

Discovering the 'Exfoliome': The Role of Diet, Microbes as Stem Cell Modifiers in Colon Cancer



For the last 32 years, Robert Chapkin, Ph.D., Texas A&M Department of Nutrition Distinguished professor, Allen Endowed Chair in Nutrition & Chronic Disease Prevention and National Cancer Institute Outstanding Investigator Award Recipient, College Station, has conducted revolutionary work around noninvasive means of investigating and modeling the role of nutrition in infant development into adulthood. His team's discovery of what has become known as the "exfoliome," as well as studies of the gut microbiome in infants, have changed the way in which science investigates nutritional development in human babies.

The lack of a noninvasive approach to repeatedly access tissue along the intestinal tract has hampered researchers' ability to study normal gut development and clinical responses to dietary or medical interventions. Thus, Chapkin spearheaded the discovery of the field of noninvasive precision *exfoliomics* — development of mRNA-based biomarkers using stool derived exfoliated cells shed from the neonatal and adult intestinal tract. This transformative body of work has enabled big-data applications in precision analysis of gut microbe (prokaryotic) and host (eukaryotic) crosstalk in response to diet and chronic disease risk.

Understanding the specifics of gut microbes through advanced phenotyping opens the door to explore precision therapies to improve human health on an individualized basis.

This discovery method has impacted our understanding of neonatal and early childhood development in relation to diet, particularly in studying the effects of breast milk vs. formula. At the same time, it has opened the doors to exploring host-microbe crosstalk and has allowed us to better understand the role diet plays in colon cancer prevention.

The noninvasive approach was used in a **previous study** to examine diet and microbes as modifiers to stem cell homeostasis and colon cancer in mice. The results demonstrated that long-chain omega-3 fatty acids found in fish oil have synergistic effects when combined with dietary fiber or curcumin, which is found in turmeric, in dramatically reducing colon cancer risk by selectively destroying damaged stem cells through a process called ferroptosis.

These preclinical findings suggest that a pescatarian vegetarian diet (high in omega-3 fatty acids and fiber) might help lower the risk of colon cancer in humans by destroying cancer stem cells before they have the chance to replicate. This project has since moved to the clinical research stage thanks to a National Institutes of Health (NIH) grant in collaboration with the Fred Hutchison Cancer Center in Seattle, WA.