



**Gerald Harris, Ph.D.**, is a professor of biomedical engineering and director of the Orthopaedic & Rehabilitation Engineering Center. His research team is discovering new information about the bones and gait patterns of children with osteogenesis imperfecta.

# CHILDREN

## PROTECTING BRITTLE BONES

Imagine bones so fragile they can snap under the slightest pressure — even from simply walking. That’s the reality for children with osteogenesis imperfecta, or “brittle bone disease.”

There’s a lot that we don’t know about this debilitating disease. But **Gerald Harris, Ph.D.**, and other experts are working to fill in the blanks.

Harris is a biomedical engineering professor and director of the Orthopaedic & Rehabilitation Engineering Center, a joint effort of Marquette University and the Medical College of Wisconsin’s Department of Orthopaedic Surgery. The OREC team is using nanotechnology and advanced modeling techniques to predict — and ultimately reduce — bone fractures in children with osteogenesis imperfecta.

The OI study is one of several research projects that OREC is conducting with funding support from the National Institute for Disability and Rehabilitation Research. Key collaborators are Zaifeng Fan, Ph.D., research assistant professor of biomedical engineering, and Peter Smith, M.D., an orthopaedic surgeon at Shriners Hospitals for Children in Chicago and one of the leading OI experts in the country.

To predict fracture, the team develops computer models of the femur or tibia and fibula specific to each child. A child is then tested in the gait laboratory at Shriners in Chicago, and as he walks, 14 cameras record body movements while twin plates under his feet record ground reaction forces. Using mathematical analysis, researchers can create fracture prediction models and identify the points of high stress in the child’s bones.

The research is revealing new information about OI gait patterns, which is quite unique, Harris says.

The team is also the first to analyze the biomechanical properties of OI bone. They remove small chips of bone while the children undergo routine corrective surgery to repair fractures. Under the direction of Fan, researchers test tiny pieces of bone to determine the mechanical properties.

Because OI patients break bones so frequently, in some cases the team will be able to evaluate the load conditions of a bone before it breaks. By understanding more about OI

bone structure and points of stress, researchers could help patients modify risky activities and avoid future fractures.

“The amount of information that we’re able to discover could be substantial,” Harris says. “We’re actually putting together a very complete database that looks not only at the specific engineering characteristics of the bones of these

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### Research could predict — and ultimately reduce — bone fractures in children with OI.

children during ambulation, but also looks at the quality of life issues, the day-to-day pain that they experience, fracture occurrence records, ability to integrate in their community and just a plethora of standardized testing.” Researchers hope that this could lead to more comprehensive and effective systems for evaluation and follow-up care.

The OI research won’t be limited to the children’s legs. Thanks to prior research by the OREC and Shriners team on children with cerebral palsy, they have developed and standardized computer models to analyze upper extremity forces. That’s useful because kids with OI often use walkers or crutches.

“We might be able to come up with some better designs for assistive devices for those kids, just as we did with cerebral palsy,” Harris says.

OREC continues to study walker-assisted gait in children with cerebral palsy, treatment methods for children with clubfoot, and the use and design of pedorthics in the management of foot pathology. Together, the OREC and Shriners motion analysis labs evaluate more than 500 patients a year.

“I predict that within two or three years,” Harris says, “we’ll be evaluating more adults and children than anyone in the country.”

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Over the past four years, Marquette faculty have increased external research funding by 36 percent and doubled federal research funding.

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### Preserving family peace

Is good parenting natural or learned?

Research by **Robert A. Fox**, Ph.D., is demonstrating that committed parents, trained in intervention techniques, can have a profound effect on limiting young children's antisocial behavior.

Fox, professor of counseling psychology, is director of the Behavior Clinic, a mental health clinic for toddlers with developmental disabilities and significant behavior issues. He and a team of graduate students help parents understand and manage children's challenging behaviors, from not listening and temper tantrums to throwing things to hurting oneself or others.

"The field of infant mental health is relatively new," Fox says. "We know early intervention can have a positive impact in changing a child's behavior patterns, thus preventing future, more serious problems."

The clinic uses direct observations of child-parent interactions, child behavior assessments, parental interviews and self-report measures. The most common diagnosis is oppositional defiant disorder.

A licensed psychologist and author of *Parenting Young Children: A Facilitator's Guide*, Fox developed an in-home therapy program. "We concentrate on training the parents — teaching them how to enjoy their children through non-directive play, showing them how to reinforce a child's strengths to encourage positive behavior and provide consistent limits and reasonable consequences for problem behavior," he says.

Fox and his team serve approximately 100 families annually, making more than 1,000 home visits. The average is 12 home visits, but it can be as many as 30. "Our challenge is to get and keep parents committed," Fox admits. "If they complete four or five sessions, they begin to see behavioral changes in their children. Then they're hooked."

After intervention, 70 to 80 percent of the children lose their psychiatric diagnosis. Fox is studying whether the behavioral changes are sustained long-term. He is also working on new assessment tools. "We need instruments for early identification of young children with behavioral and emotional problems that are appropriate for low-income, under-educated parents," he explains.



### Why child's play is history

**James Marten**, Ph.D., says that to understand history fully, historians should pay close attention to the experiences of children. Marten, professor and chair of the Department of History, spent three years assembling a treasure trove of newspaper articles, memoirs, photographs, letters and more, all to capture the history of Milwaukee's children from 1850 to today. Assisted by graduate students, he has posted these documents online for teachers, students, historians and anyone interested in the city's development — as lived by children.

They won't be disappointed. The documents conjure vivid images: Children lugging fireplace ash to frame an ice-skating pond; "newsies" publishing their own newspaper; high school students knowing the despair of the Depression; Mayor Frank Zeidler establishing the Metropolitan Youth Commission after WWII to educate young people to become "proper citizens, instead of embracing teenager culture"; and school children participating in duck-and-cover drills during the Cold War.

The Children in Urban America Project was prompted by Marten's fascination with the experiences of Civil War-era children — the subject of earlier research. "I became interested in children's experiences in urban places and began to explore developing a Web site on that topic," he says. A three-year National Endowment for the Humanities grant funded the project.

The site's 5,400 documents are organized under the themes of work, play, schooling and health. There are common threads joining generations of children, Marten notes, including play and disease. But there also are departures from one era to the next, such as limitations placed on child labor after the 1890s.

"We put the documents where anyone can access them," Marten explains. "It's a different way of approaching history, but there is nothing that you can't understand better when you look at it through the eyes of children."



### The mind-body connection

A child gets treated for asthma. Or diabetes. Or chronic constipation.

So where does a psychologist fit in? The connection is more logical than you might think, says **Astrida Kaugars**, Ph.D., an assistant professor of psychology, who studies children with health problems.

"It's become increasingly popular to have psychologists as part of teams at hospitals," says Kaugars. "I like the challenge of considering the medical and psychological perspectives about what life is like for children with health problems. There are many real-world applications, thinking about how psychological factors affect medical conditions and the interplay of your mind and body."

Kaugars specializes in emotional development in at-risk children and studied children who were prenatally exposed to cocaine for her dissertation. Her work has been published in the *Journal of Clinical Child Psychology*, *Journal of Pediatric Psychology*, *Journal of Developmental and Behavioral Pediatrics* and other publications. Her latest research focuses on children with asthma, diabetes or chronic constipation.

She started researching asthma while at the University of Colorado Health Sciences Center and National Jewish Medical and Research Center, and she continues that research with Mary D. Klinnert, Ph.D., the principal investigator at NJMRC. The study followed wheezing babies through age 7 and tracked the development and progression of asthma. Kaugars examined the influence of emotional and family factors on illness characteristics, and part of the project involved observing mothers and children interacting in stressful situations.

"We think that how well you handle your child's emotions is probably related to how effective you are in managing your child's asthma," Kaugars says.

Early data seems to suggest that a mother's psychological resources — which include intellectual functioning, mental health and belief in her ability to handle difficult situations — play a significant role in how she copes with her child's negative behavior even years later.

Kaugars expects to present preliminary results at the Society for Research in Child Development Conference in April.

