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PREVENTION BY NUMBERS

Researchers who study environmental influences on cancer tend to receive a fraction of the funds available to those researching cancer cures. But career opportunities exist — and may even be expanding. **Heidi Ledford** reports.

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The locals call it 'Cancer Alley' — a sweltering stretch of the Mississippi River from Baton Rouge, Louisiana, to New Orleans, where more than a hundred chemical plants and oil refineries share a home with some of poorest people in the United States. In truth, no one has proved a link between the local industry and the few, sporadic reports of rare-cancer clusters along Cancer Alley. But the region's bad reputation is well deserved: the state of Louisiana has a major cancer problem. In 2005, the state had 214.9 cancer deaths for every 100,000 people, second only to Kentucky in the United States; the national average is 184.1.

It was against this backdrop that Maureen Lichtveld, head of Tulane University's department of environmental health sciences in New Orleans, and her colleagues decided it was time to create an environmental-oncology programme. It draws on the resources and faculty members at Tulane's expanding cancer centre, and at nearby Louisiana State University in Baton Rouge and Xavier University of Louisiana in New Orleans (see 'Epidemiologists in demand'). Funding provided by Tulane University and the Louisiana Cancer Research Consortium allowed Lichtveld to hire five new faculty members, two of whom have not yet been recruited.

Forming the programme was a practical decision, Lichtveld says. "I saw a real opportunity in terms of where the research is going," she says. "We're seeing a new emphasis on health disparities across the board."

According to the US National Institutes of Health (NIH), environmental factors such as pollution, cigarette smoke and diet contribute to 80–90% of all cancers. Despite these numbers, research in environmental oncology — which aims to track down environmental contributions to cancer — receives only a fraction of the amount spent on the hunt for cures. "We would get more bang for our buck, although the outcome is not immediate and not as sexy, if we invest in early detection and screening," says Lichtveld.

This attitude may be changing with the recent emphasis on early disease diagnosis and personalized health care. "It is now being realized that an exclusive focus on genetic aspects of cancer is not providing solutions," says Soterios Kyrtopoulos, director of the chemical carcinogenesis and genetic toxicology programme at the National Hellenic Research Foundation in Athens, Greece. "So the pendulum is swinging back again to studying the environment."

Patchwork of grants

Funding for environmental cancer research in the United States is available as a patchwork of governmental and private foundation programmes. The NIH spent US$171 million on environmental cancer research in fiscal year 2008, and as of February, the American Cancer Society, based in Atlanta, Georgia, had eight grants totalling $5 million for environmental carcinogenesis research. Meanwhile, President Barack Obama has pledged to double the NIH budget for cancer research over the next five years.

"We anticipate significant increases in funding," says Linda Birnbaum, director of the National Institute of Environmental Health Sciences (NIEHS), although she says she can't yet predict the likely number of grants. Environmental oncologists are scrambling to assemble applications for the dozens of relevant 'challenge grants' made available under the recent US economic stimulus package. These grants of up to $1 million, including salaries for students and postdocs, are intended as jump-start funds and will last for only two years.

Large studies increasingly present opportunities for qualified researchers in environmental oncology. In 2003, the NIEHS and the National Cancer Institute jointly created a network of four centres to investigate the relationship between breast cancer and early-life environmental exposures. The NIEHS is also enrolling 50,000 sisters of breast-cancer sufferers in a decade-long prospective study looking at the possible risk effects of factors such as genetics and diet.

Investigating both genes and the

M. BOTSIVALI

Soterios Kyrtopoulos (front row, third from right) was part of the mid-March inaugural meeting of an 'Envirogenomarkers' project at the National Hellenic Research Foundation in Athens, Greece.

EPIDEMIOLOGISTS IN DEMAND

In compiling the special mix of skills inherent to the environmental oncologist, epidemiology is an often over-looked component. Indeed, the researchers behind the newly founded environmental oncology programme at Tulane University in New Orleans, Louisiana, made sure to house their degree in the university's School of Public Health and Tropical Medicine for that very reason. There, environmental oncology graduate students are required to study epidemiology.

"We were pretty adamant that we wanted a population studies component in there," says Charles Miller, who studies carcinogenesis and DNA damage at Tulane University. "Ultimately, you have to know what to do with the data."

And yet the number of cancer researchers with epidemiology training often fails to meet the demand. They are in short supply in Europe, says Richard Sullivan, a cancer researcher at King's College London and chairman of the European Cancer Research Manager forum.

Data compiled by the foundation suggest that most epidemiologists in cancer prevention are in the later stages of their careers, and the pipeline of young epidemiologists has dwindled. "Where are the next team leaders and mentors?" says Sullivan. "Where are they going to come from?"

The problem, he says, is often the length of epidemiological studies, which can take decades to complete and publish. That timescale does not mesh well with how researchers are judged in the short term by the academy. Nevertheless, he says, fellowships are available to those with training in epidemiology and an interest in environmental oncology, and often have only a small pool of applicants.

"In the United Kingdom, these positions are underfilled," says Sullivan. "We never get enough good people applying." **H.L.**

environment has piqued the interest of many: in 2006, the NIH created the Genes, Environment and Health Initiative, which receives $40 million a year and will continue until 2010. One component of the initiative is to develop technology to monitor environmental exposures that could contribute to disease. It receives $19.5 million each year, and has funded 32 investigators, including some in a project that aims to find biomarkers of exposure to environmental carcinogens. Continuation of these programmes beyond 2010 is under review.

European interest

Environmental oncology is thriving in Europe as well. In 2005, the European Union launched the Environmental Cancer Risk, Nutrition, and Individual Susceptibility (ECNIS) network of excellence under its Sixth Framework Programme for research. This programme, intended to unite European researchers in the field of environmental oncology, has received €11 million (US$14.7 million) over five years.

The Seventh Framework Programme also provides for a number of environmental oncology projects, says Kyrtopoulos. For example, it has awarded €3.5 million of the €4.7 million needed for his collaboration with ten other research groups in Europe to find biomarkers linking environmental exposures and disease, including some cancers. The project will create positions for about ten students and five postdocs, says Kyrtopoulos.

Biomarker discovery remains both a focus and a source of frustration. Finding robust clinical biomarkers can enable early detection of disease — a goal both in academia and in the burgeoning diagnostics industry. But researchers have struggled with irreproducibility when they attempt to use biomarkers discovered in small-scale experiments to larger, clinically relevant populations. This is especially a problem when high-throughput technologies such as proteomics or transcriptomics are used, says Kyrtopoulos. But the problem may be ironed out as researchers learn how to adapt the technology to the rigours of working with large, highly variable populations.

In some cases, the easiest route to funding may be to appeal to the environmental concerns that prevail in certain countries. Australia, for instance, is particularly well known for exploring the effects of ultraviolet light on skin cancer. In Norway, the past decade has seen an overall shift away from epidemiology and cancer prevention, but the government is devoting considerable funds towards monitoring the effects of pollution, in large part due to interests in the Arctic and the oil industry, says epidemiologist Eiliv Lund of the University of Tromsø, Norway. "As long as you work in pollution, it's still not so difficult to get funding."

NIEHS

"We anticipate significant increases in funding."
— Linda Birnbaum

In Japan, the exposures to target are asbestos, radiation and air pollution, says Tetsuo Noda, director of the Cancer Institute of the Japanese Foundation for Cancer Research in Tokyo. Still, environmental oncologists in Japan are struggling. The Japanese funding system, in which results that have a demonstrated societal benefit are presented to the funding agency every five years, does not mesh well with epidemiological studies, which tend to be long-term. "Because of that, we cannot get enough money to make progress in environmental oncology," says Noda.

It's a worldwide problem, as students of cancer epidemiology often fail to appreciate the major funding and study-length demands of the field, notes Shine Chang, an associate professor of epidemiology and director of research training at the University of Texas M. D. Anderson Cancer Center in Houston.

But the interest is there, although dedicated programmes such as Tulane's are rarities. Roger Giese, director of the Environmental Cancer Research Program at Northeastern University in Boston, Massachusetts, says that graduate students and postdocs come from a variety of scientific backgrounds; they go on to pursue careers in numerous fields, from regulatory agencies to industry to academia. Fellowships such as the ones at the American Cancer Society, help postdocs make the transition to their first faculty appointment. And the NIH offers an international fellowship programme for cancer-prevention researchers.

"I'm very hopeful that cancer-prevention research continues to gain strength," says Bill Chambers, scientific programme director of the American Cancer Society. "Traditionally we've focused on curing the patient, but it is much more cost-effective and far better for our lifestyle to really robustly pursue prevention." ■

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