

The Power of Prevention

Posted on January 28, 2014 by [Angel Futrell](#)

Prevention. What if it could reduce your chance of developing a chronic disease by 78%? What if it could be as simple as adjusting your diet to include more fruits, vegetables, and whole grains? What if it could save you thousands of dollars in healthcare costs? What if it could save your life?

Advances in prevention research by scientists across the country support the above claims. Chronic diseases – such as diabetes, heart disease, and cancer – affect 45 percent of Americans and account for 7 out of 10 deaths each year.ⁱⁱ The most common chronic diseases are costing the U.S. economy more than \$1 trillion annually and threatening to reach \$6 trillion by the middle of the century.

The Chronic Disease Price Tag – Estimated Direct Annual Medical Expenditures	
Cardiovascular Disease & Stroke	<u>\$444 billion</u> in 2011
Cancer	<u>\$124.6 billion</u> in 2010
Diabetes	<u>\$176 billion</u> in 2012
Arthritis	<u>\$80.8 billion</u> in 2003
Obesity	<u>\$147 billion</u> in 2009

Alarmingly, less than 1.5% of total biomedical research funding is devoted to health services and implementation of effective prevention programs.ⁱⁱ Although chronic diseases are among the most common and costly of all health problems, they are also among the most preventable.

Fortunately, one of the scientists dedicated to chronic disease prevention, specifically colon cancer, is Texas A&M University's Dr. Robert Chapkin, Regents professor and university faculty fellow, who holds appointments in both nutrition and food science

as well as biochemistry and biophysics. In his 26 years at Texas A&M, Dr. Chapkin and [his lab](#) have taken a molecular approach to identifying the role of diet in influencing one's risk for developing colorectal cancer.



Over 140,000 new cases of colorectal cancer were reported in the United States in 2013, according to the [National Cancer Institute](#). Despite advancements in the treatment of this disease, however, the five-year mortality rate has remained at 50 percent. Through his research, Dr. Chapkin and his lab are finding that dietary modifications may be the best way to decrease the risk of colon cancer.

“Many Americans have no idea how important diet is in preventing chronic disease, such as colon cancer,” Dr. Chapkin says. “As a society, we are trained to treat the disease once it’s been developed, not prevent it. Because of this mindset, the cost of keeping Americans healthy is practically bankrupting our country.”

The cost of keeping Americans healthy is practically bankrupting our country. – Dr. Chapkin

“Signaling Cascades”

In an attempt to understand the mechanisms by which diet influences colon cancer development, Dr. Chapkin and his lab have designed experiments to focus on the ability of specified nutrients to influence cellular “signaling cascades” in the colon.

These cascades are required to transmit signals from outside the cell into interpretable signals inside the cell. Diet may regulate the transmission of information that alters physiological responses

such as cell growth, differentiation, death, DNA methylation status, and membrane microdomain organization, ultimately determining the risk for developing cancer.

Using Biomarkers for Detection

“How do you assess one’s risk of cancer? This takes me into a field called biomarkers,” says Dr. Chapkin. “These are indicators, if properly interpreted, of risk. If you can analyze those indicators you can determine whether indeed risk is higher or lower and whether a treatment is effective or ineffective.”

In one project, Dr. Chapkin and his team non-invasively detect intestinal disease in premature infants by examining exfoliated epithelial cells in the stool. The epithelial cells that are shed into the feces provide a non-invasive picture of what is going on inside the infant’s gut.

Dr. Chapkin and his lab are the only group in the world using this revolutionary non-invasive technique to simultaneously examine the cross-talk between two genomic worlds – the host (the infant) and the microbiota – in the same stool sample. By evaluating the baby’s intestine to detect biomarkers, Dr. Chapkin and his team are better able to understand the influence diet and nutrition has on an infant’s chance of developing diseases.

“By integrating information from the infant and their gut

Dr. Chapkin’s Lab

You never know who or what you’ll find in Dr. Chapkin’s Lab! The team consists of research scientists, post-doctoral fellows, graduate students, and undergraduate students from a variety of disciplines, including nutrition and food science, biochemistry, statistics, and biology.

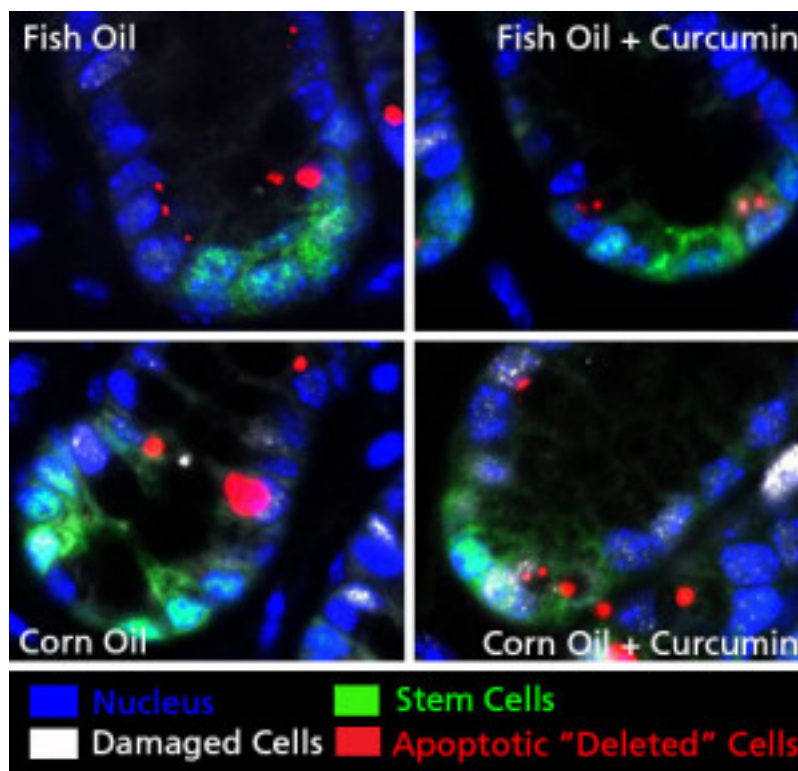
Below: Dr. Vanessa De Clercq, post-doctoral research fellow is procesing intestinal stem cells for long term propagation as “organoids.”



microbiota,” Chapkin says, “we are uniquely positioned to identify previously undetected molecular biomarkers whereby environmental factors – birth route, diet and antibiotic use – influence the cross-talk between gut microbiota and the infant.”

Stem Cells

In another developing project, Dr. Chapkin and his lab are taking diet research a step further in looking at nutrition’s impact on mutated adult stem cells. Stem cells are long-living cells that give rise to a long lineage through their remarkable potential to develop into many different cell types. When a adult stem cell is corrupted, or mutated, it can be very dangerous, resulting in cancer stem cells.



Microscopic images of mouse intestinal cells following exposure to carcinogen. Prior to exposure, mice were fed diets containing fish oil, corn oil, and/or curcumin. Cells simultaneously exhibiting green, white and red fluorescence, indicate damaged intestinal stem cells that are being deleted.

Dr. Chapkin and his team are looking at what molecules in the diet can influence stem cells by using transgenic mice. Transgenic mice contain adult stem cells that under a microscope glow fluorescent green, like a beacon. This allows the team to assess under what conditions these cells can be damaged, and then whether dietary components (e.g., fish oil and curcumin) can alter the predisposition of these stem cells.

“We’re trying to see if diet can be used for ‘targeted deletion,’ which is the methodical killing of bad stem cells,” says Dr. Chapkin. “Our research focuses on the earliest stages of the development cancer. If we could remove cancer stem cells in their early form by using something as innocuous as diet, that would be an amazing thing.”

Diet is Key

The function of protecting and developing health must rank even above that of restoring it when it is impaired. – Hippocrates
Dr. Chapkin’s research on biomarkers, adult stem cells, and the influence of diet is a testament to his commitment to chronic disease prevention research. The next step is taking this research to the public. Educating Americans on the importance of prevention empowers them to make informed decisions and take control of their lives.

The function of protecting and developing health must rank even above that of restoring it when it is impaired. – Hippocrates

“When will prevention be considered a mainstream healthcare program?” Dr. Chapkin says. “A proper diet is a powerful tool if used correctly. A proper diet could save your life.”

i Wu SY, Green A. Projection of chronic illness prevalence and cost inflation. Santa Monica, CA: RAND Health; 2000.

ii Colditz, G. A. (2012). Applying what we know to accelerate cancer prevention. *Science Translational Medicine*, 4 (127), 1-9.