

FASD brain distinctions3
 Who uses assistive technology.....4
 Interdisciplinary insights for mental health treatment.....5
 New research affiliates8

OUTLOOK

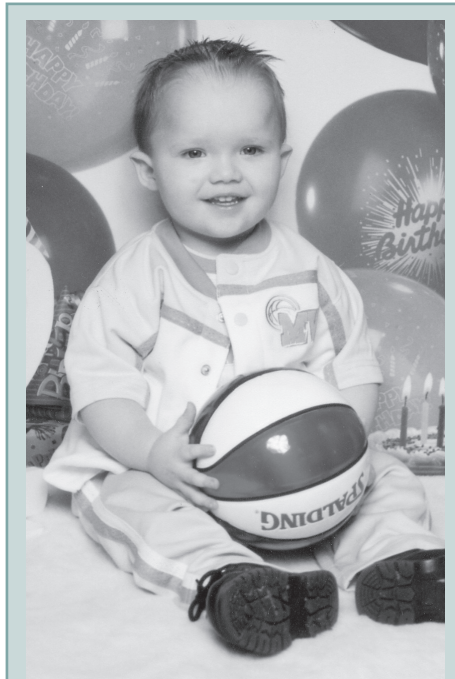
NEWS FROM THE CENTER ON HUMAN DEVELOPMENT AND DISABILITY AT THE UNIVERSITY OF WASHINGTON HEALTH SCIENCES CENTER

Implications of skull shape: Possible links between subtle malformations and developmental delays

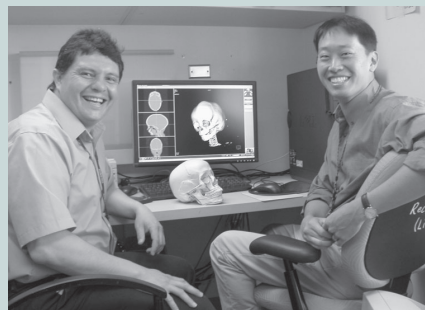
IN NORMALLY DEVELOPING INFANTS, the five plates of the skull are loosely linked by fibrous joints that expand to allow brain growth. Normally, the fibrous joints, called sutures, don't begin to close until a child is at least 9 months of age and don't fully fuse until adulthood. However, in some infants one suture fuses prematurely, a condition called single-suture craniosynostosis. The fusion restricts growth and the brain is forced to expand into other areas, resulting in a skull with a distorted shape. The primary treatment for craniosynostosis is surgery to remove the excess bone and re-shape the skull.

In addition to having joints, an infant's skull plates are also soft. Another malformation, positional plagiocephaly, can occur when external pressure on the skull results in a flat spot. This sometimes occurs when a child spends too much time in one position. Initial treatment is frequent repositioning to keep the child off the flat part of the head as much as possible. Physical therapy may be prescribed if an infant has torticollis (tight neck muscles that limit range of motion). An infant may be fitted with a special helmet designed to help mold the skull into a normal shape as it grows.

Because some children with single-suture craniosynostosis suffer from developmental disabilities and positional plagiocephaly has been associated with developmental delays, research affiliates at the Center on Human Development and Disability (CHDD) are researching possible causes and effects of these conditions in two, large multi-center studies. The studies use a unique range of developmental and anatomical measures



Surgery can correct malformations caused by craniosynostosis. Above, this two-year-old had surgery as an infant.



Salvador Ruiz-Correa (left) and Raymond Sze have developed new methods to analyze skull shape.

to tease out relationships between skull shape, genetics, and possible learning or behavioral disabilities. "We're breaking new ground," says Mathew Speltz,

Ph.D., University of Washington (UW) professor of psychiatry and behavioral sciences, director of the Child Psychiatry Outpatient Clinic at Children's Hospital and Regional Medical Center (CHRMC), and a CHDD research affiliate. He is the principal investigator of both the single-suture craniosynostosis study, which began in 2001 with funding from the National Institute of Dental and Craniofacial Research, and the positional plagiocephaly study, which is scheduled to begin in 2005 with funding from the National Institute of Child Health and Human Development.

In both studies children with and without the disorders will be tested for cognitive development at 6, 18, and 36 months of age. The craniosynostosis study includes genetic analysis and sophisticated mapping of skull shape using 3-D CT scans. In the plagiocephaly studies, brain anatomy will be analyzed using MRI scans.

Unlike previous studies, which have been limited by small numbers of participants and a lack of good comparison control groups (children without the disorder), both of the current studies will enroll at least 250 children with the disorder being studied, each matched to a child of the same age without the disorder. The current studies will track the children through age 3, but the team hopes to obtain additional funding to follow the children through school age.

Other key investigators in the studies include CHDD research affiliates Michael Cunningham, M.D., Ph.D., UW associate professor of pediatrics and director of the CHRMC Craniofacial Center;

See 'Skull Shape' on page 2



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CHDD is an interdisciplinary center dedicated to the prevention and amelioration of developmental disabilities through research, training, clinical service and community outreach. CHDD includes the University Center of Excellence in Developmental Disabilities and the Mental Retardation and Developmental Disabilities Research Center.

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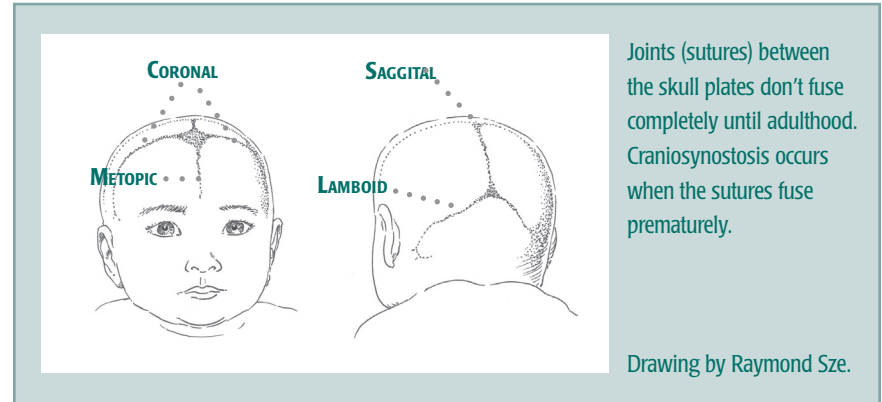
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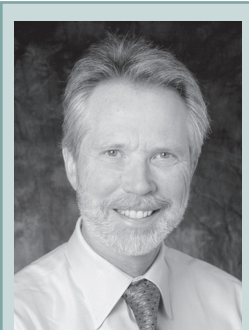
Skull shape . . . from pg. 1



Raymond Sze, M.D., UW associate professor of radiology and director of the CHRMC Pediatric Imaging Research Laboratory; and Geraldine Dawson, Ph.D., UW professor of psychology and director of the UW Autism Center. Cooperating centers in the single-suture craniosynostosis study are Northwestern University in Chicago and the Cleft Lip and Palate Institute in Westchester, Illinois; Washington University and the St. Louis Children's Hospital in St. Louis, Missouri; Children's Health Care of Atlanta in Atlanta; and the Boston University School of Medicine.

Single Suture Craniosynostosis: Cause or Effect?

The craniosynostosis study focuses on the most common form of the disorder, which occurs when only one suture fuses. While mental retardation is very rare in children with single-suture craniosynostosis, these children are three to five times more likely than children without craniosynostosis to have learning disabilities or behavioral problems. Currently, physicians have no way of predicting which children with single-suture craniosynostosis will have cognitive challenges. Moreover, previous research hasn't necessarily shown that surgery to correct fusions reduces the risk of cognitive problems.



Mathew Speltz (above)
and Michael Cunningham



Questions regarding the effectiveness of surgery point to a more basic issue regarding craniosynostosis: is it a cause of cognitive disorders or the result of a larger, underlying problem? "That question hasn't been definitively answered," says Cunningham. "One possibility is that suture fusion leads to brain injury which leads to developmental disability. The other is that genetic mutations cause both fused sutures and maldevelopment of the brain that lead, in parallel, to developmental disabilities."

Genetic Discoveries

The team has found novel mutations associated with single-suture craniosynostosis. One is in a gene called TWIST. TWIST carries the code for a protein that interacts with another protein that regulates bone formation. Previously, TWIST mutations were only associated with Saethre-Chotzen syndrome, a rare and very serious form of craniosynostosis. The team is also screening for mutations in the FGFR genes, also associated with several craniofacial syndromes. "The

See 'Skull Shape' on page 7



Brain studies show distinctions in persons with FASD

THIRTY YEARS AGO, THE MEDICAL community was only beginning to suspect that alcohol consumed during pregnancy could have disastrous effects on unborn children. There was little sense of the risk for developmental disabilities and lifelong problems. An estimated 80 percent of pregnant women drank; there was almost no notion that social drinking might be harmful to the unborn child.

Ground breaking research into the negative effects of alcohol on the embryo and fetus, begun in 1974 by Ann Streissguth, Ph.D., and colleagues, has been key to understanding the effects of prenatal alcohol exposure. Her current research focuses on the effects of fetal alcohol exposure on the brain, with the goal of developing better diagnostic techniques for people of all ages. Streissguth, a psychologist, is a University of Washington (UW) professor of psychiatry and behavioral sciences and a research affiliate at the Center on Human Development and Disability (CHDD). She steps down this year from her post as the founding director of the UW Fetal Alcohol and Drug Unit (FADU) and will be replaced by CHDD affiliate Therese Grant, Ph.D. UW professor of epidemiology and psychiatry and behavioral sciences.

The unit focuses on research studies to understand fetal alcohol syndrome (FAS) and fetal alcohol spectrum disorder (FASD) and uses research results to develop models of prevention and intervention. People with FAS have facial anomalies and growth deficiencies, as well as difficulties with learning, memory, and problem solving. Many also have vision and hearing problems. The term FASD is used to describe people with FAS as well as those with other alcohol-related birth defects and neurodevelopmental disorders.

Streissguth's brain/behavior research builds on decades of previous work. For example, a population-based study of pregnant women begun in 1974 and still ongoing revealed that social levels of drinking can have lifelong impacts on offspring health and development.

Follow-up studies of persons diagnosed with FASD showed that the effects of prenatal alcohol exposure could be severe. Exposure to alcohol affected the participants' memory, ability to concentrate and pay attention, and their executive function (the ability to plan and coordinate activities). "People with FAS or

"We are hopeful that this new neonatal assessment can lead to the earliest diagnosis of babies with prenatal alcohol exposure."

- Ann Streissguth

FASD also have a high rate of secondary disabilities or what we call adverse life outcomes," said Streissguth. "Sixty percent of the adolescents and adults with FASD who participated in one study had major school disruptions such as expulsion, suspension, or dropping out. Sixty percent had been in trouble with the law, and 40 percent had been incarcerated."

"People just don't realize how many children and adults are affected by prenatal alcohol exposure," she said. "Our population-based studies have shown that

one in every hundred live births in this area is affected by prenatal alcohol exposure."

To provide better, earlier treatment for exposed children, Streissguth's goal is the expansion of screening programs through the development of simple, cost-effective techniques. Such techniques may be an outcome of studies of brain and behavior in persons with FASD, conducted by Streissguth with colleagues including Fred Bookstein, Ph.D., FADU scientific director and UW professor of statistics and psychiatry and behavioral sciences; Paul Connor, Ph.D., FADU clinical director, assistant professor of psychiatry and behavioral sciences, and CHDD research affiliate; and Paul Sampson, Ph.D., UW professor of statistics.

With funding from the US Public Health Service and the National Institute on Alcohol Abuse and Alcoholism (NIAAA), the team used MRI to study the brains of 180 adolescents and adults with and without FASD. The study's initial focus has been on the corpus callosum (CC), which transmits signals between the brain's right and left hemispheres. Study images showed that persons with FAS had more variability in CC shape. The differences were great enough that their scans could be distinguished, with great specificity and sensitivity, from those of participants without prenatal alcohol exposure. By correlating each participant's images with results of a five-hour battery of psychological tests, the investigators found that a thicker CC was related to effects on executive functions, while a thinner CC was associated with poor motor skills.

"This is really exciting research," said Streissguth. "The corpus callosum develops early and it's easy to measure in size and shape. Knowing the importance of early diagnosis and intervention, we're now extrapolating this idea to develop a method for early detection of fetal alcohol problems in newborn infants."

In follow-up pilot research involving newborns, investigators used a standard neonatal ultrasound machine to take pictures of the infant's brains through



Ann Streissguth

See 'FASD' on page 6



Use of assistive technology by persons with spina bifida

RESearch led by Kurt Johnson, Ph.D., University of Washington (UW) professor of rehabilitation medicine and director of the Center for Technology and Disability Studies at the Center on Human Development and Disability (CHDD), is seeking to quantify and clarify how assistive technology can improve the lives of teens and young adults with spina bifida.

Assistive technology is any item, piece of equipment, or product system used to increase, maintain, or improve the functional capabilities of an individual with a disability. Assistive technology devices include accessible software, computers, and augmentative communication devices, as well as many “low tech” devices. The term also includes the services needed to make meaningful use of such devices.

According to the Spina Bifida Association, an estimated 70,000 people in the United States have the disorder, a neural tube defect that occurs in about seven out of 10,000 live births and affects more infants each year than muscular dystrophy and cystic fibrosis combined.

The most common and severe form of spina bifida is myelomeningocele. In infants with myelomeningocele, a portion of the spinal cord, as well as a sac containing cerebrospinal fluid and blood vessels, protrudes through an open lesion in the back. Corrective surgery is performed shortly after birth and, increasingly, on the fetus before birth. Many children require multiple surgeries. Despite surgical intervention, nerve and spinal cord damage causes various degrees of paralysis of the legs as well as difficulties with bladder and bowel control.

Many people with myelomeningocele also have hydrocephalus, an accumulation of fluid in the brain. A plastic shunt is surgically implanted to help drain the excess fluid; shunt failures, which are common, can result in a buildup of intracranial pressure and ensuing brain damage. As people with spina bifida cope with physical and cognitive challenges,

Adequate folic acid intake helps reduce the risk of spina bifida

The incidence of spina bifida is dropping because of the public health emphasis on daily intake of at least 400 micrograms of folic acid by women of childbearing age. However, there are still populations with a high number of births with spina bifida. For example, the Hispanic community in Yakima, Washington, has a high incidence of spina bifida, attributable to inadequate prenatal nutrition.

While folic acid, a B-vitamin, is found naturally in leafy green vegetables, a daily multivitamin or daily serving of fortified breakfast cereal can help to ensure adequate intake. Since the disorder occurs in the first month of development before many women know they are pregnant, a folic acid supplement is recommended for all women of childbearing age, to reduce—but not entirely eliminate—the risk of spina bifida.

The prevalence of neural tube defects has declined more than 25 percent in the United States since 1996, when folic acid supplementation of enriched grain products was introduced.

they often deal with social and sexual issues, as well as depression.

Johnson’s study, funded by the Centers for Disease Control and Prevention (CDC) and the Association of University Centers on Disabilities (AUCD), aims to promote the health of people with spina bifida by examining their usage of assistive technology devices and the incidence of secondary conditions related to their disability. His colleagues include Brian Dudgeon, Ph.D., assistant professor of rehabilitation medicine; William O. Walker, M.D., associate professor of pediatrics and director of the Neurodevelopmental/Birth Defects Clinic at Children’s Hospital and Regional Medical Center (CHRMC); Frederick Connell, M.D., M.P.H., professor of health services; Carrie Koehn, M.P.H., senior research scientist in rehabilitation medicine; and Alyssa Digiacomio, M.P.H., graduate research assistant in rehabilitation medicine.



Kurt Johnson

“Our hope is that assistive technology can help to mitigate secondary conditions such as pain, depression, and reduced levels of participation in the activities of everyday living.”

Johnson said. “While our findings are preliminary, we’re learning that people with spina bifida are not taking advantage of the wide range of assistive technology devices available, except for those that aid mobility, such as braces, crutches, and wheelchairs.”

The study is being carried out in two phases. The first phase utilized a database, maintained since 1960 by David Shurtleff, M.D., at the CHRMC in Seattle, to estimate the prevalence of utilization of various types of assistive technology among a large sample of individuals with myelomeningocele, aged 13 to 28. This phase also included an analysis of State of Washington Medicaid data, showing costs associated with durable medical equipment, personal assistive devices, and medical supplies from all cases of spina bifida in the state within a specified age range.

The second phase involves structured telephone and face-to-face interviews with more than 50 young people with spina bifida, aged 14 to 23. Recruitment of participants in the survey is ongoing. The participation scale utilized in the interviews is based on materials from the National Institutes of Health and the National Institute on Disability and Rehabilitation Research. The goal is to examine the personal experiences of people with spina bifida and gain their perspectives on use, or non-use, of assistive technology.

“Our goal is to draw an accurate

picture of how spina bifida affects the life of a young person,” said Johnson. “Our survey includes questions about mobility, pain, depression, and barriers to full participation in life, both physical and attitudinal. We are asking questions about the characteristics of their disability, their participation in education and employment, their utilization of assistive technology, and their ability to be independent in terms of both personal care and moving about in the community.”

Survey results thus far are somewhat unexpected, said Johnson. Since cognitive deficits often accompany spina bifida, the researchers had hoped to find that young people with such difficulties would compensate by using assistive technology that can help with tasks such as reading, writing, organizing, memory recall, and fine motor skills such as handwriting.

“But we’re finding that people with spina bifida are not utilizing much in the way of assistive technology except for mobility aids,” said Johnson. “We didn’t find a single individual using assistive technology other than mobility aids. We think there may be a lack of awareness by families of the availability assistive technology, and a perception that it is expensive. It is reasonably priced if used in appropriate situations.”

A second finding is also surprising. “We’re also learning that, in general, there is a low level of participation in social and other activities, but that this relative lack of social outlets apparently does not cause discontentment or unhappiness among young people with spina bifida,” said Johnson. “We’re curious as to why this is the case. Underutilization of assistive technology may be delaying or restricting successful transitions to independent living and full participation in the community by young people with spina bifida.”

Johnson and colleagues hope to take the results of this descriptive study and use them to define goals for more in-depth future research into the use of assistive technology and the relationships among assistive technology, quality of life, and secondary conditions that emerge for individuals functioning with and aging with spina bifida. ♦

Interdisciplinary team provides new diagnoses and insights for children in mental health treatment



Members of the Pediatric Assessment Team collaborate to improve the care of children in community-based mental health treatment. Team members in September 2005 included, front row, left to right, Kevin Sullivan, K.C. Corcoran, Kelly Johnson; back row, Lauren Crowley, Gwen Glew, John McLaughlin, Kerry Billingham, and James Peacey.

THE SEATTLE CHILDREN’S Home (SCH), a residential and outpatient mental health facility, has a long history of successfully treating children with behavioral and emotional problems. As the needs of these children have become more diverse, the home’s staff has explored new means to assist them. For example, SCH staff members were recently concerned about one of their residents, a 13-year-old boy who was having unusual difficulty in following the home’s rules. Suspecting that he might have a developmental disability, the staff referred him to the Pediatric Assessment Center (PAC), a collaborative effort of the SCH and the University of Washington (UW) Center on Human Development and Disability (CHDD).

Neuropsychological testing determined that some of the boy’s cognitive abilities were substantially delayed, even though some of his behaviors were typical of a young teenager. Specialized testing was

critical to evaluate the boy’s capabilities. “You wouldn’t pick up on the extent of his disability just by watching him. Like many people with mental retardation, this child had the ability to copy social behaviors. From minute to minute he’d figure out ways to blend in with the other kids,” says PAC member John McLaughlin, M.D., a UW professor of pediatrics and director of the CHDD Clinical Training Unit (CTU) and director of the UW Leadership Education in Neurodevelopmental and Related Disabilities (LEND) program.

Once the SCH staff understood the level of the boy’s cognitive abilities, they were able to help him better comprehend the home’s rules and the ways he could earn rewards for positive behavior. Their consultation with the PAC team also provides an opportunity to learn about the complex and often uneven patterns of development in persons with developmental disabilities. In turn, the

See ‘PAC’ on page 6



SCH staff educates the team's medical providers about mental health issues and treatments. "The PAC is an effective community-based clinical teaching site for LEND trainees in pediatrics and other disciplines, who regularly attend the PAC with CTU faculty," says McLaughlin.

From 2000, when the PAC was founded with funding from the Bill and Melinda Gates Foundation, through September 2005 PAC members evaluated 142 children. Team members include SCH psychiatrists and CHDD psychologists, specialists in speech and hearing, and developmental pediatricians (pediatricians with expertise in child development). "The program provides consultation and assessments that are usually difficult for children being treated in community mental health settings to access," says James Peacey, M.D., SCH medical director.

Clarified Diagnoses

Assessment by team members has resulted in new or clarified diagnoses for nearly 90 percent of the children evaluated so far, including diagnoses of autism, learning disorders, and deficits in executive function, such as the ability to plan and evaluate consequences. The PAC has also "unlabeled" some children, eliminating incorrect diagnoses, says McLaughlin.

The PAC evaluations have provided guidance for changing plans for some children or "at least offered validation that certain things may be harder for some children," says Peacey.

The initiative for developing PAC initially came from SCH staff. This is in keeping with the home's history of adapting its mission to meet the changing needs of the state's children. Formed as an orphanage in 1884, the SCH now provides comprehensive mental health care for children with serious emotional and behavioral issues. For example, of the first 97 children evaluated by the PAC team, 42 percent had a history of psychiatric hospitalization and 40 percent had been in group or foster care. SCH provides residential care for up to 18 children at a time. The home also runs outpatient

mental health programs.

Many children arrive at SCH with extensive medical records, even before receiving specialized examinations from the PAC team. Evaluating these records can be daunting. An important part of the team's work is to analyze this existing information and to "translate those findings to the people who work with and live with a child on a day-to-day basis," says PAC member Kelly Johnson, Ph.D., a psychologist with the CHDD Clinical Training Unit.

The team then performs additional neurodevelopmental and psychological testing as needed. They may also address basic health needs. "We found two new cases of asthma, and while treating the asthma didn't solve all the child's mental health problems, in both cases it made the kids better able to participate in SCH programs," says McLaughlin.

Team members also try to piece together family health histories. In some cases, they have found that the parents of children evaluated also suffered from learning or developmental disabilities.

"Many of these children have three strikes against them," said McLaughlin. "First, they have something different in their genetic background. Second, there's often something wrong with their prenatal experience, such as alcohol exposure or malnutrition. Third, their postnatal environment subjects them to abuse or neglect." All these factors can contribute to severe behavioral issues. As teachers and caregivers try to cope with these behaviors, children's learning problems or developmental disabilities can be overlooked. The expert evaluation offered by the PAC is especially important in cases that are difficult to diagnose, as in the case of the 13-year-old boy with a developmental disability.

New Insights

Although improved diagnoses aren't a "magic pill," says Johnson, in many cases they have provided valuable new insights. "It's been very gratifying," she adds. "There's been a number of times when you've seen a staff member or a parent have this 'aha moment,' when they say, 'Yes, that's my kid, now I understand.'"

In addition to Johnson, McLaughlin,

and Peacey, members of the PAC team include K.C. Corcoran, PAC coordinator; Sterling Clarren, M.D., F.A.A.P., clinical professor of pediatrics at the University of British Columbia and former CHDD research affiliate; Truman Coggins, Ph.D., UW associate professor of speech and hearing sciences and CTU discipline leader for speech-language pathology; Lisa Hacker, M.D., SCH staff psychiatrist; Colleen Huebner, Ph.D., UW associate professor of health services, Maternal and Child Health Program; Sally Stuart, M.S.W, social worker and interdisciplinary training director at the CHDD CTU; David Scott, Ph.D., UW associate professor of psychiatry and behavioral sciences and CTU discipline leader for psychology; and trainees with the UW LEND program. ♦

FASD . . . from page 3

the fontanel, the "soft spot" at the top of the skull. The team also developed a new method of averaging MRI images to make them sharper. "With the improved images we were able to measure the form of the midline CC, as we had with the MRI images of adult participants," said Streissguth. "Four of the seven babies exposed to high levels of alcohol in utero showed an abnormal callosal shape feature, an odd 'hook' shared by none of the eleven unexposed infants." Team members in the newborn study, funded by NIAAA under the auspices of the Collaborative Initiative on FASD, include CHDD research affiliate Ray Sze, M.D., UW associate professor of radiology and director of the CHRMC Pediatric Imaging Research Laboratory; and Christine Gleason, M.D., professor of pediatrics and CHDD research affiliate.

"We are hopeful that this new neonatal assessment can lead to the earliest diagnosis of babies with prenatal alcohol exposure," says Streissguth. "With better diagnosis, babies with abnormal ultrasound findings could more successfully obtain early intervention services, and their mothers could be referred for services like those offered by the Parent-Child Assistance Program, a home-visitation intervention program of the FADU." An expanded pilot study of neonatal ultrasound screening is underway, involving 50 babies. ♦



Skull shape . . . from page 2

FGFR genes produce proteins that regulate cartilage and bone growth. They're actually important in the development of almost every structure in your body, including the brain, lung, and liver," says Cunningham.

Quantifying Brain Shape

Another major study goal is to determine if there are correlations between cognitive delays and the type and severity of fusions, which cause distinctive head shapes. For example, fusions of the metopic suture, which runs along the middle of the forehead, result in a triangular shape. The skull is narrow in the forehead where the fusion restricts growth, and wider in back.

To gain a better understanding of possible relationships between fusions and cognitive issues, the team has developed ways to precisely categorize skull shape. Sze is heading an effort to use new multidetector 3-D CT scanning technology to analyze the skulls of study participants. "Previously, 3-D CT reformations [3-D representations created by combining a series of 2-D images from the scanner] were pretty crude," says Sze. "The new images are truly like holding the patient's skull in your hand."

In addition to increasing image quality, the team is developing new techniques for image analysis. Previously, analyses of skull shape were largely subjective, says Sze. Now the team can quantify and classify the type and severity of craniosynostosis using advanced pattern recognition and computer vision technologies developed by Salvador Ruiz-Correa, Ph.D., a CHRMC post-doctoral fellow formerly with the UW Human Interface Technology Laboratory. These new techniques may allow more precise correlations with cognitive scores. For example, says Cunningham, "the team may find that only infants with a certain type or severity of fusion may be at risk for a specific type of developmental delay or learning disorder."

Plagiocephaly

Single-suture craniosynostosis is relatively rare, affecting perhaps one in two thousand children. The incidence of positional

plagiocephaly is much higher and has increased exponentially in the last ten years. "From a public health standpoint, this is an enormous problem. We're seeing 500 or 600 children a year, and that's about ten times more than we see with all the types of craniosynostosis put together," says Cunningham.

The increase of plagiocephaly could be a side effect of the successful "Back to Sleep" campaign that has greatly reduced the incidence of sudden infant death syndrome (SIDS). The campaign, sponsored by the American Academy of Pediatrics, encourages parents to put children to sleep on their backs. "Parents may have taken this too far, becoming inflexible in their use of the supine position and not providing varied positions," says Speltz. "The result may be an increase of the prevalence of flattening of the back of infants' skulls."

However, the "Back to Sleep" campaign can't be the only cause of positional plagiocephaly, or more infants would be affected, say Cunningham and Speltz. "My personal position is that there's something subtly different about these children," says Cunningham. Recent studies indicate that some children with positional plagiocephaly may also have slight developmental delays. "If these children really do have lower cognitive scores or poorer development, it may be because they're more vulnerable to begin with" says Speltz. Infants vulnerable to plagiocephaly may be delayed in their control of motor functions, which makes them less able to change position on their own, or have another underlying problem that affects both neuromuscular control and cognitive development.

To learn if plagiocephaly affects the brain, the team will compare MRI images of 50 affected children with those from children without the condition. MRIs provide much more detailed information about brain anatomy than CT scans.

Early Intervention

In addition to better understanding the causes of plagiocephaly and craniosynostosis, the researchers hope that their work will lead to better early diagnosis and treatment for children at risk

of learning and behavioral problems. For example, if the team does find that infants with a particular type of craniosynostosis are at a greater risk for cognitive problems, sophisticated analysis of skull shape may eventually be used to refer children for early interventions.

"It looks like the impairments associated with these conditions, if they exist, are mild and clearly within the range of effects that can be reduced by known interventions," says Speltz. "There are many good preventative measures that can be taken when very young children are known to have an elevated risk of cognitive problems."

More information on craniosynostosis, plagiocephaly, and other disorders of skull and facial shape is available at the CHRMC Craniofacial Center [<http://craniofacial.seattlechildrens.org/>]. ♦

New Web Site

The Center on Human Development and Disability (CHDD) has a new, redesigned website. It provides detailed information about the extensive research, clinical services, training, and related activities of our center. Visit the new site at www.chdd.washington.edu. ♦

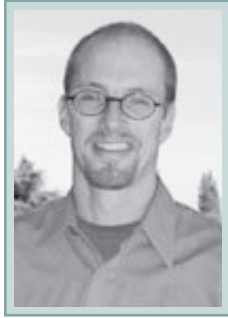
CHDD Clinical Services Report

In 2004, 9 clinics of the University Center for Excellence in Developmental Disabilities (UCEDD) at the Center on Human Development and Disability (CHDD) served 1,340 clients for a total of 5,485 client visits. More details are in the 2004 Clinical Services Annual Report; the 2005 report will cover all 12 UCEDD clinics. The report is online at http://www.chdd.washington.edu/ucedd/clinical_serv_annual_report_04.pdf#zoom=95. For hard copies, contact Becky Matter, Evaluation Specialist, CHDD, University of Washington, Box 357920, Seattle, WA 98195-7920, (206) 685-0455, bmatter@u.washington.edu. ♦



Faculty members appointed as new CHDD research affiliates

Daniel Doherty, M.D., Ph.D., is an acting assistant professor of pediatrics. His research and clinical focus is hindbrain malformation syndromes, such as Joubert syndrome. In particular, his goal is to improve the specificity of pre- and post-natal diagnosis, identify genetic causes of such disorders, and evaluate the outcomes for



individuals with hindbrain malformations. A recent study used ultrasound and MRI to make a prenatal diagnosis in pregnancies at risk for Joubert syndrome. Doherty is the recipient of grants

to investigate ways to improve service delivery to children with developmental disabilities in non-English-speaking families. He earned a Ph.D. in genetics and an M.D. from the University of California, San Francisco, and completed a fellowship in developmental/behavioral pediatrics at the University of Washington, through CHDD's Clinical Training Unit.

Robert Hevner, M.D., Ph.D., is an assistant professor of pathology. He studies the embryonic and early postnatal development of the cerebral cortex, to elucidate the neurogenesis, migration, differentiation, axon guidance, and molecular properties of cortical neurons. The goal is to shed light on normal development as well as on



neurodevelopmental disorders such as lissencephaly, in which the cortical layers do not form normally and neurological development is severely impaired. Disorders of cortical development may involve

errors tied to the formation of specific layers of neurons in the cortex. Learning to control such laminar fate specification might provide the possibility of regeneration of the nervous system, perhaps using engineered stem cells. Dr. Hevner earned medical and doctoral degrees from the Medical College of Wisconsin.

Jing Zhang, M.D., Ph.D., is an assistant professor of pathology. His research focus is on the use of proteomic techniques to discover novel proteins that are involved in chronic neurodegenerative diseases such as Parkinson's disease (PD) and Alzheimer's disease, and in the aging process. Proteins associated with aging likely also play major



roles in neural and glial development early in life. One hypothesis is that there are unique protein markers for PD, PD progression, and PD dementia in brain tissue, and that some of these markers

have the potential to be detected in human cerebrospinal fluid. Such markers could assist in the clinical diagnosis and monitoring of PD, the most common movement disorder, which afflicts millions of Americans. Dr. Zhang earned his medical degree in Shanghai, China, and received a Ph.D. in cell biology from Duke University.



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