNPLA3 Gene on Liver Fat in Children (USC – PI: Michael Goran, Ph.D.)

TREC Textbook Series – Springer Publications, Inc.

Cancer and Energy Balance, Epidemiology and Overview. Nathan A. Berger (Ed). 2010
Springer, New York

<http://www.springer.com/biomed/cancer/book/978-1-4419-5514-2>

For further volumes: <http://springer.com/series/8282>

Educational Workshops

1. Creating Effective Statistical Graphs for Oral & Poster Presentations; June 14, 2010. *Held in conjunction with 10th TREC Centers Scientific Meeting (UMN). Workshop agenda/information located under "related documents" on this sci meeting page.*
2. The NIH Peer Review Process - October 13, 2008. *Held in conjunction with 7th TREC Scientific Meeting (Bethesda). Workshop agenda noted on overall meeting agenda.*
3. The "Ins and Outs" of Structural Equation Modeling - May 5, 2008. *Held in conjunction with 6th TREC Scientific Meeting (Seattle). Workshop agenda does not exist. See comments on the scientific meeting page for the 6th TREC Sci Meeting.*
4. Geographic Information Systems: an Overview and Applications - October 10, 2007. *Held in conjunction with 5th TREC Scientific Meeting (UMN). Workshop agenda does not exist. See comments on the scientific meeting page for the 6th TREC Sci Meeting.*

TREC II Research Centers (2011 – 2015)

In the second five years, 15 research projects and 81 within and cross-center pilot projects were supported.

- **University of Pennsylvania (Principal Investigator, Kathryn Schmitz, Ph.D.)**
This center consists of three translational, transdisciplinary research projects that will explore the causal associations of energy balance and breast cancer recurrence, in animal models and humans, and integrate this knowledge for the control of obesity-related adverse events among cancer survivors.
- **Harvard (Principal Investigator, Frank Hu, M.D., Ph.D.)**
This center will address the effects of obesity on cancer incidence and survival. Research at this center will evaluate the relationship between select cancer-related biomarkers that may be influenced by the complex interrelationships between energetic factors such as diet, physical activity and sleep patterns, socioeconomic status, and the environment. Building on research from the prior TREC initiative, a unique component in the Harvard TREC is the examination of the relationship of energetic factors (diet, insulin, energy expenditure, and physical activity), sleep duration and sleep patterns, and the built environment with novel biomarkers of cancer risk for breast and prostate cancers in adults and children.
- **University of California – San Diego (Principal Investigator, Ruth Patterson, Ph.D.)**
This center will explore the relationship between insulin resistance and inflammation underlying the association of energetics and breast cancer carcinogenesis. Included is a well-balanced array of projects in preclinical mouse models, clinical translational studies and community-based approaches. The noted discovery of the role of G-protein Coupled Receptor (GRP120) as the omega-3 FA receptor and the excellent animal model (GPR120 KO mouse) will enhance this center's study of the effect of obesity on breast cancer development and metastasis.
- **Washington University in St. Louis (Principal Investigator, Graham Colditz, M.D., DrPH)**
The St. Louis TREC application expands upon transdisciplinary approaches from the first TREC initiative to address mechanisms of obesity and cancer, with a strong focus on prostate cancer. This site has the ability to work with populations of diverse race/ethnicity and socio-economic status, and will assess both genetic and social determinants of obesity. Using cellular, animal, and clinical models, this center will focus on mechanisms by which preconception diet, nutrition, and built environment influence physical activity and energy balance and its impact on body weight and carcinogenesis across the lifespan.

Selected highlights from a recent TREC Symposium:

Jorge Chavarro, MD, ScM, ScD, Harvard University School of Public Health
Maternal Fat Intake, Maternal Obesity and Methylation of Imprinted Genes in Mice and Humans

Kathleen Sturgeon, PhD, MTR, Penn State Cancer Institute
Physical Activity from Menarche to First Pregnancy and Risk of Breast Cancer in Humans and Rats

Aaron Hipp, PhD, North Carolina State University
Contributions to Worksites to the Energy Balance Equation and Contribution of TREC to an Early Career Scientist.

Sarah Gehlert, PhD, MSW, MA, Washington University School of Medicine
The Whole is Greater than the Sum of the Parts: Lessons Learned from Transdisciplinary Research in Energetics and Cancer

Transdisciplinary Research on Energetics and Cancer Training Workshop

June 18 – 23, 2017

Yale School of Public Health

Water's Edge Resort

<http://trectraining.yale.edu/>

TREC Educational Workshops

1. Energy Balance in Cancer Survivors – November 19, 2014. *Held in conjunction with Fall 2014 TREC Scientific Meeting (Boston)*
2. Media Communications – May 5, 2014. *Held in conjunction with CPHHD-TREC Joint Symposium (Los Angeles)*
3. Career Development and Mentoring for Early Career Investigators and their Mentors – November 20, 2013. *Held in conjunction with Fall 2013 TREC Scientific Meeting (UCSD)*
4. Accelerometry for the Novice and the Expert Training Workshop - March 27, 2013. *Held in conjunction with Spring 2013 TREC Scientific Meeting (Seattle)*
5. Cost effectiveness with a broad focus for multiple disciplines - June 12, 2012. *Held in conjunction with Summer 2012 TREC Scientific Meeting (St. Louis)*

TREC Evaluation Model

TREC was the first transdisciplinary initiative to plan and implement a model for evaluating collaborative initiatives during its period of funding support.

