

## Falk lecture spotlights biomarkers for cancer

By Robin Arnette

Advances in the field of metabolomics were highlighted at the 29th annual Hans L. Falk Memorial Lecture Nov. 18 at NIEHS. Metabolomics is the study of all metabolites, or end products of cellular processes, in a biological cell, tissue, organ, or organism.

The seminar, “Search for Cancer Biomarkers Using Metabolomics,” was presented by Frank Gonzalez, Ph.D., head of the Laboratory of Metabolism in the Center for Cancer Research at the National Cancer Institute.

### Gonzalez

(<https://ccr.cancer.gov/frank-j-gonzalez>)

started off by saying that the metabolome, or complete set of small-molecule metabolites found in a biological sample, is derived from a number of sources. Origins include the environment, diet, and products that result from the metabolism of the human body. The number of metabolites may run into the thousands, all of which may be found in the urine. Some of these metabolites may be identified and utilized as a diagnostic tool for diseases.

“Metabolites can be used to define the molecular profile of a drug, and discover biomarkers for organ specific toxicities, or even drug efficacy,” Gonzalez said. “Currently, many research groups search for and validate biomarkers for diseases, such as diabetes and cancer.”

### Tracking down metabolites

Gonzalez said mouse studies are easier to carry out than biomarker discovery studies in humans, because investigators can control all of the testing variables in mice. Biomarkers are key molecular or cellular events that link a specific environmental exposure to a health outcome. Since the human metabolome is influenced by age, sex, diet, health status, and genetic background, it is extremely complex. Hundreds or thousands of volunteers need to be examined to tease out biomarkers for a particular disease.

Metabolomics helped Gonzalez and his colleagues at the National Cancer Institute, notably Curtis Harris, M.D., and others in the Laboratory of Human Carcinogenesis, find four metabolites that were altered in people with early stage lung cancer — N-acetylneuraminic acid, cortisol sulfate, 561+ ion, and creatine riboside. It is likely that one or more of these biomarkers could be a diagnostic for other cancers.

“This work is exciting, because one of the molecules, the creatine riboside, hasn’t been described in the literature before, and the structure of 561+ ion has not been identified,” Gonzalez explained. “We envision that these biomarkers may help identify which people are in the early stages of cancer that could be cured by surgery.”

If an easily accessible urine sample can be used to find biomarkers for early stage cancer, his team could suggest that these patients seek more advanced spectroscopic analysis, said Gonzalez. Cancer biomarkers may also be employed to monitor the effectiveness of chemotherapy and cancer reoccurrence.

Masahiko Negishi, Ph.D., head of the Pharmacogenetics Group at NIEHS, served as host for the lecture. His group examines the effects of metabolites on the liver. Negishi underscored the importance of the work Gonzalez and his group are doing.

“His research on cancer biomarkers will eventually lead to the development of tools that will aid physicians,” Negishi said.



The research focus of the Gonzalez lab is to understand the mechanisms of chemical carcinogenesis using various mouse bioassays for colon, liver, mammary, and other cancers. (Photo courtesy of Steve McCaw)



After the lecture, the Falk family presented the Falk award to Gonzalez. From left, are Negishi; Raymond Falk, Ph.D.; Gonzalez; Donald Falk, M.D.; Gabrielle Falk, the widow of Hans Falk; and Stephen Falk, J.D. (Photo courtesy of Steve McCaw)



NIEHS Falk lecturers receive this exquisite award for making significant contributions to environmental health sciences. (Photo courtesy of Steve McCaw)

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