Dr. Linda Mayes, C'73, studies individuals, year after year, from childhood to adulthood, to discover the effects of early adversity on psychological development. And in her Yale labs, year after year, Sewanee students and graduates get unparalleled experience in biomedical research.

Taking the Long View

BY DAVID MCKAY WILSON

AS A CHILD GROWING UP just a handful of miles from Sewanee, Dr. Linda Mayes, C'73, dreamed of practicing medicine or writing history. She chose medicine, and now after almost 20 years of research, she has tracked the stories of inner-city youths who have faced tremendous adversity in their early years.

They were born to drug-addicted mothers and grew up in impoverished New Haven, Conn. Mayes's longitudinal studies, carried out at Yale University's Child Study Center, have followed hundreds of children — some now adults — for 18 years.

"When you follow them over time, you see individual trajectories," says Mayes. "It's like detective work. If you are an impulsive, highly stressed toddler, are you going to be one of those highly stressed adolescents? Probably, but it won't be 100 percent, which suggests that there are intervention points, where someone in your life is a strong social attachment figure — a teacher, coach, neighbor, or parent. They can make a difference."

Mayes's longitudinal studies are among 14 research projects she has underway with various collaborators at Yale, where she serves as the Arnold Gesell Professor of Child Psychiatry, Pediatrics, and Psychology. Her work centers on the field of behavioral neuroscience, which delves into how brain activity relates to human behavior.

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COLLABORATION is at the heart of much of Mayes's work, as she partners with physicians and other health-care professionals on research studies and intervention initiatives. She worked with experts at the Yale University School of Nursing and a local health clinic to establish a project called Minding the Baby, in which nurse practitioners and clinical social workers make home visits to at-risk young mothers who are starting families.

In one study, she's exploring the impact of poverty on children's emerging self-control mechanisms as they enter preschool and elementary school. In another study, she's working on an interdisciplinary team looking at adolescent stress, self-control, and addiction. In yet another, she's studying the maturation of the brain for children exposed to cocaine through their pregnant mothers, using cutting-edge technology that measures brain activity in real time, down to the microsecond.

For more than 10 years, Mayes's research has involved Sewanee students and graduates who work on staff and in her summer internship program at Yale's Child Study Center. Starting in the 2010-11 school year, a new program will offer Sewanee students a chance to come to Yale for a semester and a summer to work in her research lab, attend seminars, and earn college credits.

Mayes's professional portfolio extends beyond the laboratory walls, connecting her empirical research to individuals in need in New Haven. A trained psychoanalyst, she sees children in her private practice, helping them work out their anxieties through therapeutic play.

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During the home visits, the health-care professionals focus on teaching the women to think about their babies, not just care for them. It involves the process of mentalization, in which the mothers develop the capacity to understand both behavior and feelings and how they're associated with specific mental states, not just in themselves, but in others as well.

"Science is more fun when it cuts across disciplines," says Mayes. "I like to understand how the brain works. But the brain also lives in an individual, and an individual lives in a community."

Mayes, 58, works at Yale's Child Study Center, one of the nation's most prominent research facilities for the study of children, which dates back to the early 20th century, when Dr. Arnold Gesell began documenting developmental milestones for children from infancy through adolescence. In her first-floor office, a multicolored quilt made by her mother, Marion, hangs from one wall, while another has floor-to-ceiling bookshelves filled with scholarly journals and texts. Copies of her book, *The Yale Child Study Center Guide for Understanding Your Child* (2002), are piled haphazardly under a blue couch, next to a coffee table that she built.

Mayes is soft-spoken and smiles broadly. She lives in Branford, a New Haven suburb along the Long Island shore. She makes, and refinishes furniture, favoring hardwoods, such as cherry and maple. In June, she's at work on a bookshelf, made of pine and maple.

"Most of my pieces are Shaker-style, with simple clean lines," she says.

Dr. Marc Potenza, associate professor of psychiatry and child study at the Yale School of Medicine, has worked with Mayes on studies of drug-dependent mothers, studying their brain responses to infant faces and infant cries. They are also collaborating on a study of adolescent risk. "Her work on the longitudinal study has demonstrated an ability to maintain relationships with families over many years and collect important information regarding child development and parent-child interactions," he says.

Longitudinal studies can make important contributions to science because they follow subjects over many years, providing insight into individual variations over time, and the long-term impact of adversity, and intervention strategies. In one study, Mayes is following 350 low-income youths who were born to drug-addicted mothers. They represent 78 percent of those who participated in the original study. Some are as old as 18, and she expects the study to continue through 2015.

Keeping tabs of this transient population, and getting them to show up twice a year takes concerted effort. The

subjects are paid, and Mayes has two staff members who track the subjects regularly.

Part of the study involves analyzing their brain activity with an electroencephalogram, which measures and records the electrical activity of a subject's brain by using sensors on a cap that fits over the scalp.

"It's a very special privilege to have the families allow us to be in their lives for so long," says Mayes.

Born and raised in Franklin County, Mayes came to the Mountain in the mid-1960s after winning a scholarship to play clarinet in the Sewanee Summer Music Center as a high school student. There, she met Vice-Chancellor Edward McCrady, a biologist and classics scholar who found time during the summer months to play violin in the center's junior orchestra.

McCrady took a liking to Mayes, the daughter of parents who owned the Family Drive-In and Oldham Theater in Winchester. She returned to play at the summer music center the next summer, and McCrady was so taken by her that he invited her to play in his chamber music group. She was the only teen in an ensemble whose members included poet Allen Tate, who helped develop the *Sewanee Review* into one of the nation's most prestigious literary journals.

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"I didn't realize who Allen Tate was until later," she says.

Mayes hadn't considered attending Sewanee because it was still men-only during the 1960s. Then Sewanee went co-ed, and McCrady urged her to apply for the first class of female students in 1969.

She majored in chemistry and was the valedictorian of the first co-ed graduating class in 1973. Medicine, it turned out, had trumped history, and she went to Nashville to study medicine at Vanderbilt University. After her residency in pediatrics and a two-year fellowship in neonatology, she began her research into the development outcomes of high-risk pre-term infants whose mothers were abusing narcotics.

Mayes came to Yale in 1982 on a fellowship to further that work at the Child Study Center. Three years later, she joined the faculty and established a laboratory to study infant learning and attention.

Leafi Mobley's experience at Yale has led her to consider pursuing a career that combines child development research and intervention.

As she established herself in the world of biomedical research, she also continued her own education, beginning her training in 1986 to become a psychoanalyst at the Western New England Institute for Psychoanalysis. By 2000, she'd completed her training, which provided her with a solid foundation in the work of Sigmund Freud, the father of psychoanalysis.

Mayes became particularly enthralled with the research of Freud's daughter, Anna, who expanded Freudian theory to look at the developing child.

Anna Freud's connection to the Child Study Center was solidified in the 1970s when she taught seminars on crime and the family at Yale Law School and collaborated with law and medical researchers on issues such as child custody, child rights, and foster care. Mayes, who is on the directorial team of the Anna Freud Centre in London, heads up a satellite program for the Freud Centre in New Haven.

The parent-child relationship — which can be stressful for children born to drug-addicted mothers who grow up in poverty — lies at the heart of several Mayes research

studies as she explores the effects of cocaine use on fetal brain development, maternal behavior during pregnancy, as well parenting behaviors once a child is born.

Other research focuses on the brain development and the risk-taking behavior of adolescents, which can include the use of drugs. Studies show that during adolescence, the brain's prefrontal cortex has yet to fully mature. That's the part of the brain that controls executive function—the ability to tell right from wrong and make judgments on risk. Meanwhile, Mayes says, the brain's subcortical region during adolescence is "exquisitely sensitive to reward." This can spell trouble for youth with keys to the car, access to drugs, or knowledgeable about the path to the gorge sided with 20-foot cliffs from which to leap.

Adolescents are also highly sensitive to stress, and huge emotional swings. Mayes says they use rewards — such as drugs — to rid themselves of the negative feelings generated by stress, and the chaos that can be associated with growing up in poverty.

"There's a developmental imbalance," says Mayes. "Drugs are rewarding and stimulate that part of the brain involved in reward, at a time when it is sensitive to that, but the youth may be unable to judge the consequences of trying that drug."

Mayes acknowledges there's a flip side to adolescence—the propensity for risk-taking can also promote initiatives that push teens in positive directions, with positive results for themselves, their families, and their communities.

Mayes took a risk 41 years ago when she stayed in Franklin County to join Sewanee's first co-ed class. It's a risk she's glad she took. Working with Sewanee students brings her back in touch with those days on the Mountain.

"As you grow older, students can provide a concrete link to the past," she says. "But it's more about the present and the future. It's about looking at what the future holds for them, and how they will carry forward what's important about Sewanee, into the world." ■

From Sewanee to New Haven and Beyond

Linda Mayes helps a steady stream of Sewanee students and graduates get where they want to go.

At the reception desk at Dr. Linda Mayes's laboratory, a mother reports in with an infant hoisted on her hip and a seven-year-old in tow. Out bounds Ann Thomasson, C'09, the postgraduate research associate who will test the second-grader.

"Y'all come back with me, and we'll get started," says Thomasson, who majored in psychology at Sewanee. "It should take about an hour and 15 minutes."

Back in one of the study rooms, Thomasson puts the seven-year-old through a battery of tests to discern her level of cognition, IQ, attentiveness, and inhibitory control. This is the girl's fourth year in the Young Children Learning Study, and the first of two visits in 2010.

Thomasson, who was a summer intern with Mayes in 2008 and 2009, is among three Sewanee graduates now working at Yale's Child Study Center. They are among about 30 Sewanee students who have participated in Mayes's summer internship program since it began in the late-1990s. This summer, Mayes welcomed eight Sewanee undergraduates to Yale for six to eight weeks.

"It's a great and enriching experience," says Thomasson, who expects to work there through the summer of 2011 when she's hoping to enter graduate school in a yet-to-be determined field. "Dr. Mayes wants to know how you can get to where you want to go, and how she can help you get there."

The program began quite informally when Sewanee student Eric Harrell, C'95,

From left to right: Sarah Clark, C'11; Jenny Robb, C'11; Ann Thomasson, C'09; Eliza Sholtz, C'10; Jourdan Cooney, C'12; Leafi Mobley, C'09; Linda Mayes, C'73; Katherine Nix, C'10; Steffi Renninger, C'10; Kara Holcomb, C'09; Chetna Chandrasekaran, C'11.

contacted Mayes, wondering if he could intern in her lab one summer. It went so well that Mayes added a second position the next year. Since then, Mayes says the program has grown organically, as she provides the opportunity for undergraduates to participate in biomedical research at one of the world's top laboratories.

The Sewanee program served one or two students through 2007, then grew to three in 2008, six in 2009, and eight this summer.

"It gives students a chance to experience the biomedical research world and make some experience-based career decisions," Mayes says.

This summer, one of Mayes's interns received financial support from the group of Sewanee endowment funds that financed internships for 160 of the University's 1,450 undergraduates, says Lisa Howick, associate director of career services. Mayes and her Child Study Center colleagues are supporting the remaining seven interns.

Mayes says the program is her way of giving back to Sewanee, which she says helped launch her professional career with a broad background in the liberal arts. She recalls how Vice-Chancellor Edward McCrady took particular interest in her academic success and mentored her through her Sewanee years.

"He didn't have to do that," says Mayes. "That's why I feel so strongly about giving back."

As the program has grown, so has its structure, with students this summer participating in weekly seminars and lab meetings. There's also the journal club, for which students read scholarly articles and then discuss their findings over lunch.

Dr. David Reiss, clinical professor of child psychology at Yale School of Medicine, says Mayes's program is unusual because it quickly gets students working on research projects in the lab. He calls it "a clinical approach to research training," with students involved in the nitty-gritty of testing subjects soon after their arrival on South Frontage Road, within Yale University's sprawling medical complex.

"She really devotes her summer to those students," says Reiss. "And those students become fully engaged in hands-on research. I've been in research and training for 50 years, and I've never seen students produce as much in such a brief amount of time."

Sarah Clark, C'11, returned to New Haven this year for a second summer. She's assisting a Yale physician who is researching attention deficit and hyperactivity disorder in a project that's testing whether a placebo drug has an impact on adolescent behavior.

Chetna Chandrasekaran, C'11, and Jenny Robb, C'11, are working in the Yale Stress Center on a study of parent-adolescent interactions and adolescent development, looking at whether the quality of those interactions can influence future substance abuse.

Their work involves testing the stress levels of the mother and child during interviews about conflicts they have in the home. To determine stress levels, students conduct individual interviews with the subjects on areas of conflict, and periodically take saliva samples with cotton swabs to determine levels of the hormone cortisol, which rises during periods of stress. Then the parent and child engage in a 10-minute session in which they discuss a conflict situation, with the students documenting facial expressions, tone of voice, and whether they shared positive moments, such as laughing together. The cortisol levels are again measured at the end of the session.

"We would document if they were warm and supportive and looking for a solution, or if they were negative, with sarcasm and criticism," says Chandrasekaran. "There will be a follow-up in a year to see if negative parenting could relate to increased use of drugs or alcohol by the adolescent."

For students interested in careers in psychology, the internship provides valuable experience in the research lab.

Leafi Mobley, C'09, who grew up in South Pittsburg, Tenn., about 27 miles southeast of Sewanee in Marion County, has thrived under Mayes's tutelage. Mobley met Mayes at Sewanee's Beyond the Gates program in 2008, when she was contemplating life after leaving the Domain. Mobley interned in the summer of 2008, and when she neared graduation, called Mayes, who invited her back to New Haven as a postgraduate research associate.

"I was talking to her about not having a job, and she said I could come back here," says Mobley. "She is very giving, and very nurturing."

Mobley's experience at the Child Study Center tapped into two of her interests: child development research and intervention to help children at risk. She now realizes it's possible to pursue a career that includes both. She's considering graduate study that might lead to a career in research and intervention for children with HIV/AIDS.

"I thought you did either research or intervention," she says. "That's how Dr. Mayes helps — she gives you the prompt, and helps you figure it out." ■