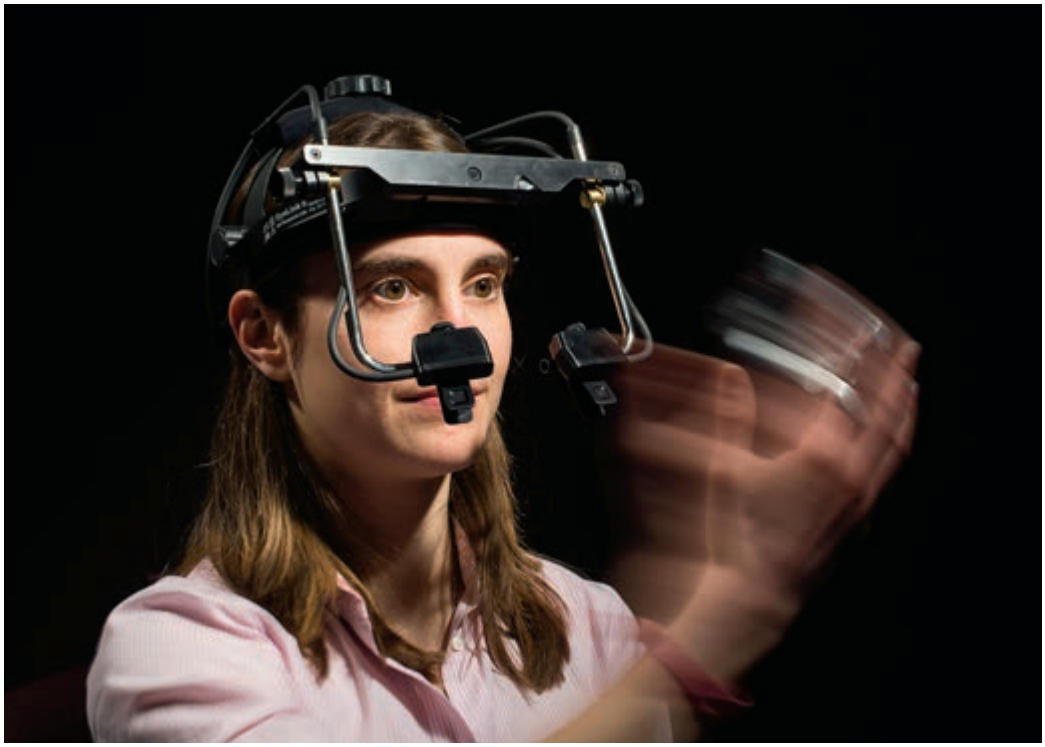
Can You 'See' in the Dark?

A new cognitive sciences study finds that at least 50 percent of people can "see" the movement of their own hand even in the absence of all light.

Reporting on results from five separate experiments involving 129 individuals, a team led by **Duje Tadin**, associate professor of brain and cognitive sciences, found that the eerie ability suggests that human brains combine information from different senses to create perceptions. The team, which included researchers from Rochester and from Vanderbilt University, published the findings online in the Association for Psychological Science's journal *Psychological Science.*

As part of the experiments, the researchers set up several scenarios to gauge each subject's self-reported ability to see the motion of their hands in conditions of total darkness.



PLAIN AS THE HAND: Lindsay Bronnenkant '10 reenacts one part of a study exploring whether people have the ability to vaguely "see" the motion of their own body even in complete darkness.

Participants also were fitted with a computerized eye tracker in total darkness to confirm whether self-reported perceptions of movement lined up with objective measures. The eye-tracker indicated that even in total darkness, many subjects could follow the movement of their hands smoothly, an ability that requires being able to track an actual object.

First author **Kevin Dieter,** a postdoctoral fellow at Vanderbilt, helped devise several of the experiments while he worked toward his PhD in Tadin's Rochester lab. He says the research "underscores that what we normally perceive of as sight is really as much a function of our brains as our eyes."

For most people, the ability to see self-motion in darkness probably is learned, the authors conclude. "We get such reliable exposure to the sight of our own hand moving that our brains learn to predict the expected moving image even without actual visual input," says Dieter.

—Susan Hagen

Menstrual Cycle Influences Concussion Outcomes

How well a woman recovers from a concussion may depend on that time of the month.

In a study published in the *Journal of Head Trauma Rehabilitation,* Medical Center researchers reported that women injured during the two weeks leading up to their period had a slower recovery and poorer health one month after the injury compared with women injured during the two weeks directly after their period or women taking birth control pills.

If confirmed, the findings could alter the treatment of and prognosis for women who suffer head injuries from sports, falls, car accidents, or combat.

In the study, researchers **Jeffrey Bazarian**, associate professor of emergency medicine, and **Kathleen Hoeger**, professor of obstetrics and gynecology, explored the influence of sex hormones such as estrogen and progesterone in how women recover from head injuries. They analyzed hormone levels of 144 women ages 18 to 60 who arrived within four hours of a blow to the head at five emergency departments in upstate New York and one in Pennsylvania.

The researchers believe that progesterone levels in women drop sharply after a head injury, especially among women whose progesterone levels are naturally high, as they are in the two weeks leading up to a period. That drop produces a kind of hormonal withdrawal which either contributes to or worsens post-concussive symptoms.

And that may account for why women recover differently from men, the researchers conclude. "I don't think doctors consider menstrual history when evaluating a patient after a concussion, but maybe we should," says Bazarian. "By taking into account the stage of their cycle at the time of injury we could better identify patients who might need more aggressive monitoring or treatment. It would also allow us to counsel women that they're more or less likely to feel poorly because of their menstrual phase."

—Emily Boynton

ADAM FENSTER

Depression Therapy Helps Poor, Minority Moms

A Rochester study indicates that screening for depression and providing short-term, relationship-focused therapy can relieve the disorder among minority mothers, even in the face of poverty and personal histories of abuse or violence.

Sheree Toth, lead author and executive director of the University's Mt. Hope Family Center, found that a 14-week series of convenient, one-hour therapy sessions relieved depression in participants much better than standard clinic-based care. The study participants also continued to improve eight months after the treatment ended, regaining a sense of hope and control over their lives and reporting feeling more connected to and supported by others.

Published online in *Development and Psychopathology,* the findings are good news for mothers and their children alike, says Toth. "Extensive research has shown that young children whose primary caregivers are depressed often begin life on the wrong foot," she says. "They may fail to develop secure attachments, setting them up for a cascade of difficulties, from behavior problems during childhood and failure in school to involvement in the juvenile justice system and major psychiatric problems down the road."

Despite the widespread prevalence of depression among minority mothers, researchers have largely overlooked the population. For the new study, researchers tracked 128 low-income mothers of one-year-olds, 60 percent of whom were African American, 20 percent Hispanic, and 20 percent Caucasian. In addition to poverty, the vast majority of the mothers faced extensive life challenges. All but 6 percent had been depressed for more than a year, 87 percent reported histories of child abuse, 30 percent had been raped or sexually assaulted by a relative, and 27 percent suffered from post-traumatic stress disorder.

Over the course of a 14-week intervention that featured home-based therapy sessions, women in the study group saw their depressive symptoms decline. By contrast, women who received community care remained clinically depressed at follow-up sessions eight months later.

The results, says Toth, point to the need for screening high-risk populations, and the authors suggest future research should explore ways to make the interview process more welcoming.

—Susan Hagen

To Sleep, Perchance to Clean

Rochester scientists are giving new meaning to the adage that a good night's sleep clears the mind.

In a study published in the journal *Science,* researchers led by **Maiken Nedergaard**, the Frank P. Smith Professor of Neurosurgery and codirector of the Center for Translational Neuromedicine, report that a recently discovered system that flushes waste from the brain is primarily active during sleep.

The findings could transform scientists' understanding of the biological purpose of sleep and point to new ways to treat neurological disorders.

"This study shows that the brain has different functional states when asleep and when awake," says Nedergaard. "In fact, the restorative nature of sleep appears to be the result of the active clearance of the by-products of neural activity that accumulate during wakefulness."

The new findings hinge on a discovery last year by Nedergaard and her colleagues that the brain has its own closed "ecosystem" to manage the removal of neurological waste created by normal neural activity. The system differs from the lymphatic system that disposes of cellular waste in the rest of the body because that system doesn't extend through the complex system of molecular gateways—called the blood-brain barrier—that controls what enters and exits the brain.

Using a new imaging technology, researchers observed what amounted to a neurological plumbing system that piggybacks on the brain's blood vessels and pumps cerebral spinal fluid through the brain's tissue. The process flushes waste back into the circulatory system where it eventually makes its way to the general blood circulation system and, ultimately, the liver.

The study indicates that the brain's system is highly active during sleep, clearing away toxins responsible for Alzheimer's disease and other neurological disorders. The researchers also found that during sleep the brain's cells reduce in size, allowing waste to be removed more effectively.

The removal of waste from the brain is essential because nearly every neurodegenerative disease is associated with the accumulation of cellular waste products.

—Mark Michaud

CORBIS