

PIONEERING WORK REVOLUTIONIZES CHILDREN'S HEALTH

Samuel L. Katz, MD

2015 Maxwell Finland Award for Scientific Achievement Award Recipient

Samuel L. Katz, MD is an innovative scientist whose work on the development and promotion of the Edmonston measles virus vaccine revolutionized children's health and reduced childhood mortality around the world.

At its height, measles hospitalized 75,000 children each year in the United States killing between 400 and 500, but its global impact was even more staggering. Prior to widespread vaccination, five to six million children died of measles in the developing world each year. Today, endemic measles has been eliminated in the United States and there has been a 71 percent reduction in death from measles in sub-Saharan Africa.

"One death is a lot if the death is in your family."

—Samuel L. Katz, MD

These are profound accomplishments for a man who started his college career more interested in music than medicine. It was a turn in the Navy after his freshman year that awakened his interest in medicine. The Navy saw his aptitude and offered to send him to hospital training school. "That sounded interesting, so off I went to San Diego," says Dr. Katz. "That was my introduction to medicine. It opened up a whole new world I had not previously considered."

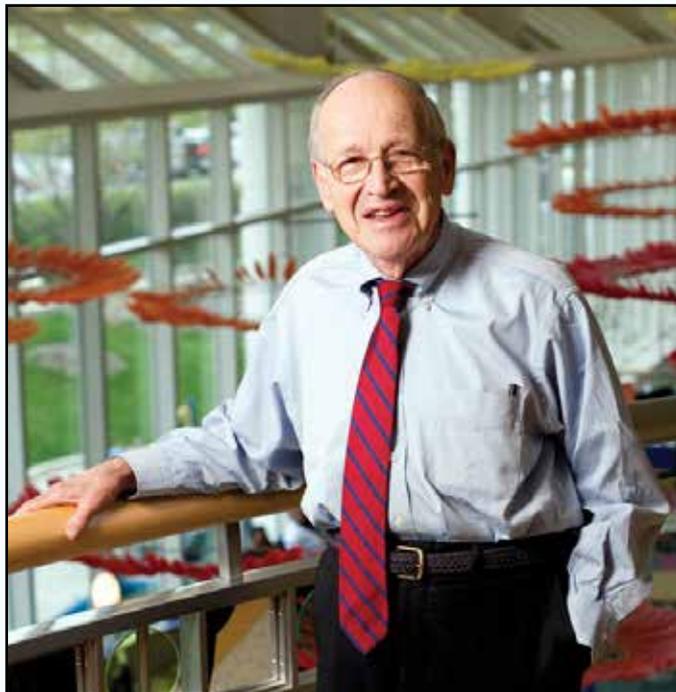
Dr. Katz's pioneering work on the measles vaccine is only part of his legacy. He is a passionate immunization ambassador who recognizes that educating and advocating for widespread vaccination are essential to disease eradication efforts. Dr. Katz is equally passionate about teaching and mentoring young students and professionals, a drive that led him to make a life-changing decision in 1968. He chose to leave Harvard, where lab work was emphasized above all, to join Duke University where he could focus not only on research, but also teaching and providing excellent clinical care.

NFID is proud to honor Samuel L. Katz, MD with the 2015 Maxwell Finland Award for Scientific Achievement for his work on the development of the Edmonston measles virus vaccine, a triumph over challenges that continue to plague vaccine development today. His work continues to provide valuable insight for others developing vaccines for today's most infectious diseases.

TRAINING MEETS OPPORTUNITY AND A YOUNG PHYSICIAN EXCELS

Dr. Katz's training prepared him well for his groundbreaking work on the measles vaccine. He graduated from Harvard Medical School with honors and completed his pediatrics residency training at Massachusetts General Hospital and Boston Children's Hospital, followed by a research fellowship in infectious diseases.

Dr. Katz deflects praise about his accomplishments, describing himself in these early years as simply a "young, enthusiastic, and naïve young pediatrician" who was lucky enough to work with some of the best minds and mentors of the time. Circumstance may have contributed, but his scientific curiosity, hands-on nature, and humanitarian drive certainly fueled his accomplishments.



A young Dr. Katz witnessed a polio epidemic that struck Boston in the summer of 1955. The third-year pediatric resident was struck by the virulence of the virus and disability caused by the infection and knew this was something he wanted to study. His chief of pediatrics suggested that he talk to John Enders, whose lab was just across the street. Just one year earlier, Enders won the Nobel Prize for his work in isolating three strains of the poliovirus.

Dr. Katz walked over to Dr. Enders' lab and describes a very casual conversation ending with Dr. Enders suggesting that he channel his interest into a fellowship in the lab. This was a perfect match for Dr. Katz. He describes Enders as the greatest mentor of his career. "John Enders was a superb mentor whose example I was pleased to emulate. He never filled the lab with a dozen fellows or more. He took only three or four because he wanted to spend time with them. He made daily rounds, asking each, 'What's new?' That was a great incentive to develop something new because then he'd sit and talk for about an hour and give you great ideas about how further to progress with what you were doing." These regular interactions were integral in Katz's work on the Edmonston measles virus.

WORKING INSIDE AND OUTSIDE OF THE LAB TO ERADICATE MEASLES

Dr. Katz spent the next 12 years in Enders' lab. For the sole purpose of eradicating a childhood disease that affected millions of children worldwide, Dr. Katz dedicated his passion, insight, and intellect to studying measles, developing a vaccine, and pioneering strategies to ensure protection for all. He was the first to culture and propagate an immunogenic but attenuated measles virus strain.

Using this "Edmonston" virus, named for David Edmonston, the Massachusetts boy from whom the virus was isolated, Dr. Katz demonstrated that the strain no longer caused disease but that it stimulated development of measles antibodies. They worked with monkeys because they developed all of the same symptoms from measles as humans and, importantly, measles virus was shown to circulate in their blood.

They worked at attenuating the virus in a number of different human-based culture systems, but in one of his frequent visits, Dr. Enders suggested using some non-human cell systems to change the virus and get it to behave differently. "That's when we began work with embryonated hen's eggs and eventually chick embryo fibroblasts," says Katz. "When we introduced this attenuated virus into monkeys they didn't get rash, fever, or any of the other symptoms of measles, but they did develop antibodies." When rechallenged with the live virus, the vaccinated monkeys were immune to measles infection. The next step was to show that the attenuated virus was safe in adult volunteers—himself included.

Dr. Katz did not stop with development of the vaccine. He was a hands-on champion of its trials and approval. The Fernald School just outside of Boston served children with various handicaps and disabilities. Measles outbreaks hit the school's population particularly hard at two- to three-year intervals, causing a few deaths with each outbreak. Dr. Katz met with the school's administrator, described his new vaccine, and asked if he might speak to the parents about enrolling their children in a small study.

He found that parents were more than willing — they were anxious to participate in the trial. The year was 1960 and the severity of measles was very apparent. The children in the Fernald trial developed protective antibodies and several years later, when another measles outbreak occurred, all of the vaccinated children at the school remained healthy.

"Dr. Katz is a world-renowned pediatrician and virologist, whose career has been devoted to vaccine research and development and to improving child healthcare and disease prevention around the world."

—Barton Haynes, MD, Director, Duke University Human Vaccine Institute

Dr. Katz extended his efforts to conduct studies nationally. He and his colleagues reached out to others across the country. All of them, of course, knew measles and its consequences well and there wasn't much convincing to be done. All across the country physicians and parents were eager to protect their children.

In just a month, they had agreements for study sites in New Haven, Buffalo, Boston, Denver, Baltimore, and San Francisco. The 25,000 children at these sites formed the basis for measles vaccine licensure.



The results of the Fernald trial, as well as the reports of the work done in Enders' lab were published in the *New England Journal of Medicine* in 1960. It was just three years later that the US Food and Drug Administration approved the Edmonston vaccine for universal childhood vaccination. While Dr. Katz's work was instrumental in this speedy process, he is quick to point out major differences in healthcare and the US attitude toward vaccination then and now.

"At that time, there was no need to convince doctors or parents that a measles vaccine was a good thing," says Katz. "It had been just eight years since the polio vaccine was introduced. Physicians and parents were thrilled to get these vaccines and regulators were able to review and approve them quickly." It's somewhat ironic that today the US measles vaccination rate has fallen in many areas to below the 95 percent threshold needed for herd immunity while 16 African countries have measles vaccination rates near 100 percent.

EXTENDING THE BENEFITS OF MEASLES VACCINE TO RESOURCE-POOR COUNTRIES

Soon after publication of his early studies, Dr. Katz began receiving letters and telegrams from the British physician, David Morley, who worked in Nigeria developing child health programs. Morley was interested in introducing the measles vaccine in Nigeria, but Katz and Enders were concerned about testing the vaccine in these children before it was proven safe in US studies.

"We were concerned about using poor children whose overall health was not as good as US kids as subjects for studies," said Katz. They were concerned that these children could have unusual complications from the vaccine because of underlying health problems. But in fact, the first study in Nigeria proved the vaccine was effective and that its side effects were innocuous. From then on, the program expanded not only in Nigeria but elsewhere in Sub-Saharan Africa.

Katz describes himself as a "parochial, naïve young man" who did not understand just how severe the morbidity and mortality of measles could be in resource-poor countries until he visited Nigeria. "The virus wasn't any more virulent in Nigeria than in the US," he says, "but the hosts were different. It was the innocent child who had all of these underlying issues that allowed the measles virus to cause so much more harm."

SAMUEL KATZ: SCIENTIST, PHYSICIAN, TEACHER, MENTOR, AND ADVOCATE

In addition to forging a strong research career, Dr. Katz has channeled much of his passion into teaching and mentoring medical students and young professionals. He was appointed chair of pediatrics at Duke University School of Medicine in 1968, where he was excited by the



opportunity to lead a department focused on teaching and research in addition to caring for patients.

It was early in his tenure at Duke that he realized that to eradicate measles, a vaccine was not sufficient. Public education and advocacy are essential to eliminating any childhood vaccine-preventable disease. Since then, Dr. Katz has worked tirelessly to educate politicians and the public on the safety and efficacy of vaccines. He served on the American Academy of Pediatrics' Committee on Infectious Diseases for ten years, six of them as its chair. He also served as a member and chair of the Centers for Disease Control and Prevention (CDC) Advisory Committee on Immunization Practices. Dr. Katz's expertise with measles helped create and drive policies that focused on measles elimination efforts.

"Dr. Katz is a revolutionary scientist, a respected teacher, a valued colleague, and a tremendous citizen of his profession and the world."

– Nancy C. Andrews, MD, PhD, Dean, Duke University School of Medicine

His early visit to Nigeria also led Dr. Katz to decades of work as a global vaccine advocate. Since that visit, he has been involved in efforts by the World Health Organization, the American Red Cross, and UNICEF to get measles vaccine to the children around the world who so badly need it.

While NFID and so many others focus on honoring Dr. Katz for the gift of health he has given so many children, he sees his opportunity to be part of helping others as his gift. "I am enormously gratified to have been part of something so meaningful. I came along at the right time, in the right laboratory, with the right colleagues. It all worked out well."