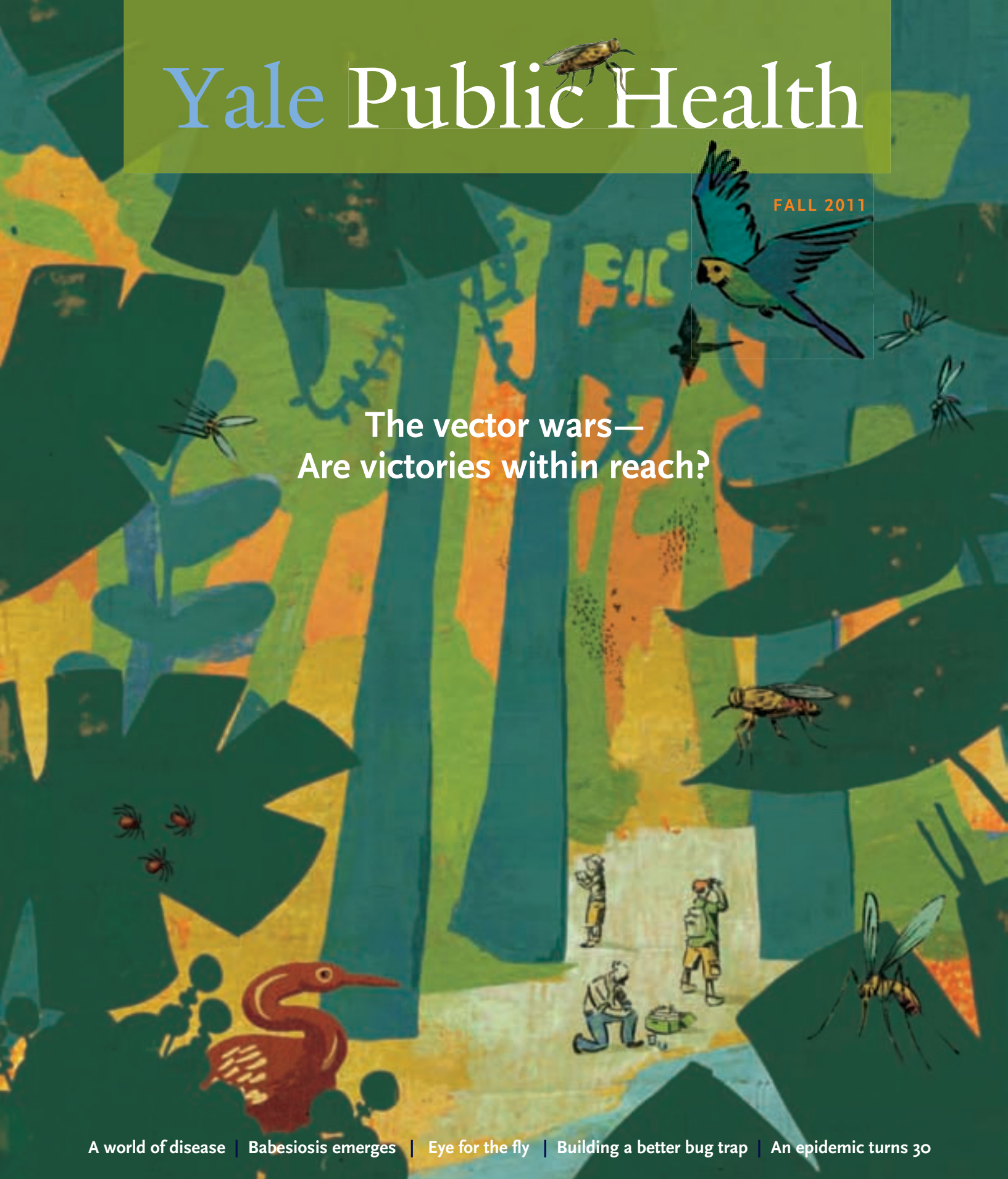
Yale Public Health

FALL 2011



The vector wars—
Are victories within reach?

A world of disease | Babesiosis emerges | Eye for the fly | Building a better bug trap | An epidemic turns 30

Yale SCHOOL OF PUBLIC HEALTH

Yale Public Health

FALL 2011

Well-fed and rounded to capacity, a female blacklegged tick is now ready for the next stage of life: reproduction. After she lays her eggs, which can number more than 1,000, she will die. This tick and thousands of others are used in ongoing research at the School of Public Health.

Geoffrey Attardo

Yale SCHOOL OF PUBLIC HEALTH

Dean's Message

A roadmap for the future

If you think you're too small to make a difference, try sleeping in a room with a mosquito.
-African proverb

In the demanding field of public health, it is important to remind ourselves of the positive differences we can make in the world. I see the exciting potential to improve health every day as I work with our faculty, staff, students and alumni. The inspiration and optimism I have derived from the ambitions and achievements of the YSPH community made it an easy decision for me to accept a second five-year term as dean of public health at Yale. Furthermore, I believe that the changes we have made together in our research, academic and practice programs have positioned the school to thrive and to be a leader in public health innovations in the coming century.

My vision is that YSPH will unquestionably be one of the world's top five public health schools, recognized for its consistent excellence in scholarship, education and service. The momentum we have gained in our scientific advances, academic programs and practice efforts in our communities, all based on sound management, fiscal and communications strategies, is a credit to each member of the YSPH community – each making a small difference, but collectively propelling us toward a brighter future.

The roadmap that I have proposed for the school's continued success over the next five years and beyond is briefly summarized as follows:

Enhancing research excellence for knowledge and impact by:
- Strategic planning for focused development in all divisions
- Cross-university collaborations
- Junior and research faculty mentoring programs
- Professional development, increasing diversity and inclusion among faculty, staff and students

Maximizing student experiences by:
- Continuously assessing our curricula, implementing improvements and enhancing the sense of community between students and faculty

Focusing and coordinating practice and service activities by:
- Promoting healthy communities through student internships, collaborative translational community-based research and volunteer outreach efforts

Improving management and infrastructure by:
- Developing a long-term plan for better contiguous space
- Focusing administrative staff support and reorganizing administrative functions
- Creating a new IT support model

Improving the financial foundation of school activities by:
- Vigorous development of resources for research and education
- Celebrating YSPH's centennial in 2015 and planning for a sustainable future

Among the priorities for research excellence at YSPH are global infectious diseases and environmental health, which are particularly salient in the focus of this issue: vector-borne diseases.

The relationship between human populations and the environment always involves a delicate balance. For example, a slight climate change can affect mosquito populations and their capacity to transmit disease. Vectors such as mosquitoes, tsetse flies and ticks, though small in size, cause devastating illnesses around the world.

In this issue, you will read about how our researchers are finding creative solutions to historic challenges such as African trypanosomiasis, Lyme disease, babesiosis and leishmaniasis. Their work brings us closer each day to understanding the genetic, biological, ecological and epidemiological factors of vector-borne diseases – and therefore closer to mitigating human suffering around the globe.

I am enthusiastic about my next term as dean, as I am for the future of the school and the potential for sustained, novel public health research. In our own ways, we each will tackle unique tasks, continue to make small differences and identify transformative solutions for the challenges that lie before us.

Paul D. Cleary, Ph.D.
Dean, Yale School of Public Health

Letters to the Editor

Remembering Adrian M. Ostfeld

Yale Public Health
The Journal of the Yale School of Public Health
Fall 2011, Vol. 3, No. 2

Dean
Paul D. Cleary, Ph.D.
The Anna M.R. Lauder Professor of Public Health

Managing Editor
Michael A. Greenwood

Web Coordinator
Denise L. Meyer

Copy Editor
Anne Sommer

Design
AH Design, Angie Hurlbut
NYM Design, Nilou Moochhala

Address correspondence to
Managing Editor, *Yale Public Health*
60 College Street
P.O. Box 208034
New Haven, CT 06520-8034
Phone: 203-737-5151
Fax: 203-785-7296
E-mail: *michael.greenwood@yale.edu*
Web: *publichealth.yale.edu*

Yale Public Health is published twice a year and is distributed to alumni, faculty, students and friends of the Yale School of Public Health.

Acronyms used in *Yale Public Health* include YSPH for Yale School of Public Health and LEPH for Laboratory of Epidemiology and Public Health (the school's main building).

Cover art by Hadley Hooper

Printer
Pyne-Davidson Co.

MIX
Paper from responsible sources
FSC® C103525

Printed on recycled paper with soy-based inks

Follow the Yale School of Public Health on Facebook, Twitter and LinkedIn.

A digital archive of Yale Public Health is available at *publichealth.yale.edu/news/magazine/index.aspx*.

In the Spring 2011 edition of *Yale Public Health,* I read with deep sadness of the passing of my mentor and friend, Dr. Adrian M. Ostfeld. For those of us who trained in the Epidemiology Department from the late 1960s through the early 1990s, this remarkable gentleman scholar exemplified the very best of Yale.

Giants walked the land in those days – engaged, socially conscious pioneers of the developing subspecialty of chronic disease epidemiology – and Adrian strode among them, inspiring his department and his students by his sterling example. He never hesitated to tread where so many others feared to go, as he embraced the big issues that really mattered to patients and their families but that had previously defied study because of their seemingly insurmountable method challenges.

These were problems such as the impact of poverty and discrimination on the health of inner-city minority groups; the adverse effects of social isolation on the health of the elderly; and the health consequences of bereavement. He reveled in clarifying and alleviating these and similar serious threats to the very fabric of our society and our public health. Adrian opened our eyes to new approaches and solutions in these "difficult" and sometimes previously neglected areas, and he did so in his trademark dignified yet unassuming way.

Even while heading the most complex, multidisciplinary research teams, he was always in control but never controlling, open to new and creative ideas but never tolerant of senseless distractions, his vision unerringly clear and focused but never limited. His kindness to his students and his colleagues was legendary, and we loved him in return. His pedagogical principles were elegantly simple and akin to those of a virtuoso musician in a master class: first get the basics of the craft right, and the performance with its interpretive contributions will follow. Without the foundational understanding of research methods and medicine being secure, no interpretation of evidence built upon it can stand. This was the lesson that we could take with us and profit from no matter where, how or to what we applied our field.

I close by recounting something that Adrian said to me when I was trying to decide whether to remain at Yale for my doctoral work after having just completed my M.P.H. As we pondered together the pros and cons of the several excellent places under consideration for my continued training, he said: "Yale may not be perfect, but somehow really great work manages to get done here. And, if you choose to remain, I want you to know that I don't intend to go anywhere; I'll be with you every step of the way." I stayed; he kept his word to me then; and he stays with me now, always.

Edward A. Bortnichak, M.P.H. '77, Ph.D. '81; Lecturer, Yale School of Public Health; Global Head, Pharmacoepidemiology and Database Research Unit, Merck Research Laboratories

Michael Woloschinow (2)

Childhood antibiotic use heightens asthma risk

Children who receive antibiotics within the first six months of life are at a significantly increased risk of developing asthma and allergy by 6 years of age, new research suggests.

The YSPH study followed a large cohort of women, collecting data throughout their pregnancies and from their children until their sixth birthday. The researchers found that infants exposed to antibiotics during their first six months were up to 52 percent more likely to develop childhood asthma and allergies than their peers who did not receive antibiotics.

While previous studies have also found that antibiotic use may increase the risk of asthma in children, those studies may have been biased, because antibiotics are used to treat respiratory tract infections that could themselves be early symptoms of asthma. The Yale study sought to eliminate this bias and concluded that antibiotic use increased risk of childhood asthma even in children who had not experienced respiratory tract infections and in children whose asthma was first diagnosed after 3 years of age.

The association between antibiotic use and increased asthma and allergy risk relates to the so-called hygiene hypothesis, which may explain why asthma rates have increased in developed countries for children growing up in apparently overly hygienic environments, said Michael B. Bracken, M.P.H. '70, Ph.D. '74, the Susan Dwight Bliss Professor of Epidemiology and the study's lead author.

Very early microbial exposure seems necessary for the transition to a mature and balanced immune system in childhood. Antibiotic use may alter microbial flora in the gut, thereby causing imbalances in the immune system and a poor allergic response. A third of U.S. infants are exposed to antibiotics in their first six months.

Michael Greenwood

Heavier women prone to endometrial cancer

Women who put on substantial weight in early adulthood were diagnosed with endometrial cancer at much younger ages than their peers who gained weight later in life, new research at YSPH has found.

In addition, long-term obesity significantly increased the risk of this type of cancer, which develops in the lining of the uterus and is the most commonly diagnosed gynecological cancer in the United States today. Some 42,000 American women are diagnosed with endometrial cancer annually, and nearly 8,000 die from the disease. The number of women developing the disease has risen steadily in recent years.

The study gathered data from 668 cancer patients and 665 women of comparable ages without the disease. The heights and weights of the participants were tracked during each decade of adulthood.

At any given age, a significant trend was observed between the length of time that a woman was overweight and her risk of endometrial cancer. The longer the time overweight, the higher the risk of endometrial cancer.

"These data indicate the significant impact of lifestyle in early adult life on health later on," said Herbert Yu, M.D., M.Sc., Ph.D., professor in the division of Chronic Disease Epidemiology and the study's lead author.

After menopause, adipose tissue (which stores fat) converts androgens from the adrenal glands to estrogens without progesterone, as is made by the ovaries in the premenopausal years. These "unopposed" estrogens are believed to play a crucial role in the development of endometrial cancer.

Denise Meyer

Autism associated with genetic variant

Yale researchers have established that a rare genetic variant accounts for approximately 1 percent of the incidence of autism.

Autism is one of the most heritable complex disorders, but numerous studies have had little success in determining the underlying genetic causes of the condition. Recently, several rare deletions and duplications of chromosomal regions, known as copy-number variants, have been shown to contribute to autism incidence. Most individuals have two copies of each gene, one inherited from the mother and the other from the father. Individuals with copy-number variants have either too many or too few copies of a gene. Depending on which genes are affected, copy-number variants can be either benign or disease-causing mutations.

Variants in a specific region on chromosome 16 have repeatedly been linked to autism, but individual studies found copy-number variants in only a small proportion of the patients under study. To estimate what proportion of autism spectrum disorders may be attributable to this variant, the researchers sought to determine what proportion of autistic individuals carry this copy-number variant. Combining genetic data from 3,613 autistic patients using a technique known as meta-analysis, the researchers determined that 0.76 percent of all autism spectrum disorders may be caused by duplication or deletion of this region of chromosome 16.

"Combined with other copy-number variants that also have strong associations with autism, genomewide scans for gene deletions/duplication are expected to become part of routine clinical practice when caring for autistic patients," said Kyle M. Walsh, a Ph.D. candidate at the School of Public Health and the study's lead author.

M.G.

Videophones aid nurse-client dialogue, study finds

Videophone conversations between a nurse and an at-home caregiver providing for a loved one who is sick offer valuable emotional information for both parties that would be lost in a traditional telephone call.

The new research by Joan K. Monin, Ph.D., assistant professor in the division of Chronic Disease Epidemiology and in the Social and Behavioral Sciences program, along with colleagues from the University of Pittsburgh, identified a range of facial expressions that are revealed during videophone conversations. They found that both the nurse and the at-home caregiver revealed important emotional cues through subtle facial expressions, indicating feelings as diverse as happiness, concern and sorrow.

Such nonverbal communication provides important information to both parties, enhancing the caregiver-nurse relationship and potentially improving the level of care the client receives. The at-home caregivers benefit by knowing that another person understands and has empathy for what they are experiencing. The nurse benefits by gleaning more information about what is happening and, thus, is better able to provide more specific and speedy advice to the caregiver.

"Nonverbal behavior is crucial to effective nurse-client relationships," said Monin. "Relying only on verbal communication might reduce the amount of empathy that people have for one another. To provide responsive support to their clients, nurses need to be able to see the whole picture."

Francesco Bongiorni

Millions of adults in the United States actively provide at-home care for sick family members.

M.G.

Significantly higher levels of visceral fat identified

Middle-aged women who reported frequent instances of mistreatment or discrimination were found to have significantly higher levels of one of the most toxic forms of fat, visceral fat, making them more susceptible to a range of chronic conditions.

While previous studies have identified a relationship between discrimination and physical health, the new YSPH study is believed to be the first that links discrimination with specific subtypes of abdominal fat.

Led by Tené T. Lewis, Ph.D., associate professor in the division of Chronic Disease Epidemiology, the researchers studied 402 African-American and Caucasian women. Each participant's exposure to discrimination was assessed with a

Advances

Francesco Bongiorni

standardized scale that rated day-to-day experiences over the previous 12 months. Participants also had their levels of abdominal fat measured with computed tomography scans.

Each one-point increase on the discrimination scale was associated with a 13.03-cm^2 increase in visceral fat. This association remained intact even after considering overall body fat, cardiovascular risk factors and depressive symptoms.

"It is important to note that this is the type of fat that you don't see. Many people believe that discrimination and fat are associated primarily because of discrimination against the overweight and obese—that the fat you see leads to mistreatment. What we found suggests that the association may also go in the other direction, with experiences of discrimination and mistreatment actually contributing to the development of fat," said Lewis.

The relation between discrimination and visceral-fat levels did not differ significantly among African-American and Caucasian women.

Michael Greenwood

Trafficked sex workers face greater health perils

A significant number of female sex workers in India report themselves as trafficked and are likely to face more safety and health risks than other women involved in the sex trade, new research has found.

Researchers led by Jhumka Gupta, Sc.D., M.P.H., assistant professor in the division of Chronic Disease Epidemiology, analyzed whether women who originally entered sex work via trafficking were subjected to greater levels of recent violence and were more likely to engage in behaviors that increased their risk of HIV infection.

The study sample consisted of 812 female sex workers in the coastal state of Andhra Pradesh and found that nearly 20 percent of the women had been forced into the sex trade. Women who were trafficked were nearly twice as likely as others to experience physical and sexual violence; had, on average, more clients and more days of sex work per week; and were less likely to report the recent use of available health and safety services.

The study concluded that entry into sex work via trafficking may be associated with a range of conditions that increase women's vulnerability to poor health, including HIV.

The issue of sex trafficking is an important public health concern, because some 150,000 women and girls are estimated to be trafficked across South Asia each year, according to a report by Congressional Research Service. India is currently home to some 2.5 million people living with HIV.

M.G.

Laborers at increased risk of obesity after retirement

Laborers and other workers in traditionally blue-collar jobs have a significantly higher body mass index after retirement than their peers who worked in management and other executive positions.

A team led by Ralitza Gueorguieva, Ph.D., a research scientist in the division of Biostatistics, compared body mass index (BMI) patterns for workers in four broad occupational groups: professional, sales and clerical, the service industry and laborers.

They found that retired white-collar workers have no significant change in their BMI postretirement, while the BMI of their blue-collar peers increased significantly after retirement. The study appeared in the *International Journal of Public Health*.

"Our findings may be useful for employment-based medical professionals and family physicians who can convey information to individuals regarding the health risks of weight gain during the retirement transition," said Gueorguieva. "The result of intervening prior to retirement may be to delay or reduce the onset of obesity-related chronic diseases."

Obesity, especially among older adults, is associated with a wide range of chronic conditions, including heart disease, hypertension, type 2 diabetes and some forms of cancer. The findings suggest that adults at retirement age should be targeted for obesity prevention.

Blue-collar workers tend to be more physically active on the job, and the cessation of regular work after retirement could lead to weight gain. White-collar workers, meanwhile, generally do not face physical demands in the workplace, but education and socioeconomic status are likely to inform their postretirement lifestyle choices.

M.G.

Perspective

Will warmer weather mean more insect-borne diseases? Well, maybe.

Dengue fever rising

There is no doubt that climate plays an important role in the incidence and range of vector-borne and zoonotic diseases (VBZD). And even though climate change is unlikely to cause new VBZD to emerge, it is likely to change the range of existing vector-borne diseases in the United States and elsewhere.

But climate is not the only factor that is important to the spread of VBZD. Life-threatening VBZD have been virtually eliminated from the United States, but they are still prevalent in developing countries and appear to be re-emerging in some areas of the United States. In 2009, for example, dengue infection in Florida residents who had not ventured outside of the country represented the first cases in that state since 1934. The cause is unknown, but environmental and social conditions for dengue transmission have long been present in south Florida, and the potential for international travel reintroducing dengue, as well as the presence of *Aedes aegypti* mosquitoes, a population with no innate immunity to the disease and insufficient controls, all likely contributed to the re-emergence.

Michael Sloan

Predicting VBZD incidence is complicated, given the complexity of transmission cycles, climate change and limited information about the impacts of local ecology on disease transmission. The re-emergence of dengue in Florida and the shifting patterns of other VBZD underscore a continued need for better understanding of the critical factors governing VBZD transmission, improved disease tracking and increased research on how to prevent these diseases.

Christopher J. Portier, Ph.D., director of the National Center for Environmental Health and the Agency for Toxic Substances and Disease Registry at the Centers for Disease Control and Prevention, spoke at Yale in June about climate change

The complexities of climate

Climate change affects all species, including humans, their pathogens and the insect vectors that transmit disease.

Nonetheless, connecting human-induced environmental change with human health is proving to be extremely challenging. Science has supported the anthropogenic basis of global warming, the underlying molecular mechanisms through which diseases operate and the association of particular weather variables with disease. All of this has led to easily applicable conclusions: lowering carbon dioxide emissions reduces warming, substance *X* interferes with the reproduction of pathogen *Y*, longer summers could result in malaria in New Haven, and so on. Even so, the cross-cutting, global nature of climate change has also exposed major gaps in our understanding of how ecological and social processes influence the dynamics of disease, and how humans and vectors cope behaviorally and physiologically with changing weather patterns.

Rather than being separable and unidirectional, the effects of climate change on disease systems are interactive, uneven and context-specific. For example, it is nearly impossible to prove that global warming is causing dengue fever to occur at higher altitudes in Colombia. However, we can readily demonstrate that climate change-associated increases in the uncertainty over water supply are exacerbating the dengue burden amongst populations where the disease is endemic, because the storage of household water increases mosquito breeding habitats.

Part of the solution, which is increasingly recognized, lies in enriching the traditional epidemiological and biomedical sciences with approaches adapted to understanding the dynamics of complex systems, commonly employed in the ecological and social sciences. A more difficult challenge, however, is the democratization of science such that the populations most vulnerable to the consequences of climate change can exert a greater influence in defining the research agenda. This will allow us to move forward in determining the optimal strategies for adapting human-ecological interactions to the realities of climate change.

Harish Padmanabha, Ph.D., postdoctoral fellow at the Yale Climate & Energy Institute

A world of DISEASE

Insect-related illnesses take a heavy human and economic toll globally.

By Michael Greenwood

10,000

Approximate number of new cases of African trypanosomiasis annually

Geoffrey Attardo

Tsetse fly

African trypanosomiasis, also known as sleeping sickness, is transmitted by the tsetse fly. Currently, about 10,000 new cases are reported each year; however, it is believed that many cases go undiagnosed and unreported. A parasite invades the central nervous system and eventually causes mental deterioration and other neurologic problems. Without treatment, death ensues usually within months. East African trypanosomiasis primarily occurs in rural parts of Africa, including Uganda, Tanzania and Zambia. A West African form of the disease occurs in the continent's central and western regions.

The *Trypanosoma brucei* parasite, responsible for African sleeping sickness, enters the bloodstream of its mammalian hosts through the bite of an infected tsetse fly.

2,000,000

Estimated number of new cases of leishmaniasis annually

Centers for Disease Control and Prevention (3)

Sand fly

Leishmaniasis consists of two major diseases, cutaneous leishmaniasis and visceral leishmaniasis, with the cutaneous form being the most common. There are about 2 million new cases of the two forms of the disease worldwide each year, and the disease infects many animals as well as humans. Symptoms include fever, weight loss and an enlarged spleen and liver. People with cutaneous leishmaniasis develop sores on their skin that can change from bumps or nodules into ulcers. Leishmaniasis occurs in parts of the tropics, subtropics and southern Europe.

Sand flies suck blood from many warm-blooded animals and, in the process, can transmit the parasite responsible for leishmaniasis. The disease can result in disfiguring ulcers on the skin.

100 Approximate number of countries where dengue fever is endemic

Tick

Lyme disease is transmitted through the bite of infected blacklegged ticks and is the most commonly reported vector-borne disease in the United States. Symptoms include fatigue, chills, fever, headache, muscle and joint aches, swollen lymph nodes and, sometimes, an expanding red rash. Lyme disease is most commonly found in the northeastern United States and in north central states such as Michigan and Minnesota.

Babesiosis is an emerging disease that is transmitted through the bite of an infected blacklegged tick or, less commonly, through blood transfusions from an infected person. Many people who are infected with *Babesia microti* do not exhibit symptoms. Others develop flu-like symptoms, such as fever, chills, sweats, headache, body aches, loss of appetite, nausea and fatigue. In certain cases, the disease can be life-threatening. It occurs primarily in the northeastern and upper midwestern United States, particularly in parts of New England, New York, New Jersey, Wisconsin and Minnesota.

Anaplasmosis cases have risen steadily in the past decade, from 348 in 2000 to 1,006 in 2008. Symptoms include fever, headache, muscle pain, chills, nausea, confusion and, rarely, a rash. Death can result without proper treatment. Anaplasmosis is transmitted by the blacklegged tick and the Western blacklegged tick and occurs primarily in the upper midwestern and northeastern United States. Cases have also been reported in northern California.

A dorsal view of an adult female Western blacklegged tick, *Ixodes pacificus*, which has been shown to transmit *Borrelia burgdorferi*, the agent of Lyme disease.

1,000,000 Estimated malaria deaths each year

Mosquito

Dengue fever results in an estimated 100 million infections worldwide each year. Symptoms include high fever, headaches, severe pain behind the eyes, joint pain, muscle pain and bone pain. Dengue hemorrhagic fever can result in death. Dengue fever is endemic in more than 100 countries and is found in Asia, the Pacific, the Americas, Africa and the Caribbean. It is considered an emerging disease.

Malaria infects as many as 300 million people throughout the world each year. The disease results in fever and flu-like illness, including shaking chills, headache, muscle aches and fatigue. Nausea, vomiting and diarrhea may also occur. As many as 1 million people die from the disease every year, the vast majority of whom live in Africa. The disease continues to be a major economic and human drain on developing countries.

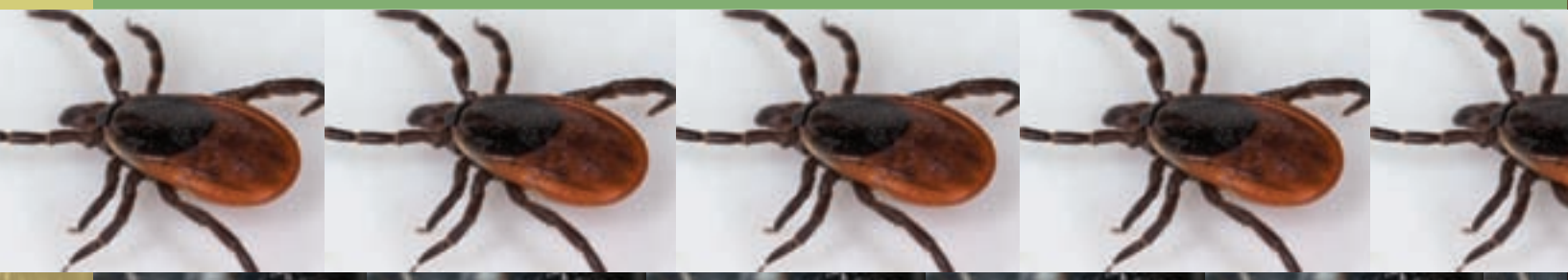
West Nile virus is a potentially serious illness whose symptoms include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors and convulsions. Death occurs in some instances. Mosquitoes become infected with the virus when they feed on infected birds. The mosquitoes then spread the disease to other animals and to humans. West Nile virus was discovered most recently in North America and occurs at varying levels throughout most of the United States.

Freshly fed, a now-heavy female *Aedes aegypti* mosquito takes flight as she leaves her host's skin surface.

Victory

The abdomen of a freshly fed tsetse fly. The white tubules visible under the cuticle are tracheoles that are responsible for carrying oxygen to the tissues of the fly. The droplets on the side of the tube are water that is being excreted by the fly to concentrate the blood meal.

"The toolbox for fighting off sleeping sickness epidemics is very small."
— *Serap Aksoy*



over the vector

Yale public health researchers are pursuing widely different approaches to stem or stop insect-borne diseases that plague different areas of the world.

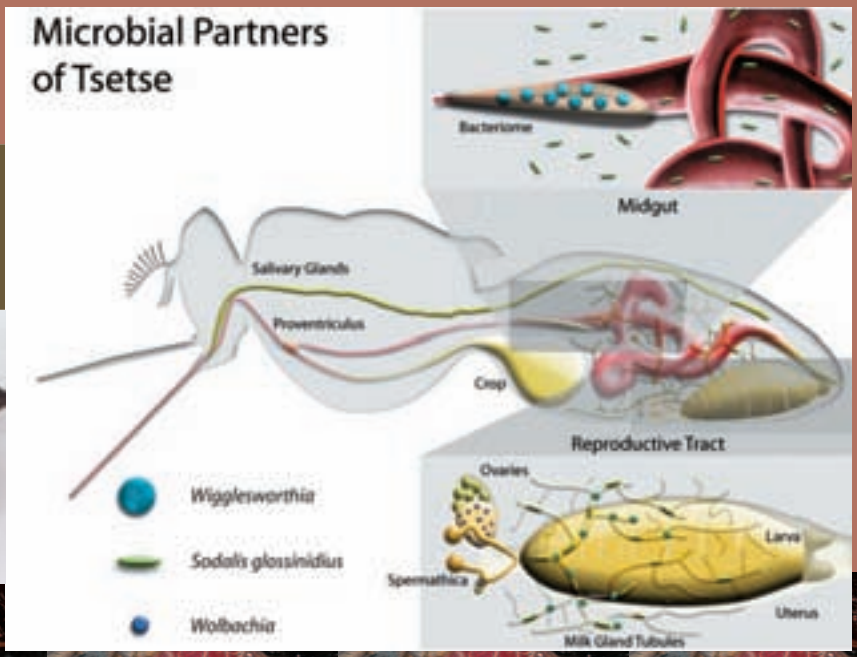
By Steve Kemper

Not so long ago the main weapon against insect diseases was insecticide. Health officials relied on these poisons to kill the infected flies, ticks, mosquitoes and other insects—the vectors—whose bites transmit diseases such as dengue, sleeping sickness, leishmaniasis, Lyme and others. But insecticides must be reapplied frequently and the insects eventually develop resistance. Such poisons may also have adverse consequences for the environment and the other creatures in it.

Researchers at the Yale School of Public Health are using an array of scientific innovations, such as molecular genetics, sequencing technology and PCR (polymerase chain reaction), to identify new approaches to fighting vector-borne diseases. Some of these scientists work in labs, manipulating genes, dismantling molecular mechanisms or stalking protean pathogens. Others are pursuing an ecological approach, gathering data in the field via satellites and doing basic legwork.

The challenges are steep. Since some of the diseases occur mostly among the poor, they have been neglected by pharmaceutical companies, and funding for research can be scarce. The vector insects also pose their own daunting challenges, not only by their sheer numbers, but also by their diversity—for instance, some 30 different species of sand flies are known to carry *Leishmania*. And the pathogens tend to be tricky adversaries, constantly changing to elude antibodies and, not incidentally, potential vaccines. Factors that influence the spread of disease are also evolving quickly. Environments are altered by development, the movement of human populations and climate change.

Though the targets keep moving, the goal of YSPH researchers remains constant: to identify novel ways to reduce, control or even eliminate the vector-borne diseases that afflict so many people across the globe.



The tsetse fly has evolved with three types of symbiotic bacteria: *Sodalis, Wigglesworthia*,and *Wolbachia*. Researchers are working to modify these bacteria and enhance the fly's immune system. The goal of this strategy is for the fly to kill the trypanosomiasis parasite responsible for sleeping sickness before it is transmitted to people.

Geoffrey Attardo (2)

Genetically modified flies

Human African trypanosomiasis – a vector-borne disease better known as African sleeping sickness – has plagued the continent for centuries, and epidemics can be devastating. In 1901 sleeping sickness killed an estimated 250,000 people in Uganda alone. The most recent epidemic there, in 2008, killed 48,000. And the disease afflicts 36 other sub-Saharan countries.

But there is a glimmer of hope; in 2009, for the first time in 50 years, the number of reported cases dropped below 10,000. But since sleeping sickness strikes mostly poor rural areas that often lack adequate health care, many cases go unreported. The World Health Organization estimates that actual cases number at least 30,000 at the present time and that many people die without being diagnosed or treated.

The disease begins when a tsetse fly infected with parasitic trypanosomes bites a person. The initial symptoms include fever, headache and joint pain. Without treatment, the parasites next invade the lymph nodes, producing massive swelling. Once in the circulatory system, the parasites can cause anemia as well as malfunctions in the heart and kidneys. Lastly, they attack the central nervous system. The patient's muscular coordination deteriorates. Insomnia, fatigue and confusion worsen, leading to coma and death. As the disease progresses, the treatments become more complex and expensive.

Though sleeping sickness can be reduced by killing tsetse flies, current methods are inefficient. Traps require a lot of personnel and effort. Insecticides come with environmental side effects, and the flies quickly become resistant. A vaccine seems unlikely because the parasite constantly changes its surface proteins to evade attack.

In an effort to develop more progressive control strategies, Serap Aksoy, Ph.D., professor in the division of Epidemiology of Microbial Diseases, is hoping to curtail the disease at its source by engineering a tsetse fly whose immune system will kill the parasite before it can be transmitted to people. The flies themselves hold the secret to success: more than 90 percent of them mount a robust immune response that eliminates the parasite.

"What is it about those 90 percent?" asks Aksoy. "If we can understand tsetse's immune responses and identify those anti-parasitic gene products that clear trypanosomes, we may be able to make the other 10 percent of flies more resistant."

The search began with the tsetse's unique biology, which presented challenges but also opportunities for influencing genetics. The fly's reproductive biology resembles that of a mammal. A female tsetse has a uterus, carries an embryo and gives birth to live larvae. The female produces milk that nurtures the larvae in the uterus. Tsetse flies also differ from other biting insects, such as mosquitoes, by feeding solely on vertebrate blood. Because this diet lacks essential vitamins, tsetse has evolved with two symbiotic bacteria, *Wigglesworthia* and *Sodalis*, that live in its gut and cells, where the bacteria produce nutrients crucial for, among other things, fertility.

Aksoy and her colleagues discovered that both symbionts are transmitted to larvae through the female's milk. Aksoy reasoned that if these bacteria could be genetically modified to express anti-parasitic genes and placed back into the fly – an approach called paratransgenesis – the genes would be passed to tsetse's progeny and then inherited from generation to generation. If enough modified flies enter the population, the result would be greater resistance to the parasite among all tsetse. Even 15 years ago such an approach would have been considered science fiction, but today it is moving closer to reality in Aksoy's lab.

One of the symbionts, *Sodalis*, proved amenable to culturing. This characteristic makes it possible to modify the bacterium by incorporating genes into its chromosome. But which genes? First the epidemiologists had to find the tsetse genes that cause resistance to the parasites.

"We've found several compounds from the tsetse's immune system that kill trypanosomes," says Brian L. Weiss, M.Sc., Ph.D., an associate research scientist in Aksoy's lab who has been working on tsetse for eight years. "We're trying to use symbiotic *Sodalis* as a vehicle to produce and secrete trypanocidal compounds. We can then reintroduce the modified bacteria back into host flies as a means of reducing their ability to become infected. Basically we're boosting tsetse's immune system artificially with genetically modified *Sodalis*."

All of this has become possible, note Aksoy and Weiss, because of innovations such as cloning, genomics and PCR, which allows researchers to put a piece of DNA into a thermal cycler and copy it millions of times in a couple of hours.

"Once we make this paratransgenic fly," says Weiss, "how do we get it into the field? That's where tsetse's third symbiont, *Wolbachia*, may come into play." This symbiont can be used to induce reproductive abnormalities that give benefit to female flies that harbor genetically modified *Sodalis*. Thus, releasing female tsetse that carry specific *Wolbachia* strains along with trypanosome-killing *Sodalis* should cause a population boom among flies that are less able to carry the sleeping sickness-inducing parasite. Trypanosome-infected flies could eventually disappear. Other insects also carry *Wolbachia*, and this replacement strategy is now being tried in Europe to eradicate the Mediterranean fruit fly and in Australia to control *Anopheles* mosquitoes.

Weiss believes that field trials for genetically altered tsetse flies are 10 years away. Meanwhile Aksoy and her colleagues continue to study the disease in the lab and, with the help of a National Institutes of Health grant, in Uganda and Kenya.

> "We're trying to understand the immune response and modulate it in a way that will give us healing."
>
> — *Diane McMahon-Pratt*

Centers for Disease Control and Prevention

A sand fly takes a blood meal, which is visible through its distended abdomen. Sand flies are responsible for the spread of the vector-borne parasitic disease leishmaniasis.

If their work someday reduces the number of infected flies even slightly, Aksoy and Weiss say, thousands of lives will be saved.

"The toolbox for fighting off sleeping sickness epidemics is very small," says Aksoy. "Furthermore, the ability to deliver the necessary drugs or vaccines that may one day be developed to neglected and underserved populations in remote areas where the disease is endemic is full of technical challenges. Thus, innovative vector control methods such as the one being pursued can have a major impact on disease control."

Developing a vaccine

The World Health Organization calls leishmaniasis a category 1 disease, defined as "emerging and uncontrolled."

This parasitic vector-borne pathogen is endemic in 88 countries, ranging from the Indian subcontinent across the Middle East to northern Africa and southern Europe ("Old World leishmaniasis"), and on to South and Central America ("New World leishmaniasis"). The parasite infects an estimated 2 million people each year and kills more than 50,000 – a toll exceeded only by that of malaria.

The disease is transmitted by sand flies, which become carriers after sucking blood from infected animals or humans, and takes two common forms: cutaneous and visceral. About 75 percent of new infections are cutaneous, characterized by ulcerating lesions in the skin or the mucous membranes that can spread and become horribly disfiguring. The visceral form is even more treacherous, attacking organs such as the liver, spleen and lymph nodes.

For 70 years the most common treatment has been antimony, given in a series of injections. While antimony compounds are effective, the approach is also seriously flawed. "They're toxic," says Diane McMahon-Pratt, Ph.D., professor in the division of Epidemiology of Microbial Diseases. "They're injected for 28 straight days, and it's essentially heavy metal poisoning. You can imagine the side effects." The potential effects on children are especially worrisome and can include anemia and myalgia.

The disease can resolve on its own without treatment, but people still choose the ordeal of antimony injections rather than risk deformity. "We can't yet test genetically to see if someone is at high risk for that form of the disease," says McMahon-Pratt. In addition to being poisonous and prolonged, loss of work time during treatment makes this an expensive option for the average person. Leishmaniasis is predominantly a disease that afflicts the impoverished, and overcrowding, substandard housing and poor nutrition and sanitation all contribute to its prevalence.

McMahon-Pratt was drawn to the disease for all these reasons, and also because the leishmaniasis parasite fascinates her. Since epidemiologists now know that not everyone infected will develop a severe form of the disease, researchers are focusing on early interventions that avert long-term systemic treatments.

"The idea is to get a topical treatment," says McMahon-Pratt. "We're trying to understand the immune response and modulate it in a way that will give us healing," she says. "But we still don't have a clear idea why people can get such a spectrum of disease – anything from a limited

cutaneous infection to a chronic infection to mucocutaneous leishmaniasis."

To complicate matters, the parasite evolved with different sand fly species and different reservoir hosts in different regions. Consequently there are nearly two dozen species of *Leishmania*. The differences between the species that cause cutaneous and visceral leishmaniasis amount to 10 or 12 percent of their DNA—"as different as mice from men," notes McMahon-Pratt. "*Huge* differences." Such diversity complicates the search for a universal treatment.

To start, McMahon-Pratt went through the laborious process of developing a mouse model that would mimic human responses to the pathogen. Whereas other researchers had tried and failed, McMahon-Pratt succeeded after a couple of years. Now she and her colleagues are using mice to screen possible treatments and look for ways to modulate and control immune responses to the parasite.

> "If we understood the environmental drivers of vector distribution and abundance as intimately as we understand the tick's genome, we would have more options for managing epidemics of vector-borne disease."
>
> *– Durland Fish*

For a potential topical treatment, they are combining nanoparticles of miltefosine, a proven anti-leishmaniasis drug, with an immuno-modulator that would drive T-cells (white blood cells crucial to the immune system) into a healing response—a double blow against the parasite. The topical medicine would target people who already have the disease.

McMahon-Pratt is also working on a vaccine, a related but different weapon. A vaccine would trigger a person's immune response as soon as a sand fly injected the parasite, preventing the pathogen from causing lesions or invading the viscera. Finding a vaccine for a parasitic disease is especially challenging, she says. Most current vaccines use antigens to stimulate the production of antibodies that provide immunity. But with parasitic diseases, antibodies aren't sufficient.

"*Leishmania* isn't like a virus," says McMahon-Pratt. "Viruses are out there circulating in your system, and antibodies can neutralize them effectively. But leishmanial parasites spend most of their lives inside cells, so you have to crank up T-cells to eradicate them. Antibodies have little to no effect."

McMahon-Pratt is trying to understand what T-cells contribute to healing while also searching for antigens against leishmaniasis. She injects mice first with various antigens and then with the parasite and monitors the immune response. Her lab has been collaborating with two other labs outside of Yale in the development of a vaccine. This group has identified about 20 promising antigens and is now cross-screening them to see which might provide protection across *Leishmania* species. So far, three show strong potential. But much more research is necessary before anything can be tested in humans.

McMahon-Pratt believes that a first-generation vaccine is still at least a decade away. "We should be able to control [this disease] and give people better lives," she says. "You look at the people affected, and that's pretty much my driving force."

An ecological approach

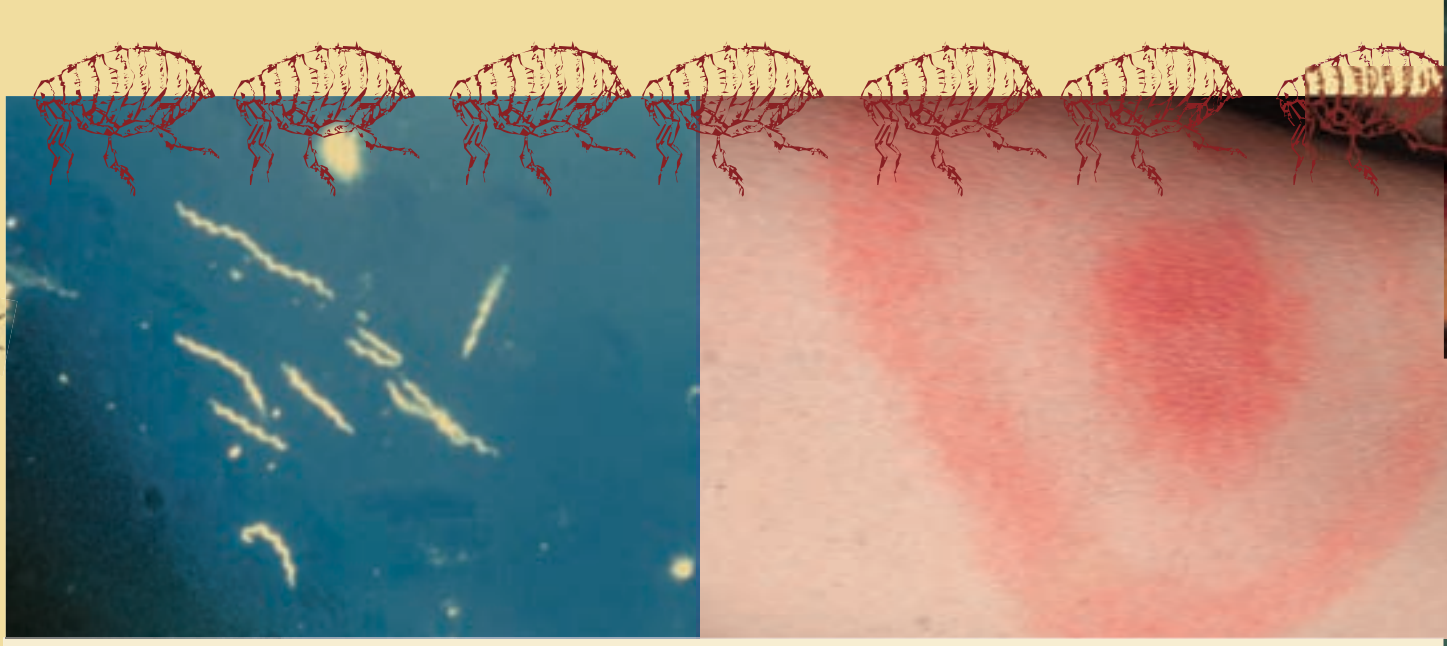
The most common vector-borne illness in North America is Lyme disease. It attained that position in just three decades since its discovery by Yale scientists and continues to widen its lead over other vector-borne illnesses while expanding its territory.

The Centers for Disease Control and Prevention reported that the annual number of Lyme cases more than doubled between 1997 and 2007, to 27,444. Only two years later (the most recent year for which figures are available), the number had risen to 38,468. Officials estimate the real number of cases to be nine or 10 times that high, since many go unreported. About 90 percent of the confirmed infections occurred in 12 states in the country's northeast and upper Midwest.

Lyme is transmitted to humans by the bite of an *Ixodes* tick infected with the pathogen *Borrelia burgdorferi*. Left untreated, victims suffer fatigue, chills, fever and achiness. Advanced symptoms include severe headaches, heart palpitations, Bell's palsy, arthritis and joint and muscle pain.

Durland Fish, Ph.D., professor in the division of Epidemiology of Microbial Diseases and director of the Yale Center for EcoEpidemiology, has been researching Lyme for decades and is frustrated that the disease continues to multiply and spread. "For 30 years we've been putting our emphasis on the wrong stuff, on medical solutions," he says. "Vector-borne diseases are caused by a population of vectors. Where they are and how many there are are what cause infections in people. That's an ecological problem, not a medical problem."

Fish believes that rather than searching for solutions in the lab, researchers should be focusing on basic ecological questions in the field, especially the factors that regulate tick populations and their expansion. Why are there more ticks in some years than in others? Because of climate?



Borrelia burgdorferi is a helix-shaped bacterium, about 10 to 25 micrometers in length, which is transmitted to humans by the bite of an infected tick. There is an increasing number of cases of Lyme disease reported in the United States each year.

A key component in the early diagnosis of Lyme disease is the recognition of a characteristic rash. This rash often manifests itself in a "bull's-eye" appearance and is observed in about 80 percent of Lyme disease patients.

Centers for Disease Control and Prevention (2)

Vegetation? The number of available host animals?

"We don't know," says Fish. "And how do ticks die? We don't know, and that's another basic question. If we understood the environmental drivers of vector distribution and abundance as intimately as we understand the tick's genome, we would have more options for managing epidemics of vector-borne disease."

Fish does know what he calls "the weak spot" in the ticks' life cycle: they depend on deer. If science could find a way to keep ticks from feeding on deer, he says, the number of ticks would plummet and so would the incidence of Lyme disease. To this end, he conducted a project with deer feeding stations in five states over seven years. The deer reached the corn bait by sticking their heads between paint rollers treated with insecticide, which killed the ticks on their heads. Most of the remaining ticks were killed as the deer groomed themselves. After six years the number of *Ixodes* nymphs dropped 70 percent. But the method was expensive, and some states don't allow feeding of the deer.

Ticks also could be controlled by reducing the number of deer they feed on. At what point would such a reduction lower the risk of human disease? To answer that question, Fish and his colleagues recently began a project on Block Island, whose residents hope to get rid of Lyme by culling the deer population through hunting or marksmanship. Fish and his colleagues are collecting baseline field data: the number of deer on the island (by using infrared photography), the number of infected ticks and the number of infected people. As the deer population drops, the researchers will measure the effects on the incidence of Lyme.

He also would like to know how the ticks and the pathogen are spreading, because then it might be possible to find a way to stop their spread. That would require basic fieldwork at the edges of the disease's territory, but funding for ecological research on vector-borne diseases has become harder and harder to find.

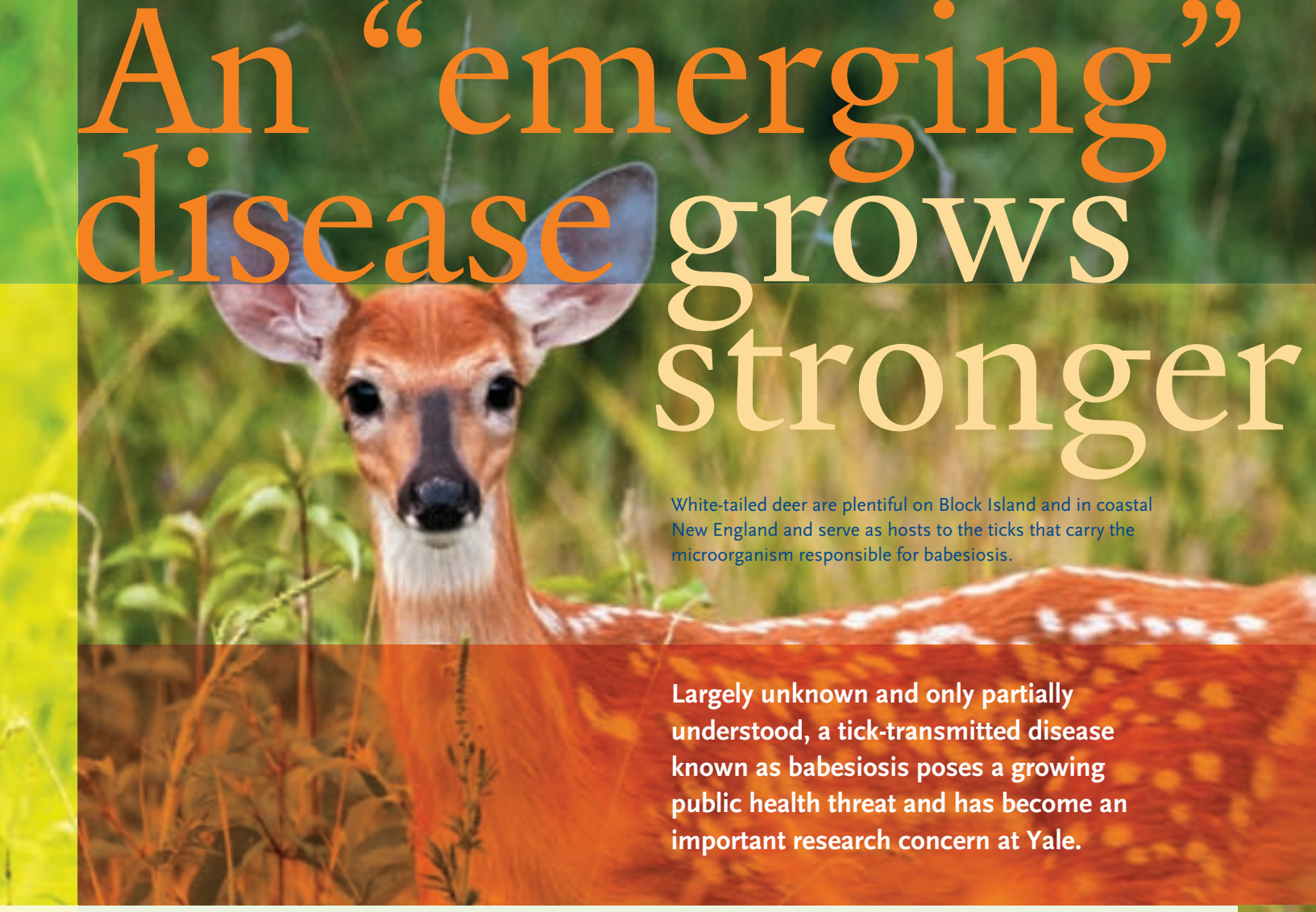
The reason, says Fish, is that the main funder of research on vector-borne diseases, the National Institutes of Health, lacks interest in ecologically based studies and even basic field entomology. "All the emphasis now goes into these molecular approaches," says Fish, "looking at mechanisms by which this biochemical process happens, which genes do this and that, sequencing the genome. It's all very interesting and elegant, but a lot of it has to do with developing a drug or a vaccine or some biochemical or genetic intervention that's going to result in a product that somebody can manufacture and make money from. If your idea doesn't do that, there's not a lot of interest."

None of the lab-based molecular approaches, he points out, have provided any direct applications for controlling vector-borne diseases. He doubts that will change any time soon. Meanwhile other approaches are being ignored.

"Look at the trajectory of Lyme disease over the last 30 years," he says. "It's a straight line. And look at the hundreds of millions of dollars that have gone into Lyme disease research—it hasn't made that line bend at all. People ought to be asking what we're doing wrong. There should be a balance between lab-based approaches and environmentally based approaches. Basic ecology has the same potential as molecular techniques and could provide opportunities for intervention that probably would be a lot cheaper and a lot more environmentally compatible." YPH

Steve Kemper is a freelance writer in West Hartford, Conn.

An "emerging" disease grows stronger



White-tailed deer are plentiful on Block Island and in coastal New England and serve as hosts to the ticks that carry the microorganism responsible for babesiosis.

Largely unknown and only partially understood, a tick-transmitted disease known as babesiosis poses a growing public health threat and has become an important research concern at Yale.

By Michael Greenwood

Most residents of Connecticut and the Northeast are well-schooled in Lyme disease, its various symptoms (including a bull's-eye-like red rash and achiness) and the measures they can take to lessen the chance of infection, such as wearing full-length clothes and avoiding the grassy, leafy areas where hungry ticks thrive.

Not as well-known is that ticks spread diseases other than Lyme, and a largely unknown tick-borne illness is making steady inroads into many of the same regions where Lyme disease is well-rooted. Known as babesiosis, the disease is potentially deadly but is still unfamiliar enough that even people versed in health issues stumble over its pronunciation.

Like Lyme disease, babesiosis (*buh-bee-zee-oh-sis*) is spread by blacklegged ticks (*Ixodes scapularis*), which are abundant in New England and much of the Northeast, as well as regions of the Midwest. And, similarly, the two diseases have their origins in mice and other small rodents that pass parasites on to ticks.

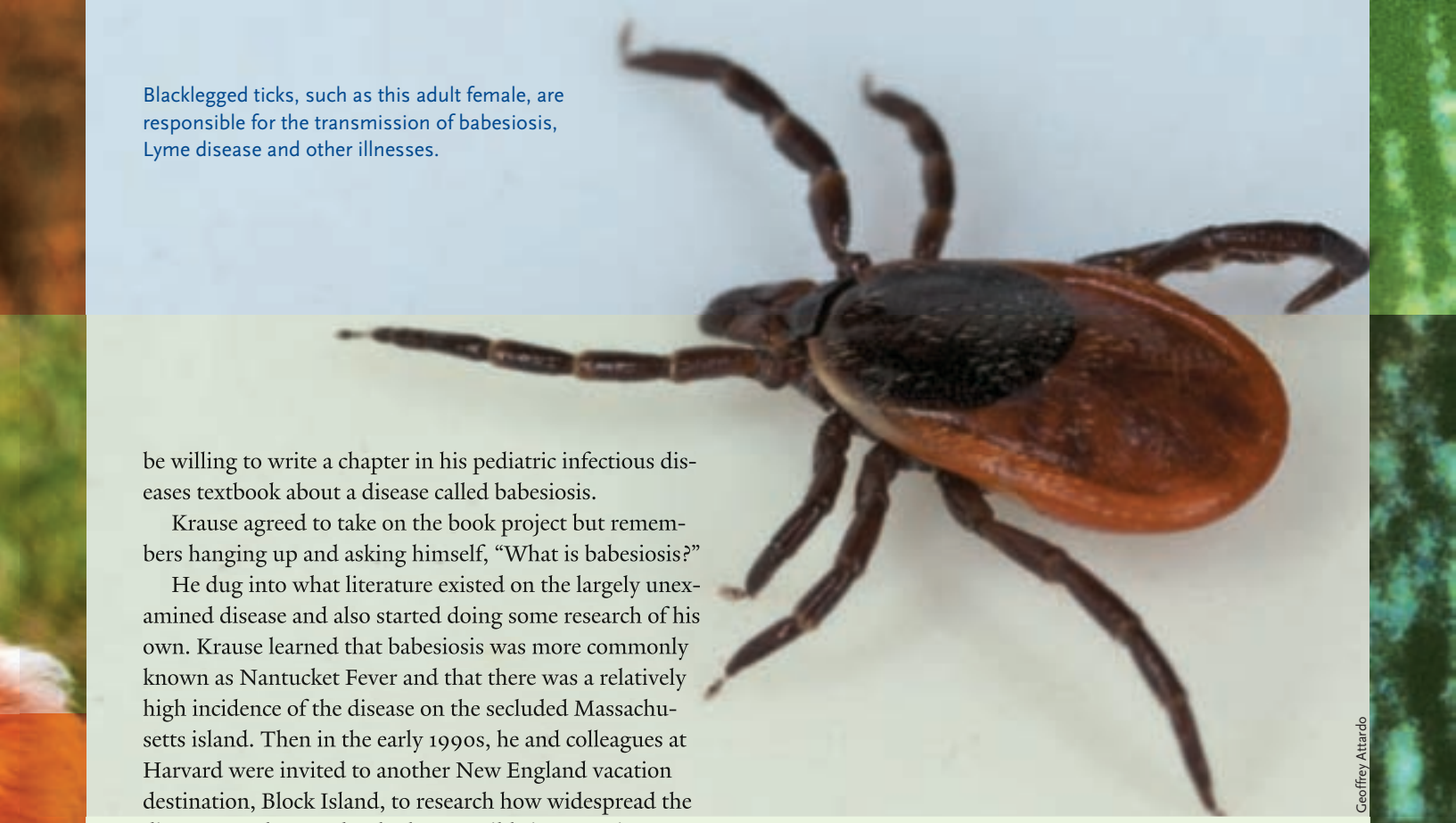
But there are some crucial differences between the two diseases. To begin with, a different microorganism causes babesiosis, and people who have been infected are not alerted by the large and unambiguous scarlet rash that usually signals Lyme disease. *Babesia* parasites infect the host's red blood cells and can trigger severe symptoms, mirroring those of malaria. In its most serious form, the disease can cause death, especially in people with a weakened immune system. And, alarmingly, there have been an increasing number of cases where the parasite has been acquired through transfusions of tainted blood.

While the incidence of babesiosis is relatively low (there is now about one nationally reported case for every 25 cases of Lyme disease), it is considered an "emerging" disease and studies have found that its range and incidence are both increasing at a steady rate. At the School of Public Health, researchers are now focusing on this growing public health threat.

A babesiosis specialty

Peter J. Krause, M.D., senior research scientist and lecturer in the division of Epidemiology of Microbial Diseases, recalls his introduction to the disease more than 20 years ago, which started with a telephone call.

Krause was a young researcher interested in infectious diseases when his mentor contacted him to see if he would



Blacklegged ticks, such as this adult female, are responsible for the transmission of babesiosis, Lyme disease and other illnesses.

Geoffrey Attardo

be willing to write a chapter in his pediatric infectious diseases textbook about a disease called babesiosis.

Krause agreed to take on the book project but remembers hanging up and asking himself, "What is babesiosis?"

He dug into what literature existed on the largely unexamined disease and also started doing some research of his own. Krause learned that babesiosis was more commonly known as Nantucket Fever and that there was a relatively high incidence of the disease on the secluded Massachusetts island. Then in the early 1990s, he and colleagues at Harvard were invited to another New England vacation destination, Block Island, to research how widespread the disease was there and to look at possible interventions to slow or stop its spread.

Krause has been studying the illness ever since and has established a reputation as a leading authority, not just in New England, but internationally. He receives calls from all over the world and occasionally travels outside the United States to help with serious cases of babesiosis.

Meanwhile, he continues to build on his research on Block Island, Nantucket and in Storrs, Conn. He joined the Yale School of Public Health in 2008.

The study of babesiosis has been a good fit for him. "One of the aspects of the infection that thrills me is the interaction with nature, the ecology of it," Krause says. "It fascinates me."

A natural laboratory

Situated some 20 kilometers off the Rhode Island coast, Block Island's pure waters and ample beaches attract capacity crowds every summer.

But Krause and other School of Public Health researchers are drawn to the island for another purpose—it is a near-perfect laboratory to study and gather data on an emerging disease such as babesiosis. The island is small (less than 10 square miles in total land mass), making it relatively easy to control research variables. It has a small year-round population (about 1,000 people), most of whom are treated at the Block Island Medical Center, the island's sole medical facility. And importantly, the deer population is bountiful and the incidence of tick-related diseases, including babesiosis, is pronounced.

Indeed, it was one of Krause's studies that established just how serious a threat babesiosis poses on the island and, by extension, elsewhere if conditions are optimal.

This 10-year project tested and tracked babesiosis and Lyme disease cases, as well as antibodies in the blood serum of the island's residents. The effort included the majority of people who live on the island beyond the influx of the summer tourist season. And while it was time-consuming and complex, the study yielded scientifically valuable results.

The study found that babesiosis could approach the incidence of Lyme disease—there were about 7.5 cases of babesiosis for every 10 cases of Lyme disease (which is by far the most frequent tick-borne disease in the United States). Additional data suggested that babesiosis was occurring at the same rate in southeastern Connecticut. Nothing close to this level of babesiosis had been reported before. And the number of infections was increasing, with noticeable gains in even the relatively brief span of 10 years. In short, the researchers concluded that the risk of babesial infection (as well as borrelial infection, or Lyme disease) was "intense."

A more recent study in the Lower Hudson Valley, a region north of New York City, echoed the Block Island findings. Researchers there documented a mere six cases of babesiosis in the region in 2001; by 2008 the number had grown to 119 cases, a 20-fold increase in less than a decade. In fact, the number of reported cases in every state where it has become endemic has markedly increased over the past decade, including Connecticut, Massachusetts, New Jersey, New York and Rhode Island.

The seeds for Block Island's current dilemma were unintentionally sown in the 1960s, when deer were introduced to the island to diversify fauna. Today, the island is thick with deer, and the deer are thick with ticks, as is the case in many areas of New England and its coastal islands.

"Deer amplify the number of ticks," Krause says. "Wherever deer are present, the number of ticks increases and the incidence of tick-borne diseases, including babesiosis, increases."

Krause refers to deer as "traveling hotels," as they offer ample amounts of food (blood) and ample opportunities for mating among the ticks that gather on a single deer (they can number well into the hundreds). Other than cars and restricted hunting, Block Island's deer population faces few hazards and no natural predators.

So the question now being studied—and debated—is whether an ecological intervention might be in order for Block Island.

Krause and his colleagues, including Professor Durland Fish, Ph.D., an international authority on tick-related diseases; Maria A. Diuk-Wasser, Ph.D., assistant professor; and Sahar Usmani-Brown, M.Sc., Ph.D., associate research scientist, all of whom are in the division of Epidemiology of Microbial Diseases, are working with island officials, residents and others to generate more precise information on how many deer now inhabit Block Island. This latest research has included flights over the island in a plane outfitted with an infrared sensor, a device that detects a deer's body heat even in the heavily wooded, undeveloped areas of the island such as Rodman's Hollow on the southern tip. The infrared scans are expected to provide a detailed tally of the island's deer population and provide state and local officials with valuable information about where the deer are congregated and in what numbers.

"This is a very emotional issue," says Mary Sue Record, a year-round resident and chair of the island's nine-member Deer Task Force. "It's very important to have accurate information."

Since its creation in late 2009, the task force has worked with private landowners and conservation groups to extend managed deer hunts onto their sizeable tracts. Concerns over liability, however, continue to limit the areas where hunters are allowed.

In terms of research, if scientists can track the number of deer over time and continue to test the island's human population for the incidence of babesiosis and Lyme disease, they will be able to better understand the complex ecological balance between ticks, mice, deer and humans. The research could allow them to gauge the number of deer that are necessary for different levels of human infection. "There's still much that we don't understand," Krause says.

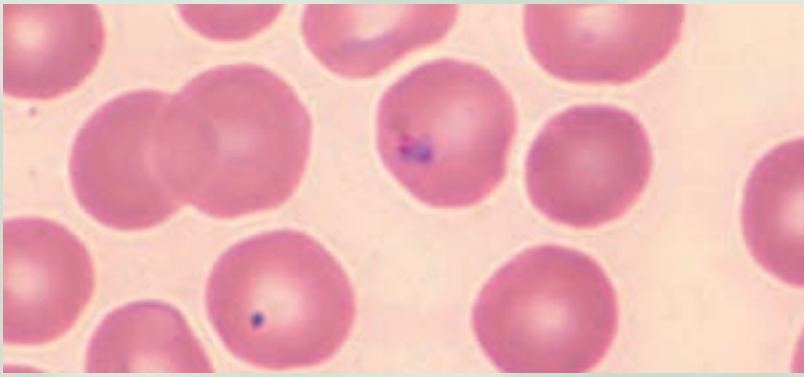
When the latest deer count is ready, the data will be passed on to officials and a decision will be made about proceeding with efforts to further cull—though some favor all-out elimination—Block Island's deer population. Any course of action is likely to encounter strong feelings on all sides of the issue.

Babesiosis unfolds

So where did babesiosis come from? And now that it is here, how—and where—might the disease develop in the coming years?

These are key questions that Krause and colleagues are working to answer. As for the history of babesiosis, it is pretty brief. The disease can be traced back to the late 19th century, when the parasite was discovered and described in cattle by bacteriologist Victor Babes, for whom the disease is named. Human cases remained unheard of—or were at least unreported or unrecognized—until 1957, when a case was documented in Europe. Twelve years later, the first case in North America was verified on Nantucket Island, and the disease was subsequently found to be endemic there. It wasn't until the 1970s that the zoonotic cycles of *Babesia* were recognized on the chain of islands off New England and New York, and not until the 1980s that the cycles were identified on the mainland. More recently, the disease has been identified in Africa, Asia and South America. "This is a worldwide disease," says Krause.

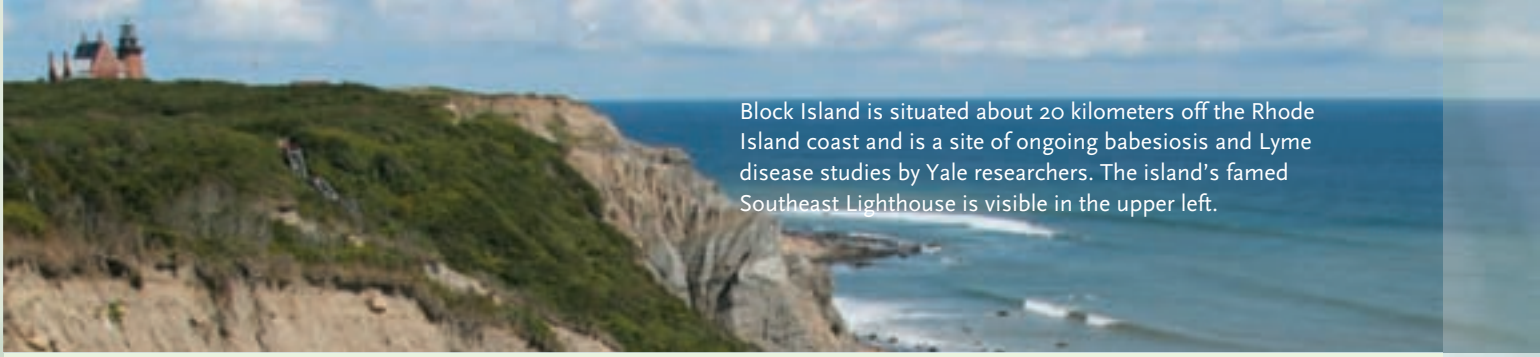
Today there are about 1,000 cases of babesiosis reported annually in the United States. But Krause strongly suspects that this number is off, possibly way off. As many as a quarter of the adults and half of the children infected with the disease remain asymptomatic and never know that they



Ring forms of *Babesia microti* infect the host's red blood cells and can sometimes lead to severe symptoms, mirroring those of malaria.

have the disease, even though the parasite can linger in the body for months or even years. The disease is also easily misdiagnosed, as its symptoms are similar to those of other diseases and many medical professionals, even now, are not well-versed in the details of this emerging health threat.

There also has not been a coordinated system to monitor the incidence of babesiosis from state to state. That changed this year with a new reporting protocol established by the Centers for Disease Control and Prevention that



Block Island is situated about 20 kilometers off the Rhode Island coast and is a site of ongoing babesiosis and Lyme disease studies by Yale researchers. The island's famed Southeast Lighthouse is visible in the upper left.

"It's really spreading from what appears to be an epicenter in the southern New England area." – *Peter Krause*

classified babesiosis as a nationally notifiable disease. This means that accurate national records will be kept for the first time.

Krause, meanwhile, believes that the parasite range is actively spreading into areas where Lyme disease is already present and that the number of babesiosis infections will likely climb in tandem.

"It's really spreading from what appears to be an epicenter in the southern New England area," he says. "The disease [in the eastern United States] is spreading northward and westward, as well as southward."

If diagnosed in time, there are two antibiotic combinations that are used to successfully treat the disease. People in good health usually recover after a course of treatment. However, for people who have had their spleens removed or are living with cancer, HIV or an otherwise compromised immune system, an encounter with babesiosis can be fatal. Among such patients, at least 10 percent—and as many as 25 percent—die as a result of their infection.

Krause and colleagues are also working with other Yale faculty beyond the School of Public Health on innovative research on *B. microti*, the most important *Babesia* species that infects humans. These investigators include Choukri Ben Mamoun, Ph.D., associate professor of medicine; Linda K. Bockenstedt, M.D., the Harold W. Jockers Professor of Medicine and an authority on Lyme disease; and Alexia A. Belperron, Ph.D., research scientist in the Department of Internal Medicine. The research includes the development of a transfected fluorescent *Babesia* that can be visualized in a mouse model to help determine the pathogenesis of *B. microti* infection; the sequencing of the *B. microti* genome to determine the diversity and virulence of strains from the United States, Asia and Europe; and the development of an in vitro culture system for *B. microti*.

The Yale scientists also are working with Edouard Vannier, Ph.D., assistant professor in the Division of Geographic Medicine and Infectious Diseases at Tufts Medical Center in Boston, to identify key determinants of host resistance/susceptibility to *B. microti* infection, and with Sanjai Kumar, Ph.D., at the U.S. Food and Drug Administration (FDA), on biomarker discovery for improved diagnosis of babesiosis. "Taken together, our research on *Babesia* should lead to important discoveries about the ecology, epidemiology, pathogenesis, diagnosis and treatment of this emerging disease," Krause says. The research is supported in part by the National Institutes of Health, but the primary funding comes from an award from the Gordon and Llura Gund Foundation.

Meanwhile, another feature of babesiosis is also receiving heightened attention. Unlike Lyme disease, babesiosis can be transmitted through blood transfusions.

Babesia is now the most common pathogen transmitted through blood transfusion, and meetings with experts on babesiosis, including Krause, have been convened by the FDA to find a solution.

Blood banks have relied on donor questionnaires to screen for a history of babesiosis, a method that is less than foolproof. Working with Carolyn T. Young, M.D., at the Rhode Island Blood Center, and other colleagues, Krause has helped develop the first laboratory-based blood screening program that aims to accurately detect *Babesia* microbes in donated blood. This screening relies on an antibody assay and a polymerase chain reaction test that can detect the organism's DNA. This method is now in limited use in a few Rhode Island hospitals and will soon be introduced at Children's Hospital Boston.

Still, a national screening test for babesiosis is currently not available, says David A. Leiby, Ph.D., head of the Transmissible Diseases Department at the American Red Cross. Such a test will need the approval of the FDA before it is available for general use.

Since the late 1970s there have been more than 100 cases—including newborns—where *Babesia* is recognized as having been transmitted through blood transfusion. And the incidence of these cases appears to have increased in recent years. Of the people infected by tainted blood, 12 have died, and *Babesia* is believed to have contributed to these deaths in varying degrees.

"We take the safety of the blood supply very seriously," Leiby says. "There's a lot of effort being put forth to get a test for some type of intervention." YPH

An eye for the tsetse fly

By Denise Meyer

A research scientist's passion for photography results in an award-winning image of the insects he studies.

Lisa Wilder

Geoffrey M. Attardo was one of those little boys who made pets of the spiders outside his bedroom window, feeding them and watching as they spun intricate webs. Age has not diminished his fascination with the insect/arthropod world.

Attardo now studies tsetse flies for a living and photographs them as a hobby. His growing collection of photographs has resulted in a book and, more recently, an award.

An associate research scientist in the division of Epidemiology of Microbial Diseases, Attardo, Ph.D., researches the reproductive biology of insect vectors of human disease. His doctoral thesis in genetics at Michigan State University focused on how the nutritional components of blood regulate yolk protein gene expression in the yellow fever mosquito.

Prior to embarking on his graduate studies, Attardo seriously considered a career in graphic design, illustration and photography, but science ultimately won out. At that time he was head technician for a medical entomology lab at the University of Massachusetts, Amherst, where he was the only undergraduate to ever begin a major in entomology as a freshman.

His current work in the lab of Serap Aksoy, Ph.D., professor in the division of Epidemiology of Microbial Diseases, involves the molecular characterization of reproductive processes of the tsetse fly (*Glossina morsitans morsitans*), a viviparous insect that transmits sleeping sickness in regions of sub-Saharan Africa. His work examines many aspects of tsetse reproduction, including nutrient metabolism and mobilization to intrauterine offspring; identification and characterization of reproductive genes and regulatory mechanisms; and the role of the symbiotic bacterium *Wigglesworthia* in tsetse fertility. Tsetse flies are one of the only types of insect that lactate and provide nutrients for their young during the entirety of their development.

While photography and illustration are sidelines for Attardo, they enhance his publications, his lab's and YSPH's websites and his insight as a scientist. One of his photos, a tsetse close-up, was recently selected as an Image of the Year by the National Institutes of Health Fogarty International Center.

"It's good to look at the whole picture of an organism you are working with," explains Attardo. "Photos tell me about the insect's history and lifestyle and the story of its adaptations. When doing molecular biology it's easy to lose sight of the forest for the trees." Details in pictures such as coloring, surface textures and anatomy that are brought out through macro photography allow him to make connections that many molecular biologists lose sight of. "The more I study biology, the more I see how all life is connected and how it makes amazing adaptations to survive in difficult places. All living things are just trying to make their way in the world. Even creatures many consider to be gross or creepy are fascinating when you take a close look at them."

When photographing tsetse in the laboratory, Attardo temporarily incapacitates the specimen by using carbon dioxide or ice. Without harming the creature, these substances slow the subject's movement and eliminate the risk of escape. They also allow Attardo to focus on the incredible and often beautiful details that go unnoticed by the casual observer.

Digital cameras have played a big part in this hobby, he explains, since, unlike shooting with traditional film, the feedback on shutter speed and aperture settings is immediate. Macro photography is a delicate art of balance—between lighting at close range, exposure and the blur of a moving creature. Attardo generally uses a macro lens and ring flash to capture his quarry. He has also used a scanning electron microscope to attain a level of detail that is not possible with a hand-held camera.

Attardo has published a book of insect images, *Small World: Life Is in the Details*, and his hobby has taken him well beyond the lab to photograph an array of other subjects, including tarantulas, butterflies, scorpions and crickets.

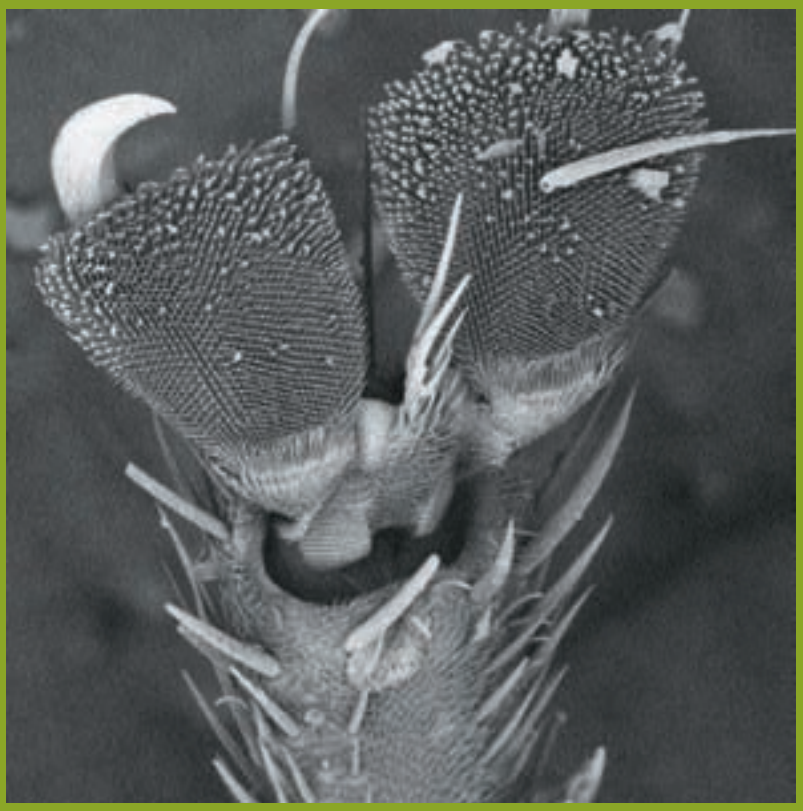
Shooting in the wild, says Attardo, requires patience, a good eye, a steady hand and luck. "Generally insects will let you get close enough to take a good look at them if you use slow movements and try to make yourself a part of the environment. If you are quiet enough, sometimes they don't even realize you are there." At times, Attardo says, his subjects have crawled right onto his lens. YPH

This image was selected as an Image of the Year by the John E. Fogarty International Center. Attardo is fond of bringing insects' eyes into focus. "The way we're wired, it feels like we're being looked back at, bringing a sense of connection to what you are looking at," says Attardo. The dark spot is not an anatomical pupil but an optical illusion created by the light absorption patterns.

Geoffrey Attardo (2)

Young tsetse in love. The gestational process of the tsetse is unusual among arthropods. Females rear intrauterine larvae and supply nutrients through a milk gland. Over the female's lifetime, she may give birth to eight offspring, but only one at a time. Each larva weighs as much as the mother at birth.

The white markings on the belly of the tsetse fly are known as tracheoles. These tubes supply the oxygen to fuel the metabolic processes required to produce milk and support the development of the intrauterine offspring. Each female tsetse produces up to 30 milligrams of milk during a pregnancy, more than its own body weight.



Equipment list

Camera
Canon EOS Rebel T2i SLR
Macro lens: Canon MP65
(1-5x magnification)

Ring flash
Canon Macro Ring Lite MR-14EX

Scanning electron microscope
FEI/Phenom

To see more of Attardo's photos, visit:
picasaweb.google.com/geoffrey.attardo.

Magnified 512x, the detail of an adult tsetse fly's foot comes into view with a scanning electron microscope. The Velcro-like texture of the footpad allows the fly to land on virtually any surface, while the pronounced hook is used to assist in releasing the sticky foot from the ground.

The female *Aedes aegypti* mosquito "is the lab rat of vector insects," says Attardo, who studied gene signaling in these mosquitoes for his doctoral research. "They are easy to rear and medically significant." *Aedes aegypti* transmits dengue fever and yellow fever. The female is a blood feeder and therefore responsible for disease transmission.

Geoffrey Attardo (4)

The male *Aedes aegypti* mosquito uses elaborate antennae to locate females based upon the vibration frequency of their wing beats. The male feeds on plant nectar rather than blood and does not transmit disease.

Durland Fish

What makes ticks tick?

A veteran researcher ponders the past, present and future of Lyme disease and worries about increasingly vocal attacks on medical science.

Durland Fish, Ph.D., has researched ticks and their associated diseases for decades. A professor in the division of Epidemiology of Microbial Diseases, he has, among other things, contributed to the discovery that the bacterium that causes Lyme disease has European ancestry and that the disease, once nearly eradicated in North America, roared back with reforestation. More recently he helped develop a Lyme disease "app" for the iPhone and other Apple devices that provides users with detailed information about tick populations in any given area in the United States and even comes with a video on how to safely remove a tick. He has also worked on mosquito-borne West Nile virus and dengue fever. Students selected Fish as the school's mentor of the year in 2010.

In terms of its incidence and range, what is happening with Lyme disease?

DF: It depends upon scale. The range of the tick vector is definitely expanding, and we have some estimates of how fast and where. More people are exposed, which increases the incidence along the expanding front. In areas where the tick has been established for some time, the incidence seems to stabilize, with small changes dependent upon local tick densities, which may fluctuate year to year for unknown reasons. Nationally, the case reports have been steadily increasing over the past 30 years. I expect this trend to continue.

What's driving this?

DF: I am not entirely sure. In the Northeast, the deer tick was uncommon before the 1970s except on Long Island and some smaller islands off Massachusetts. Deer ticks were first found in significant numbers when the outbreak of Lyme disease was first recognized in eastern Connecticut. Since then the ticks have expanded northward to Maine, westward to Pennsylvania and southward to Virginia. Initially, reforestation in the Northeast permitted the reintroduction of deer into many areas where they had been hunted to extinction. Later, suburbanization increased deer densities by fractionating forests and reducing hunting pressure. The deer tick is totally dependent upon deer for reproduction, and Lyme disease followed this pattern when the tick somehow made it to the mainland. A similar expansion is occurring in the upper Midwest, where ticks and Lyme disease have always occurred in northern Wisconsin and Minnesota. They have since expanded southward into Illinois, Indiana and southern Michigan. Most of the range expansion is probably due to changes in landscape and deer abundance, but climate change may also be playing a role. It is difficult to distinguish between the effects of these factors.

How serious a threat to public health is Lyme disease?

DF: The vast majority of cases do not cause serious illness, and in fact, many infections do not cause any illness at all. Still, with 30,000 cases being reported annually and probably 10 times more actually occurring, even a small minority of serious cases result in a significant public health problem. Some patients may experience arthritis or neurological problems years after initial infection if they are untreated, so early diagnosis and appropriate therapy are an important public health challenge. Knowledge of geographic areas where the disease is endemic because of the presence of infected ticks is crucial in educating the public and physicians about the risk of Lyme disease. Most of the country is at very little or no risk, but many of the population centers in the Northeast and upper Midwest are at high risk, so the severity of the problem is geographically focused.

Is there any possibility that the disease will be eradicated in the coming decades?

DF: I see no chance of this happening unless we find a way to control the tick populations. Little research is being funded to find new ways to eliminate ticks, so I do not see this happening anytime soon. I believe we will be living with Lyme disease for a very long time.

"I believe we will be living with Lyme disease for a very long time."

—Durland Fish

There is an ongoing, and sometimes acrimonious, debate between the scientific community and people who believe they are suffering from a chronic form of Lyme disease. Is there chronic Lyme disease?

DF: The Infectious Diseases Society of America has taken a strong stand against the belief that people are chronically infected with the Lyme disease bacterium. Unfortunately, a large number of patients have been misled by self-appointed lay experts who have organized support groups that aggressively dispute the views of the academic research community and public health agencies. They have a strong presence on the Internet and an alarming amount of political influence. The result is that a large number of people are being treated needlessly for an infection they do not have. The misdiagnosis and mistreatment of Lyme disease have the potential to become a larger public health problem than Lyme disease itself.

How has this belief taken hold?

DF: I do not know how or why this has happened, but it would be extremely important to understand. Such an aggressive attack on medical science is very worrisome to me, but the sociological and psychological aspects of disease are out of my area of training and expertise.

There has been a lot of research on Lyme disease, and much of this scientific evidence is publicly available. Is this evidence starting to convince people otherwise?

DF: It is hard to tell. People have all kinds of beliefs that defy science. Evolution is a prominent example. It is hard for me to understand how people can believe they have a chronic infection of Lyme disease when multiple, double-blinded, placebo-controlled studies of such patients have all demonstrated no benefit to prolonged antibiotic therapy. It is even more difficult to understand how people can believe that they have chronic Lyme disease when they have never been exposed to infected ticks. There are chronic Lyme support groups in many states where ticks that could infect humans are not found.

If these people don't have a long-term form of Lyme disease, what do they have?

DF: I am not a physician, so I cannot answer that question. But I do understand science, and the science overwhelmingly indicates that they do not have a chronic infection of Lyme disease.

What do you see as the biggest challenge right now in Lyme disease research?

DF: Finding a way to reduce populations of ticks is by far the greatest challenge. I see no hope of solving this problem without significant progress in this area. The Lyme disease vaccine was a failure for a variety of reasons and there is not likely to be another. Even if there was, these ticks also transmit other diseases such as babesiosis, anaplasmosis and probably more. Babesiosis is also spreading, but at a much slower rate than Lyme disease. I see no reason why babesiosis will not someday affect as many people as Lyme disease does today, and it is a much more serious disease. It could ultimately eclipse Lyme disease as the most important vector-borne disease in the country. The organism that causes babesiosis is very similar to that which causes malaria, and scientists have been working on a malaria vaccine for more than half a century. It seems illogical to invest so much money in vaccine development and so little in tick control.

You have worked around ticks a long time. Have you ever been infected with the disease?

DF: I think Lyme disease is fairly hard to get. You have to be very unlucky. I have been living in areas where Lyme disease is highly endemic for more than 30 years, and I now live close to Lyme, Connecticut. I frequently find ticks on me and I have been bitten many times, probably more than I am aware. I have aches and pains, bad moods, memory loss and I occasionally limp, but I have never had Lyme disease.

Most people have a visceral aversion to ticks. How do you respond to them?

DF: I like weird stuff. There is a lot of it around, so I am never bored. YPH

Michael Greenwood

Building a better BUG TRAP

Research in the remote and rugged terrain of Peru prompts a breakthrough in the way that insects are collected.

The LED-based insect trap (right) is smaller and lighter and uses less energy than traditional light-based collection devices.

By Michael Greenwood

Fieldwork in Peru's Andes Mountains is demanding, especially when it involves hauling heavy equipment to remote sites that are accessible only by traversing the region's rugged terrain.

But the task of collecting insects for the study of vector-borne diseases and other purposes has become a little less onerous since a Yale School of Public Health researcher and colleagues designed a lighter – and perhaps better – trap.

The updated device incorporates modern lighting technology in the form of light emitting diodes (LEDs) that offer researchers conducting fieldwork some distinct advantages over previous light-based designs. The new trap is substantially lighter and more durable and runs far longer in isolated areas where fresh batteries will likely be hard to come by.

LEDs also may be more effective at luring the insects that researchers want to study. This is because LEDs offer much more flexibility in the wavelength of light emitted than conventional incandescent or fluorescent forms of lighting. With an LED, a specific range of light, down to a few nanometers of the electromagnetic spectrum, can be selected. Traditional lighting sources emit light over a much broader range of the spectrum, even across hundreds of nanometers, the vast majority of which is infrared light and cannot be seen by insects. It is, thus, little more than wasted energy.

"It's a boon to fieldwork," Leonard E. Munstermann, Ph.D., senior research scientist in the division of Epidemiology of Microbial Diseases, says of the device, which is now commercially available through a company that supplies field and laboratory equipment to researchers and entomologists. "It was born of the need to travel light."

Courtesy of Leonard Munstermann (2)

Leonard Munstermann (right) and Lorenza Beati, a former research scientist in his lab, use an LED-modified trap to catch sand flies during field research in French Guiana.

The idea for the redesigned device came about several years ago during fieldwork in Peru on the sand fly that causes leishmaniasis, a disfiguring and potentially deadly disease that afflicts people in many parts of South America and other regions of the world.

Munstermann and a then-doctoral student, Lee W. Cohnstaedt, Ph.D. '09, were doing research in three adjacent highland valleys, each of which was separated from the next valley by steep terrain that the fly is incapable of crossing. The setting allowed them to study the evolutionary effects of time—eons of it—on three isolated pockets of sand flies that geography had prevented from breeding with one another. It was a perfect laboratory, but existing light trap technology proved burdensome.

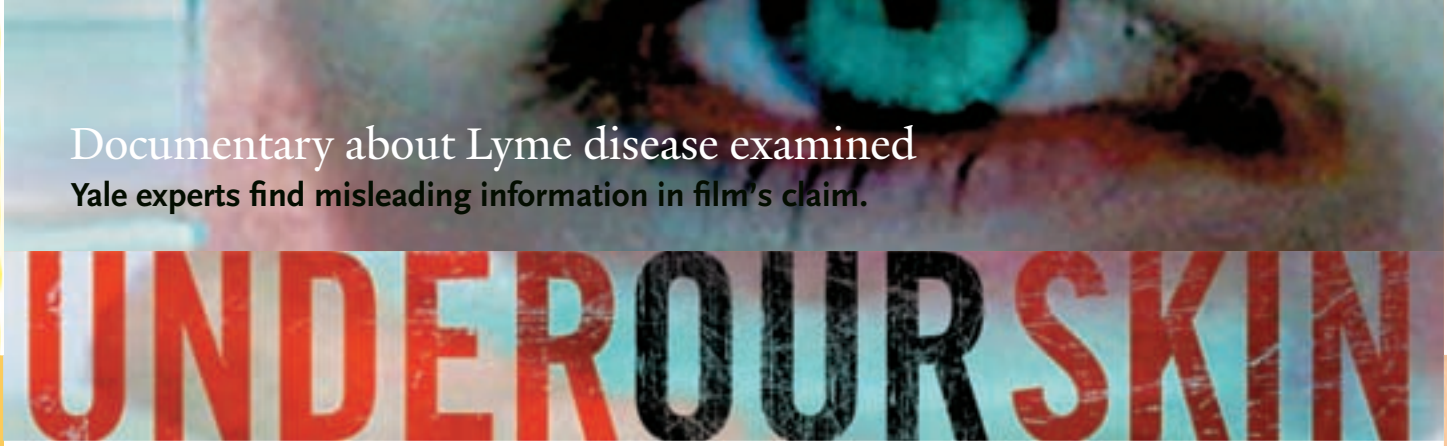
The research required backpacking into each of the isolated valleys and traversing some pretty rough terrain. Under such conditions every pound of research equipment matters, and it was important that, once the equipment was in place, it was able to run for nights at a time on the original batteries. The LED-modified version did all of this, and the light that was emitted resulted in the capture of plenty of sand flies as well. With an abundance of flies to study from each of the region's three distinct valleys, the researchers were able to identify genetic variations among the flies from valley to valley. In short, they uncovered evidence that sand fly evolution was taking place.

The finding has a number of implications, both practical and theoretical. Sand fly specification could affect the resistance to existing pesticides and change the virulence of the pathogens they carry. It also provides researchers with a window into the epidemiology of leishmaniasis and how it might develop in the future. But it complicates things considerably for the taxonomist, requiring molecular genetic methods for distinguishing these closely related species.

As for the LED-modified trap models, they were further field-tested in places such as Colombia and French Guiana and performed well. In one experiment, three types of light sources (LED, fluorescent and incandescent) were used in separate devices to see how many sand flies each caught. The one with LEDs netted 92 flies, compared with 46 for the device using the fluorescent bulb and 65 flies for the incandescent light. The National Institute of Allergy and Infectious Diseases, at the National Institutes of Health, provided funding for the redesigned trap.

Munstermann briefly considered trying to patent the new LED-modified model, but he discovered that the process was both complicated and expensive. And, in the end, there is only a limited market for devices that entrap insects, no matter how good they might be.

Of course, light-based collection devices are only one of the types used to collect insects. Other types of traps rely on animal carcasses, molasses and even piles of fresh manure to entice their quarry. There are no plans, Munstermann notes, to modify any of these. YPH



Documentary about Lyme disease examined

Yale experts find misleading information in film's claim.

By Michael Greenwood

A panel of Yale experts is contesting some of the conclusions and claims about Lyme disease presented in the award-winning documentary film *Under Our Skin*.

The 104-minute movie was considered for an Academy Award and was shown in many states earlier this year on Public Broadcasting Service (PBS) stations. The film portrays real-life stories of people who contend that they are suffering from a chronic form of the tick-transmitted disease and believe that their condition has been either ignored or inadequately treated by the medical establishment.

The film also questions the validity of official medical guidelines on Lyme disease put forth by the Infectious Diseases Society of America (IDSA), which are corroborated by similar guidelines from four other medical societies in the United States and Europe. These guidelines do not support the concept that the Lyme bacterium persists despite standard antibiotic therapy or that the disease frequently results in chronic disability that requires long-term antibiotic therapy.

The three-member Yale panel was moderated by Durland Fish, Ph.D., professor in the division of Epidemiology of Microbial Diseases, who conducts Lyme disease research. The movie was screened in Winslow Auditorium, and the panel invited questions from members of the Yale community in attendance.

While Lyme disease remains an important public health concern and is actively studied at Yale, panel members Peter J. Krause, M.D., senior research scientist and lecturer in the division of Epidemiology of Microbial Diseases, and Eugene D. Shapiro, M.D., professor of pediatrics, described the film as misleading, especially for people who become infected with the illness and may be influenced by the film's often poignant and moving scenes of suffering.

Krause and Shapiro argued that several research studies have found no scientific basis for the claim that the bacterium that causes the disease survives in the human body long after conventional therapy. Further, they argued, the extended use of antibiotics, a treatment advocated by some, cannot be medically supported. They pointed out that several rigorous clinical studies have found no benefit to patients of long-term antibiotic therapy and that substantial adverse effects can occur. However, Krause and Shapiro said that most academic and practicing physicians do not deny the fact that some patients who have had Lyme disease have persistent symptoms following their disease and that further research on the cause of these symptoms is needed.

Shapiro appeared in several scenes of *Under Our Skin,* and both Fish and Krause had their photos and names shown during the course of the film. All three were co-authors, along with 11 other Lyme disease experts, of the controversial IDSA guidelines on the clinical assessment, treatment and prevention of Lyme disease. The guidelines were investigated by the Connecticut Office of the Attorney General, but a review panel formed as part of an agreement with the office unanimously upheld all of the original guidelines last year, a fact that is not mentioned in the film. The IDSA guidelines are available to physicians to help them decide what treatments are best for their patients.

In response to the other panelists' comments and audience questions, panelist Abigail Dumes, a Yale doctoral candidate in anthropology who is conducting dissertation research on Lyme disease, cautioned that no issue related to the disease is black and white. She argued that it is important to recognize that there is disagreement about Lyme disease within the scientific community and that there are significant communication barriers between the sides.

When asked by Fish whether they thought the showing of *Under Our Skin* on more than 100 PBS stations throughout the country was in the best interest of public health, Krause and Shapiro said that the film should only be shown in conjunction with information from other agencies such as the Centers for Disease Control and Prevention, to provide viewers with a more balanced view of the issues.

Lyme disease is the most prevalent vector-borne disease in the United States, but Fish warned that its misdiagnosis and mistreatment are becoming a significant public health problem in their own right. Research on Lyme disease and other tick-borne diseases such as babesiosis is ongoing and many questions remain unanswered, panel members said.

YPH

Tracking HPV

Disparities persist in Connecticut despite promising new vaccines.

By Denise Meyer

As a public health issue, human papillomavirus (HPV) is recognized as a serious threat. Millions of people become infected each year in the United States alone, and younger men and women are most affected by this sexually transmitted infection.

Even in its milder forms, infection causes substantial symptoms, such as warts in the genital region. Other people face an even more devastating diagnosis: cancer—including cervical, throat, head and neck. Cervical cancer alone causes the death of over 4,000 women in the United States every year.

Two HPV vaccines introduced in the past few years were welcomed by the public health community as important tools in fighting the spread of the virus and in addressing the wide racial and economic disparities associated with HPV infections. But narrowing that gap may be tougher than some thought.

Ongoing monitoring of HPV vaccine impact in the state by Connecticut's Emerging Infections Program (EIP), a program within the School of Public Health, shows that significant racial, ethnic and economic disparities in the incidence of cervical disease associated with HPV persist. As alarming, researchers have documented significant racial and socioeconomic differences in who does and does not get the vaccine as recommended.

"The degree to which the HPV vaccine can narrow disparities in cervical cancer depends on adequate and targeted vaccine uptake for those at greatest risk, namely low-income women and racial and ethnic minorities," says Linda M. Niccolai, Ph.D., lead researcher on the monitoring project and associate professor in the division of Epidemiology of Microbial Diseases. "The development and licensure of these highly efficacious vaccines represent a tremendous public health achievement. Now we must work to ensure that they reduce not only the overall burden of disease but also the striking health disparities. Clearly, enhanced efforts are needed to achieve this goal."

Researchers at EIP started monitoring the vaccine's impact in 2008, two years after Gardasil, the primary vaccine being used in the United States, became available for use. A second vaccine, Cervarix, was licensed in 2009. Both require three doses and offer protection against two strains of HPV that cause the majority of cervical cancers.

The vaccine is recommended for 11- and 12-year-old girls and as a "catch-up" immunization for women through the age of 26. The data, however, suggest that it is not reaching the populations at greatest risk—minorities and girls from low-income households.

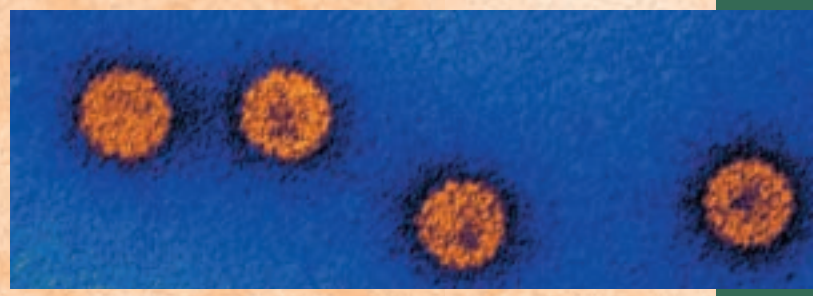


Photo Researchers

Human papillomavirus (HPV) particles are revealed under a powerful microscope. HPV causes warts, and some strains are associated with cancers, especially cervical cancer.

One barrier to vaccination is the necessity of three doses. While the cost is generally covered by either private insurance or the federal Vaccines for Children program, data from national studies reveal that rates of compliance in getting all three doses are significantly lower among African-Americans (47 percent) and Hispanics (42 percent) than among Caucasians (62 percent).

Furthermore, adolescents living below the poverty level are much less likely to complete the three-dose course than those with a household income greater than $75,000 (41 percent versus 63 percent). Interventions that could help with compliance rates include more parental and provider education, implementation of reminder systems and computerized immunization registries or flagging of charts. Interventions that address financial barriers to repeat visits to a health care provider and culturally relevant measures may also be called for.

Niccolai and her colleagues also found other barriers to vaccination, including the lack of a recommendation by a health provider, and women's beliefs that they were "too old" for the vaccine or that they did not need it because of a previous HPV diagnosis—neither of which is accurate. Furthermore, racial disparities emerged in the timing of vaccination: African-American women were significantly more likely to receive their first dose after a diagnosis of cervical disease than were Caucasian women. "This racial disparity suggests that black women are remaining disproportionately vulnerable to the consequences of HPV infection." YPH

An epidemic turns 30

Yale conference examines new AIDS research, treatment and prevention.

It's been 30 years since the first cases of AIDS were diagnosed. The virus has since caused untold suffering and millions of deaths throughout developed and developing countries. And while new research on its treatment and prevention has made progress, HIV/AIDS remains a prevailing public health threat.

A daylong conference sponsored by Yale's Center for Interdisciplinary Research on AIDS (CIRA) in March examined the state of the epidemic—particularly among the poor and in communities of color—and the latest scientific research that is being conducted to slow the disease's spread. Over 300 scientists, students, community members, researchers and others attended the event.

Paul D. Cleary, dean of the Yale School of Public Health and director of CIRA, recalled his optimism as a young researcher that the new virus would be quickly contained. Not only did that not happen, but today, he noted, there is hardly a person who has not been affected directly or indirectly by the virus.

"We have not finished with our work," said Elaine O'Keefe, M.S., CIRA's executive director. "Thirty years into the epidemic, AIDS research, service and activism matter as much as they did in the early days, before we knew the cause of AIDS and before the advent of effective therapies to stem the progression and severity of the disease. For all our efforts, HIV disparities persist."

Among the topics explored at the conference were whether the biomedical and behavioral sciences can successfully converge to meet the challenge of reducing the incidence of HIV; the challenges of accessing treatment, care and support faced by those with the virus; HIV transmission trends in Connecticut; and a series of updates on what is happening with the disease outside the United States.

The biennial event—the 10th sponsored by CIRA—started with a moment of silence for actress Elizabeth Taylor, an outspoken activist for AIDS awareness, research and finding a cure, who passed away only hours before the conference started. Connecticut Gov. Dannel P. Malloy, meanwhile, issued a proclamation that designated March 23 as AIDS Science Day in Connecticut.

In her plenary address, Judith Auerbach, Ph.D., vice president of research and evaluation at the San Francisco AIDS Foundation, opened the conference with a cautious note on future funding for AIDS research. A faltering economy and tight budgets have led some members of the U.S. Congress to call for rolling back HIV/AIDS funding to 2008 levels. These proposed cuts are ominous at a time when more people living with HIV/AIDS are being identified and accessing government-funded care.

"It's going to be quite serious if that goes through," she told the gathering at the Omni New Haven Hotel. "We'll see budget fights. We'll see politics. These are challenging times for HIV prevention."

Scientists from Yale and other organizations provided brief overviews of the diverse research projects that are under way to stem the spread of the disease. They include how relationship satisfaction among young couples having a child affects risk for developing sexually transmitted

Joanne Wilcox (3)

infections; understanding the relationship between HIV testing and condom use among drug offenders recently released from prison; using social media for patient support; and drug funding policies in the United States.

Kimberly Hieftje, a postdoctoral associate at the Yale School of Medicine, explained her research group's plan to develop a role-playing video game with an HIV prevention theme for at-risk adolescents. Players would control an avatar that is faced with health-related choices. The player's decisions will be reflected in the avatar's health as the game progresses.

> Dozens of people discuss their defining moment with HIV/AIDS in a series of short videos taped at AIDS Science Day 2011. The videos can be viewed at *youtube.com/CIRAcenter*.

The keynote panel featured Marjorie Hill, chief executive officer of Gay Men's Health Crisis, the first and oldest AIDS service organization in the country based in New York City, and Stephen F. Morin, Ph.D., director of the Center for AIDS Prevention Studies at the University of California, San Francisco, in a discussion of the ways that the biomedical and behavioral sciences are converging to reduce HIV incidence.

"Thirty years ago we raised hell and helped people die," said Hill, recalling the early years of the AIDS epidemic. "Now, with antiretroviral drugs, we help people lead normal lives."

The conference spotlighted only a portion of the AIDS-related work that is ongoing at the School of Public Health, CIRA and throughout Yale.

Above: Jordan Sloshower, a student at the Yale School of Medicine, explains his research on HIV/AIDS vulnerability and risk among female sex workers in rural India.

Opposite top: Attendees at AIDS Science Day applaud the ongoing research and educational initiatives at Yale University to combat the spread of the virus.

Opposite bottom: Gerald Friedland, a prominent AIDS researcher and clinician at Yale, listens intently to the latest research findings presented during the daylong event.

A number of other Yale scientists, for instance, contributed to a series of articles published recently in a special issue of *JAIDS: Journal of Acquired Immune Deficiency Syndromes* on integrating buprenorphine/naloxone treatment into HIV clinical care for opioid abuse.

Dean Cleary, meanwhile, chaired an Institute of Medicine report that found that the HIV care system in the United States is being swamped by a rising tide of new patients. More people with the virus are being identified and improved treatment is extending lives. These gains, in turn, are taxing treatment centers.

"Our system is getting stretched," said Cleary. "When we begin treating this many more people, we find that there are barriers to getting them into available treatment facilities. Still, there is reason for optimism with the new investment in a National HIV/AIDS Strategy and a more coordinated approach. We are a clever and caring nation. We will find ways to reduce the burden on the system and providers." YPH

Michael Greenwood and Denise Meyer

Students

SIX PATHS

Incoming students with different backgrounds, interests and goals all share a common passion for public health.

By Cathy Shufro

Stephanie Davis

Thomasville, Ga.

Advanced professional M.P.H. program

Stephanie Davis' duties as an Air Force doctor included an appointment with the upper atmosphere.

As a flight surgeon at Fairchild Air Force Base in Washington state, she provided air crews with health care. "I experienced the same physiological environment that the air crews experienced," she explains.

You might trace her career path back to her days judging dairy cows in her 4-H club. This led her to veterinary school at Tuskegee University on an Air Force scholarship. She went on to spend four years as an Air Force Public Health Officer and then attended medical school. Her career has included one deployment to Bahrain and two to Kyrgyzstan, where, among other things, she helped refuel U.S. and coalition aircraft. Davis was recently selected for promotion to lieutenant colonel.

Yale is her latest assignment for the Air Force and she welcomes the chance to expand her knowledge. "To be able to focus on one thing is really refreshing right now."

Margaret Lippitt

Talbotton, Ga.

M.P.H. program

When Margaret Lippitt went to Panama to teach English during the summer of 2005, she thought she'd be learning about educational disparities and about how to teach.

"But the parts of my experience that stuck with me were how basic health issues affected the community I was working with," she says. "The children I was teaching were so malnourished that they had problems staying awake."

The next time she went abroad, during a year off from college, Lippitt chose a public health job, working in Brazil on issues of reproductive health and domestic violence. After graduating from Georgetown University, she worked at the U.S. Department of State, coordinating the work of the U.S. President's Emergency Plan for AIDS Relief with that of other organizations.

She hopes to do similar work after graduating fromYale. "I'm really interested in working with sexual and reproductive health, particularly in vulnerable populations such as sex workers and injection drug users."

Petter Risøe

Oslo, Norway

Advanced professional M.P.H. program

Petter Risøe already has a medical degree, and he's nearly completed a doctorate on how genes affect people who develop postoperative infections. He also studied law for a year while on paternity leave with his oldest child.

He has come from Oslo to Yale to hone his research skills. "The prime reason for coming is for a good toolbox for doing high-quality studies later on," he says. "One of the good things about America is you put a lot of emphasis on methodology in your science training, more than they do in Europe."

One resource for research is Norway's long-term study of 110,000 pregnant women and their children, the Norwegian Mother and Child Cohort Study. "It will be a gold mine as these people grow up and develop certain diseases," Risøe says. "There are endless possibilities."

He and his wife, immigration lawyer Christine Oppegaard, are settling in with their three children, including a newborn.

"It's nice to invest the time in learning the skills to do good, good science," says Risøe. He's especially interested in biostatistics, epidemiology and clinical research design. "Then you go on and design good studies," he says. "I want to use what I learn to improve the world."

114

incoming M.P.H. students

Kelsey Schuder

Waukesha, Wis.
Joint-degree program

Kelsey Schuder found her calling while teaching the warrior pose in Turkmenistan.

Leading a yoga class in Central Asia was one stop on what she describes as "a long and winding road" to Yale. Schuder planned to go to medical school, but she wondered if medicine was the right fit. To get perspective, Schuder joined the Peace Corps.

In her village in Turkmenistan, she discovered that middle-aged women often became quite overweight after raising their children.

The women wanted to exercise. The problem? Exercise violated cultural norms. "Working out is not seen as a woman's right in Turkmenistan," says Schuder. "Unless they're walking to a specific destination, they're supposed to be at home."

Schuder helped village women negotiate to set up a workout center at the local health center. In a village of 2,000, nearly 200 women each week went there to use the treadmill and exercise bicycle and to do yoga. The reaction from local men? "The only thing I heard from the men was, 'Why can't we have one?'"

Longer term, Schuder says she would like to use her public health training in a refugee camp, in a war zone or in the aftermath of a natural disaster.

29
students from other countries

25
states represented

Ana Sierra

Tegucigalpa, Honduras
M.P.H. program

Ana Sierra was born on the Miskito Coast of Honduras, a place so remote that a kayak or small plane is needed to get there.

On the other hand, her childhood was spent at Harvard alongside her father, who was completing his postgraduate studies in international and tropical public health.

"When people ask me where I'm from, it's hard to say," she says, given that she has relocated 10 different times with her parents, who have served as missionaries to various ethnic groups in Honduras.

Her interest in research began at Bethel College in Indiana, where she completed her undergraduate degree as she aided in establishing the Undergraduate Research Lab and Program. But while in the lab, she missed her real passion in life, which mirrored her parents' work—"working with people."

She comes to Yale after spending more than two years in the impoverished southwest of her home country, where she taught at Abundant Life Christian School. Her experiences in Honduras and around the world have led her to the division of Environmental Health Sciences and, ultimately, she hopes, to a career as a public health consultant.

Gihoon Sung

Naperville, Ill.
Joint-degree program

Gihoon "G" Sung is fascinated by risk.

He discovered this interest while taking a risk management course as an undergraduate at the Wharton School of the University of Pennsylvania. He describes the field as the study of "what types of risks are involved in making a decision; how those risks are assessed; and using that knowledge to predict how populations will manage the risks."

Not surprisingly, studying risk within health care also appeals to Sung.

After working for several years as a health care actuary in the insurance and consulting sector, Sung saw the importance of experiencing a breadth of roles in health care delivery. He came to Yale to broaden his vision. He wants his understanding of the health care system to integrate the viewpoints of all the major stakeholders, and he feels that the School of Public Health will help him accomplish that.

Sung spent last year at the Yale School of Management and was impressed with the experience. People were willing to sit down and discuss his professional goals and improving skill sets.

"I'd like to be a thought leader in the [health care] area, to look at things more holistically and make recommendations to further health care in the United States," he says.

Cathy Shufro is a freelance writer in Woodbridge, Conn.

26
average age

Alumni Spotlight

A MASTER MODELER

An alumna devises a mathematical formula that removes the guesswork from fighting a dreaded tropical disease.

By Jack El-Hai

Growing up in Rio de Janeiro, Paula Mendez Luz was well-acquainted with dengue fever. The disease was part of everyday life in the Brazilian city.

"Anyone in Rio would have to know some people who had come down with it," she says. Most of the time, the mosquito-borne viral disease leaves its victims bedridden for several days with a high fever, muscular pain and bad headaches. Occasionally, though, the illness evolves into a life-threatening form, dengue hemorrhagic fever, which produces internal bleeding and may lead to circulatory system failure. Death is a potential outcome.

In both guises, the disease has a long reach, afflicting some 50 million to 100 million people annually (many of them children), and it wreaks social and economic havoc across a wide swath of the globe, including parts of the Americas, Africa, southeast Asia and the eastern Mediterranean. There is no vaccine or effective treatment. The mosquito carriers of the virus, primarily the species *Aedes aegypti*, thrive in the growing and densely populated urban areas, and the incidence of dengue fever is increasing.

Luz, M.D., who earned her Ph.D. at Yale in the epidemiology of infectious diseases in 2009 and now works as a researcher at the Evandro Chagas Clinical Research Institute of the Oswaldo Cruz Foundation in Rio de Janeiro, has seen public health authorities try to eliminate the insect hosts through a variety of methods.

They have targeted the mosquitoes as larvae and as adults, both indoors and outdoors. Oftentimes, government officials apply insecticides to breeding sites for larval control or, for adult control, spray them into the air from cars and backpacks.

When it comes to dengue fever, many methods of control are possible. Luz and a team of colleagues wondered which of 43 control strategies work best over a span of years and are most cost-effective. They published their results this year in *The Lancet* and in the process delivered some sobering news: the most common dengue fever control efforts are nearly worthless and may even contribute to the spread of the disease. The question now is whether public health authorities will pay attention.

A mathematical approach

Luz's expertise in developing analytical tools, nurtured by her childhood interest in mathematics and chemistry, was crucial in bringing the dengue study to completion. Together with her Yale adviser, Alison P. Galvani, Ph.D., associate professor in the division of Epidemiology of Microbial Diseases, she created a mathematical model that simulates the transmission of dengue fever from person to person via the mosquito carrier.

The model takes into account a complex tangle of variables that influence the efficacy of mosquito control measures: insecticide resistance, seasonality, larval versus adult control, frequency of insecticide application, mosquito birth and death rates, rate of egg production, incubation period, biting rate, the susceptibility of victims, economic assessments and the human risk of death from infection, among others. An especially important part of the model considered a factor known as herd immunity, a form of immunity that occurs when a percentage of people become immune to a virus and can thus block transmission to other susceptible victims.

"If in one year dengue affects a lot of people," Luz says, "then the next year there may not be enough susceptible people to sustain widespread transmission of the disease."

In the end, the model yielded 10,000 estimates projected over five years for the outcome and cost of each control strategy. "The model is very complicated, and it includes 28 differential equations," Luz says.

Devising it was a colossal undertaking. What accounts for her determination to find a solution to such a problem? Luz traces her passion for research back to her childhood, when she and her brothers accompanied their mother, an academic, to university libraries where Luz could study and see her mother study.

Christian Tschudi, Ph.D., professor in the division of Epidemiology of Microbial Diseases, who also served as Luz's adviser, believes that a combination of qualities enables Luz to face tough scientific challenges. "She has a great ability to focus and to pinpoint important aspects of

her research, which shows her maturity as a scientist," he says. "She's motivated by strong curiosity and a great desire to improve the health of the public."

When Luz first arrived at Yale, she worked in Tschudi's lab doing basic benchwork that resulted in her co-authorship of a paper in *Molecular Microbiology* on genomic rearrangements in the parasite that causes sleeping sickness. For a time, she considered changing her specialty from computer and mathematical analysis to wet-lab research. Since then, Luz has contributed to published papers on a wide range of topics, including cervical abnormalities in HIV-infected women, sepsis as a determinant of outcome among HIV/AIDS patients, evolutionary epidemiology and modeling transmission dynamics of neglected tropical diseases.

"I like to build mathematical models and evaluate them," she says. "Or when conducting statistical analysis, I like to manage the data and carry out the necessary analysis. The other parts of research are also fun, but the analytical methods are definitely what intrigue me."

What's easy isn't efficient

Luz and her collaborators discovered that over the model's five-year period, the customary methods of controlling *Aedes aegypti*—applying insecticides to breeding sites to kill the larvae—were not the most effective or cost-efficient, even though larval control can persist for up to two months.

The model showed that targeting larvae reduces the incidence of dengue fever only for the first two projected years, after which the efficacy of this control method plummets because the mosquitoes develop resistance to the insecticide and the human population experiences less herd immunity.

Consequently, dengue outbreaks can worsen in years three through five. Killing adult mosquitoes brings much better results, which is not necessarily an intuitive conclusion because a single application of adult insecticide remains effective for only one day. But the mosquitoes are less likely to develop resistance, and herd immunity can be relied upon to inhibit the transmission of dengue fever in the later years. Luz and the other researchers recommend six applications of high-efficacy adult insecticide per year to reach the highest standard of cost-effectiveness.

Luz believes that public health authorities in areas plagued by dengue fever should re-examine their control policies, with the goal of eliminating reliance on larval control. "I hope my research shows the need to do effective adult control instead," she says. "The spraying needs to be done indoors and inside homes, which is the only way to achieve a 90 percent mortality of the mosquitoes." She harbors no illusions, however, that the study will ignite immediate changes in governmental actions against dengue fever, which are rooted in the tradition of locating and destroying mosquito breeding sites. "Governments work in their own way, and if they find something interesting in our study they will take it into account."

Such resignation does not diminish the importance of the study, which broke new ground in assessing the efficacy of control methods.

"It took about two years to get published and a long time to be reviewed for *The Lancet*, which does not very often publish on tropical diseases," Luz says. "I'm really satisfied with the result." YPH

Jack El-Hai is a freelance writer in Minneapolis, Minn.

Courtesy of Paula Mendez Luz

Paula Mendez Luz helped to develop a mathematical model that simulates the transmission of dengue fever and discovered that current methods to control the mosquito host may not be effective.

> "I like to build mathematical models and evaluate them."
>
> *– Paula Mendez Luz*

Alumni Spotlight

The health of women WARRIORS

An alumna devotes her research to helping a growing segment of the armed forces.

By Theresa Sullivan Barger

Women today make up about 20 percent of the armed forces, and America's military leaders have told Congress that they are vital to the success of ongoing operations in Iraq and Afghanistan.

These female soldiers drive military vehicles, patrol roads and work as medics. They carry and shoot guns. They are fighter pilots and instructors. They command vessels at sea and operate missile battalions. In short, women are involved in nearly every aspect of today's military.

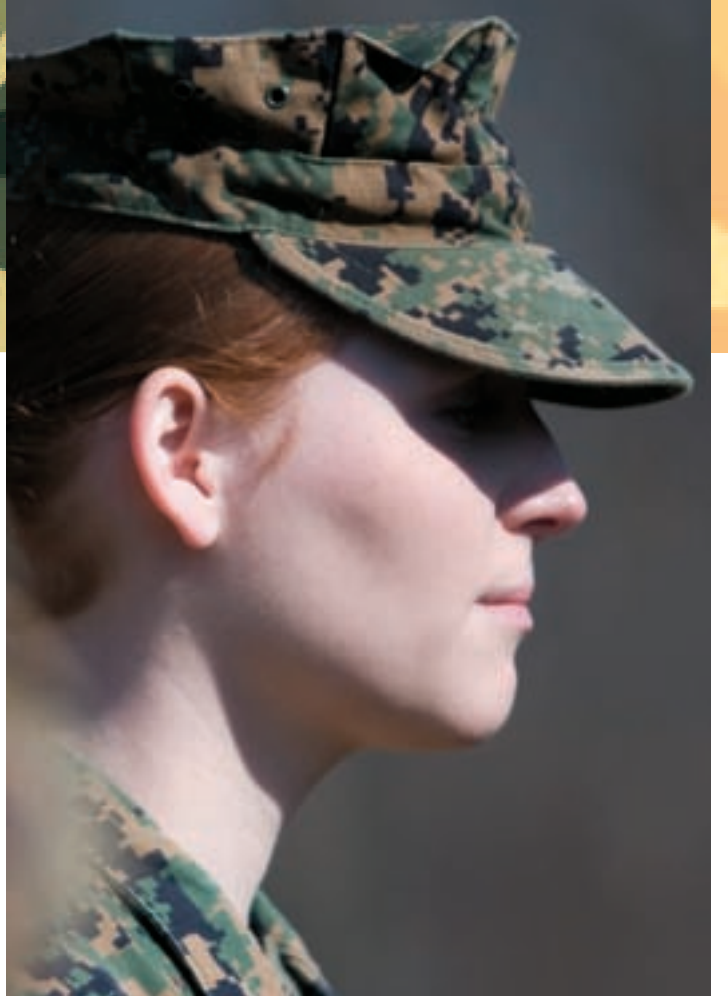
"Women are doing the job. America does rely on them," says Connecticut Commissioner of Veterans' Affairs Linda S. Schwartz, R.N., M.S.N. '84, Dr.P.H. '98, president of the National Association of State Directors of Veteran Affairs.

Indeed, more than 150,000 women soldiers have been deployed in Iraq and Afghanistan alone, and 44 percent of them have received some type of treatment from the Veterans Health Administration (VHA) upon their return home. But in what ways does military service affect women? This question is the basis of a new field of research, and many of the findings are still preliminary.

A team of Yale researchers is now working with the VHA to better understand the consequences of combat for women and their needs away from the war zone in order to help them lead healthy lives.

One member of that team is Kristin M. Mattocks, M.P.H. '99, Ph.D. '05, whose work with people with HIV led to her research on veterans and now, in particular, female veterans. Mattocks has devoted her research to the issue because she feels that it can make a tangible difference in their lives.

"I'm so committed to this work," says Mattocks, associate chief of staff for research at the Northampton VA Medical Center in Massachusetts, assistant professor of quantitative health sciences at the University of Massachusetts Medical School and lecturer in public health at Yale. "We're all working to make the VA a place that women can get the health services they need."



Some 150,000 women have served in the U.S. Army in Iraq and Afghanistan in a variety of roles.

A deep respect

Although not a veteran herself, Mattocks has developed a deep respect and appreciation for veterans through her many hours of interviews. She admires the patriotism of women soldiers, who are often torn about leaving behind babies and toddlers to serve their country.

In a six-year study that appeared recently in the *Journal of Women's Health*, Mattocks, the principal investigator, and a team of researchers found that 32 percent of pregnant women veterans received at least one mental health diagnosis after returning from deployment, while only 21 percent of women veterans who were not pregnant received mental health diagnoses. In addition, the study of some 43,000 women veterans being treated at the VA Connecticut Healthcare System in West Haven found that those who were pregnant were twice as likely to have a diagnosis of depression, anxiety, post-traumatic stress disorder, bipolar disorder or schizophrenia as their nonpregnant peers.

While researchers were surprised by the findings, they need more data before drawing firm conclusions. The

"The VA cares for a large patient population of poor, disenfranchised individuals, and I guess I feel very connected to the larger social mission of the VA."

—Kristin Mattocks

Lisa Wilder

Kristin Mattocks

pregnant veterans who choose to receive care in the VA system, for instance, may be different from other women veterans receiving VA care. In Mattocks' study, the pregnant women veterans were younger and more likely to be single and have less education, and they might have chosen the VA because they could not afford private health care.

"Our data may reflect that women with mental health disorders are more likely to use the VA to pay for their pregnancies, not necessarily that pregnant veterans are more likely to have mental illness," says Sally G. Haskell, M.D., a member of the research team who worked with Mattocks on the study. Haskell serves in a leadership role with the Women Veterans Health Strategic Health Care Group in Washington, D.C.

Pregnant veterans also face other challenges. Many VA hospitals are still not equipped to provide obstetrical care, so these veterans are often seen by a community-based doctor. Historically, Mattocks says, the private doctor and the VA medical staff have not communicated, so the VA wouldn't know the outcome of the pregnancy or whether there were complications relating to military service.

Partly as a result of Mattocks' study, the VA is in the process of developing coordination and tracking mechanisms to ensure that community-based obstetricians and VA providers can communicate important information regarding prenatal health and pregnancy outcomes for women veterans. The tracking system will collect data on babies born to women veterans, including whether there are any problems, such as premature birth or low birth weight.

"That's a great example of how research can drive practice and policy decisions at the federal level," Mattocks says. She hopes to be able to eventually study the data to look for patterns and, ultimately, to contribute to policies and practices that can improve maternal and infant health.

Mattocks' recent paper is actually a substudy of a larger project, known as the Women Veterans Cohort Study. This larger study is examining gender differences in health care utilization, as well as costs and outcomes among veterans who have served in Iraq, Afghanistan and surrounding military support areas.

A social worker at heart

In 1993, about a year after graduating from college with degrees in biology and psychology, Mattocks was working in a biotech lab when she read a book that changed her life. In the book, *And the Band Played On: Politics, People, and the AIDS Epidemic*, author Randy Shilts detailed the discrimination faced by those with HIV/AIDS. The book so moved the then-23-year-old Mattocks that she vowed that she would eventually work with HIV/AIDS patients.

"I was initially torn about whether to apply to medical school or public health school, but I felt more connected to social justice issues rather than treating patients directly, so I opted for a public health education," says Mattocks.

She was drawn to the Master of Public Health program at Yale, in large part because her degree required work on a community project. During a health policy class taught by Mark J. Schlesinger, Ph.D., professor in the division of Health Policy and Administration, Mattocks discovered a passion for public policy.

"It's funny because I think that's why I enjoy being at the VA so much," she says. "The VA cares for a large patient population of poor, disenfranchised individuals, and I guess I feel very connected to the larger social mission of the VA."

Mattocks wrote her dissertation on the stigma and discrimination faced by those living with HIV, and YSPH's Amy C. Justice, M.D. '88, M.Sc., Ph.D., associate professor in the division of Health Policy and Administration, invited her to conduct research as part of her National Institutes of Health study on aging veterans living with HIV. Under the mentorship of Justice and Dean Paul D. Cleary, Mattocks received an American Foundation for AIDS Research fellowship to investigate issues of HIV conspiracy theories and physician mistrust among HIV-infected veterans.

After conducting in-depth interviews with about 50 HIV-infected men for this project, Mattocks knew she wanted to spend the rest of her career working with veterans.

She turned her focus to women veterans to respond to a need. With some 75,000 women veterans from the Iraq and Afghanistan conflicts treated by the VA, the department has been eager for data that can inform strategy decisions to help this growing population.

"You can do a study, get findings, work directly with the policymakers in D.C. and say, 'This is what my findings were.' They are very invested in research to guide policy," Mattocks says. "I don't know of a better environment to be linking research to policy." YPH

Theresa Sullivan Barger is a freelance writer in Canton, Conn.

Alumni Day 2011

Keynote speaker Christopher Portier spoke about the health effects associated with global warming.

Public health professionals play a vital role in meeting the challenges of climate change.

Warnings about global climate change from the environmental community have largely gone unheeded, but public health professionals have the ability to reframe the debate and move the issue into the public's consciousness.

Public health workers are listened to, but so far they have been largely silent on the topic, Edward W. Maibach told a gathering at the School of Public Health's annual Alumni Day. He contended that the environmental sciences have run their course on the issue and that two-thirds of Americans have negative perceptions of environmentalism.

"You are the answer," said Maibach, M.P.H., Ph.D., director of the Center for Climate Change Communication and professor in the Department of Communication at George Mason University. "There is a lot that can be accomplished by reframing climate change into human health issues."

All of the speakers agreed that the consequences of climate change on human health will be profound.

Global warming will eventually affect virtually every area of human health, including respiratory ailments, cancer, food-borne diseases, nutrition, human development, mental health and heat-related mortality, said the keynote speaker, Christopher J. Portier, Ph.D. The director of the National Center for Environmental Health and the Agency for Toxic Substances and Disease Registry at the Centers for Disease Control and Prevention, Portier outlined a wide range of public health implications and the need for more research in order for communities worldwide to adjust to the consequences and mitigate the effects.

Portier also called for strengthening not just the public health infrastructure, but health care itself, which he characterized as "not organized or optimized." Infrastructure and capacity improvements are needed worldwide to meet the shifting spectrums of disease, populations and ecosystems.

Some climate models, said Portier, show regions of the world becoming more arid, while other areas will become increasingly coastal. Farming and food production will need to change, he said, pointing to the example of Finnish potato farmers who have been faced with earlier-than-usual blight. In Alaska, warmer coastal water temperatures are causing parasitic blooms and melting permafrost, forcing some people to move inland and jeopardizing water and sewage safety in other communities.

Throughout history, said Portier, change and progress have resulted from failures. The ineffectiveness of witch doctors led to the science of medicine; the plague and dysentery led to improved sanitation; and disease spreading across continents spurrred immigration control. He cautioned, however, that failure to meet the challenges of climate change might be too severe to recover from.

"The planet is on the edge. We don't want to find [out] the consequences here," he said.

Vectors, heat waves and research

Two of the panelists, Durland Fish, Ph.D., and Jeremy Hess, M.D., M.P.H., further probed the effects of climate change in their particular areas of specialty.

Fish, professor in the division of the Epidemiology of Microbial Diseases at Yale, called for broadening the field of environmental health to include vector-borne diseases, noting that other biologic disciplines are further along in understanding the importance of climate change. Fish pointed to the mosquito as an example of how unprepared we are for evolution of the species and of disease. "West Nile virus was the scariest thing that ever happened in my career," he said.

Warming temperatures will increase mosquito populations and lead to higher mortality for all mammals, not just humans, potentially impacting food supply, he said. Mosquito species will move to new locations and earlier foliage will extend their breeding season in many climates, allowing for more reproductive cycles. As a result, Fish predicted, malaria, dengue fever and other tropical diseases will affect many more parts of the world.

Hess, assistant professor at the Emory schools of Medicine and Public Health, described the narrow range of thermal comfort humans have and how the 2006 heat wave in California resulted in 1,000 emergency department visits and 140 deaths.

"Mitigation is not enough," said Hess, "we need to adapt." Those adaptations may include not only the development of emergency plans, but also measures such as planting more trees in cities and altering building techniques to keep buildings cooler. "We need to pay attention to extreme events."

Social media as a health tool

The gathering began with a professional-development workshop featuring Peggy Neu, president of the Monday Campaigns. She explained how the Meatless Monday campaign was developed and promoted through relatively inexpensive outlets such as social media and the blogosphere.

The group's initial goal was to reduce American meat consumption by 15 percent to more closely align with the Institute of Medicine's dietary guidelines. Recent polls show that 50 percent of Americans know about Meatless Monday and that it has influenced 27 percent to consume less meat.

The group has since launched a number of other public health initiatives, including Quit & Stay Quit Monday and Move It Monday!, which seek to reduce smoking and promote exercise, respectively. It is also launching a new initiative—Man Up Monday!—to encourage men in Harlem to take more responsibility for their sexual behavior and health.

The organization distributes free educational and promotional materials on its website and has partnerships with national health organizations and the schools of public health at Columbia, Johns Hopkins and Syracuse universities.

"We've stolen a day of the week for health," Neu said. YPH

Denise Meyer

Alumni Day 2011 awards

Patrick A. Charmel, M.P.H. '83, president and chief executive officer of Griffin Hospital and its parent organization, Griffin Health Services Corp., was presented with the Distinguished Alumni Award.

John Brownstein, Ph.D. '04, assistant professor at the Harvard Medical School and research faculty at the Children's Hospital Boston Informatics Program, was given the Eric W. Mood New Professional Award.

Travis Hedrick, Ph.D., M.P.H. '77, received the YSPH Alumni Bulldog Award.

Lloyd M. Mueller, Ph.D. '84, was inducted into the Alumni Public Service Honor Roll.

A slideshow of Alumni Day 2011 can be viewed at *publichealth.yale.edu/news/slideshows/alumni2011.aspx*.

Joanne Wilcox (4)

Top: Alumna Lynne Bannister.

Middle: Longtime friends and colleagues David Pearson and Sue Addiss shared a hug on Alumni Day.

Bottom: Alumnus Eric Triffin donned a pea outfit and alternately a carrot costume to promote healthy eating habits. "Peas be with you," he wished his fellow alumni. He is pictured here with alumna Elaine Anderson.

Alumni News


Marna Borgstrom


Robert Steele


Judy Garber


Rock Positano


Linda Schwartz

1970s

Marna P. Borgstrom, M.P.H. '79, president and CEO of Yale-New Haven Hospital, has been named to the Association of American Medical Colleges 2010-2011 board of directors.

Robert W. Buckingham, Dr.P.H. '78, has been appointed inaugural executive director/dean of the School of Public Health at the University of Saskatchewan.

Selby C. Jacobs, M.D., M.P.H. '72, travelled with the Yale Alumni Service Corps to the Dominican Republic in March. Nearly 100 Yale affiliates took part in the volunteer excursion. For Selby, the trip was a return to the country where he served as a Peace Corps volunteer from 1966 to 1968.

Gilbert L. Rochon, Ph.D., M.P.H. '76, has been named the sixth president of Tuskegee University in Alabama. Gilbert studied health services administration at Yale and earned his Ph.D. at the Massachusetts Institute of Technology in urban and regional planning.

Robert E. Steele, M.P.H. '71, M.S. '74, Ph.D. '75, served as co-director of the Yale University Art Gallery's spring exhibit, *Embodied: Black Identities in American Art*. The Yale exhibit featured more than 50 paintings that engaged issues of race and questioned the meanings that have been assigned to African-American bodies throughout history.

1980s

Judy E. Garber, M.D. '81, M.P.H. '81, was named president of the American Association for Cancer Research at its annual meeting in April.

Rock G. Positano, D.P.M., M.Sc., M.P.H. '89, has been appointed deputy chair of the New York College of Podiatric Medicine (NYCPM) Board. He is director of the Non-Surgical Foot and Ankle Service at the Hospital for Special Surgery in New York City and has been a member of the NYCPM board of trustees since January 2009.

1990s

Linda S. Schwartz, R.N., M.S.N. '84, Dr.P.H. '98, was reappointed by Connecticut's Gov. Dannel P. Malloy to the position of Commissioner of the Department of Veterans Affairs.

2000s

Spiros G. Frangos, M.D., M.P.H. '00, was promoted to associate professor of surgery at the New York University School of Medicine in the section of Trauma, Critical Care and Surgical Emergencies. Additionally, Spiros recently published his first novel, *Reflections in the Stream*.

Have an update?

Your classmates want to hear about you! Help us share your news of a new job, promotion, recognition, marriage, birth of a child, etc. Send items (and photos) to *ysph.alumni@yale.edu*.

Bryan Harper, M.P.H. '05, was appointed global access lead for ViiV Healthcare in England. He will be responsible for leading the interdisciplinary Global Market Access Team, which comprises members from ViiV Healthcare, Pfizer and GlaxoSmithKline.

Kimberly (Affat) Mackey, M.P.H. '07, gave birth to a second baby girl, Kamryn Kayla, on March 24. She weighed 7 pounds, 2 ounces.

Akshara Menon, J.D., M.P.H. '09, passed the Connecticut bar examination. She is currently a research associate at the Yale School of Public Health and is working on the Consumer Assessment of Healthcare Providers and Systems grant with Dean Paul D. Cleary.

Prapti Paul, M.P.H. '04, and her husband, Suman Das, welcomed their daughter, Raika, to the world on May 31. Raika, which means "born out of a prayer/hymn" in Sanskrit, weighed 7 pounds, 3 ounces, and was 20.5 inches at birth.

2010s

Kelley C. Bemis, M.P.H. '11, and **Heather N. Fowler**, D.V.M., M.P.H. '11, have been accepted into the Centers for Disease Control and Prevention/Council of State and Territorial Epidemiologists' Applied Epidemiology Fellowship Program.

Jennifer M. Schmitzer, M.P.H. '11, received the David A. Winston Fellowship from the Association of University Programs in Health Administration.

"Yale is fortunate to have Paul Cleary leading the School of Public Health, and I know you join me in thanking him for his willingness to serve for a second term."

—Richard Levin

Paul Cleary's deanship renewed

Yale's president cites numerous accomplishments, "impressive progress" during past five years.

Yale President Richard C. Levin formally announced the reappointment of Paul D. Cleary as dean of the Yale School of Public Health in June. Dean Cleary's second five-year term began July 1 and will run through 2016. Here is President Levin's full message to the Yale community:

Dean Paul Cleary (left) converses with Richard Schottenfeld (center) and Huaihui Zhang about current HIV research during AIDS Science Day earlier this year.

To the faculty and staff in the School of Public Health:

It is with great pleasure that I announce the reappointment of Paul D. Cleary, Anna M.R. Lauder Professor of Public Health, as the dean of the School of Public Health and chair of the Department of Epidemiology and Public Health. His second five-year term will begin July 1, 2011.

Faculty, staff and students enthusiastically support Dean Cleary's reappointment, noting his commitment to public health, his clear vision for the school and the school's steadily upward trend during his tenure. In his first term, applications for M.P.H. admission have increased 30 percent, to a record number of 1,049 applications in 2010. In September 2009, the new M.P.H. Global Health Concentration admitted its first cohort of students and in 2010 it accounted for 27 percent of M.P.H. applicants. The school's doctoral program also has been independently recognized by the National Research Council as one of the finest in the nation.

Dean Cleary has made impressive progress in developing and expanding the school's public health service and practice activities. A sustainable model for community service activities has been created through the new Office of Community Health, which focuses on regional programs and activities aimed at improving the health of New Haven-area residents. In addition, the school has established the Community Alliance for Research and Engagement (CARE), a transdisciplinary "bench to bedside to community" collaboration with the Yale Center for Clinical Investigation and the City of New Haven's municipal offices, school system and community organizations.

Under Dean Cleary's direction, the school has expanded its research portfolio, especially in cancer prevention, one of the school's core areas of focus. Researchers are currently studying the link between nutrition and exercise and several cancers, including lung, mouth and throat, esophageal, stomach, breast and ovarian cancers. Dean Cleary has strengthened the school's ongoing research on global infectious diseases such as HIV/AIDS, including studies aimed at the prevention of HIV infection and the reduction of the negative consequences of the disease in vulnerable and underserved populations, as well as research on related legal and policy issues.

The school is also deeply involved in Yale's Global Health Initiative, which has developed a strategy for engaging a broader group of scholars at Yale who are making major contributions to global health research and education.

Equal access to quality health care is essential for disease prevention and health promotion for every individual around the world. Faculty, staff and students are actively engaged in the study of health disparities; health care quality, access and delivery; and public and private policy in this country and across the globe.

Yale is fortunate to have Paul Cleary leading the School of Public Health, and I know you join me in thanking him for his willingness to serve for a second term.

Thomas Scully predicts that health care reform in the United States will likely be delayed and that portions of the legislation will be cut as the country seeks to control spiraling debt.

Health care's future

Expert predicts that reform efforts will be "picked away."

While some form of the recent health care legislation passed in the United States will likely survive, its implementation could be delayed for years—even a decade or more—as political leaders search for ways to tame a massive budget deficit that threatens the country's well-being.

In an oftentimes provocative assessment of health care, politics and spiraling national debt, Thomas A. Scully, who served as an administrator of the Centers for Medicare & Medicaid Services (CMS) from 2001 to 2004 and is now senior counsel in the Washington, D.C., law firm Alston & Bird, outlined what he sees as a possible scenario for students and faculty during a Dean's Lecture in April.

Brutal politics (on both sides of the aisle) now prevent a rational discussion of policy and there will essentially be gridlock until the next national election in 2012, he predicted. Democratic President Barack Obama will likely win re-election (he put Obama's chances at 70 percent), but Republicans will retain their majority in the House of Representatives and will probably overcome the slim Democratic majority that now exists in the U.S. Senate.

With this new political landscape, tangible, though painful, financial reform could begin in 2013. This will almost certainly include delaying the implementation of health care reform for several years, or even to 2022 or beyond. Another likely measure will be to raise the retirement age for Social Security and Medicare recipients. The retirement age is now 65; it could be raised in increments to as high as 69 years of age as a means to control spending, he said. There are not many other options.

Scully, who worked for both Bush administrations, described himself as a "mushy" moderate Republican and complimented Obama's landmark health reform several times during his talk, calling it "moral" and the "right thing" to do. "It's not as wildly radical as people thought," he said.

Still, given the country's growing financial crisis, it is unlikely to survive as is. He cited a rapidly growing deficit—(the United States now collects as revenue only 60 percent of the money it spends), legal challenges from several states that could end up in the U.S. Supreme Court and an assertive bloc of very conservative legislators.

"It's going to get picked away and picked away," Scully said during his talk in Winslow Auditorium.

Despite the sometimes dire outlook for the economy and health care, Scully managed to mix his hour-plus-long talk with humor that prompted laughter from the audience.

He noted that he was probably the only Republican within several square blocks and asked the mostly younger crowd if they have ever met a Republican. Recent medical research, he said, has also shown that Democrats do in fact have bigger hearts.

Scully oversaw significant changes during his tenure at CMS that made the massive agency more open and accountable to the public, Dean Paul D. Cleary said during his introduction.

Cleary described Scully's work on Medicare and Medicaid as in "some ways revolutionary" and innovative. "There's arguably not a better person to speak about this."

Scully recalled taking his lumps during his tenure at CMS and how difficult it was to oversee and manage two very political pillars of the American economy. At one point, Scully counted 273 negative newspaper editorials written about him in just one week. Scully expressed admiration for the person who currently holds his former job—Donald M. Berwick—but said he is unlikely to last in the position beyond the end of the term of his recess appointment because of the current political climate.

The lecture was supported by the Laurence ('69) and Judith Weiss Dean's Resource Fund.

Michael Greenwood

Commencement 2011

Graduating class urged to go forth and heal the world.

A steady and driving rain outside Battell Chapel did little to dampen the mood inside, as hundreds of people gathered to celebrate a new generation of public health professionals.

"I've really developed a deep sense of optimism for our future," Paul Cleary, dean of the Yale School of Public Health, told the 118 students earning their M.P.H. degrees in front of celebratory friends and family. "You've chosen careers that will lead to better futures for us all."

Cleary introduced commencement speaker Howard K. Koh, M.D. '77, M.P.H., as a consummate public health professional. "I can think of no better role model for your careers," said Cleary, noting that Koh's many contributions to health even earned him an invitation to throw out the first pitch at a Red Sox game.

Koh, assistant secretary for health at the U.S. Department of Health and Human Services, recalled his days as a student at Yale, when he listened to the late William Sloane Coffin Jr., a clergyman and peace activist, speak inside the same ornate chapel where Commencement was held. Coffin talked about the widespread human suffering found throughout the world and asked his audience what they would do to lessen it. Koh said the question is just as relevant today and that it is now up to the Class of 2011 and others to address it.

"We need each of you to add your healing touch," Koh said. "We hold in our hands the promise of better health."

Koh described public health as a "unique passion" that "seeps into the soul" of its practitioners. He also told the graduates that their sense of wonder would grow as they pushed deeper into public health and that they would come to see that the discipline is connected to nearly all other fields, including law, economics, business and politics. "Opportunities abound," he said.

He thanked the graduates for their commitment to public health and promised a long, rich journey. Perhaps one day, he noted, the graduates would return to their alma mater to share with a future class of students the "everlasting difference" that public health has made in their lives.

Shelley D. Geballe, J.D. '76, M.P.H. '95, who was chosen by the graduates as this year's mentor of the year, told the audience that health expands or limits one's capacity for everything. She urged the graduates to plug away until they have identified the root causes of public health problems

Peter Ragusa listens to the keynote speech inside Battell Chapel.

Commencement speaker Howard Koh told the graduating class that public health is a "unique passion" that "seeps into the soul" of its practitioners.

"We need each of you to add your healing touch. We hold in our hands the promise of better health."

—Howard Koh

and solved them. On a personal note, Geballe said that the confidence and trust students showed in selecting her as mentor of the year brought tears to her eyes. "I feel very humbled."

Her colleague, Tené T. Lewis, Ph.D., was selected by students as Teacher of the Year. Lewis said that she loves conducting research on health disparities. "Teaching allows me to share that passion with others," Lewis said. "It has been wonderful to share this journey with you." Lewis' primary area of research is psychosocial epidemiology, with an emphasis on cardiovascular disease (CVD) in women. She has a particular interest in understanding how social and psychological factors contribute to the disproportionately high rates of CVD morbidity and mortality for African-American women compared with the rates for women of all other racial/ethnic groups.

The student address was given by Lindsey Smith, who reminisced about two remarkable years at the School of Public Health and said that it was a combination of curiosity, passion and a desire to make people healthier that drew her and many others to the school. "We're here because of a basic instinct to make the world better around us."

A new student award, the Brandon James Brei Memorial Award, was presented for the first time this year. It honors Brei, a former student who died in 2003 while on a Yale-sponsored research trip to Puerto Rico. Brei drowned while attempting to help another student who was struggling in the water. This inaugural award for commitment and achievement in the field of vector-borne diseases was presented to Eliza Little.

Michael Greenwood

The following awards and fellowships were presented during the 2011 Commencement:

Distinguished Student Mentor Award
Shelley Geballe

Teacher of the Year Award
Tené Lewis

Dean's Prize for Outstanding M.P.H. Thesis
Alan Fu, *Molecular Epidemiology of Chronic Diseases: Genetic and Epigenetic Association Studies and Functional Analysis in Cancer and Asthma*

Fleur Porter, *Urban Ecology of* Rattus Norvegicus *and Zoonotic Leptospirosis in Salvador, Brazil*

Benjamin Simms, *Epidemiology of Hookworm Infection Among School Aged Children in Kintampo North District: An Evaluation of Nutritional Status, Albendazole Efficacy, and Implications for Future Control Efforts*

Brandon James Brei Memorial Award
Eliza Little

Henry J. (Sam) Chauncey Jr. Inspiration Award
Jessica Hardy

Lowell Levin Award for Excellence in Global Health
Jonathan Smith

Top: Mafo Yakubu celebrates her accomplishment with family and friends.

Above: Graduates prepare to receive their degrees inside Battell Chapel.

Right: Graduates applaud as their peers are recognized for exceptional scholarship and contributions to public health.

YSPH Notes

Strengthening the YSPH community

Do you know who at the Yale School of Public Health plays the drums? (Nancy H. Ruddle) Was a ballet dancer? (Elaine O'Keefe) Wrote a sex column for her college paper? (Joan K. Monin) Or was arrested for crossing an international border illegally? (Stanislav V. Kasl)

The school's first staff/faculty retreat held in late April provided opportunities to examine assumptions about colleagues as well as broaden knowledge of the research being done at the Yale School of Public Health.

"This is a rare opportunity to share and learn about the important work that collectively supports the school's mission," said Dean Paul C. Cleary.

Close to 150 members of the staff and faculty attended the daylong event, participating in diversity training and learning about some of the school's research. Brief presentations were given by faculty members Becca Levy, Ph.D.; Rafael Pérez-Escamilla, Ph.D.; Kathleen Belanger, Ph.D. '85; Albert I. Ko, M.D.; Elizabeth B. Claus, Ph.D. '88, M.D. '94; and Serap Aksoy, Ph.D.

John Armendariz, associate director of Yale's Office of Diversity and Inclusion, led a number of activities to highlight the frequent assumptions people make about others based on how they speak, look and present themselves. Moving past such assumptions and getting to know one's colleagues—or, for researchers, the populations that they study—can result in more effective research and better public health, he said.

Denise Meyer

Kaveh Khoshnood

Yale, China join to create bioethics program

Yale University will further its ongoing scientific relationship with China through a newly awarded grant from the National Institutes of Health's Fogarty International Center that allows for the development of a bioethics research training program.

The School of Public Health will lead the five-year effort at Xiangya School of Medicine, Central South University, in Changsha to train Chinese scientists and health care professionals in the ethical challenges of health-related research. The $1.2 million grant will allow for the development of graduate-level curricula in international research ethics; the development of a cohort of Chinese scholars who can teach bioethics to future students; the creation of short courses and workshops on research methods and grant and manuscript writing; the development of enhanced protocols and procedures surrounding human subjects protection; and strengthening of the capacity of review boards to review research protocols.

"The goal is for Central South University and its affiliated health professional schools to become a center for excellence for bioethics," said Kaveh Khoshnood, M.P.H. '89, Ph.D. '95, an associate professor in the division of Epidemiology of Microbial Diseases and the project's principal investigator. "There's a foundation already there. We want to build on this foundation and enhance it."

Michael Greenwood

Invasion of the Bloodsuckers—researcher curates exhibit

An exhibit at the Yale Peabody Museum of Natural History features those dreaded little creatures notorious for preying on humans and sucking their blood: bedbugs, head lice, pubic lice, mosquitoes, ticks and fleas. *Invasion of the Bloodsuckers: Bedbugs and Beyond* explores the biology and habitats of these bloodsucking arthropods, including where and how they live, how to deal with them and how to tell them apart from look-alikes.

The family-friendly exhibit demonstrates the diversity of these blood-feeding organisms and their relationship to humans. Each organism has a repertoire of adaptations and a distinct lifestyle that have evolved in close association with a host.

Leonard E. Munstermann, Ph.D., the Peabody's curator of entomology and senior research scientist in the division of Epidemiology of Microbial Diseases, wanted to show the public how to distinguish between

bloodsuckers and other organisms often mistaken for them—important information, because whereas most bites are harmless, deadly ones may go unnoticed. Some two dozen look-alike specimens from the Peabody collections are on display along with those of the bloodsuckers and information regarding anatomy and habits.

Invasion of the Bloodsuckers will be on view through January 8, 2012.

D.M.

Rethinking the "War on Drugs" in the U.S. and Mexico

A select group of scholars and policy advisers gathered at Yale in May to examine the effects of the War on Drugs on both the United States and Mexico.

The "Rethinking the 'War on Drugs' through the U.S.-Mexico Prism" conference assembled experts in economics, law, public health, medicine, public policy and national security to examine the impact of a 40-year-old policy initiated by former President Richard Nixon. Jody L. Sindelar, Ph.D., professor in the division of Health Policy and Administration, and Ernesto Zedillo, a former president of Mexico and director of the Yale Center for the Study of Globalization, co-chaired the May event.

One point that all of the panelists agreed upon was that the drug war has been a failure for both countries. Another area of agreement was that there is a worldwide trend toward decriminalization of marijuana, which will lessen the burden on the criminal justice system and could raise revenue by fining users with small quantities. There was also consensus that more emphasis should be placed on public health than on criminal justice.

"There is growing interest in decriminalization and even legalization," said Sindelar, "but there needs to be a lot of research and modeling into what that might look like." For instance, what will happen to rates of use and abuse in the United States if lawmakers apply taxes to drug purchases? What prevention and treatment measures are best?

The damage to Mexico in terms of lives lost has been unprecedented. Over 34,000 people have been killed in the last four years in Mexico, with over 15,000 killed in 2010 alone in drug-related violence.

D.M.

Remembering Denise Travis, devoted scholar, friend

Denise Travis, Ph.D., a visiting fellow of the inaugural summer institute of the Research Education Institute for Diverse Scholars (REIDS), passed away suddenly and unexpectedly on Friday, July 22.

Denise was an assistant professor at Indiana University Northwest until 2010, after which she was an assistant professor at North Carolina Central University. She was in Connecticut to attend the institute.

"We will always feel lucky to have spent this brief time with a talented scholar and wonderful person. The entire REIDS community conveys its deepest condolences to Dr. Travis' family, friends and colleagues," the institute's organizers said. Donations can be made to the *Dr. Denise Travis Scholarship for Social Work*. For details, e-mail *d.travisfund@gmail.com*.

Kyla Day, Ph.D., one of the inaugural Research Education Institute for Diverse Scholars (REIDS) Fellows, works on a community-based AIDS research project. Day and the other fellows were in New Haven, Storrs and Hartford in June and July for the first of two six-week summer residencies. The program is a collaboration between the Center for Interdisciplinary Research on AIDS at Yale; the Center for Health, Intervention, and Prevention at the University of Connecticut; the Institute for Community Research; and the Yale School of Nursing. Fellows, while retaining appointments at their home institutions during their two-year affiliation with REIDS, attend the institute for mentorship and support in the field of community-based HIV prevention research.

Student receives $100,000 grant from Gates Foundation

A second-year M.P.H. student was a Grand Challenges Explorations winner, an initiative funded by the Bill & Melinda Gates Foundation to foster innovative global health and development research projects.

Margo Klar, M.P.H. '11, will use the grant to develop a clean, simple and sharp umbilical cord cutting device to reduce the incidence of infection related to poor delivery hygiene in developing countries.

Klar will develop the cutting device from already available ceramic materials and distribute the prototype to select communities in developing countries that have a high incidence of tetanus and perinatal infections. Data will be collected to determine the association between the use of the ceramic scissor and the reduction of infection. The device will also be analyzed for its ease of use, shape, ability to maintain a sterile cutting edge and acceptance by birthing mothers. If the device is successful, a recommendation will be made to replace the widely used disposable scalpel with the ceramic scissor.

This Gates Foundation program is open to anyone from any discipline and from any organization. Successful projects have the opportunity to receive an additional grant of up to $1 million.

Michael Greenwood

Michel Sidibé, executive director of the Joint United Nations Programme on HIV/AIDS, opened this year's Global Health Leadership Institute conference at Yale. Delegates from five African countries attended the weeklong workshop to develop responses to some of their most pressing health care needs.

Professor urges action against household food insecurity

Many children in the United States are at high risk for developmental problems due to household food insecurity.

Rafael Pérez-Escamilla, Ph.D., professor in the division of Chronic Disease Epidemiology and director of the Office of Community Health, noted during a recent seminar sponsored by the Edward Zigler Center in Child Development & Social Policy that in 2008 nearly 15 percent of U.S. households were classified as having some degree of food insecurity. That figure is the highest since 1995 and includes some 17 million households, most of which include children.

Food insecurity is most likely found in households that are poor, are formed by ethnic/racial minorities, and have a single female head of household and children. However, data show that not all poor people experience food insecurity and not all people with food insecurity are poor. "That suggests that resilience and household management skills have a role to play," he said.

The risks to children's psychosocial and emotional development and academic performance are high, even after adjusting for poverty. Problems manifest in high rates of absenteeism from school, tardiness, hyperactivity, aggression, anxiety, depression, suicidal symptoms and low test scores.

"There is enough evidence to call for children's health and development professionals and services to probe for household food insecurity. Food insecurity is a powerful stressor," said Pérez-Escamilla.

Denise Meyer

Big Food coming to the Peabody Museum in February

A wide-ranging exhibit on the food challenges of the 21st century, including changing eating habits and alarming levels of obesity, opens at the Yale Peabody Museum of Natural History in early 2012.

Displays will cover the neuroscience behind appetite and obesity and how the body stores food and energy. They will also examine behavioral choices in nutrition and exercise and the influence of social, environmental and cultural settings. Visitors will investigate human origins as hunter-gatherers; explore societal pressures, such as the progressive growth of portion sizes; tackle media influences on food preferences; and consider the serious health consequences associated with obesity.

The exhibit, *Big Food: Health, Culture and the Evolution of Eating*, will conclude with a challenge forvisitors to reflect on their role in personal and community health, environmental justice and the food system's sustainability.

"We hope visitors will leave with an enhanced understanding of one of the most important transformations in health and the human experience in the past century," said Jeannette R. Ickovics, Ph.D., professor and director of the Social and Behavioral Sciences program, director of the Community Alliance for Research and Engagement (CARE) and the exhibit's lead curator.

According to the World Health Organization, more than a billion adults worldwide are overweight, with at least 300 million of them clinically obese.

Big Food is a collaboration between CARE, the Peabody Museum and the Rudd Center for Food Policy & Obesity. The exhibit runs from February 11 through November 30.

M.G.

Public health commissioner returns to alma mater

It was a homecoming for Jewel M. Mullen, Connecticut's new public health commissioner, as she returned to her alma mater in April to present a Dean's Lecture in Winslow Auditorium.

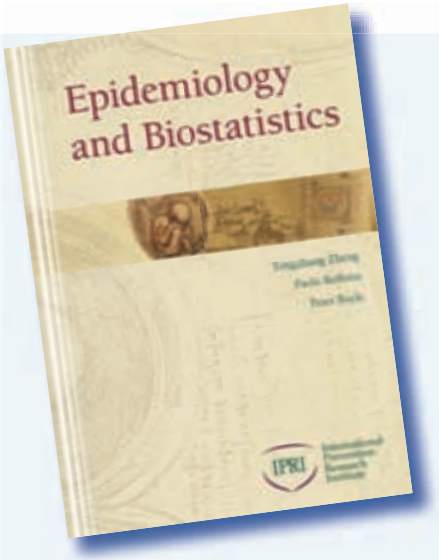
Even though her tenure has been short, Mullen, M.D., M.P.H. '96, said she has already discovered that many people don't really understand what the Connecticut Department of Public Health does.

The agency employs more than 800 people and has an annual budget of some $250 million. It provides a wide range of health services and programs that include asthma prevention, breastfeeding promotion, tracking of health disparities and monitoring of everything from lead poisoning to the safety of seafood.

And while most would agree that such services and many others are vital to a healthy Connecticut, the agency is facing severe budget constraints that could curtail important preventative services throughout the state.

Mullen said that the department remains committed to innovative ideas that will improve its effectiveness despite the fact that 65 percent of its budget is targeted federal funds.

M.G.



Epidemiology and Biostatistics, a new introductory textbook edited by Tongzhang Zheng, Paolo Boffetta and Peter Boyle, has been published by the International Prevention Research Institute. Zheng is head of the division of Environmental Health Sciences at YSPH and Boyle is an adjunct professor in the same division. Among the contributing authors from the School of Public Health are Mayur M. Desai, Theodore R. Holford, Brian P. Leaderer, Xiaomei Ma, Robert W. Makuch, Herbert Yu, Yawei Zhang and Yong Zhu.

YSPH Notes

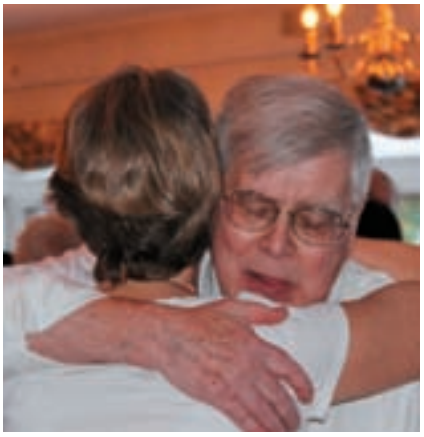
A biostatistics boot camp for area high school students is only in its second year but is growing and incorporating technology into its curriculum that appeals to every teenager: texting. The Young Scholars Program, sponsored by the Yale Center for Analytic Studies, hosted eight students in July (up from four last year). It now includes a teacher in residence, an undergraduate attendee and an undergraduate intern (who was one of last year's attendees).

After more than four decades, Kasl retires from YSPH

Professor Stanislav V. Kasl arrived at the Yale School of Public Health as a young researcher in the late 1960s and never left.

His prolific career at Yale spanned more than four decades, produced over 300 publications (an average of about seven a year) and included service on numerous scientific advisory and editorial boards. Kasl's many contributions to the school were remembered during a retirement party in June thrown by his colleagues and friends.

"Stan's scientific leadership, teaching and mentoring, combined with his gracious and gentle presence, have had a deep and lasting impact on the Yale School of Public Health for more than four decades and will be sorely missed," said Dean Paul D. Cleary. "He takes with him our enduring gratitude, respect and affection."



Stanislav Kasl

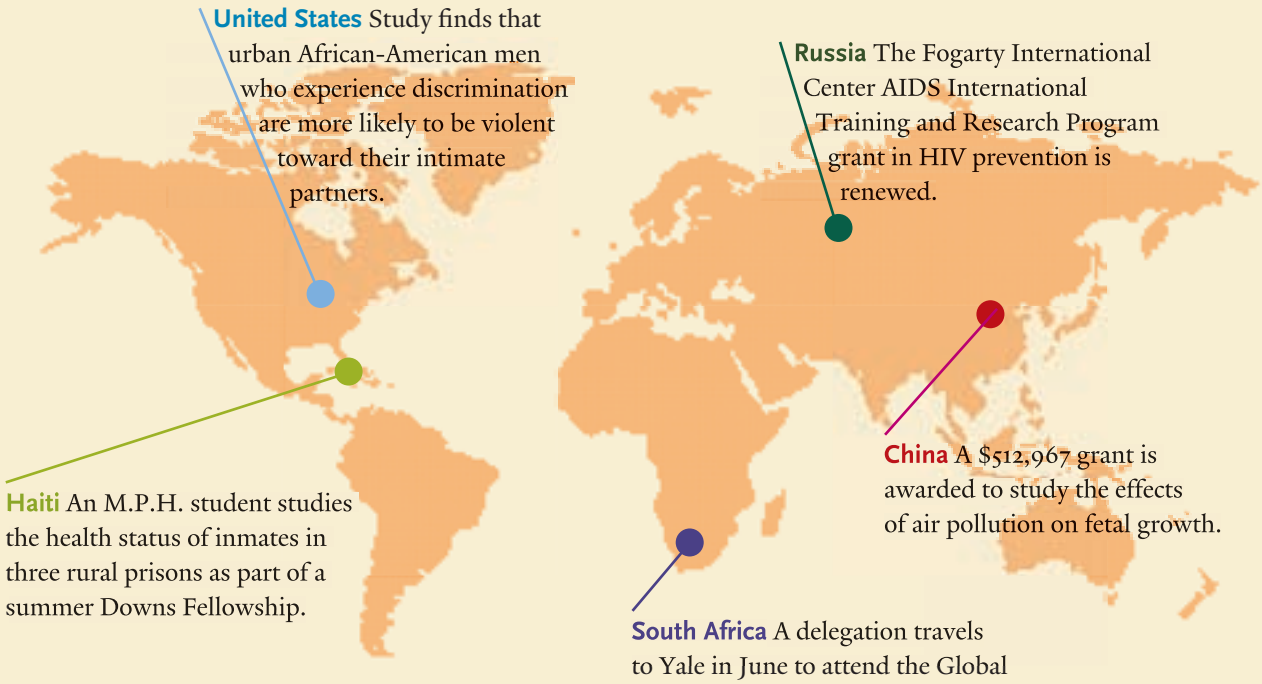
Kasl's research focused on psychosocial epidemiology, the study of social and psychological risk factors for physical illness. His contributions to the field were recognized in 2008 with the Lifetime Career Achievement Award, co-conferred by the American Psychological Association, the National Institute for Occupational Safety and Health and the Society for Occupational Health Psychology.

In addition to influential research on job loss and stress, his research interests also included incidence of disease; course of illness and disability; psychiatric epidemiology; the study of risk factors for psychiatric outcomes; and aspects of mental health and well-being.

Kasl is relocating to California and plans to fully enjoy retirement with his family.

Michael Greenwood

YSPH around the world



United States Study finds that urban African-American men who experience discrimination are more likely to be violent toward their intimate partners.

Russia The Fogarty International Center AIDS International Training and Research Program grant in HIV prevention is renewed.

China A $512,967 grant is awarded to study the effects of air pollution on fetal growth.

Haiti An M.P.H. student studies the health status of inmates in three rural prisons as part of a summer Downs Fellowship.

South Africa A delegation travels to Yale in June to attend the Global Health Leadership Institute conference for the first time.

YSPH awards and honors

Geoffrey Attardo, Ph.D., associate research scientist in the division of Epidemiology of Microbial Diseases, had one of his tsetse fly photographs selected as an Image of the Year by the Fogarty International Center.

Elizabeth H. Bradley, Ph.D. '96, professor in the division of Health Policy and Administration and director of the Global Health Concentration, Global Health Initiative and Global Health Leadership Institute, has been named master of Branford College, an undergraduate residential college at Yale.

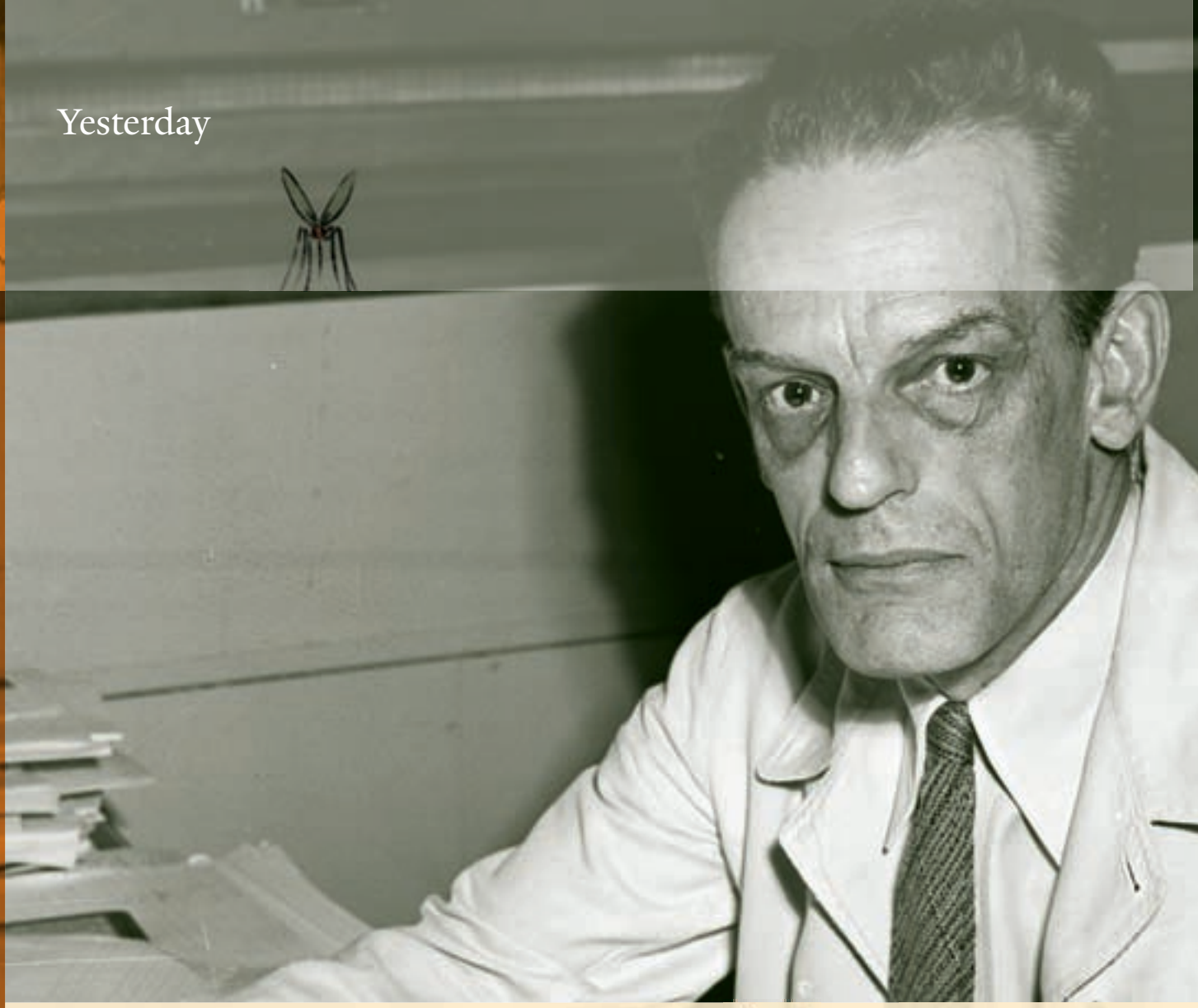
Adrienne S. Ettinger, M.P.H., Sc.D., assistant professor in the division of Chronic Disease Epidemiology, has been named a Reviewer of the Year by Environmental Health Perspectives for editorial contributions.

Shelley D. Geballe, J.D. '76, M.P.H. '95, lecturer in the division of Health Policy and Administration and a visiting lecturer at the Yale Law School, was named the YSPH 2011 mentor of the year.

Tené Lewis, Ph.D., associate professor in the division of Chronic Disease Epidemiology, was named the YSPH 2011 Teacher of the Year by the graduating class.

Rafael Pérez-Escamilla, Ph.D., professor in the division of Chronic Disease Epidemiology and director of the Office of Community Health, has been appointed to the Advisory Committee of the New York Academy of Sciences' Sackler Institute for Nutrition Science. In collaboration with the World Health Organization, the Sackler Institute is launching a global initiative to formulate a prioritized agenda for nutrition science research.

Jennifer Prah Ruger, M.Sc., Ph.D., associate professor in the division of Health Policy and Administration, is a recipient of a 2011 Guggenheim Fellowship to support the completion of her forthcoming book, *Global Health Justice and Governance*.



YSPH's Nobel laureate

The only Nobel Prize in physiology or medicine ever awarded for the discovery of a vaccine was given to Max Theiler in 1951 for his work on yellow fever. Theiler, a South African by birth, was director of the Rockefeller Foundation Virus Laboratory at that time, but in 1964 the foundation bequeathed its collection of viruses and virologists to Yale, which opened the Yale Arbovirus Research Unit (YARU) in the new Laboratory of Epidemiology and Public Health building.

The foundation donated generously to the building and provided several years of funding for YARU. YARU faculty members and research scientists included Wilbur G. Downs, M.D., M.P.H., Robert E. Shope, M.D., and, of course, Theiler.

His first significant yellow fever breakthrough was his discovery in the 1920s that mice had several research advantages over rhesus monkeys. Most importantly, when injected with yellow fever virus, the mice didn't develop human-like symptoms. Theiler, fortuitously, contracted a mild case of yellow fever from one of his mice and developed immunity, in effect becoming the first vaccine recipient for yellow fever.

In accepting the Nobel Prize, Theiler said: "I like to feel that in honoring me you are honoring all the workers in the laboratory, field, and jungle who have contributed so much, often under conditions of hardship and danger, to our understanding of this disease. I would also like to feel that you are honoring the memory of those who gave their lives in gaining knowledge which was of inestimable value. They were truly martyrs of science, who died that others might live."

Denise Meyer

Associated Press

Tick, tick, tick…

It is a collection without rival.

The School of Public Health keeps some 100,000 *Ixodes scapularis* ticks, which transmit Lyme disease and other illnesses, in a "tickery" that is crawling with life. The specially designed facility holds ticks in all stages of development—egg, larva, nymph and adult—for use in a variety of research projects at Yale and beyond.

Keeping tens of thousands of ticks alive and healthy is no small task. They are kept in incubators to control the temperature, lighting cycles and humidity levels. If these conditions are not properly maintained, the whole colony could be lost.

"It takes lots of care to ensure that they continue to thrive," said Lindsay Rollend, a research associate in the laboratory of Durland Fish, Ph.D., who helps care for the colony.

Routine maintenance also requires that all of the holding chambers are changed and washed monthly. Ticks are individually inspected for mold development and transferred one by one into new tubes if necessary. Records are maintained on the ticks (e.g., molting time, egg development and hatching), and DNA analysis is used to screen them for infection. The tickery routinely keeps ticks infected with *Borrelia burgdorferi*, *Borrelia miyamotoi*, *Anaplasma phagocytophilum* and *Babesia microti* isolates.

Yale's collection of infected ticks is believed to be the largest in the United States and, perhaps, the world. And with so many ticks to care for, one might reasonably wonder if one or two ever manage to escape. The answer is no. "Every individual tick is accounted for," Rollend said.

Michael Greenwood

Yale Public Health
60 College Street
P.O. Box 208034
New Haven, CT 06520-8034

Non-Profit
U.S. Postage
PAID
New Haven, CT
Permit No. 526

Yale SCHOOL OF PUBLIC HEALTH