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NEWSLETTER

The following research articles can be found in their complete format at Science Daily.com. This research represents academic and clinical efforts which we believe would be of benefit for you to know and implement into your lives, as well as supporting many of the principles of Metaphorical Iconicity.

Monkey See, Monkey Do: Visual Feedback Is Necessary for Imitating Facial Expressions

Dec. 27, 2012 — Research using new technology shows that our ability to imitate facial expressions depends on learning that occurs through visual feedback. Studies of the chameleon effect confirm what salespeople, tricksters, and Lotharios have long known: **Imitating another person's postures and expressions is an important social lubricant. But how do we learn to imitate with any accuracy when we can't see our own facial expressions and we can't feel the facial expressions of others?**

Richard Cook of City University London, Alan Johnston of University College London, and Cecilia Heyes of the University of Oxford investigate possible mechanisms underlying our ability to imitate in two studies published in *Psychological Science*, a journal of the Association for Psychological Science.

In the first experiment, the researchers videotaped participants as they recited jokes and then asked them to imitate four randomly selected facial expressions from their videos. When they achieved what they perceived to be the target expression, the participants recorded the attempt with the click of a computer mouse.

A computer program evaluated the accuracy of participants' imitation attempts against a map of the target expression. In contrast to previous studies that relied on subjective assessments, this new technology allowed for automated and objective measurement of imitative accuracy.

In one experiment, the researchers found that participants who were able to see their imitation attempts through visual feedback improved over successive attempts. But participants who had to rely solely on proprioception -- sensing the relative position of their facial features -- got progressively worse.

These results are consistent with the *associative sequence-learning model,* which holds that **our ability to imitate accurately depends on learned associations between what we see (in the mirror or through feedback from others) and what we feel.**

Cook and colleagues conclude that contingent visual feedback may be a useful component of rehabilitation and skill-training programs that are designed to improve individuals' ability to imitate facial gestures.

The Mirror, Not the Scale, Is the Enemy of Many This New Year's Resolution Time

Dec. 27, 2012 — For years Blanca Ramirez, like many Americans, started each new year with a resolution to lose weight. But no more. "I lost 55 pounds this year and the weight is rolling off and will stay off," said the 42 year-old, married, mother of three. Ramirez underwent bariatric surgery at Loyola Center for Metabolic Surgery & Bariatric Care in August and has lost 55 pounds in four months. Losing weight and improving health are top New Year's resolutions expected to challenge Americans this year, experts say.

According to a study released in December, 2012, more than a quarter (27.8%) of Americans are obese. The United Health Foundation also reports that 30.8 % of American adults have high blood pressure.

"Losing weight has a positive effect on diabetes, heart disease, orthopaedic injuries, and even cancer," said Bipan Chand, MD, director, Loyola Center for Metabolic Surgery & Bariatric Care, who performed Ramirez's gastric sleeve surgery. "Looking good is just one part of the weight-loss equation; adding years to your life is the real benefit."

Chand says there are many reasons that spur people to choose weight-loss surgery, from years of trying and failing to lose weight to experiencing a serious health scare. For Chicago-area resident Blanca Ramirez, it was her own reflection that spurred a decision to have a gastric-sleeve bariatric procedure. "I have been overweight since I was a teenager and I didn't like what I saw when I looked in the mirror," said Ramirez, who is 5 ft. 3 inches and weighed 225 pounds before her surgery in August. "People would tell me I was pretty and I didn't need to lose weight but I knew I was obese and was sick of being fat."

Diets, exercise programs, prescription pills, Ramirez says she tried everything from Atkins to Weight Watchers. The final straw was when poor health affected her family. "My brother had a heart attack at the age of 35. I already had cholesterol problems and I knew my weight would continue to cause more health problems," said the administrative secretary.

Ramirez attended a free weight loss information session offered by Loyola. "I liked what I heard about their program especially the nutritional counseling, exercise guidance and regular support groups," said Ramirez. "Loyola confirmed that my insurance would cover the procedure and that was the final green light to decide bariatric surgery was right for me." Loyola offers medical as well as surgical weight-loss interventions, including laparoscopic adjustable gastric banding, Roux-en-Y gastric bypass and laparoscopic sleeve gastrectomy.

And Ramirez's resolution for 2013? "To help others win the battle of the bulge.People are always asking me my success and I tell them to attend a Loyola information session," she says. "I like looking at myself in the mirror now. I want others to lose weight and like what they see in the mirror, too."

Kindness Key to Happiness and Acceptance for Children

Dec. 26, 2012 — **Children who make an effort to perform acts of kindness are happier and experience greater acceptance from their peers,** suggests new research from the University of British Columbia and the University of California, Riverside. Kimberly Schonert-Reichl, a professor in UBC's Faculty of Education, and co-author Kristin Layous, of the University of California, Riverside, say that **increasing peer acceptance is key to preventing bullying**.

In the study, published December 26 by *PLOS ONE*, researchers examined how to boost happiness in students aged 9 to 11 years. Four hundred students from Vancouver elementary schools were asked to report on their happiness and to identify which of their classmates they would like to work with on school activities. Half of the students were asked by their teachers to perform acts of kindness -- like sharing their lunch or giving their mom a hug when she felt stressed -- and half were asked to keep track of pleasant places they visited -- like the playground or a grandparent's house.

After four weeks, the students again reported on their happiness and identified classmates they would like to work with. **While both groups said they were happier, kids that had performed acts of kindness selected higher numbers of classmates to work with on school activities**. "**We show that kindness has some real benefits for the personal happiness of children but also for the classroom community**," says Schonert-Reichl, also a researcher with the Human Early Learning Partnership at UBC.

According to Schonert-Reichl, **bullying tends to increase in Grades 4 and 5. By simply asking students to think about how they can act kindly to those around them, "teachers can create a sense of connectedness in the classroom and reduce the likelihood of bullying**."

People With Mental Disorders More Likely to Have Experienced Domestic Violence

Dec. 26, 2012 — **Men and women with mental health disorders, across all diagnoses, are more likely to have experienced domestic violence than the general population**, according to new research from King's College London's Institute of Psychiatry, in collaboration with the University of Bristol. Previous studies into the link between domestic violence and mental health problems have mainly focused on depression, but this is **the first study to look at a wide range of mental health problems in both male and female victims.**

In this study, funded by the National Institute for Health Research (NIHR) and published December 26 in *PLOS ONE*, researchers reviewed data from 41 studies worldwide. Compared to women without mental health problems, women with depressive disorders were around 2 and a ½ times more likely to have experienced domestic violence over their adult lifetime (prevalence estimate 45.8%); women with anxiety disorders were over 3 and a ½ times more likely (prevalence estimate 27.6%); and women with post-traumatic stress disorder (PTSD) were around 7 times more likely (prevalence estimate 61.0%).

Women with other disorders including obsessive compulsive disorder (OCD), eating disorders, common mental health problems, schizophrenia and bipolar disorder were also at an increased risk of domestic violence compared to women without mental health problems. Men with all types of mental disorders were also at an increased risk of domestic violence. However, prevalence estimates for men were lower than those for women, indicating that it is less common for men to be victims of repeated severe domestic violence.

Professor Louise Howard, senior author of the study from King's Institute of Psychiatry, says: "In this study, we found that both men and women with mental health problems are at an increased risk of domestic violence. The evidence suggests that there are two things happening: domestic violence can often lead to victims developing mental health problems, and people with mental health problems are more likely to experience domestic violence."

This study is part of PROVIDE, a 5-year research programme on domestic violence funded by NIHR. Professor Gene Feder, co-author of the study from the University of Bristol's School of Social and Community Medicine and chief investigator of PROVIDE says: "We hope this review will draw attention to the mental health needs of survivors of domestic violence and remind general practitioners and mental health teams that experience of domestic violence may lie behind the presentation of mental health problems."

Internationally, the lifetime prevalence of physical and/or sexual partner violence among women ranges from 15-71%. In the UK, the2010/11 British Crime Survey reported that 27% of women

and 17% of men had experienced partner abuse during their lifetime, with women experiencing more repeated and severe violence than men. From March 2013, the UK Home Office will be amending its definition of domestic violence to include 16 and 17 year olds, and will be defined as "any incident or pattern of incidents of controlling, coercive or threatening behaviour, violence or abuse between those aged 16 or over who are or have been intimate partners or family members regardless of gender or sexuality. This can encompass, but is not limited to, psychological, physical, sexual, financial or emotional abuse."

Professor Howard concludes: "Mental health professionals need to be aware of the link between domestic violence and mental health problems, and ensure that their patients are safe from domestic violence and are treated for the mental health impact of such abuse."

Eating Asparagus May Prevent a Hangover, Study Suggests

Dec. 26, 2012 — Drinking to ring in the New Year may leave many suffering with the dreaded hangover. According to a 2009 study in the *Journal of Food Science*, published by the Institute of Food Technologists (IFT), **the amino acids and minerals found in asparagus extract may alleviate alcohol hangover and protect liver cells against toxins**. Researchers at the Institute of Medical Science and Jeju National University in Korea analyzed the components of young asparagus shoots and leaves to compare their biochemical effects on human and rat liver cells. **"The amino acid and mineral contents were found to be much higher in the leaves than the shoots,"** says lead researcher B.Y. Kim.

Chronic alcohol use causes oxidative stress on the liver as well as unpleasant physical effects associated with a hangover. "Cellular toxicities were significantly alleviated in response to treatment with the extracts of asparagus leaves and shoots," says Kim. "These results provide evidence of how the biological functions of asparagus can help alleviate alcohol hangover and protect liver cells."

Asparagus officinalis is a common vegetable that is widely consumed worldwide and has long been used as an herbal medicine **due to its anticancer effects**. **It also has antifungal, anti-inflammatory and diuretic properties.**

Elevated Levels of C-Reactive Protein Appear Associated With Psychological Distress, Depression

Dec. 24, 2012 — **Elevated levels of C-reactive protein, a marker of inflammatory disease, appear to be associated with increased risk of psychological distress and depression in the**

general population of adults in Denmark, according to a report published Online First by *Archives of General Psychiatry*, a JAMA Network publication.

Depression is one of the leading causes of disability and **previous studies suggest that low-grade systemic inflammation may contribute to the development of depression**. C-reactive protein (CRP) is a commonly used marker of inflammation, and inflammatory disease is suspected when CRP levels exceed 10 mg/L. Researchers are unclear whether and to what extent elevated CRP levels are associated with psychological distress and depression in the general population, according to the study background.

Marie Kim Wium-Andersen, M.D., of Herlev Hospital and Copenhagen University Hospital, Denmark, and colleagues examined whether elevated plasma levels of CRP were associated with distress and depression. Researchers analyzed CRP levels using data from two general population studies in Copenhagen, which included 73,131 men and women ages 20 to 100 years. "The main finding of this study consisted of an association of elevated CRP levels with an increased risk for psychological distress and depression in the general population," the authors comment.

Increasing CRP levels were associated with increasing risk for psychological distress and depression in analyses. For self-reported antidepressant use, the odds ratio was 1.38 for CRP levels of 1.01 to 3 mg/L, 2.02 for 3.01 to 10 mg/L, and 2.7 for greater than 10 mg/L compared with 0.01 to 1 mg/L. For prescription of antidepressants, the corresponding odds ratios were 1.08, 1.47 and 1.77, respectively; for hospitalization with depression they were 1.30, 1.84 and 2.27 respectively. Other analyses suggest that increasing CRP levels also were associated with increasing risk for hospitalization with depression, according to the study results.

"More research is needed to establish the direction of the association between CRP and depression because this study and others are primarily cross-sectional. The results also support the initiation of intervention studies to examine whether adding anti-inflammatory drugs to antidepressants for treatment of depression will improve outcome," the authors conclude.

Decision to Give a Group Effort in the Brain

Dec. 23, 2012 — A monkey would probably never agree that it is better to give than to receive, but **they do apparently get some reward from giving to another monkey**. During a task in which rhesus macaques had control over whether they or another monkey would receive a squirt of fruit juice, three distinct areas of the brain were found to be involved in weighing benefits to oneself against benefits to the other, according to new research by Duke University researchers.

The team used sensitive electrodes to detect the activity of individual neurons as the animals weighed different scenarios, such as whether to reward themselves, the other monkey or nobody at all. **Three areas of the brain were seen to weigh the problem differently depending on the social context of the reward.** The research appears Dec. 24 in the journal *Nature Neuroscience*.

Using a computer screen to allocate juice rewards, the monkeys preferred to reward themselves first and foremost. **But they also chose to reward the other monkey when it was either that or nothing for either of them. They also were more likely to give the reward to a monkey they knew over one they didn't, preferred to give to lower status than higher status monkeys, and had almost no interest in giving the juice to an inanimate object**.

Calculating the social aspects of the reward system seems to be a combination of action by two centers involved in calculating all sorts of rewards and a third center that adds the social dimension, according to lead researcher Michael Platt, director of the Duke Institute for Brain Sciences and the Center for Cognitive Neuroscience.

The orbital frontal cortex, right above the eyes, was activated when calculating rewards to the self. The anterior cingulate sulcus in the middle of the top of the brain seemed to calculate giving up a reward. **But both centers appear "divorced from social context**," Platt said. **A third area, the anterior cingulate gyrus (ACCg), seemed to "care a lot about what happened to the other monkey,**" Platt said. Based on results of various combinations of the reward-giving scenario the monkeys were put through, it would appear that **neurons in the ACCg encode both the giving and receiving of rewards, and do so in a remarkably similar way**.

The use of single-neuron electrodes to measure the activity of brain areas gives a much more precise picture than brain imaging, Platt said. Even the best imaging available now is "a six-second snapshot of tens of thousands of neurons," which are typically operating in milliseconds. What the team has seen happening is consistent with other studies of damaged ACCg regions in which animals lost their typical hesitation about retrieving food when facing social choices. This same region of the brain is active in people when they empathize with someone else.

"Many neurons in the anterior cingulate gyrus (ACCg) respond both when monkeys choose a drink for themselves and when they choose to give a drink to another monkey," Platt said. "One might view these as sort of mirror neurons for the reward system." The region is active as an animal merely watches another animal receiving a reward without having one themselves.

The research is another piece of the puzzle as neuroscientists search for the roots of charity and social behavior in our species and others. There have been two schools of thought about how the social reward system is set up, Platt said. One holds that there is generic circuitry for rewards that has been adapted to our social behavior because it helped humans and other social animals like monkeys thrive. Another school holds that social behavior is so important to humans and other highly social animals like monkeys that there may be some special circuits for it, Platt said.

This finding, in macaques that have only a very distant common ancestor with us and are "not a particularly prosocial animal," suggests that "this specialized social circuitry evolved a long time ago presumably to support cooperative behavior," Platt said.

The research was supported by grants from the Ruth K. Broad Biomedical Foundation, Canadian Institutes of Health Research, National Institute of Mental Health (MH095894), and Department of Defense (W81XWH-11-1-0584).

Fat Influences Decisions Taken by Brain Cells for Production and Survival

Dec. 23, 2012 — Scientists at Karolinska Institutet in Sweden have identified **two molecules that play an important role in the survival and production of nerve cells in the brain, including nerve cells that produce dopamine.** The discovery, which is published in the journal *Nature Chemical Biology*, may be significant in the long term for the treatment of several diseases, such as Parkinson's disease.

The same scientists have previously shown that receptors known as "liver X receptors" or LXR, are necessary for the production of different types of nerve cells, or neurons, in the developing ventral midbrain. One these types, the midbrain dopamine-producing neurons play an important role in a number of diseases, such as Parkinson's disease.

What was not known, however, was which molecules stimulate LXR in the midbrain, such that the production of new nerve cells could be initiated. The scientists have used mass spectrometry and systematic experiments on zebrafish and mice to identify two molecules that bind to LXR and activate it. These two molecules are named cholic acid and 24,25-EC, and are bile acid and a derivate of cholesterol, respectively. The first molecule, cholic acid, influences the production and survival of neurons in what is known as the "red nucleus," which is important for incoming signals from other parts of the brain. The other molecule, 24,25-EC, influences the generation of new dopamine-producing nerve cells, which are important in controlling movement.

One important conclusion of the study is that 24,25-EC can be used to turn stem cells into midbrain dopamine-producing neurons, the cell type that dies in Parkinson's disease. This finding opens the possibility of using cholesterol derivates in future regenerative medicine, since new dopamine-producing cells created in the laboratory could be used for transplantation to patients with Parkinson's disease.

"We are familiar with the idea of cholesterol as a fuel for cells, and we know that it is harmful for humans to consume too much cholesterol," says Ernest Arenas, Professor of Stem Cell Neurobiology at the Department of Medical Biochemistry and Biophysics at Karolinska Institutet, who led the study. "What we have shown now is that cholesterol has several functions, and that it is involved in extremely important decisions for neurons. Derivatives of cholesterol control the production of new neurons in the developing brain. When such a decision has been taken, cholesterol aids in the construction of these new cells, and in their survival. Thus cholesterol is extremely important for the body, and in particular for the development and function of the brain."

The study has been financed by grants from (among other bodies) the Swedish Brain Foundation, the European Union, the Swedish Foundation for Strategic Research, Karolinska Institutet and the Swedish Research Council.

A New Type of Nerve Cell Found in the Brain

Dec. 21, 2012 — Scientists at Karolinska Institutet in Sweden, in collaboration with colleagues in Germany and the Netherlands, have **identified a previously unknown group of nerve cells in the brain. The nerve cells regulate cardiovascular functions such as heart rhythm and blood pressure.** It is hoped that the discovery, which is published in the *Journal of Clinical Investigation*, will be significant in the long term in the treatment of cardiovascular diseases in humans.

The scientists have managed to identify in mice a previously totally unknown group of nerve cells in the brain. These nerve cells, also known as 'neurons', develop in the brain with the aid of thyroid hormone, which is produced in the thyroid gland. Patients in whom the function of the thyroid gland is disturbed and who therefore produce too much or too little thyroid hormone, thus risk developing problems with these nerve cells. This in turn has an effect on the function of the heart, leading to cardiovascular disease.

It is well-known that patients with untreated hyperthyroidism (too high a production of thyroid hormone) or hypothyroidism (too low a production of thyroid hormone) often develop heart problems. It has previously been believed that this was solely a result of the hormone affecting the heart directly. The new study, however, shows that thyroid hormone also affects the heart indirectly, through the newly discovered neurons.

"This discovery opens the possibility of a completely new way of combating cardiovascular disease," says Jens Mittag, group leader at the Department of Cell and Molecular Biology at Karolinska Institutet. "If we learn how to control these neurons, we will be able to treat certain cardiovascular problems like hypertension through the brain. This is, however, still far in the future. A more immediate conclusion is that it is of utmost importance to identify and treat pregnant women with hypothyroidism, since their low level of thyroid hormone may harm the production of these neurons in the fetus, and this may in the long run cause cardiovascular disorders in the offspring."

The study has been financed with grants from the European Molecular Biology Organisation, Deutsche Forschungsgemeinschaft, the Fredrik and Ingrid Thuring Foundation, Karolinska Institutet Foundation, the American Thyroid Association, the Swedish Research Council, the Swedish Cancer Society, the Söderberg Foundations, the Swedish Heart-Lung Foundation, the Netherlands Organization for Health Research and Development, and the Ludgardine Bouwman Foundation.

Genetic Differences May Influence Sensitivity to Pain, According to New Study

Dec. 20, 2012 — The study, published in *PLOS Genetics* on 20 December, adds to growing evidence that **particular genes are involved in chronic pain and highlights this pathway as a**

potential target for more effective pain relief treatments for patients. The collaborative study between King's, Pfizer Ltd and the Beijing Genomics Institute (BGI), used a new method to study and compare DNA, called 'exome sequencing', to identify genetic variations relating to pain sensitivity.

Lead author Dr Frances Williams, from the Department of Twin Research and Genetic Epidemiology at King's College London said: 'Chronic pain is a significant personal and socio-economic burden, with nearly one in five people experiencing it at some time in their lives. Current pain treatments often have either limited efficacy or side effects for many, so the possibility of a new approach to pain relief is an exciting development.

It is known that people who are most sensitive to pain encountered in everyday life are more likely to go on to develop chronic pain. To identify sensitivity levels, researchers tested 2,500 volunteers using a heating probe on the arm. Volunteers were asked to press a button when the heat became painful for them, which allowed the scientists to determine individuals' pain thresholds. Exome sequencing was then used to analyse the DNA of 200 of the most pain sensitive and 200 of the least pain sensitive people.

Xin Jin, project manager from BGI, said: 'More and more evidence supports our theory that rare variants, which were overlooked in genome-wide association study, play a very important role in complex diseases and traits. The next generation of sequencing will make it possible to explore these rare variants and will lead to a wave of new discoveries in biomedical research.'

The results showed different patterns of genetic variants in each group -- the pain sensitive people had less variation in their DNA than those who were pain insensitive. Serena Scollen, Geneticist from Pfizer and co-author on the work said: 'Further studies are needed to understand fully the genetics that underlie pain sensitivity in humans, but early studies in this area are promising.'

Ruth McKernan, Chief Scientific Officer of Pfizer's Research Unit in Cambridge that works on new pain drugs said: 'This study demonstrates the value of collaborative efforts between academia and industry. The genetic influence on normal pain processing in human volunteer populations will add to other approaches and help us prioritise potential new mechanisms for treating pain.'

Toddlers' Language Skills Predict Less Anger by Preschool

Dec. 20, 2012 — **Toddlers with more developed language skills are better able to manage frustration and less likely to express anger by the time they're in preschool.** That's the conclusion of a new longitudinal study from researchers at the Pennsylvania State University that appears in the journal *Child Development*.

"This is the first longitudinal evidence of early language abilities predicting later aspects of anger regulation," according to Pamela M. Cole, liberal arts research professor of psychology and human development and family studies at Pennsylvania State University, who was the principal investigator of the study.

Angry outbursts like temper tantrums are common among toddlers, but by the time children enter school, they're expected to have more self-control. To help them acquire this skill, they're taught to use language skills like "using your words." This study sought to determine whether developing language skills relates to developing anger control. Does developing language ability reduce anger between ages 2 and 4?

Researchers looked at 120 predominantly White children from families above poverty but below middle income from the time they were 18 months to 48 months. Through home and lab visits, they measured children's language and their ability to cope with tasks that might elicit frustration.

In one lab-based task, children were asked to wait 8 minutes before opening a gift while their moms finished "work" (a series of questions about how the child usually coped with waiting). Children's anger and regulatory strategies were observed during the 8-minute wait. Among the strategies the children used were seeking support ("Mom, are you done yet?" or "I wonder what it is?") and distracting themselves from the gift (making up a story or counting aloud).

Children who had better language skills as toddlers and whose language developed more quickly expressed less anger at age 4 than their peers whose toddler language skills weren't as good. Children whose language developed more quickly were more likely to calmly seek their mother's support while waiting when they were 3, which in turn predicted less anger at 4. Children whose language developed more quickly also were better able to occupy themselves when they were 4, which in turn helped them tolerate the wait. "Better language skills may help children verbalize rather than use emotions to convey needs and use their imaginations to occupy themselves while enduring a frustrating wait," according to Cole.

Motivation, Study Habits -- Not IQ -- Determine Growth in Math Achievement

Dec. 20, 2012 — **It's not how smart students are but how motivated they are and how they study that determines their growth in math achievement**. That's the main finding of a new study that appears in the journal *Child Development*. The study was conducted by researchers at the University of Munich and the University of Bielefeld.

"While intelligence as assessed by IQ tests is important in the early stages of developing mathematical competence, motivation and study skills play a more important role in students' subsequent growth," according to Kou Murayama, postdoctoral researcher of psychology at the University of California, Los Angeles (who was at the University of Munich when he led the study).

Murayama and colleagues looked at six annual waves of data from a German longitudinal study assessing math ability in 3,520 students in grades 5 to 10. They investigated how students' motivation, study skills, and intelligence jointly predicted long-term growth in their math achievement over five years.

Intelligence was strongly linked to students' math achievement, but only in the initial development of competence in the subject. Motivation and study skills turned out to be more important factors in terms of students' growth (their learning curve or ability to learn) in math. Students who felt competent; were intrinsically motivated; used skills like summarizing, explaining, and making connections to other materials; and avoided rote learning showed more growth in math achievement than those who didn't. In contrast, students' intelligence had no relation to growth in math achievement.

"Our study suggests that students' competencies to learn in math involve factors that can be nurtured by education," explained Murayama. "Educational programs focusing on students' motivation and study skills could be an important way to advance their competency in math as well as in other subjects."

Our Hands Evolved for Punching, Not Just Dexterity

Dec. 19, 2012 — Men whacked punching bags for a University of Utah study that suggests **human hands evolved not only for the manual dexterity needed to use tools, play a violin or paint a work of art, but so men could make fists and fight.** Compared with apes, humans have shorter palms and fingers and longer, stronger, flexible thumbs -- features that have been long thought to have evolved so our ancestors had the manual dexterity to make and use tools.

"The role aggression has played in our evolution has not been adequately appreciated," says University of Utah biology Professor David Carrier, senior author of the study, scheduled for publication Dec. 19 by the *Journal of Experimental Biology*. **"There are people who do not like this idea, but it is clear that compared with other mammals, great apes are a relatively aggressive group, with lots of fighting and violence, and that includes us**," Carrier says. "We're the poster children for violence."

Humans have debated for centuries "about whether we are, by nature, aggressive animals," he adds. "Our anatomy holds clues to that question. If we can understand what our anatomy has evolved to do, we'll have a clearer picture of who we were in the beginning, and whether aggression is part of who we are." Carrier agrees that human hands evolved for improved manual dexterity, but adds that "the proportions of our hands also allow us to make a fist," protecting delicate hand bones, muscles and ligaments during hand-to-hand combat.

As our ancestors evolved, "an individual who could strike with a clenched fist could hit harder without injuring themselves, so they were better able to fight for mates and thus more likely to reproduce," he says. Fights also were for food, water, land and shelter to support a family, and "over pride, reputation and for revenge," he adds. "If a fist posture does provide a performance advantage for punching, the proportions of our hands also may have evolved in response to selection for fighting ability, in addition to selection for dexterity," Carrier says.

So Carrier and study co-author Michael H. Morgan -- a University of Utah medical student -- conducted their study to identify any performance advantages a human fist may provide during fighting. The research was funded by the National Science Foundation.

Three Experiments and the Findings

The first experiment tested the hypothesis that humans can hit harder with a fist. So, Carrier and Morgan had 10 male students and nonstudents -- ages 22 to 50 and all of them with boxing or martial arts experience -- hit a punching bag as hard as they could.

Each subject delivered 18 hits, or three of each for six kinds of hits: overhead hammer fists and slaps, side punches and slaps, and forward punches and palm shoves. The bag was instrumented to allow calculation of the force of the punches and slaps.

To the researchers' surprise, the peak force was the same, whether the bag was punched with a fist or slapped with an open hand. However, a fist delivers the same force with one-third of the surface area as the palm and fingers, and 60 percent of the surface area of the palm alone. So the peak stress delivered to the punching bag -- the force per area -- was 1.7 to three times greater with a fist strike compared with a slap.

"Because you have higher pressure when hitting with a fist, you are more likely to cause injury" to tissue, bones, teeth, eyes and the jaw, Carrier says. The second and third experiments -- which each also involved 10 male subjects -- tested the hypothesis that a fist provides buttressing to protect the hand during punching. To do that, the researchers measured the stiffness of the knuckle joint of the first finger, and how force is transferred from the fingers to the thumb. Both measurements were made with normal, buttressed fists or when partial fists were not buttressed.

Humans buttress -- strengthen and stabilize -- fists in two ways that apes cannot: The pads of the four fingertips touch the pads at the top of the palm closest to the fingers. And the thumb wraps in front of the index and middle fingers, and to some extent the ring finger, and those fingers are locked in place by the palm at the base of the thumb.

To measure stiffness of the second knuckle joint, the study's 10 male subjects slowly pushed a pressure transducer, with clenched fists or with fingers bent but the fist unclenched. Researchers measured the force and also how much the index finger flexed. Force transfer from fingers to the thumb also was measured, but in this case the subjects got in a one-handed pushup position, with their knuckles pushing down on a block placed on a different force transducer.

The second and third experiments found that buttressing provided by the human fist increased the stiffness of the knuckle joint fourfold (or reduced flexing fourfold), and also doubled the ability of the fingers to transmit punching force, mainly due to the force transferred from the fingers to the thumb when the fist is clenched. "Because the experiments show the proportions of the human hand provide a performance advantage when striking with a fist, we suggest that the proportions of our hands resulted, in part, from selection to improve fighting performance," Carrier says.

Carrier notes that besides dexterity and aggression, a third theory to explain the proportions of human hands also may be true: Natural selection for walking and running among human ancestors led to shorter toes and a longer big toe -- and the responsible genes also led to shorter fingers and longer thumbs.

How Selection Favored Fists and Aggression

Apes' elongated fingers and hands evolved so they could climb trees. "The standard argument is that once our ancestors came out of the trees, the selection for climbing was gone, so selection for manipulation became dominant, and that's what changed the shape of our ancestors' hands," Carrier says. "Human-like hand proportions appear in the fossil record at the same time our ancestors started walking upright 4 million to 5 million years ago. An alternative possible explanation is that we stood up on two legs and evolved these hand proportions to beat each other."

Carrier says that if manual dexterity was the only driving force, humans could have evolved manual dexterity with longer thumbs without the fingers and palms getting shorter. But, he adds, "there is only one way you can have a buttressed, clenched fist: the palms and fingers got shorter at the same time the thumb got longer."

Morgan and Carrier cite other arguments that fighting helped shape human hands:

-- No ape hits with a clenched fist other than humans. Gorilla hands are closer in proportion to human hands than are other apes' hands -- a paradox since chimps are better known for tool-making and dexterity. So Morgan and Carrier also believe aggression was a factor in the evolution of gorillas' hands.

-- Humans use fists as threat displays. "If you are angry, the reflexive response is to form a fist," Carrier says. "If you want to intimidate somebody, you wave your fist."

-- Sexual dimorphism -- a difference in body size between males and females -- is greater if there is more male-male competition in a primate species. "Look at humans and gorillas. The difference between the sexes is mainly in the upper body and the arms, and especially the hands," Carrier says. "It's consistent with the hand being a weapon."

Carrier and Morgan write that the human hand is paradoxical.

"It is arguably our most important anatomical weapon, used to threaten, beat and sometimes kill to resolve conflict," they say. "Yet it is also the part of our musculoskeletal system that crafts and uses delicate tools, plays musical instruments, produces art, conveys complex intentions and emotions, and nurtures."

"More than any other part of our anatomy, the hand represents the identity of Homo sapiens. Ultimately, the evolutionary significance of the human hand may lie in its remarkable ability to serve two seemingly incompatible but intrinsically human functions."

Are Bacteria Making You Hungry?

Dec. 19, 2012 — **O**ver the last half decade, it has become increasingly clear that the normal gastrointestinal (GI) bacteria play a variety of very important roles in the biology of human and animals. Now Vic Norris of the University of Rouen, France, and coauthors propose yet another role for GI bacteria: **that they exert some control over their hosts' appetites**. Their review was published online ahead of print in the *Journal of Bacteriology*.

This hypothesis is based in large part on observations of the number of roles bacteria are already known to play in host biology, as well as their relationship to the host system. **"Bacteria both recognize and synthesize neuroendocrine hormones**," Norris et al. write. "This has led to the hypothesis **that microbes within the gut comprise a community that forms a microbial organ interfacing with the mammalian nervous system that innervates the gastrointestinal tract**." (That nervous system innervating the GI tract is called the **"enteric nervous system."** It contains roughly half a billion neurons, compared with 85 billion neurons in the central nervous system.)

"The gut microbiota respond both to both the nutrients consumed by their hosts and to the state of their hosts as signaled by various hormones," write Norris et al. That communication presumably goes both ways: they also generate compounds that are used for signaling within the human system, "including neurotransmitters such as GABA, amino acids such as tyrosine and tryptophan -- which can be converted into the mood-determining molecules, dopamine and serotonin" -- and much else, says Norris.

Furthermore, it is becoming increasingly clear that gut bacteria may play a role in diseases such as cancer, metabolic syndrome, and thyroid disease, through their influence on host signaling pathways. They may even influence mood disorders, according to recent, pioneering studies, via actions on dopamine and peptides involved in appetite. **The gut bacterium, *Campilobacter jejuni*, has been implicated in the induction of anxiety in mice,** says Norris.

But do the gut flora in fact use their abilities to influence choice of food? The investigators propose a variety of experiments that could help answer this question, including epidemiological studies, and "experiments correlating the presence of particular bacterial metabolites with images of the activity of regions of the brain associated with appetite and pleasure."

Scientists Construct First Detailed Map of How the Brain Organizes Everything We See

Dec. 19, 2012 — Our eyes may be our window to the world, but **how do we make sense of the thousands of images that flood our retinas each day?** Scientists at the University of California, Berkeley, have found that **the brain is wired to put in order all the categories of objects and actions that we see. They have created the first interactive map of how the brain organizes these groupings.** The result -- achieved through computational models of brain imaging data collected while the subjects watched hours of movie clips -- is what researchers call **"a continuous semantic space."**

Some relationships between categories make sense (humans and animals share the same "semantic neighborhood") while others (hallways and buckets) are less obvious. The researchers found that **different people share a similar semantic layout**. "Our methods open a door that will quickly lead to a more complete and detailed understanding of **how the brain is organized**. Already, our online brain viewer appears to provide the most detailed look ever at the visual function and organization of a single human brain," said Alexander Huth, a doctoral student in neuroscience at UC Berkeley and lead author of the study published **Dec. 19 in the journal *Neuron*.**

A clearer understanding of how the brain organizes visual input can help with the medical diagnosis and treatment of brain disorders. These findings may also be used to create brain-machine interfaces, particularly for facial and other image recognition systems. Among other things, they could improve a grocery store self-checkout system's ability to recognize different kinds of merchandise. "Our discovery suggests that brain scans could soon be used to label an image that someone is seeing, and may also help teach computers how to better recognize images," said Huth.

It has long been thought that each category of object or action humans see -- people, animals, vehicles, household appliances and movements -- is represented in a separate region of the visual cortex. In this latest study, UC Berkeley researchers found that **these categories are actually represented in highly organized, overlapping maps that cover as much as 20 percent of the brain, including the somatosensory and frontal cortices**.

To conduct the experiment, the brain activity of five researchers was recorded via functional Magnetic Resonance Imaging (fMRI) as they each watched two hours of movie clips. The brain scans simultaneously measured blood flow in thousands of locations across the brain. Researchers then used regularized linear regression analysis, which finds correlations in data, to build a model showing how each of the roughly 30,000 locations in the cortex responded to each of the 1,700 categories of objects and actions seen in the movie clips. Next, they used principal components analysis, a statistical method that can summarize large data sets, to find the "semantic space" that was common to all the study subjects.

The results are presented in multicolored, multidimensional maps showing the more than 1,700 visual categories and their relationships to one another. Categories that activate the same brain areas have similar colors. For example, humans are green, animals are yellow, vehicles are pink and violet and buildings are blue. "Using the semantic space as a visualization tool, we immediately saw that categories are represented in these incredibly intricate maps that cover much more of the brain than we expected," Huth said. Other co-authors of the study are UC Berkeley neuroscientists Shinji Nishimoto, An T. Vu and Jack Gallant.

Scientists Debunk the IQ Myth: Notion of Measuring One's Intelligence Quotient by Singular, Standardized Test Is Highly Misleading

Dec. 19, 2012 — After conducting the largest online intelligence study on record, a Western University-led research team has concluded that **the notion of measuring one's intelligence quotient or IQ by a singular, standardized test is highly misleading**.

The findings from the landmark study, which included more than 100,000 participants, were published Dec. 19 in the journal *Neuron*. The article, "Fractionating human intelligence," was written by Adrian M. Owen and Adam Hampshire from Western's Brain and Mind Institute (London, Canada) and Roger Highfield, Director of External Affairs, Science Museum Group (London, U.K).

Utilizing an online study open to anyone, anywhere in the world, the researchers asked respondents to complete 12 cognitive tests tapping memory, reasoning, attention and planning abilities, as well as a survey about their background and lifestyle habits. "The uptake was astonishing," says Owen, the Canada Excellence Research Chair in Cognitive Neuroscience and Imaging and senior investigator on the project. "We expected a few hundred responses, but thousands and thousands of people took part, including people of all ages, cultures and creeds from every corner of the world."

The results showed that when a wide range of cognitive abilities are explored, the observed variations in performance can only be explained with at least three distinct components: short-term memory, reasoning and a verbal component. No one component, or IQ, explained everything. Furthermore, the scientists used a brain scanning technique known as functional magnetic resonance imaging (fMRI), to show that these differences in cognitive ability map onto distinct circuits in the brain.

With so many respondents, the results also provided a wealth of new information about how factors such as age, gender and the tendency to play computer games influence our brain function. "**Regular brain training didn't help people's cognitive performance at all yet aging had a profound negative effect on both memory and reasoning abilities,"** says Owen.

Hampshire adds, "Intriguingly, people who regularly played computer games did perform significantly better in terms of both reasoning and short-term memory. And smokers performed poorly on the short-term memory and the verbal factors, while people who frequently suffer from anxiety performed badly on the short-term memory factor in particular."

Five Reasons Why New Year's Resolutions to Diet and Exercise Might Be Unhealthy

Dec. 19, 2012 — Year after year, one of the most popular New Year's resolutions is to eat healthy and lose weight. But as resolutions and health regimens are about to be in full swing, many might find that instead of feeling good they are feeling worse. And the reason might be due to the one thing that should be helping: exercise.

"Not only can new workout routines be difficult for those with asthma, but several allergens can be found lurking in health clubs making this healthy activity bothersome for the more than 40 million Americans that suffer from allergies," said allergist Richard Weber, MD, president of the American College of Allergy, Asthma and Immunology (ACAAI). "By understanding what triggers symptoms, those with allergies and asthma will be able to feel good and remain active."

To help those with New Year's resolutions succeed, ACAAI has identified the five most common allergy and asthma exercise ailments, with tips on how to overcome them.

• **Over Stepping your Boundaries -** If you're experiencing shortness of breath, wheezing, coughing, chest tightness and unusual fatigue you might have exercise-induced bronchoconstriction (EIB). The condition affects about 10 percent of Americans. Find relief by using your allergist prescribed inhaler before you begin your workout routine. Breathing through your nose, rather than your mouth, can also help.

• **Think Before you Eat -** Whether you've signed up for a dieting meal plan or are opting for foods with less calories, be sure to always read nutrition labels before you consume new items. Many products contain hidden food allergens, such as milk, wheat and egg. Energy bars can also be loaded with allergens, including soy and nuts, that affect certain people.

• **Choose Equipment Wisely -** While most exercise machines won't cause you to sneeze or wheeze, rubber mats, medicine balls and some rubber coated free weights might. Latex can often be found in these items, causing those with latex allergies to develop a rash or hives. Also beware of disinfectant wipes and sprays used to clean gym equipment. They can contain volatile organic compounds (VOCs) which can spur an asthma attack or cause skin irritation.

• **Explore the Great Indoors -** If you're allergic to pollen, grass and other environmental factors, hit the ground running indoors. Not a fan of treadmills and indoor tracks? Take your allergy medication and avoid running outdoors during mid-day and afternoon hours when pollen counts may be highest. Be sure to change your clothes and shower immediately after finishing your workout to remove any particles that might have fallen onto your clothes and hair.

• **Opt for Comfort over Fashion -** If your workout leaves you itchy and you've ruled out other gym culprits, your clothing might be the setback. Synthetic materials used in everything from shirts to socks could be irritating your skin. ACAAI recommends checking clothing labels and opting for Lycra (spandex) which is higher quality and less likely to irritate your skin. Garments made of natural products can also help. If you have a latex allergy, be wary of athletic shoes and elastic waistbands.

Aerobic Exercise Trumps Resistance Training for Weight and Fat Loss

Dec. 15, 2012 — **Aerobic training is the best mode of exercise for burning fat**, according to Duke researchers who compared aerobic training, resistance training, and a combination of the two. The study, which appears Dec. 15, 2012, in the *Journal of Applied Physiology*, is **the largest randomized trial to analyze changes in body composition from the three modes of exercise in overweight or obese adults without diabetes.**

Aerobic exercise -- including walking, running, and swimming -- has been proven to be an effective way to lose weight. However, recent guidelines have suggested that resistance training, which includes weight lifting to build and maintain muscle mass, may also help with weight loss by increasing a person's resting metabolic rate. Research has demonstrated health benefits for resistance training, such as improving glucose control, but studies on the effects of resistance training on fat mass have been inconclusive.

"Given that approximately two-thirds of adults in the United States are overweight due to excess body fat, we want to offer clear, evidence-based exercise recommendations that will truly help people lose weight and body fat," said Leslie H. Willis, MS, an exercise physiologist at Duke Medicine and the study's lead author.

Researchers enrolled 234 overweight or obese adults in the study. Participants were randomly assigned to one of three exercise training groups: resistance training (three days per week of weight lifting, three sets per day, 8-12 repetitions per set), aerobic training (approximately 12 miles per week), or aerobic plus resistance training (three days a week, three set per day, 8-12 repetitions per set for resistance training, plus approximately 12 miles per week of aerobic exercise).

The exercise sessions were supervised in order to accurately measure adherence among participants. Data from 119 people who completed the study and had complete body composition data were analyzed to determine the effectiveness of each exercise regimen. The groups assigned to aerobic training and aerobic plus resistance training lost more weight than those who did just resistance training. The resistance training group actually gained weight due to an increase in lean body mass.

Aerobic exercise was also a more efficient method of exercise for losing body fat. The aerobic exercise group spent an average of 133 minutes a week training and lost weight, while the

resistance training group spent approximately 180 minutes exercising a week without shedding pounds. The combination exercise group, while requiring double the time commitment, provided a mixed result. The regimen helped participants lose weight and fat mass, but did not significantly reduce body mass nor fat mass over aerobic training alone. **This group did notice the largest decrease in waist circumference, which may be attributed to the amount of time participants spent exercising.**

Resting metabolic rate, which determines how many calories are burned while at rest, was not directly measured in this study. While theories suggest that resistance training can improve resting metabolic rates and therefore aid in weight loss, in this study, resistance training did not significantly decrease fat mass nor body weight irrespective of any change in resting metabolic rate that might have occurred.

"No one type of exercise will be best for every health benefit," Willis added. "However, it might be time to reconsider the conventional wisdom that resistance training alone can induce changes in body mass or fat mass due to an increase in metabolism, as our study found no change."

Duke researchers added that exercise recommendations are age-specific. For older adults experiencing muscle atrophy, studies have found resistance training to be beneficial. However, younger, healthy adults or those looking to lose weight would see better results doing aerobic training.

"Balancing time commitments against health benefits, our study suggests that aerobic exercise is the best option for reducing fat mass and body mass," said Cris A. Slentz, PhD, a Duke exercise physiologist and study co-author. "It's not that resistance training isn't good for you; it's just not very good at burning fat."

In addition to Willis and Slentz, Duke study authors include Lori A. Bateman, Lucy W. Piner, Connie W. Bales, and William E. Kraus. East Carolina University study authors include A. Tamlyn Shields and Joseph A. Houmard. The study was funded with a grant from the National Heart, Lung, and Blood Institute, National Institutes of Health (2R01-HL057354).

Curbing Car Travel Could Be as Effective as Cutting Calories

Dec. 18, 2012 — Those considering how to maintain a healthy weight during holiday festivities, or looking ahead to New Year's resolutions, may want to think twice before reaching for traditional staples like cookies or candy -- or the car keys.

A new study by University of Illinois researchers, led by computer science and mathematics professor Sheldon H. Jacobson, suggests that **both daily automobile travel and calories consumed are related to body weight, and reducing either one, even by a small amount, correlates with a reduction in body mass index (BMI).**

"We're saying that making small changes in travel or diet choices may lead to comparable obesity reduction, which implies that travel-based interventions may be as effective as dietary interventions," said graduate student Banafsheh Behzad, a co-author of the study, published in the journal Preventive Medicine.

Obesity is a multidimensional problem with many social and medical factors, but maintaining body weight essentially is a result of energy consumed and energy expended. Other studies look at the two issues individually, or at a local or individual level, but Jacobson's group wanted to look at both sides of the equation through a national lens. As an outgrowth of previous work examining the relationship between driving and obesity, they decided to use driving as a proxy for physical activity.

"An easy way to be more physically active is to spend less time in an automobile. Any time a person sits behind the wheel of a car, it's one of the most docile activities they can do in a day," Jacobson said. "The automobile is the quickest mode of transportation we have. But a consequence of this need for speed in getting things done may be the obesity epidemic."

The researchers used publicly available data on national average BMI, caloric intake and driving habits. To capture the complexity in the relationship among the three variables, they developed a multivariable model showing how calories consumed and miles driven correlate with BMI.

They found that if all adults in the United States drove 1 mile less per day, the model predicted an associated decrease in the national average BMI by 0.21 kg/m2 after six years. (The national average BMI in 2010, the most recent data available, was 27.55.) In comparison, reducing diet by 100 calories per day would be associated with reducing national average BMI by 0.16 kg/m2 after three years.

"One mile is really not much," Behzad said. "If they would just consider even taking the bus, walking the distance to the bus stop could have an impact like eating 100 calories less per day. The main thing is paying attention to caloric intake and moving more, together, can help reduce BMI."

Even a modest decrease in BMI, like that predicted by the model, could represent significant cost savings. If drivers nationwide traveled 1 mile less by car each day, not only would fuel consumption fall, but annual health care costs could drop by billions of dollars as fewer people would be classified as obese or overweight, Jacobson estimates.

"The most important thing for people to learn from this study is that they have a choice," Jacobson said. "One has to be just as careful about when you choose to drive as when you choose to eat. These small changes in our driving and dietary habits can lead to long-term significant changes in obesity issues. Those are the kind of changes we advocate."

Douglas King, a visiting lecturer of industrial and systems enterprise engineering at the U. of I., also was a co-author of the paper.

The Best-Laid Plans: How We Update Our Goals Based On New Information

Dec. 18, 2012 — **Humans are adept at setting goals and updating them as new situations arise** -- for example, a person who is playing a video game may switch to a new goal when their phone rings.

Now, Princeton University researchers have identified **mechanisms that govern how the brain incorporates information about new situations into our existing goals**, according to research recently published in the *Proceedings of the National Academy of Sciences (PNAS).*

Using brain scans of human volunteers, researchers at the Princeton Neuroscience Institute (PNI) found that **updating goals takes place in a region known as the prefrontal cortex, and appears to involve signals associated with the brain chemical dopamine.** When the researchers used a magnetic pulse to interrupt activity in that region of the brain, the volunteers became unable to switch to a new task when playing a game requiring them to push a button after seeing letters pop up on a screen.

"We have found a fundamental mechanism that contributes to the brain's ability to concentrate on one task and then flexibly switch to another task," said Jonathan Cohen, Princeton's Robert Bendheim and Lynn Bendheim Thoman Professor in Neuroscience and co-director of PNI. "Impairments in this system are central to many critical disorders of cognitive function such as those observed in schizophrenia and obsessive-compulsive disorder."

Cohen worked with lead author Kimberlee D'Ardenne, who earned her Ph.D. in chemistry and neuroscience from Princeton in 2008 and is now a postdoctoral associate at Virginia Tech; Neir Eshel, a graduate student at Harvard Medical School who conducted the research as an undergraduate as part of his Princeton senior thesis; Joseph Luka, a medical student at Tulane University School of Medicine; Agatha Lenartowicz, a postdoctoral scholar at the University of California-Los Angeles; and Leigh Nystrom, co-director of the Neuroscience Cognitive Control Laboratory at PNI.

Existing research has shown that when new information is used to update a task, behavior or goal, this information is held in a type of short-term memory storage known as working memory. Investigators did not know, however, what mechanisms were involved in updating this information.

To find out, Cohen's team used functional magnetic resonance imaging (fMRI) to scan the brains of human volunteers playing a game wherein they pressed a specific button depending on a particular visual cue. If the volunteer saw the letter A prior to seeing the letter X, he or she had to press button 1. But if the volunteer saw the letter B prior to seeing the X, the participant had to press button 2. The A and B served as the new information that the participant used to update their goal of deciding which button to press. Another version of the task required the same participants to press button 1 upon seeing an X regardless of whether an A or B was shown.

With the fMRI, the researchers detected activity in the right prefrontal cortex during tasks that required the participants to remember whether they saw an A or a B before pressing the correct button, but not during tasks where the participant only had to press the button when prompted by an X.

These results confirmed findings from a previous study led by Cohen and published in the journal Cognitive, Affective and Behavioral Neuroscience in 2010 that used another scanning method to gauge the timing of the brain activity. Using electroencephalography (EEG), the researchers found that the prefrontal cortex showed a spike in brain electrical activity 150 milliseconds after the participant viewed the context letter A or B.

For the current study, the researchers demonstrated that the prefrontal cortex is indeed the area of the brain involved with updating working memory by sending a short magnetic pulse to the region. This pulse disrupted cortex activity at the precise time -- as revealed by the EEG -- the researchers suspected that the prefrontal cortex was updating working memory. When the researchers introduced the pulse to the right side of prefrontal cortex about 150 milliseconds after the volunteers saw the A or B, the participants were unable to press the correct buttons, Cohen said.

"We predicted that if the pulse was delivered to the **part of the right prefrontal cortex** observed using fMRI, and at the time when the brain is updating its information as revealed by EEG, then the subject would not retain the information about A and B, interfering with his or her performance on the button-pushing task," Cohen said.

Finally, the researchers explored their theory that dopamine -- a naturally occurring chemical involved in motivation and reward among other brain functions -- tags new information entering the prefrontal cortex as important for updating working memory and goals. Cohen and his team imaged a brain region called the midbrain, which contains clusters of nerve cells called dopaminergic nuclei that are the source of most of the dopamine signals in the brain. Using high-resolution fMRI, the researchers probed the activity of these dopamine-releasing cells in the brains of volunteers engaged in the game described above. The researchers found that the brain activity in these areas correlated both with the activity in the right prefrontal cortex and with the ability of the volunteers to press the correct buttons.

"The remarkable part was that the dopamine signals correlated both with the behavior of our volunteers and their brain activity in the prefrontal cortex," Cohen said. "This constellation of findings provides strong evidence that the dopaminergic nuclei are enabling the prefrontal cortex to hold on to information that is relevant for updating behavior, but not information that isn't."

David Badre, a Brown University assistant professor of cognitive, linguistic and psychological sciences, said that the work is an important step forward in understanding how working memory is updated. Badre is familiar with the work but had no role in it.

In a commentary published online Nov. 9 by *PNAS*, Badre wrote: "The mechanisms by which the brain achieves an adaptive balance between flexibility and stability remain the basis of much

current investigation in cognitive neuroscience. These results provide a basis for new investigations into the neural mechanisms of flexible, goal-directed behavior."

Psychologists: Scrooge's Transformation Parallels Real Life-Changing Experiences

Dec. 18, 2012 — "Bah, humbug!" is the line most closely associated with Ebenezer Scrooge, the famous miser from "A Christmas Carol." But the authors of a new study on life-changing experiences give author Charles Dickens high marks for his portrayal of Scrooge's sudden switch to saintliness. Former grad student Jon Skalski and Brigham Young University psychology professor Sam Hardy conducted an in-depth study of 14 people who experienced profound, sudden and lasting change. They say the fictional Scrooge would fit right in.

"Like our participants, Scrooge was suffering," Skalski said. "There was disintegration. There was a world that was ripe for change because of suffering going on." Though Scrooge had money, he hit rock bottom in terms of relationships. Orphaned as a child and broken-hearted from a failed engagement, Scrooge's pains intensify each Christmas Eve, the anniversary of the death of his only friend, Jacob Marley. In the story, Marley appears seven years after his death as a voice of warning. Though a ghost, the role he plays is true to life. Most study participants described the presence of a trusted other person during their experience.

"Just by their presence, a trusted friend can open up possibilities and a sense of faith in what's possible that one can't see," Skalski said. Skalski and Hardy's research will appear in the January issue of *The Humanistic Psychologist*. Finding people that fit the criteria was no easy task. To do so, they employed ads on Craigslist in Illinois and Utah. Notably, the experiences shared by the participants were not recent events. On average, nine years had passed between the transformation and their interview. Most of them could remember the exact time of day when the turning point occurred.

"I've often thought about this, whether these transformations are really sudden or gradual," Skalski said. "It's like water boiling -- you can look at that as a discontinuous change from not boiling to boiling, but there are certain elements going on beneath the surface that allow for the dramatic change to take place."

For an entrepreneur referred to as Kevin in the study, the preceding turmoil arose because his identity as a successful businessman crashed along with his failed ventures. Like Scrooge, he had neglected relationships and said his psyche was "in a very dark place." But with his breakthrough moment, life instantly took on a whole new meaning for Kevin.

"I say it's the best thing that could've happened, because my life is so much more rewarding than it once was. You can't put a price tag on certain…events that I maybe missed before -- certain events, and a marriage, and a family, birthdays, you know? Certain things that are just really fun to be a part of are more meaningful, and it is happiness -- the kind that lasts. I know these truths have been around forever. But for me they're new."

Similarly, another participant's world crumbled because she based her worth on how well she did in school. Like Scrooge and Kevin, she emerged with a focus on other people. "Now I measure success by my -- how much time I spend serving and doing those things, because those -- serving and being with people -- are really what bring me satisfaction now." Each of the study participants experienced overwhelming stress prior to their breakthrough. Hardy, an expert in human development, wonders whether hitting rock bottom is a necessary ingredient for such positive transformations.

"That led me to think, well, is there a way that people can capitalize on these mechanisms of change and initiate them themselves instead of bottoming out," Hardy said. "Can you self-initiate this kind of change?" Skalski sees another holiday parallel with his research in the film "It's a Wonderful Life." After planning to end his life, George Bailey realizes how other people depend on him in Bedford Falls, prompting his famous line, "I want to live again!"

"Those stories are stuck within our culture," Skalski said. "We all know deep down inside that human beings can and do change in profound and significant ways." Skalski is seeking a Ph.D. in psychology at the University of West Georgia.

Survival of the Females: Horse Embryo Study Provides Important New Information

Dec. 18, 2012 — It is well known that many mammals are able to adjust the ratio of male and female young depending on the surrounding conditions at the time of conception but how precisely this is accomplished remains a matter for debate. A recent study in the group of Christine Aurich at the University of Veterinary Medicine, Vienna has provided important information on **how the survival of female embryos may be enhanced under conditions that would otherwise tend to favour the birth of males**. The work is published in the journal *Theriogenology*.

Because of the process involved in the formation of sperm cells, there should be an equal chance that a mammalian egg will be fertilized by "male" sperm, carrying a Y chromosome, as by a "female" sperm, carrying an X chromosome. The symmetry of the system ensures that roughly the same number of males and females are born, which is clearly helpful for the species' long-term survival. Surprisingly, though, **many mammals do not produce equal numbers of male and female offspring.**

The discrepancy could theoretically be explained by differential fertilization efficiencies of male and female sperm (Y chromosomes are smaller than X chromosomes so perhaps male sperm can swim faster?) or by different rates of survival of male and female foetuses in the uterus. Indeed, it does seem as though male embryos are better able to survive under conditions of high energy intake. But how does this work?

Jana Beckelmann in Christine Aurich's laboratory at the University of Veterinary Medicine, Vienna now presents provocative evidence that **a particular protein, insulin-like growth factor-1 or IGF1, might somehow be involved.** From an examination of about 30 embryos, Beckelmann noticed that during early pregnancy (between eight and twelve days after fertilization) the level of messenger RNA encoding IGF1 was approximately twice as high in female embryos as in male embryos.

The difference could relate to the fact that female embryos have two X chromosomes, which might produce more of a factor required for the expression of the IGF1 gene (which is not encoded on the X chromosome) than the single X chromosome in males is able to generate. Beckelmann was also able to confirm that the IGF1 protein was present in the embryos, confirming that the messenger RNA is actually translated to protein.

IGF1 is known to have important functions in growth and to inhibit apoptosis, or programmed cell death. As IGF1 treatment of cattle embryos produced *in vivo* improves their survival, it is likely that the factor has positive effects on the development of the early embryo in the horse. So why should female embryos contain more of the factor than males? Losses in early pregnancy are unusually high in the horse and it is believed that female embryos are especially prone to spontaneous abortion. Male embryos are known to be better able to survive under high glucose concentrations, so well-nourished mares preferentially give birth to male foals.

As Beckelmann says, "We think the higher IGF1 concentrations in female embryos might represent a mechanism to ensure the survival of the embryos under conditions that would otherwise strongly favour males." If this is so, the ratio of the sexes in horses is the result of a subtle interplay between environmental and internal factors, including insulin-like growth factor-1.

The paper "Sex-dependent insulin like growth factor-1 expression in preattachment equine embryos" by Jana Beckelmann, Sven Budik, Magdalena Helmreich, Franziska Palm, Ingrid Walter and Christine Aurich in the journal "Theriogenology" is available online and will appear in print in the issue of January 1, 2013 (Volume 79, Issue 1, 1 January 2013, pp. 193-199)."

Hypertension Traced to Source in Brain, Triggering New Paradigm for Hypertension Treatment

Dec. 17, 2012 — When the heart works too hard, the brain may be to blame, says new Cornell University research that is changing how scientists look at high blood pressure (hypertension). The study, published in the *Journal of Clinical Investigation* in November, **traces hypertension to a newfound cellular source in the brain and shows that treatments targeting this area can reverse the disease.**

In what peer reviewers are calling "a new paradigm" for tackling the worldwide hypertension epidemic, this insight into its roots could give hope to the billion people it currently afflicts. Hypertension occurs when the force of blood against vessel walls grows strong enough to potentially cause such problems as heart attack, stroke and heart or kidney disease. The heart pumps harder, and often **the hormone angiotensin-II (AngII) gets the pressure cooking by triggering nerve cells that constrict blood vessels**.

"We knew the central nervous system orchestrates this process, and now we've found the conductor," said Robin Davisson, a professor of molecular physiology with a joint appointment at Cornell's College of Veterinary Medicine and Weill Cornell Medical College. Two-thirds of Americans have hypertension, which is the leading cause of North America's No. 1 killer: heart disease, according to the Centers for Disease Control and Prevention.

Davisson's lab **traced neurochemical signals back to endoplasmic reticulum (ER), the protein factory and stress-management control center in every cell.** If something goes wrong in a cell, the ER activates processes to adapt to the stress**. Long-term ER stress can cause chronic disease, and several stressors that ER responds to have been connected to hypertension**. Davisson's lab found that **high levels of AngII put stress on the ER, which responds by triggering the cascade of neural and hormonal signals that start hypertension**.

But not just any cell's ER can conduct this complex orchestra. Those that can trigger the signal cascade are **clustered near the bottom of the brain in a gate-like structure called the subfornical organ (SFO). Unlike most of the brain, the SFO hangs outside a protective barrier that keeps most circulating particles from entering the brain. The SFO can interact with particles like AngII that are too big to cross through and can also communicate with the brain's inner chambers**.

This is good news for developing therapies -- because the SFO sits outside the barrier, it can be reached through such normal treatment routes as pills or injections rather than riskier brain procedures. Davisson's lab showed that treatments that inhibit ER stress in the SFO can completely stop AngII-based hypertension and lower blood pressure to normal levels.

"Our work provides the first evidence that higher levels of AngII cause ER stress in the SFO, that this causes hypertension, and that we can do something about it," said Davisson. "This finding may also suggest a role for ER stress in hypertension types that don't involve AngII, like some spontaneous or genetic forms."

Inspired by the paradigm shift that this study has sparked, the editors of the Journal of Clinical Investigation published a commentary concluding that this discovery "opens new avenues for investigation and may lead to new therapeutic approaches for this disease."

Two Cups of Milk a Day Ideal for Children's Health, New Research Shows

Dec. 17, 2012 — New research has answered one of the most common questions parents ask their doctors: **How much milk should I be giving my children? The answer is two cups per day**. "We started to research the question because professional recommendations around milk intake were unclear and doctors and parents were seeking answers," said Dr. Jonathon Maguire, a pediatrician at St. Michael's Hospital and the lead author of the study.

Dr. Maguire and his team looked at how cow's milk affected body stores of iron and vitamin D -- two of the most important nutrients in milk -- in more than 1,300 children aged two to five years. The results of the study appeared online in *Pediatrics* December 17. They found that children who drank more cow's milk had higher Vitamin D stores but lower iron stores.

"We saw that two cups of cow's milk per day was enough to maintain adequate vitamin D levels for most children, while also maintaining iron stores. With additional cow's milk, there was a further reduction in iron stores without greater benefit from vitamin D," Dr. Maguire said.

The researchers recruited healthy children during routine doctor's appointments between 2008 and 2010. Parents were asked to fill out an extensive questionnaire about their children's milk drinking habits and other factors that could affect iron and Vitamin D stores. A blood sample was obtained from each child to determine body stores of iron and Vitamin D.

The children were participating in TARGet Kids!, a unique collaboration between children's doctors and researchers from St. Michael's Hospital and The Hospital for Sick Children. The program follows children from birth with the aim of understanding and preventing common nutrition problems in the early years and their impact on health and disease later in life.

The study also suggested that children with darker skin pigmentation may not have enough vitamin D stores during the winter months. Dr. Maguire suggested that instead of consuming more milk to increase these levels, wintertime vitamin D supplementation may be a more appropriate way of increasing vitamin D stores while preserving iron stores.

"Vitamin D deficiency in children has been linked to bone health issues and iron deficiency has been linked to anemia and delays in cognitive development," Dr. Maguire said. "Being able to answer parent's questions about healthy cow's milk intake is important to avoiding these potentially serious complications of low vitamin D and iron stores."

The Canadian Paediatric Society recommends that cow's milk not be started before one year of age. The study was supported in part by the Canadian Institutes of Health Research and the St. Michael's Hospital Foundation.

Should Physicians Prescribe Cognitive Enhancers to Healthy Individuals?

Dec. 17, 2012 — **Physicians should not prescribe cognitive enhancers to healthy individuals**, states a report being published today in the *Canadian Medical Association Journal (CMAJ).* Dr. Eric Racine and his research team at the IRCM, the study's authors, provide their recommendation based on the professional integrity of physicians, the drugs' uncertain benefits and harms, and limited health care resources.

Prescription stimulants and other neuropharmaceuticals, generally prescribed to treat attention deficit disorder (ADD), are often used by healthy people to enhance concentration, memory, alertness and mood, a phenomenon described as cognitive enhancement.

"Individuals take prescription stimulants to perform better in school or at work," says Dr. Racine, a Montréal neuroethics specialist and Director of the Neuroethics research unit at the IRCM. "However, because these drugs are available in Canada by prescription only, people must request them from their doctors. Physicians are thus important stakeholders in this debate, given the risks and regulations of prescription drugs and the potential for requests from patients for such cognitive enhancers."

The prevalence of cognitive enhancers used by students on university campuses ranges from 1 per cent to 11 per cent. Taking such stimulants is associated with risks of dependence, cardiovascular problems, and psychosis.

"Current evidence has not shown that the desired benefits of enhanced mental performance are achieved with these substances," explains **Cynthia Forlini**, first author of the study and doctoral student in Dr. Racine's research unit. "With uncertain benefits and clear harms, it is difficult to support the notion that physicians should prescribe a medication to a healthy individual for enhancement purposes."

"Physicians in Canada provide prescriptions through a publicly-funded health care system with expanding demands for care," adds Ms. Forlini. "Prescribing cognitive enhancers may therefore not be an appropriate use of resources. The concern is that those who need the medication for health reasons but cannot afford it will be at a disadvantage."

"An international bioethics discussion has surfaced on the ethics of cognitive enhancement and the role of physicians in prescribing stimulants to healthy people," concludes Dr. Racine. "We hope that our analysis prompts reflection in the Canadian medical community about these cognitive enhancers." Éric Racine's research is funded through a New Investigator Award from the Canadian Institutes for Health Research (CIHR). The report's co-author is Dr. Serge Gauthier from the McGill Centre for Studies in Aging.

Perceived Stress May Predict Future Coronary Heart Disease Risk

Dec. 17, 2012 — **Are you stressed**? Results of a new meta-analysis of six studies involving nearly 120,000 people indicate that **the answer to that question may help predict one's risk of incident coronary heart disease (CHD) or death from CHD.** The study, led by Columbia University Medical Center researchers, was published in a recent issue of the *American Journal of Cardiology*.

The six studies included in the analysis were large prospective observational cohort studies in which **participants were asked about their perceived stress** (e.g., "How stressed do you feel?" or "How often are you stressed?"). Respondents scored either high or low; researchers then followed them for an average of 14 years to compare the number of heart attacks and CHD deaths between the two groups. Results demonstrate that **high perceived stress is associated with** a 27% increased risk for incident CHD (defined as a new diagnosis or hospitalization) or CHD mortality.

"While it is generally accepted that stress is related to heart disease, **this is the first meta-analytic review of the association of perceived stress** and incident CHD," said senior author Donald Edmondson, PhD, assistant professor of behavioral medicine at CUMC. "This is the most precise estimate of that relationship, and it gives credence to the widely held belief that general stress is related to heart health. In comparison with traditional cardiovascular risk factors, high stress provides a moderate increase in the risk of CHD -- e.g., the equivalent of a 50 mg/dL increase in LDL cholesterol, a 2.7/1.4 mmHg increase in blood pressure or smoking five more cigarettes per day."

"These findings are significant because they are applicable to nearly everyone," said first author Safiya Richardson, MD, who collaborated with Dr. Edmondson on the paper while attending the Columbia University College of Physicians and Surgeons (she graduated in 2012 and is currently a resident at North Shore Long Island Jewish Health System in Manhasset, New York). "The key takeaway is that how people feel is important for their heart health, so anything they can do to reduce stress may improve their heart health in the future."

Coronary heart disease (CHD), also called coronary artery disease, is a narrowing of the small blood vessels that supply blood and oxygen to the heart. It is caused by a buildup of plaque in the arteries, which can lead to hardening of the arteries, or atherosclerosis. CHD is the leading cause of death in the United States for men and women; more than 385,000 people die each year from CHD.

The researchers did further analysis to try to learn what might underlie the association between stress and CHD. They found that while gender was not a significant factor, age was. The people in the studies were between the ages of 43-74; among older people, the relationship between stress and CHD was stronger.

"While we do not know for certain why there appears to be an association between age and the effect of perceived stress on CHD, we think that stress may be compounding over time. For example, someone who reports high perceived stress at age 60 may also have felt high stress at ages 40 and 50, as well." Dr. Edmondson also noted that older individuals tend to have worse CHD risk factors such as hypertension to begin with, and that stress may interact with those risk factors to produce CHD events.

"The next step is to conduct randomized trials to assess whether broad population-based measures to decrease stress are cost-effective. Further research should look at whether the stress that people report is about actual life circumstances (e.g., moving or caregiving), or about stable personality characteristics (e.g., type A vs. B), said Dr. Edmondson.

"We also need to ask why we found this association between stress and CHD, e.g., what biological components or mechanisms are involved, and what is the role of environment or lifestyle (e.g., diet, alcohol and drug use, exercise), and how best to moderate these factors to lower the risk of CHD," said Dr. Richardson.

The paper is titled, "Meta-Analysis of Perceived Stress and Its Association With Incident Coronary Heart Disease." The other contributors are Jonathan A. Shaffer, Louise Falzon, David Krupka and Karina W. Davidson, all from CUMC's Center for Behavioral Cardiovascular Health.

This research was supported by National Institutes of Health (NIH) grants HL-088117 and CA-156709. It was supported in part by Columbia University's Clinical and Translational Science Awards (CTSA) grant No. UL1RR024156 from the National Center for Advancing Translational Sciences -- National Center for Research Resources/NIH. Dr. Edmondson is supported by NIH grant KM1CA156709.

Significant Link Found Between Daytime Sleepiness and Vitamin D

Dec. 14, 2012 — A new study suggests that **there is a significant correlation between excessive daytime sleepiness and vitamin D, and race plays an important factor**. Results show that in **patients with normal vitamin D levels, progressively higher levels of daytime sleepiness were correlated inversely with progressively lower levels of vitamin D**. Among patients with vitamin D deficiency, sleepiness and vitamin D levels were associated only among black patients. Surprisingly, this correlation was observed in a direct relationship, with higher vitamin D levels associated with a higher level of sleepiness among black patients.

"While we found a significant correlation between vitamin D and sleepiness, the relationship appears to be more complex than we had originally thought," said David McCarty, MD, the study's principal investigator. "It's important to now do a follow-up study and look deeper into this correlation."

The study, appearing online in the Dec. 15 issue of the *Journal of Clinical Sleep Medicine*, involved a consecutive series of 81 sleep clinic patients who complained of sleep problems and nonspecific pain. All patients eventually were diagnosed with a sleep disorder, which in the majority of cases was obstructive sleep apnea. Vitamin D level was measured by blood sampling, and sleepiness was determined using the Epworth Sleepiness Scale.

According to the authors, this is the first study to demonstrate a significant relationship between sleepiness and vitamin D. **They noted that it is logical for race to affect this relationship because increased skin pigmentation is an established risk factor for low vitamin D**.

The study was not designed to examine causality. However, the authors' previous and current research suggests that suboptimal levels of vitamin D may cause or contribute to excessive daytime sleepiness, either directly or by means of chronic pain.

Chronic Alcohol and Marijuana Use During Youth Can Compromise White-Matter Integrity

Dec. 14, 2012 — **Chronic use of alcohol and marijuana during youth is associated with poorer neural structure, function, and metabolism, as well as worsened neurocognitive abilities into later adolescence and adulthood.** This may be due to **biological and psychosocial transitions occurring during adolescence that impart increased vulnerability to neurotoxic influences. A** study of longitudinal changes in fiber tract integrity associated with adolescent alcohol and marijuana use during 1.5 years **supports previous findings of reduced white-matter integrity in these youth.** Results will be published in a special online issue of *Alcoholism: Clinical & Experimental Research* and are currently available at Early View.

"Research has shown differences in the brains of teens who use alcohol and marijuana as compared to teens who do not use these drugs or report only very infrequent, minimal use," said Joanna Jacobus, postdoctoral fellow at the University of California, San Diego as well as corresponding author for the study. "Alcohol and marijuana may have a negative impact by altering important cellular communication in the brain, preventing development of new healthy cells, and/or causing inflammation, which can adversely impact healthy brain development in many ways. For example, the results can lead to changes in brain structure such as volume, and function such as activity."

"The areas of the brain that are composed mostly of connecting axons have been termed 'white matter,' since these areas appear white in color," added Duncan Clark, associate professor of psychiatry at the University of Pittsburgh Medical Center. "However, prior research has not clearly demonstrated that this white matter disorganization is caused by alcohol or marijuana use. In some studies where adolescents are studied only once, white matter disorganization may have been present prior to alcohol or marijuana use."

"The teen brain is continuing to develop, so many neural systems are not yet fully matured, as compared to adults' brains," said Jacobus. "Brain connections important for inhibiting risky behaviors are still forming, and some youth are more likely to choose immediate effects, such as alcohol or marijuana use, over long-term benefits."

Clark agreed. "Maturation of the brain during adolescence is thought to be the foundation for self-control," he said. "The developing adolescent brain, compared to the fully developed adult brain, is also probably more vulnerable to alcohol neurotoxicity. Adolescents are vulnerable to loss of control and, when this loss of control involves substance use, excessive or risky substance use can have adverse consequences."

For 18 months, the researchers followed 92 adolescents (63 males, 29 females), ages 16 to 20 years, divided into two groups: 41 with extensive alcohol and marijuana use histories by mid-adolescence, and 51 with consistently minimal if any substance use. Participants were part of an ongoing longitudinal study of substance use in adolescence with teens recruited from local schools from 2005 to 2007. Both groups received diffusion tensor imaging and detailed substance use assessments, along with toxicology screening, at baseline and 18-month follow-ups -- 182 scans in all -- as well as interim substance-use interviews every six months.

"We found evidence for poorer white matter tissue health in teens who engage in heavy alcohol and marijuana use compared to those who abstain," said Jacobus. She noted that white matter, the "information highway of the brain," allows for quick and efficient communication between brain regions. Compromised white matter can mean slower cognitive processing and poorer cognitive performance such as memory, attention, and decision-making.

"As to whether there were differences in these teens before they began using alcohol and marijuana is difficult to determine, but we found that increasing alcohol use over 1.5 years in late adolescence was related to a decline in white matter health 18 months later, supporting a negative effect of alcohol use on the brain despite potential pre-existing differences," Jacobus said.

"White matter organization was particularly compromised in an area called the superior longitudinal fasciculus," added Clark. "This is one of the major connection roadways in the brain. When the connections between brain areas are severely damaged, those areas of the brain cannot properly function. While the more subtle deficit shown here may impair functioning, the degree of deficit involved is not likely to be obvious in day-to day functioning. However, we are concerned that even these subtle deficits in brain microstructure may lead to diminished self-control."

"Our findings underscore that early initiation of alcohol and marijuana use can have negative implications on the brain" said Jacobus. "We hope this information can be communicated to teens to help them understand why drinking during adolescence is discouraged. In the future, biomarkers such as tissue health may help identify teens that are particularly vulnerable for engaging in riskier behaviors such as drinking."

Targeting Neurotransmitter May Help Treat Gastrointestinal Conditions

Dec. 4, 2012 — **Selective targeting of the neurotransmitter that differentially affects brain cells that control the two distinct functions of the pancreas may allow for new medication therapies** for conditions such as diabetes, dyspepsia and gastro-esophageal reflux, according to Penn State College of Medicine researchers.

"**This study differs from what's been reported previously about brain neurons that control the gastrointestinal tract**," said R. Alberto Travagli, professor, Department of Neural and Behavioral Sciences, and lead investigator. "It provides further support to the idea that **separate nerve pathways regulate the diverse functions of organs along the upper gastrointestinal tract**." **The pancreas has two functional parts: one that releases digestive enzymes, and one that releases hormones like insulin and glucagon.**

The vagus nerve, which originates in the brain, regulates both of these pancreatic functions. This nerve detects chemical and biological changes that occur along the gastrointestinal tract and interprets and integrates these signals before sending appropriate responses back to the organs. In the brain, these signals tell the nerves controlling each specific organ what the proper response is -- for example, digestive processes and insulin release -- according to the signals detected in the GI tract.

Neurotransmitters in the brain and in organs like the pancreas control the nerve networks that receive these signals. Neurotransmitters are chemicals released from nerves that allow them to communicate with each other as well as with organs of the body. One of these neurotransmitters is glutamate, which acts on specific proteins called receptors that are present on the nerve cells. There are different classes and types of receptors that glutamate can act upon; one major class of these receptors is metabotropic glutamate receptors (mGluRs). This class is further divided into three subgroups -- I, II or III -- depending on their location and function on the nerve cells.

"The aim of this study was to investigate how these mGluRs are organized on nerve synapses -- the specialized structures that allow a signal to pass from one cell to another cell," Travagli said. "The second aim of the study was to see whether pancreatic insulin and enzyme secretions are controlled by different types of vagal motoneurons -- the cells of the nervous system that control motor functions of the pancreas through the vagus nerve."

Group II and III mGluRs are present in synapses that can either excite or inhibit the vagal nerve cells that send signals to the pancreas, and different outcomes can be seen depending on which group of mGluRs glutamate acts upon. When glutamate acts upon either group II or group III mGluR, insulin secretion is decreased. Pancreatic enzyme secretion is increased only by activation of group II mGluR by glutamate.

"The data shows mGluRs on brainstem vagal nerve circuits that regulate pancreatic functions are organized in a very specific manner," Travagli said. "This type of separation in their organization may allow for development of selective drugs that target very specific vagal neurocircuits in patients with such conditions as gastrointestinal reflux disorders, functional dyspepsia, gastroparesis and pancreatic exocrine or endocrine dysfunctions."

Researchers published results in a recent issue of *The Journal of Physiology.* This research was funded through grants from National Science Foundation and the National Institutes of Health.

Understanding Anger, Overcoming Anxiety

Dec. 4, 2012 — **Anger is a powerful emotion with serious health consequences**. A new study from Concordia University shows that for millions of individuals around the world who suffer from Generalized Anxiety Disorder (GAD), **anger is more than an emotion; it's an agent that exacerbates their illness.**

Concordia graduate student Sonya Deschênes investigated the subject after conducting a literature review for her PhD research, supervised by psychology professor Michel Dugas. While some of the studies she came across showed that **anger and anxiety were linked, she noticed that this relationship was poorly understood.** "This was surprising to me because **irritability, which is part of the anger family, is a diagnostic feature of Generalized Anxiety Disorder** (GAD)," she explains.

GAD is a serious affliction characterized by excessive and uncontrollable worry about everyday things. It often interferes with a person's ability to function normally. Individuals suffering from GAD typically anticipate disaster, and are overly concerned about everyday issues, such as health, money, and relationships.

Deschênes and her colleagues at Concordia and Ryerson University in Toronto looked into how specific components of anger contribute to GAD. They examined hostility, physical and verbal aggression, anger expression and anger control. The team assessed more than 380 participants for GAD symptoms and their tendency to respond to anger-inducing scenarios, by testing responses to such statements as, "I strike out at whatever infuriates me" and "I boil inside, but I don't show it."

The study, which was recently published in *Cognitive Behaviour Therapy*, found that in the 131 participants who exhibited GAD symptoms, higher levels of anger and its various dimensions were associated with worry and anxiety. Furthermore, hostility and internalized anger contributed to the severity of their GAD symptoms.

This suggests not only that anger and anxiety go hand in hand, but also that heightened levels of anger are uniquely related to GAD status. What's more, **internalized anger expression -- boiling inside without showing it -- is a stronger predictor of GAD than other forms of anger.**

Deschênes acknowledges that more research is needed to understand why anger and anxiety tend to co-occur -- and she intends for her doctoral research to proceed in this direction. According to Deschênes, a possible explanation for the link is that, **"when a situation is ambiguous, such that the outcome could be good or bad, anxious individuals tend to assume the worst. That often results in heightened anxiety. There is also evidence of that same thought process in individuals who are easily angered. Therefore, anger and GAD may be two manifestations of the same biased thought process."**

Deschênes also argues that symptoms of anger could get in the way of the treatment for anxiety, which can be done with a technique called cognitive-behavioural therapy. "If anger and hostility are contributing to the maintenance of symptoms, and these are not targeted during treatment, these people may not be benefiting as much from that treatment," Deschênes says. "It's my hope that, by furthering our understanding of the role of anger in GAD, we can improve treatment outcomes for individuals with this disorder."

The Radical Restructuring of Brain Networks in Comatose Patients

Dec. 4, 2012 — Researchers from Inserm, CNRS and the Université Joseph Fourier in Grenoble, in collaboration with Cambridge university, Strasbourg university and clinical practitioners from the Strasbourg University Hospital Centre, have **analysed data from 17 comatose patients using functional MRI data. Their research reveals that the brain networks of these patients have been restructured.** The results, published in *PNAS* on 26 November 2012, could help clinical practitioners diagnose comatose patients.

The researchers are focusing on analysing brain networks of brain-damaged comatose (non-traumatised) patients, a state where the individual is considered to be unconscious.

The authors of the study used an original graph theory-based methodology, where images were constructed using functional MRI data at rest and using robust statistical signal-processing methods. Local and overall effectiveness indices of functional brain networks were obtained for 17 brain-damaged patients and 20 healthy volunteers.Correlations in 417 brain regions were extracted to produce brain connection graphs using the statistically significant correlations.

Inserm unit 836 "Grenoble Institut des neurosciences," CNRS researchers from the "GIPSA lab" and from the Behavioural and Clinical Neuroscience Institute in Cambridge, in collaboration with clinical practitioners from the Strasbourg University Hospital Centre, have been able to highlight restructured brain networks in brain-damaged (non-traumatized) comatose patients.

Through comparisons with the healthy subjects, the results demonstrate that **the overall cerebral connectivity is preserved in comatose patients. By analysing the connectivity at a local level, the authors of the study have observed that some brain regions ("hubs"), which are highly connected in healthy volunteers, are less well connected in comatose patients. Conversely,**

the less densely connected regions in the network in healthy subjects become "hubs" in comatose patients.

Brain imaging obtained from connectivity graphs

The connectivity graph method is used to summarize in a single image data acquired through MRI scanning. It translates the effectiveness of connections in a single region compared to all the others. By grouping the most interconnected regions, modules are revealed (each represented by a different colour). Patients and healthy volunteers both have different models in their spatial location, representing radical alterations to the brain connections.

According to current hypotheses, **consciousness disorders in persistently comatose patients could be linked to disconnection phenomena between specific cortical regions, particularly the precuneus. The results of this study also point in this direction**. "From an overall perspective, the topology of brain connections resists well to traumatism by reorganising the most interconnected regions in the network. It therefore seems that **comas may be linked to changes in the location of "hubs" among the brain networks"** suggests Chantal Delon Martin, an Inserm researcher.

An assessment of brain injury and comas

Patients with brain injury may go through various clinically-defined states: vegetative state that ischaracterized by the preserved sleep-wake cycle (eyes opening spontaneously, autonomous breathing, etc.); minimally conscious state where patients have partially preserved environmental consciousness (eye movement capacity, reaction to stimulation); locked in syndrome where the patient is paralysed but conscious (communication using eyes); brain death when the coma is irreversible flat line EEG, no blood flow).

Coma (from the Greek κῶμα kôma meaning "deep sleep") is one of the different states where self awareness and consciousness of the outside world is eradicated further to an accident (cerebral, cardiac, etc.). There are two coma phases: the "acute" coma phase (a few days after the accident) and the "chronic" phase (one month or more). Brain restructuring was observed by researchers during the "acute" phase, when it is not known which coma type the patient will develop.

Assessments of brain injuries in comatose patients are currently conducted through clinical examination, morphological MRI, evoked potentials and by SPECT (Single-photon emission computed tomography) or TEP (Positron emission tomography (PET). "The results of this study could help clinical practitioners in the difficult diagnosis process for comatose patients, since this method makes it possible to characterize each patient individually", conclude the researchers.

Multiple Media Use Tied to Depression, Anxiety

Dec. 4, 2012 — Using multiple forms of media at the same time -- such as playing a computer game while watching TV -- is linked to symptoms of anxiety and depression, scientists have found for the first time.

Michigan State University's Mark Becker, lead investigator on the study, said he was surprised to find such a clear association between media multitasking and mental health problems. What's not yet clear is the cause.

"We don't know whether the media multitasking is causing symptoms of depression and social anxiety, or if it's that people who are depressed and anxious are turning to media multitasking as a form of distraction from their problems," said Becker, assistant professor of psychology.

While overall media use among American youth has increased 20 percent in the past decade, the amount of time spent multitasking with media spiked 120 percent during that period, Becker said.

For the study, which appears in the journal *Cyberpsychology, Behavior and Social Networking*, Becker and fellow MSU researchers Reem Alzahabi and Christopher Hopwood surveyed 319 people on their media use and mental health.

Participants were asked how many hours per week they used two or more of the primary forms of media, which include television, music, cell phones, text messaging, computer and video games, web surfing and others. For the mental health survey, the researchers used well-established measures, although the results do not reflect a clinical diagnosis.

Becker said future research should explore cause and effect. If it turns out media multitasking is causing depression and anxiety, recommendations could be made to alleviate the problem, he said.

On the other hand, if depressed or anxious people are turning to media multitasking, that might actually help them deal with their problems. It could also serve as a warning sign that a youngster is becoming depressed or anxious.

"Whatever the case, it's very important information to have," Becker said. "This could have important implications for understanding how to minimize the negative impacts of increased media multitasking."

Parents Key to Preventing Alcohol, Marijuana Use by Kids

Dec. 4, 2012 — New research from North Carolina State University, Brigham Young University and the Pennsylvania State University finds that parental involvement is more important than the school environment when it comes to preventing or limiting alcohol and marijuana use by children.

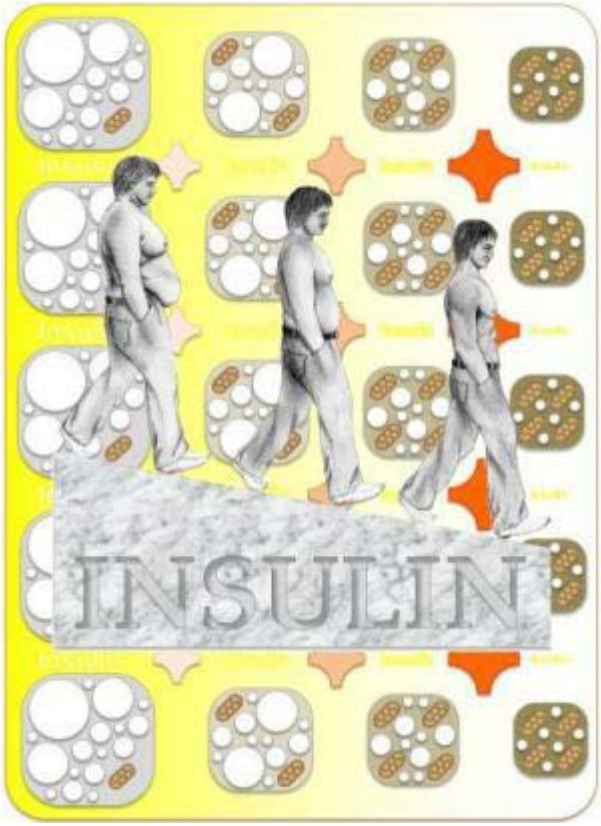
"Parents play an important role in shaping the decisions their children make when it comes to alcohol and marijuana," says Dr. Toby Parcel, a professor of sociology at NC State and co-author of a paper on the work. "To be clear, school programs that address alcohol and marijuana use are definitely valuable, but the bonds parents form with their children are more important. Ideally, we can have both."

The researchers evaluated data from a nationally representative study that collected information from more than 10,000 students, as well as their parents, teachers and school administrators.

Specifically, the researchers looked at how "family social capital" and "school social capital" affected the likelihood and/or frequency of marijuana use and alcohol use by children. Family social capital can essentially be described as the bonds between parents and children, such as trust, open lines of communication and active engagement in a child's life. School social capital captures a school's ability to serve as a positive environment for learning, including measures such as student involvement in extracurricular activities, teacher morale and the ability of teachers to address the needs of individual students.

The researchers evaluated marijuana use and alcohol use separately. In both cases, researchers found that students with high levels of family social capital and low levels of school social capital were less likely to have used marijuana or alcohol -- or to have used those substances less frequently -- than students with high levels of school social capital but low family social capital.

Could High Insulin Make You Fat? Mouse Study Says Yes



When we eat too much, obesity may develop as a result of chronically high insulin levels, not the other way around. That's according to new evidence in mice reported in the December 4th Cell Metabolism, a Cell Press publication, which challenges the widespread view that rising insulin is a secondary consequence of obesity and insulin resistance. (Credit: Mehran et al., Current Biology)

Dec. 4, 2012 — When we eat too much, obesity may develop as a result of chronically high insulin levels, not the other way around. That's according to new evidence in mice reported in the December 4th *Cell Metabolism*, a Cell Press publication, which challenges the widespread view that rising insulin is a secondary consequence of obesity and insulin resistance.

The new study helps to solve this chicken-or-the-egg dilemma by showing that animals with persistently lower insulin stay trim even as they indulge themselves on a high-fat, all-you-can-eat buffet. The findings come as some of the first direct evidence in mammals that circulating insulin itself drives obesity, the researchers say.

The results are also consistent with clinical studies showing that long-term insulin use by people with diabetes tends to come with weight gain, says James Johnson of the University of British Columbia.

"We are very inclined to think of insulin as either good or bad, but it's neither," Johnson said. "This doesn't mean anyone should stop taking insulin; there are nuances and ranges at which insulin levels are optimal."

Johnson and his colleagues took advantage of a genetic quirk in mice: that they have two insulin genes. Insulin1 shows up primarily in the pancreas and insulin2 in the brain, in addition to the pancreas. By eliminating insulin2 altogether and varying the number of good copies of insulin1, the researchers produced mice that varied only in their fasting blood insulin levels. When presented with high-fat food, those with one copy and lower fasting insulin were completely protected from obesity even without any loss of appetite. They also enjoyed lower levels of inflammation and less fat in their livers, too.

Those differences traced to a "reprogramming" of the animals' fat tissue to burn and waste more energy in the form of heat. In other words, the mice had white fat that looked and acted more like the coveted, calorie-burning brown fat most familiar for keeping babies warm.

Johnson says it isn't clear what the findings might mean in the clinic just yet, noting that drugs designed to block insulin have been shown to come with unwanted side effects. But, he added, "there are ways to eat and diets that keep insulin levels lower or that allow insulin levels to return to a healthy baseline each day."

Unfortunately, constant snacking is probably not the answer.

Infants Learn to Look and Look to Learn: Model Explains Crucial Links Among Looking, Learning, and Memory

Dec. 4, 2012 — Researchers at the University of Iowa have documented an activity by infants that begins nearly from birth: They learn by taking inventory of the things they see.

In a new paper, the psychologists contend that infants create knowledge by looking at and learning about their surroundings. The activities should be viewed as intertwined, rather than considered separately, to fully appreciate how infants gain knowledge and how that knowledge is seared into memory.

"The link between looking and learning is much more intricate than what people have assumed," says John Spencer, a psychology professor at the UI and a co-author on the paper published in the journal *Cognitive Science*.

The researchers created a mathematical model that mimics, in real time and through months of child development, how infants use looking to understand their environment. Such a model is important because it validates the importance of looking to learning and to forming memories. It also can be adapted by child development specialists to help special-needs children and infants born prematurely to combine looking and learning more effectively.

"The model can look, like infants, at a world that includes dynamic, stimulating events that influence where it looks. We contend (the model) provides a critical link to studying how social partners influence how infants distribute their looks, learn, and develop," the authors write.

The model examines the looking-learning behavior of infants as young as 6 weeks through one year of age, through 4,800 simulations at various points in development involving multiple stimuli and tasks. As would be expected, most infants introduced to new objects tend to look at them to gather information about them; once they do, they are "biased" to look away from them in search of something new. In other words, an infant will linger on something that's being shown to it for the first time as it learns about it, and that the "total looking time" will decrease as the infant becomes more familiar with it.

But the researchers found that infants who don't spend a sufficient amount of time studying a new object -- in effect, failing to learn about it and to catalog that knowledge into memory -- don't catch on as well, which can affect their learning later on.

"Infants need to dwell on things for a while to learn about them," says Sammy Perone, a post-doctoral researcher in psychology at the UI and corresponding author on the paper.

To examine why infants need to dwell on objects to learn about them, the researchers created two different models. One model learned in a "responsive" world: Every time the model looked away from a new object, the object was jiggled to get the model to look at it again. The other model learned in a "nonresponsive" world: when this model looked at a new object, objects elsewhere were jiggled to distract it. The results showed that the responsive models"learned about new objects more robustly, more quickly, and are better learners in the end," says Perone, who earned his doctorate at the UI in 2010. The model captures infant looking and learning as young as 6 weeks. Even at that age, the UI researchers were able to document that infants can familiarize themselves with new objects, and store them into memory well enough that when shown them again, they quickly recognized them.

"To our knowledge, these are the first quantitative simulations of looking data from infants this young," the authors write.

The results underscore the notion that looking is a critical entry point into the cognitive processes in the brain that begin in children nearly from birth. And, "if that's the case, we can manipulate and change what the brain is doing" to aid infants born prematurely or who have special needs, Perone adds.

"The promise of a model that implements looking as an active behavior is that it might explain and predict how specific manipulations of looking over time will impact subsequent learning," the researchers write.

The research was funded by the National Institutes of Health, grant number 5R01MH62480.

Researchers Successfully Destroy Brain Tumor Cells; Use Unique Combination of Diet and Radiation Therapy

Dec. 3, 2012 — A team of brain cancer researchers at Barrow Neurological Institute at St. Joseph's Hospital and Medical Center has effectively treated brain tumor cells using a unique combination of diet and radiation therapy. The study, "The Ketogenic Diet Is an Effective Adjuvant to Radiation Therapy for the Treatment of Malignant Glioma," was published in *PLOS ONE*.

Led by Adrienne C. Scheck, PhD, Principal Investigator in Neuro-Oncology and Neurosurgery Research at Barrow, the groundbreaking research studied the effects of the ketogenic diet in conjunction with radiation therapy for the treatment of malignant gliomas, an aggressive and deadly type of brain tumor. **The ketogenic diet is a high-fat, low-carbohydrate diet** that alters metabolism and is used in the treatment of pediatric epilepsy that does not respond to conventional therapies. The diet's effects on brain homeostasis have potential for the treatment of other neurological diseases, as well.

In the study, mice with high-level malignant gliomas were maintained on either a standard or a ketogenic diet. Both groups received radiation therapy. Dr. Scheck's team discovered that animals fed a ketogenic diet had an increased median survival of approximately five days relative to animals maintained on a standard diet. Of the mice that were fed a ketogenic diet and received radiation, nine of 11 survived with no signs of tumor recurrence, even after being switched back to standard food, for over 200 days. None on the standard diet survived more than 33 days.

One theory behind the success of the treatment is that the ketogenic diet **may reduce growth factor stimulation**, inhibiting tumor growth. Barrow scientists also believe that **it may reduce inflammation and edema** surrounding the tumors. This is believed to be the first study of its kind to look at the effects of the ketogenic diet with radiation.

Dr. Scheck believes that the study has promising implications in the treatment of human malignant gliomas. "We found that the ketogenic diet significantly enhances the anti-tumor effect of radiation, which suggests that it may be useful as an adjuvant to the current standard of care for the treatment of human malignant gliomas," she says.

Dr. Scheck adds that the ketogenic diet could quickly and easily be added into current brain tumor treatment plans as an adjuvant therapy without the need for FDA approval. She is currently exploring options for clinical trials.

Moderate Coffee Consumption May Reduce Risk of Diabetes by Up to 25 Percent

Drinking three to four cups of coffee per day may help to prevent type 2 diabetes according to new research. (Credit: © Antonio Gravante / Fotolia)

Dec. 4, 2012 — Drinking three to four cups of coffee per day may help to prevent type 2 diabetes according to research highlighted in a session report published by the Institute for Scientific Information on Coffee (ISIC), a not-for-profit organisation devoted to the study and disclosure of science related to coffee and health.

Recent scientific evidence has consistently linked regular, moderate coffee consumption with a possible reduced risk of developing type 2 diabetes. An update of this research and key findings presented during a session at the 2012 World Congress on Prevention of Diabetes and Its Complications (WCPD) is summarised in the report.

The report outlines the epidemiological evidence linking coffee consumption to diabetes prevention, highlighting research that shows three to four cups of coffee per day is associated with an approximate 25 per cent lower risk of developing type 2 diabetes, compared to consuming none or less than two cups per day1. Another study also found an inverse dose dependent response effect with each additional cup of coffee reducing the relative risk by 7-8 per cent2.

Whilst these epidemiological studies suggest an association between moderate coffee consumption and reduced risk of developing diabetes, they are unable to infer a causal effect. As such, clinical intervention trails are required to study the effect in a controlled setting. One prospective randomized controlled trial3, tested glucose and insulin after an oral glucose tolerance test with 12g decaffeinated coffee, 1g chlorogenic acid, 500 mg trigonelline, or placebo. This study demonstrated that chlorogenic acid, and trigonelline reduced early glucose and insulin responses, and contribute to the putative beneficial effect of coffee.

The report notes that the association between coffee consumption a reduced risk of type 2 diabetes could be seen as counter intuitive, as drinking coffee is often linked to unhealthier habits, such as smoking and low levels of physical activity. Furthermore, studies have illustrated that moderate coffee consumption is not associated with an increased risk of hypertension, stroke or coronary heart disease4 ,5, 6. Research with patients with CVD has also shown that moderate coffee consumption is inversely associated with risk of heart failure, with a J-shaped relationship7.

Finally, the report puts forward some of the key mechanistic theories that underlie the possible relationship between coffee consumption and the reduced risk of diabetes. These included the 'Energy Expenditure Hypothesis', which suggests that the caffeine in coffee stimulates metabolism and increases energy expenditure and the 'Carbohydrate Metabolic Hypothesis', whereby it is thought that coffee components play a key role by influencing the glucose balance within the body. There is also a subset of theories that suggest coffee contains components that may improve insulin sensitivity though mechanisms such as modulating inflammatory pathways, mediating the oxidative stress of cells, hormonal effects or by reducing iron stores.

Dr. Pilar Riobó Serván, Associate Chief of Endocrinology and Nutrition, Jiménez Díaz-Capio Hospital of Madrid and a speaker at the WCPD session concludes the report, commenting: "A dose-dependent inverse association between coffee drinking and total mortality has been demonstrated in general population and it persists among diabetics. Although more research on the effect of coffee in health is yet needed, current information suggests that coffee is not as bad as previously considered!"

Working Towards Happiness: Retiring Later Is Unlikely to Affect Men's Quality of Life

Dec. 4, 2012 — Raising the retirement age to increase financial stability does not make men worse off psychologically in the long-run, according to a new study by Dr. Elizabeth Mokyr Horner, from the University of California, Berkeley in the US. Her work shows that individuals go through the same psychological stages as they adjust to retirement, with life satisfaction stabilizing after 70, irrespective of how old they are when they retire.

The study is published online in Springer's *Journal of Happiness Studies*.

As we live longer, the size of the retired population relative to that of tax payers is growing, creating mounting costs with dwindling resources. Despite country variation in public pension programs and retirement age regimes, the vast majority of current social security programs are financially unstable. As a result, several countries have been steadily raising their retirement age.

Dr. Mokyr Horner's work investigates the relationship between retirement and happiness in individuals near retirement and afterwards. She analyzed international data from the 2006 Survey of Health, Ageing and Retirement in Europe for 14 EU countries, the 2006 English Longitudinal Study of Ageing in the UK and the 2004 Health and Retirement Study for the US. The data covered a total of 18,345 fully retired men aged between 50-70 years. The researcher was particularly interested in how satisfied they were with their lives at different time points after retirement.

In the time surrounding retirement, the men experienced a large improvement in well-being and life satisfaction. A few years after retirement, however, levels of happiness fell rapidly. This happened irrespective of how old men were when they retired. In the long-run i.e. post 70 years, happiness levels stabilized for all.

Dr. Mokyr Horner concludes: "A later formal retirement simply delays the well-being benefits of retirement in men, and age of formal retirement is relatively neutral with regard to overall happiness. Given the growing fiscal pressures to adjust the age of retirement upwards, it can be inferred from my studies that well-being may be, on balance, affected only marginally -- if at all -- by such changes."

Second-Hand Smoke Linked to Children's Behavior Problems

Dec. 4, 2012 — It is a known fact that active maternal smoking during pregnancy has negative effects on child health, such as attention deficit and hyperactivity disorder (ADHD). However, new research suggests that second hand smoke, or environmental tobacco smoke (ETS), may be just as harmful.

In one of the first studies of its kind, researchers from the University of Pennsylvania School of Nursing examined data from 646 mother-child pairs in China, where more than 70 percent of men smoke, and concluded that 25% children of whose mothers were exposed to smoke exhibited behavior problems compared to 16% of children of unexposed mothers.

"Such findings could inform public health efforts to reduce public smoking and underscores the need for including ETS avoidance as a potential component of prenatal care among pregnant women," said lead-author Jianghong-Liu, PhD, RN, FAAN, associate professor at Penn Nursing.

Using the Child Behavior Checklist (CBCL), a widely used, 99-item scale for assessing behavioral and emotional problems in children, researchers determined children of mothers with ETS exposure had 10% more prevalence of externalizing behavior problems than children of

unexposed mothers. The results took factors like parental education, occupation, psychological problems and marriage status into account. The full results were published online this week in the journal *NeuroToxicology*.

Externalizing behavior problems included attention problems and aggression. Children of passive smoking mothers demonstrated worse performance on tests of speech and language skills, intelligence, and behavioral outcomes (conduct disorders).

"Given the high prevalence of ETS exposure among pregnant women in China and the far-reaching effects of child behavioral disturbance on public health outcomes, it is critical to reduce ETS exposure in order to improve the health of not only mothers and their children but that of society at large," said Dr. Liu. "The key message for pregnant women is to protect their growing fetus from exposure to secondhand smoke."

While additional, more longitudinal, research is needed to validate the findings, the researchers agree that this study gives some clarity to the relationship between ETS and behavioral disturbance in children.

This study was based on data collected from the China Jintan Child Cohort Study, led by Dr. Liu, an on-going prospective longitudinal study with the main aim of assessing the early health risk factors for the development of child neurobehavioral outcomes. The study was funded, in part, by the National Institute of Environmental Health Sciences.

Low Fat Diet Helps Drop Pounds, Study Suggests

Dec. 6, 2012 — Exchanging fatty foods for lower fat alternatives will help people shift around three-and-a-half pounds -- without any other form of dieting. People taking part in trials also saw their waist-lines become slimmer, and levels of bad cholesterol decrease. The results demonstrate that weight loss can happen without actively trying to lose weight beyond simply choosing foods lower in fat.

The report was commissioned by the World Health Organisation (WHO) Nutrition Guidance Expert Advisory Group (NUGAG) Subgroup on Diet and Health following a request to update their guidelines on total fat intake. The results will be crucial in making global recommendations.

The research is particularly important because being overweight or obese increases the risk of many cancers, coronary heart disease and stroke. Reductions in total fat were also associated with small but statistically significant reductions in cholesterols and blood pressure, suggesting a beneficial effect on other major cardiovascular risk factors.

The systematic review included results from 33 randomised controlled trials, in North America, Europe and New Zealand, involving 73,589 men, women and children.

Those taking part had varying states of health. Comparisons were made between those eating less fat than usual (intervention group) and those eating their usual amount of fat (control group). The effect on weight and waist line was measured after at least six months.

The results show that eating less fat reduces body weight by 1.6kg, BMI by 0.56kg/m^2 and waist circumference by 0.5cm. All these effects were in trials in which weight loss was not the intended outcome, suggesting that they occur in people with normal diets. The weight loss happened quickly and was maintained over at least seven years.

The research was led by Dr Lee Hooper from UEA's Norwich Medical School. She said: "The weight reduction that we found when people ate less fat was remarkably consistent -- we saw it in almost every trial. Those who cut down more on fat, lost more weight.

"The effect isn't dramatic, like going on a diet. The research specifically looked at people who were cutting down on fat, but didn't aim to lose weight -- so they were continuing to consume a normal amount of food. What surprised us was that they did lose weight, their BMI decreased and their waists became slimmer. On top of this, they kept their weight down over at least seven years. There isn't a specific goal, the more fat you cut down, the more your weight falls.

"We didn't consider different types of fat in this study," said Dr Hooper. "But cutting down on saturated fat reduces our risk of heart disease and strokes, so the healthiest way to cut down on fat is to cut down on saturated fats.

"This means having low fat milk and yogurt, cutting down on butter and cheese, and cutting the fat off meat. Most importantly have fruit instead of fatty snacks like biscuits, cake and crisps. And remember, this isn't a diet, so don't take it to extremes, but work out a way of eating that you can stick to permanently.

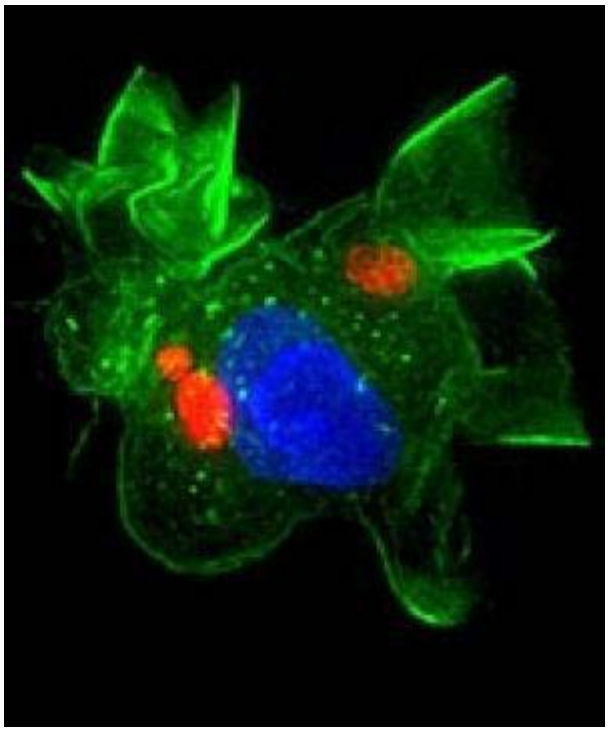
"Keeping healthy is not just about fat and weight -- but cutting down on fat, especially saturated fat, is a great start. Being physically active, not smoking, drinking alcohol in moderation, eating plenty of fruit and vegetables, and drinking plenty of fluid also help to keep us healthy. We just need to get in the habit of doing these things," she added.

Co-author Prof Carolyn Summerbell, from Durham University, said: "A healthy diet is a way of eating that people can sustain over time. That's the trick, to find a comfortable way to eat that you can stick to for life which helps you maintain your weight. Cutting down on fat will help.

"Doing exercise and being physically active is good for maintaining weight and also has other health benefits, but it's not a replacement for a healthy diet."

The small amount of data available for children in the same analysis confirmed a relationship between total fat intake and subsequent weight change. Further trials are needed to examine the effect of reducing fat intake on body weight in developing countries as well as in children.

How Common 'Cat Parasite' Gets Into Human Brain and Influences Human Behavior



A dendritic cell infected by Toxoplasma gondii (in red). (Credit: Copyright A. Barragan)

Dec. 6, 2012 — Toxoplasma is a common 'cat parasite', and has previously been in the spotlight owing to its observed effect on risk-taking and other human behaviours. To some extent, it has also been associated with mental illness. A study led by researchers from Karolinska Institutet in Sweden now demonstrates for the first time how the parasite enters the brain to influence its host.

"We believe that this knowledge may be important for the further understanding of complex interactions in some major public health issues, that modern science still hasn't been able to explain fully," says Antonio Barragan, researcher at the Center for Infectious Medicine at Karolinska Institutet and the Swedish Institute for Communicable Disease Control. "At the same time, it's important to emphasize that humans have lived with this parasite for many millennia, so today's carriers of Toxoplasma need not be particularly worried."

The current study, which is published in the scientific journal *PLoS Pathogens*, was led by Dr Barragan and conducted together with researchers at Uppsala University.

Toxoplasmosis is caused by the extremely common Toxoplasma gondii parasite. Between 30 and 50 per cent of the global population is thought to be infected, and an estimated twenty per cent or

so of people in Sweden. The infection is also found in animals, especially domestic cats. People contract the parasite mostly by eating the poorly cooked flesh of infected animals or through contact with cat faeces. The infection causes mild flu-like symptoms in adults and otherwise healthy people before entering a chronic and dormant phase, which has previously been regarded as symptom-free. It is, however, known that toxoplasmosis in the brain can be fatal in people with depleted immune defence and in fetuses, which can be infected through the mother. Because of this risk, pregnant women are recommended to avoid contact with cat litter trays.

A number of studies have been presented in recent years showing that the toxoplasmosis parasite affects its host even during the dormant phase. It has, for example, already been observed that rats become unafraid of cats and even attracted by their scent, which makes them easy prey. This has been interpreted as the parasite assuring its survival and propagation, since the consumed rat then infects the cat, which through its faces can infect the food that other rats might then proceed to eat. A number of studies also confirm that mental diseases like schizophrenia, depression and anxiety syndrome are more common in people with toxoplasmosis, while others suggest that toxoplasmosis can influence how extroverted, aggressive or risk-inclined an individual's behaviour is.

"We've not looked at behavioural changes in people infected with toxoplasma, as that's been dealt with by previous studies," says Dr Barragan. "Instead, we've shown for the first time how the parasite behaves in the body of its host, by which I mean how it enters the brain and manipulates the host by taking over one of the brain's neurotransmitters."

In one laboratory experiment, human dendritic cells were infected with toxoplasma. After infection, the cells, which are a key component of the immune defence, started secreting the signal substance GABA. In another experiment on live mice, the team was able to trace the movement of infected dendritic cells in the body after introducing the parasite into the brain, from where it spread and continued to affect the GABA system.

GABA is a signal substance that, amongst other effects, inhibits the sensation of fear and anxiety. Disturbances of the GABA system are seen in people with depression, schizophrenia, bipolar diseases, anxiety syndrome and other mental diseases.

"For toxoplasma to make cells in the immune defence secrete GABA was as surprising as it was unexpected, and is very clever of the parasite," says Dr Barragan. "It would now be worth studying the links that exist between toxoplasmosis, the GABA systems and major public health threats."

The study was financed with a grant from the Swedish Research Council.

Deception Can Be Perfected: Can a Repeated Lie Become 'a Truth? '

Dec. 6, 2012 — With a little practice, one could learn to tell a lie that may be indistinguishable from the truth. New Northwestern University research shows that lying is more malleable than previously thought, and with a certain amount of training and instruction, the art of deception can be perfected.

People generally take longer and make more mistakes when telling lies than telling the truth, because they are holding two conflicting answers in mind and suppressing the honest response, previous research has shown. Consequently, researchers in the present study investigated whether lying can be trained to be more automatic and less task demanding.

This research could have implications for law enforcement and the administering of lie detector tests to better handle deceptions in more realistic scenarios.

Researchers found that instruction alone significantly reduced reaction times associated with participants' deceptive responses.

They used a control group -- an instruction group in which participants were told to speed up their lies and make fewer errors, but were not given time to prepare their lies -- and a training group, which received training in how to speed up their deceptive responses and were given time to prepare their lies. In the training group that practiced their lies, the differences between deceptive and truthful responses were completely eliminated.

"We found that lying is more malleable and can be changed upon intentional practice," said Xiaoqing Hu, lead author of the study and a doctoral candidate in the department of psychology at Northwestern.

Hu said they were surprised that even in the instruction group, members who were not given time to prepare their lies and told only to try to speed up their responses and make fewer errors were able to significantly reduce their deceptive response reaction time.

"This was really unexpected because it suggests that people can be really flexible, and after they know what is expected from them, they want to avoid being detected," Hu said, noting the findings could help in crime fighting.

"In real life, there's usually a time delay between the crime and interrogation," said Hu. "Most people would have time to prepare and practice their lies prior to the interrogation." However, previous research in deception usually gave participants very little time to prepare their lies.

Lie detector tests most often rely on physiological responses. Therefore, Hu said further research warrants looking at whether additional training could result in physiological changes in addition to inducing behavior changes as observed in their study.

How Calorie Restriction Influences Longevity: Protecting Cells from Damage Caused by Chronic Disease

enlarge

Scientists at the Gladstone Institutes have identified a novel mechanism by which a type of low-carb, low-calorie diet -- called a "ketogenic diet" -- could delay the effects of aging. (Credit: © Chariclo / Fotolia)

Dec. 6, 2012 — Scientists at the Gladstone Institutes have identified a novel mechanism by which a type of low-carb, low-calorie diet -- called a "ketogenic diet" -- could delay the effects of aging. This fundamental discovery reveals how such a diet could slow the aging process and may one day allow scientists to better treat or prevent age-related diseases, including heart disease, Alzheimer's disease and many forms of cancer.

As the aging population continues to grow, age-related illnesses have become increasingly common. Already in the United States, nearly one in six people are over the age of 65. Heart disease continues to be the nation's number one killer, with cancer and Alzheimer's close behind. Such diseases place tremendous strain on patients, families and our healthcare system. But now, researchers in the laboratory of Gladstone Senior Investigator Eric Verdin, MD, have identified the role that a chemical compound in the human body plays in the aging process -- and which may be key to new therapies for treating or preventing a variety of age-related diseases.

In the latest issue of the journal *Science*, available online December 6, Dr. Verdin and his team examined the role of the compound β-hydroxybutyrate (βOHB), a so-called "ketone body" that is produced during a prolonged low-calorie or ketogenic diet. While ketone bodies such as βOHB can be toxic when present at very high concentrations in people with diseases such as Type I diabetes, Dr. Verdin and colleagues found that at lower concentrations, βOHB helps protect cells from "oxidative stress" -- which occurs as certain molecules build to toxic levels in the body and contributes to the aging process.

"Over the years, studies have found that restricting calories slows aging and increases longevity -- however the mechanism of this effect has remained elusive" Dr. Verdin said. Dr. Verdin, the paper's senior author, directs the Center for HIV & Aging at Gladstone and is also a professor at the University of California, San Francisco, with which Gladstone is affiliated. "Here, we find that βOHB -- the body's major source of energy during exercise or fasting -- blocks a class of enzymes that would otherwise promote oxidative stress, thus protecting cells from aging."

Oxidative stress occurs as cells use oxygen to produce energy, but this activity also releases other potentially toxic molecules, known as free radicals. As cells age, they become less effective in clearing these free radicals -- leading to cell damage, oxidative stress and the effects of aging.

However, Dr. Verdin and his team found that βOHB might actually help delay this process. In a series of laboratory experiments -- first in human cells in a dish and then in tissues taken from mice -- the team monitored the biochemical changes that occur when βOHB is administered during a chronic calorie-restricted diet. The researchers found that calorie restriction spurs βOHB production, which blocked the activity of a class of enzymes called histone deacetylases, or HDACs.

Normally HDACs keep a pair of genes, called Foxo3a and Mt2, switched off. But increased levels of βOHB block the HDACs from doing so, which by default activates the two genes. Once activated, these genes kick-start a process that helps cells resist oxidative stress. This discovery not only identifies a novel signaling role for βOHB, but it could also represent a way to slow the detrimental effects of aging in all cells of the body.

"This breakthrough also greatly advances our understanding of the underlying mechanism behind HDACs, which had already been known to be involved in aging and neurological disease," said Gladstone Investigator Katerina Akassoglou, PhD, an expert in neurological diseases and one of the paper's co-authors. "The findings could be relevant for a wide range of neurological conditions, such as Alzheimer's, Parkinson's, autism and traumatic brain injury -- diseases that afflict millions and for which there are few treatment options."

"Identifying βOHB as a link between caloric restriction and protection from oxidative stress opens up a variety of new avenues to researchers for combating disease," said Tadahiro Shimazu, a Gladstone postdoctoral fellow and the paper's lead author. "In the future, we will continue to explore the role of βOHB -- especially how it affects the body's other organs, such as the heart or brain -- to confirm whether the compound's protective effects can be applied throughout the body."

His and Hers: Male Sex Hormones Control Differences in Mammary Gland Nerve Growth

Dec. 6, 2012 — Johns Hopkins scientists have found a surprising mechanism that gives male sex hormones like testosterone control over the gender-specific absence or presence of mammary gland nerves that sense the amount of milk available in breast milk ducts.

In a Dec. 7 report on their discovery in *Science*, they say the hormones do the job by altering the availability of a nerve growth factor, called BDNF for short.

The most obvious differences between males and females involve the presence or absence of physical structures. Below the surface, however, these structures are penetrated by nerves, which also are present in a sex-specific way.

"We now think we have a broader understanding of how sex-specific nerves reach their proper target in a given sex, say in mammary milk ducts in females, but disappear in the other sex," says David Ginty, Ph.D., a Howard Hughes investigator and professor of neuroscience in the Institute for Basic Biomedical Sciences at the Johns Hopkins School of Medicine.

For their experiments with sex-specific neural wiring, Yin Liu, a student in Ginty's laboratory, studied nerves in mice that monitor the fullness of milk ducts in females. If the milk supply is low, the nerves are believed to report this to the brain to stimulate milk production, Ginty says. Early in embryonic development, there are no differences between the mammary glands of males and females and this milk-monitoring set of nerves is present in both. Later in development, the nerves are lost in males.

In one experiment, to figure out how the nerves find their way to the immature mammary glands of both sexes during early development, the researchers analyzed the gland cells for the presence of four proteins known to encourage nerve growth. They found only one that was there in significant quantities -- BDNF -- and it was present at similar levels in both sexes.

Ginty says BDNF is known to bind to a protein, known as TrkB, found on the surface of nerve cells. This binding event triggers a series of messages within the nerve cell, telling it to grow towards the source of the signal. When the researchers looked for TrkB in developing mice, they found it, as expected, on the surfaces of nerve cells that grow into the immature glands of both sexes. "So early development could be explained quite simply," says Ginty. "The cells of the early mammary glands released the signaling molecule BDNF, which was detected by TrkB on the nerve cells, which made them grow toward the mammary glands. What remained a mystery was why these nerve cells are lost a few hours later in males."

In a subsequent experiment, using molecular tests, the scientists ruled out the possibility that nerve cells in male pre-mammary glands were receiving a "suicide signal" and dying off. They reasoned that if the nerve cells weren't dying, they must be retracting, and went hunting for what signal was telling them to do so.

Since sex hormones play many different roles in determining sex-specific differences, the researchers monitored the effects of adding male sex hormones to females, and the effects of blocking male sex hormones in males. They found that the female pattern of nerve growth was

the "default" and that male sex hormones would cause withdrawal of the nerves from the glands of either sex.

"At this point, we knew that BDNF is found at comparable levels in the glands of both sexes, that TrkB is found at comparable levels on the nerve cells of both sexes, and that male sex hormones were still somehow creating a difference in the system," says Ginty.

To figure out just how the hormones caused the nerve growth differences, they searched for the BDNF receptor protein TrkB in the immature gland tissue (instead of in the nerve cells). They found it -- but only in males.

It turns out that, in addition to regular TrkB made by nerve cells, a shorter version of the protein, dubbed TrkB.T1, also exists. From their experiments, Ginty and his team concluded that as the male embryos got older, male sex hormones, produced by the testes, commanded non-nerve cells in the immature gland tissue to produce TrkB.T1. Though TrkB.T1 can still bind BDNF, once it does so, both proteins are taken inside the cell and recycled, essentially removing BDNF -- and its nerve-growth-promoting signals -- from early mammary gland tissue in males.

"It's as if testosterone sounds the horn for retreat, so that without BDNF present, the nerve endings that had already reached the male mammary glands pull away," says Ginty. "We believe this is the first study to show sex hormones regulating nerve growth and retraction by affecting the availability of BDNF," he adds, noting that "it will be interesting to see if similar mechanisms create other sex-specific differences in neural wiring, including those that affect general behavior."

Other authors of the report include Yin Liu, Michael Rutlin and Siyi Huang of the Johns Hopkins University School of Medicine; Colleen Barrick and Lino Tessarollo of the National Cancer Institute; Fan Wang of Duke University Medical Center; and Kevin Jones of the University of Colorado.

This work was supported by grants from the National Institute of Stroke and Neurological Disorders (NS34814), the National Eye Institute (EY014998), the National Institute of Dental and Craniofacial Research (DE019440) and the Howard Hughes Medical Institute.

New Evidence for Epigenetic Effects of Diet On Healthy Aging

Dec. 6, 2012 — New research in human volunteers has shown that molecular changes to our genes, known as epigenetic marks, are driven mainly by aging but are also affected by what we eat.

The study showed that whilst age had the biggest effects on these molecular changes, selenium and vitamin D status reduced the accumulation of epigenetic changes, and high blood folate and

obesity increased them. These findings support the idea that healthy aging is affected by what we eat.

Researchers from the Institute of Food Research led by Dr Nigel Belshaw, working with Prof John Mathers and colleagues from Newcastle University, examined the cells lining the gut wall from volunteers attending colonoscopy clinic. The Institute of Food Research is strategically funded the Biotechnology and Biological Sciences Research Council and this study was also funded by the Food Standards Agency.

The study volunteers were free from cancer or inflammatory bowel disease and consumed their usual diet without any supplements. The researchers looked for specific epigenetic modifications of the volunteers' genes that have been associated with the earliest signs of the onset of bowel cancer -- an age-related disease. These epigenetic marks, known as DNA methylation, do not alter the genetic code but affect whether the genes are turned on or off. These methylation marks are transmitted when cells divide, and some have been associated with the development of cancer.

The investigators studied the relationship between the occurrence of these epigenetic marks at genes known to be affected in cancer, and factors including the volunteers' age, sex, body size and the levels of some nutrients in the volunteers' blood. The biggest influence on gene methylation was age. This fits with the fact that the biggest risk factor for bowel cancer is age, with risk increasing exponentially over 50 years old.

The findings, published in the journal Aging Cell, showed that men tended to have a higher frequency of these epigenetic changes than women, which is consistent with men being at a greater risk of bowel cancer. Volunteers with higher vitamin D status tended to show lower levels of methylation, and a similar effect was observed for selenium status. Again, this is consistent with the known links between higher vitamin D and selenium and reduced bowel cancer risk.

The B vitamin folate is essential for health, but in this study, high folate status was associated with increased levels of epigenetic changes linked with bowel cancer. These findings are consistent with some epidemiological studies suggesting that excessive folate intakes may increase risk in some people. The results of this study showing an association between folate status and epigenetic changes linked to cancer, together with those from another recent study by Nigel Belshaw's group showing that, in cells grown in the laboratory, they could be induced by exposure to high levels of folic acid, emphasise the need for further research on optimal folate status in humans. The researchers intend to investigate the mechanism for the effect of folate on DNA methylation in a follow-up study.

Obesity is also a risk factor for bowel cancer. This study found relationships between body size (height, weight and waist circumference) and epigenetic changes. How excess body weight induces these epigenetic changes, and the consequences for gut health, are currently being investigated at IFR and in Newcastle University.

In summary, the results of this study support the hypothesis that aging affects the epigenetic status of some genes and that these effects can be modulated by diet and body fatness.

Brain Study Shows Why Some People Are More in Tune With What They Want

Dec. 9, 2012 — Wellcome Trust researchers have discovered how the brain assesses confidence in its decisions. The findings explain why some people have better insight into their choices than others.

Throughout life, we're constantly evaluating our options and making decisions based on the information we have available. How confident we are in those decisions has clear consequences. For example, investment bankers have to be confident that they're making the right choice when deciding where to put their clients' money.

Researchers at the Wellcome Trust Centre for Neuroimaging at UCL led by Professor Ray Dolan have pinpointed the specific areas of the brain that interact to compute both the value of the choices we have in front of us and our confidence in those choices, giving us the ability to know what we want.

The team used functional magnetic resonance imaging (fMRI) to measure activity in the brains of twenty hungry volunteers while they made choices between food items that they would later eat. To determine the subjective value of the snack options, the participants were asked to indicate how much they would be willing to pay for each snack. Then after making their choice, they were asked to report how confident they were that they had made the right decision and selected the best snack.

It has previously been shown that a region at the front of the brain, the ventromedial prefrontal cortex, is important for working out the value of decision options. The new findings reveal that the level of activity in this area is also linked to the level of confidence participants placed on choosing the best option. The study also shows that the interaction between this area of the brain and an adjacent area reflects participants' ability to access and report their level of confidence in their choices.

Dr Steve Fleming, a Sir Henry Wellcome Postdoctoral Fellow now based at New York University, explains: "We found that people's confidence varied from decision to decision. While we knew where to look for signals of value computation, it was very interesting to also observe neural signals of confidence in the same brain region."

Dr Benedetto De Martino, a Sir Henry Wellcome Postdoctoral Fellow at UCL, added: "Overall, we think our results provide an initial account both of how people make choices, and also their insight into the decision process."

We Are Basically Honest – Except When We Are at Work, Study Suggests

Dec. 14, 2012 — A new study has revealed we are more honest than you might think. The research by the University of Oxford and the University of Bonn suggests that **it pains us to tell lies, particularly when we are in our own homes. It appears that being honest is hugely important to our sense of who we are. However, while it might bother us to tell lies at home, we are less circumspect at work where we are probably more likely to bend the truth**, suggests the study.

The researchers conducted simple honesty tests by ringing people in their own homes in Germany and asking them to flip a coin. The study participants were asked over the phone to report on how it landed. The catch to this test was that each of the individuals taking part was given a strong financial incentive to lie without the fear of being found out. The study participants were told that if the coin landed tails up, they would receive 15 euros or a gift voucher; while if the coin landed heads up, they would receive nothing.

Using randomly generated home phone numbers, 658 people were contacted who agreed to take part. Although the researchers could not directly observe the behavior of the individuals in their own homes, the aggregated reports show a remarkably high level of honesty. Over half of the study participants (55.6 per cent) reported that the coin landed heads-up, which meant they would receive nothing. Only 44.4 per cent reported tails up, collecting their financial reward as a result.

A second similar test was done involving 94 participants over the phone. This time they were asked to report on the results of four consecutive coin tosses with the promise of five euros for every time the coin landed tails up. Despite a potential maximum pay-off of 20 euros, the reports they received from the respondents reflected the likely distribution of a fair coin. This is based on the premise that the coin would have landed tails up around 50 per cent of the time.

All those taking part in the experiments answered questions about their own gender, age, views on honesty and their religious background. The study suggests, however, that **personal attributes play no part here as the overall level of honesty demonstrated in both experiments was high**.

This latest study can be compared with previous similar studies, which were conducted with students in tightly controlled laboratory situations. In those studies around 75 per cent of participants reported tails-up, which the researchers suggest could infer that people are more honest when they are in their own homes.

Dr Johannes Abeler, from the Department of Economics at the University of Oxford, said: The fact that the financial incentive to lie was outweighed by the perceived cost of lying shows just how honest most people are when they are in their own homes. **One theory is that being honest is at the very core of how we want to perceive ourselves and is very important to our sense**

of self identity. Why it is so important? It may be to do with the social norms we have been given about what is right and wrong from the moment we could walk and talk.

'This study has implications for policy-makers. For instance, if they want to catch those involved in fraudulent behaviour, perhaps the forms and questionnaires could be designed to reveal more about our personal lives and sense of self-identity. Our experiments showed that if people plainly see that to lie in a given situation would be fraudulent, they shy away from it. However, if people are given "wriggle room," they can convince themselves that their behaviour is not fraudulent and this does not attack their sense of who they are.'

The computer-assisted telephone interviews were carried out by the Institute for Applied Social Sciences (infas), a private, well-known German research institute. They were conducted between November 2010 and February 2011. Telephone numbers were selected using a random digit dialling technique with numbers randomly based on a data set of all potential landline telephone numbers in Germany. Part of the study consisted of questions relating to the participants' social background, age and education, their economic and political preferences, their religious beliefs, their attitudes to crime, and their beliefs about other people's behaviour in the experiment.

In Decision-Making, It Might Be Worth Trusting Your Gut

Dec. 14, 2012 — Turns out the trope is true: **You should trust your gut -- as long as you're an expert.** So says a new study from researchers at Rice University, George Mason University and Boston College.

"How expert someone is within a particular domain has a positive impact on their ability to make an accurate gut decision," said Rice's Erik Dane, lead author of a study published last month in the journal Organizational Behavior and Human Decision Processes. However, he added, **"Even if you're an expert, intuitive decision-making is better for some types of tasks than others. Tasks that can be solved through predetermined steps, like math problems, are not as conducive to intuitive decision-making as less-structured tasks, which may include certain strategic or human resource management problems."**

"Although there's been a lot of research on the concept of intuition, there's relatively little research directly comparing whether it's best to 'trust your gut' versus taking time to make a decision," said Dane, assistant professor of management at Rice's Jones Graduate School of Business. So the researchers took on the task of examining circumstances in which intuitive decision-making is effective compared with analytical decision-making.

They conducted two studies, one in which participants rated the difficulty of basketball shots and one in which participants judged whether designer handbags were real or fake.

In the first study, 184 undergraduate students (79 males, 105 females) watched 13 video clips of basketball shots taken during two college basketball games and were given 10 seconds after each

shot to rate its difficulty on a scale from 1 to 10. Beforehand, the researchers had estimated the difficulty of the shots by collaborating with the men's basketball coaching staff (one head coach and three assistant coaches) at a highly successful NCAA Division I college basketball program.

Participants were assigned to either an "intuitive" group -- they based their decisions entirely on their first impression -- or an "analytical" group. The analytical group was given two minutes before the exercise to develop a list of factors that would determine the difficulty of a basketball shot, such as the number of defenders near the shooter, whether the shooter is stationary or moving, and the point value of the shot. They were told to base their decisions on these factors.

To measure participants' expertise with basketball, the researchers assessed (via a questionnaire) the extent to which they had played the sport. Given that the task entailed judging shots in the same manner as successful basketball coaches, the researchers wanted a measure that would separate those who had simply watched a lot of basketball from those who had actual experience playing the sport. They determined that playing competitive basketball for at least three years of high school classified participants as "experts"; the rest were classified as low in expertise.

They found that, indeed, intuition was more effective for those with high expertise. In the intuitive group, those who had played competitive basketball for three years in high school performed better on the task. In contrast, there was no significant difference in the analytical group between those with high and low expertise.

In the second study, the researchers turned to a different expertise domain: designer handbags. They recruited 239 undergraduate students (120 males, 119 females) to make decisions about whether designer handbags were authentic or counterfeit.

The participants made their decisions by looking at -- but not touching -- 10 designer handbags, including two authentic and three counterfeit Coach handbags and three authentic and two counterfeit Louis Vuitton handbags. All handbags were either brand new or very lightly used.

Participants were again split into an intuitive group and an analytical group and instructed to judge whether the handbags were real or fake. The intuition group was given five seconds to view each handbag and told to base their decisions entirely on their first impression. The analysis group was told to ignore any first impressions or gut instincts and base their decisions on careful analysis. Prior to the task, participants in the analysis group were given two minutes to list the features they would look for to determine whether a given handbag was real or fake, such as material, stitching and color. This group was given 30 seconds to make their decision for each bag.

The researchers assessed the participants' expertise based on the total number of Coach and Louis Vuitton handbags each participant owned and determined that owning more than three made them an expert for this study.

Once again, the researchers found that intuition was more effective for those with high expertise. In the intuition condition, participants with high expertise demonstrated higher task performance. In the analysis condition, those with high expertise performed no better than those with low

expertise. Across both studies, participants who possessed expertise within the task domain performed on average just as well intuitively as analytically. In addition, experts significantly outperformed novices when making their decisions intuitively but not when making their decisions analytically.

Dane and his co-authors hope the research will advance scholarship on intuitive decision-making and help people understand when they should trust their gut to make decisions.

The research was funded by Rice University and co-authored by Kevin Rockmann, associate professor of management at George Mason University, and Michael Pratt, the O'Connor Family Professor at Boston College.

Research Explores How Children Reason, Think About Others

Dec. 14, 2012 — As social creatures, **humans must constantly monitor each other's intentions, beliefs, desires, and other mental states. A particularly important social skill is the ability to take another person's perspective and understand what the person knows, even when that knowledge may ultimately be false.** Past research has shown that **before the age of 4, children fail to pass standard tasks designed to measure false belief; however, new research has shown that very young children can pass nonverbal versions of false-belief tasks**.

Paula Rubio-Fernández of University College London and Bart Geurts of the University of Nijmegen tested 3-year-old children using a standard false-belief task called the Smarties task and using an altered, more streamlined version of the false-belief task called the Duplo task. The Duplo task was designed to minimize disruptions in children's perspective-taking. The researchers found that while only 22.7% of children passed the Smarties task, 80% of children passed the Duplo task. This suggests that **3-year-old children are able to pass a verbal false-belief task if they are able to keep track of the protagonist's perspective**.

Early Executive Function Predicts Reasoning Development

Although analogical reasoning is a core cognitive skill that distinguishes humans from other animals, its origins are still not well understood. Psychological scientists Lindsey Richland of the University of Chicago and Margaret Burchinal of the University of North Carolina, Chapel Hill analyzed data from children who were part of the Study of Early Child Care and Youth Development. They assessed children for vocabulary knowledge, sustained attention, short-term memory skills, executive functioning skills, and analytical reasoning skills and found that **children's early vocabulary knowledge and executive-functioning predicted their analytical reasoning skills at age 15.** These results indicate that composite executive-function skills make specialized contributions to the development of children's analytical reasoning. They also support the idea that **language and knowledge are necessary for the development of analytical-reasoning skills.**

Changes in the Gut Bacteria Protect Against Stroke, Research Finds

Dec. 14, 2012 — Researchers at the University of Gothenburg, Sweden, and the Chalmers University of Technology, Sweden, demonstrate that **an altered gut microbiota in humans is associated with symptomatic atherosclerosis and stroke.** These findings are presented in a study published Dec. 4 in *Nature Communications.*

The human body contains ten times more bacterial cells than human cells, most of which are found in the gut. These bacteria contain an enormous number of genes in addition to our host genome, and are collectively known as the gut metagenome.

Rapidly expanding field

How does the metagenome affect our health? This question is currently being addressed by researchers in the rapidly expanding field of metagenomic research. Several diseases have been linked to variations in the metagenome.

Researchers at Chalmers University of Technology and Sahlgrenska Academy, University of Gothenburg, now also show that **changes in the gut metagenome can be linked to atherosclerosis and stroke.**

Differences in gut microbiota

The researchers **compared a group of stroke patients with a group of healthy subjects and found major differences in their gut microbiota**. In particular, they showed that genes required for **the production of carotenoids** were more frequently found in gut microbiota from healthy subjects. The healthy subjects also had significantly higher levels of a certain carotenoid in the blood than the stroke survivors.

Affects disease states

Carotenoids are a type of antioxidant, and it has been claimed for many years that they protect against angina and stroke. Thus, the increased incidence of carotenoid-producing bacteria in the gut of healthy subjects may offer clues to explain how the gut metagenome affects disease states. Carotenoids are marketed today as a dietary supplement. The market for them is huge, but clinical studies of their efficacy in protecting against angina and stroke have produced varying results.

Important health benefits

Jens Nielsen, Professor of Systems Biology at Chalmers, says that it may be preferable to take probiotics instead -- for example dietary supplements containing types of bacteria that produce carotenoids.

"Our results indicate that long-term exposure to carotenoids, through production by the bacteria in the digestive system, has important health benefits. These results should make it possible to develop new probiotics. We think that the bacterial species in the probiotics would establish themselves as a permanent culture in the gut and have a long-term effect."

Develop risk prognoses

"By examining the patient's bacterial microbiota, we should also be able to develop risk prognoses for cardiovascular disease," says Fredrik Bäckhed, Professor of Molecular Medicine at the University of Gothenburg,. "It should be possible to provide completely new disease-prevention options."

Close cooperation

The researchers have now started a company, Metabogen, to further develop their discoveries relating to the metagenome. Their success is based on close cooperation between engineers, microbiologists and doctors. Jens Nielsen and Fredrik Bäckhed both agree that one of the challenges in the rapidly developing area of metagenomics is its multidisciplinary facets, requiring novel collaborations and merging of research fields.

The research was funded by: Knut and Alice Wallenberg Foundation, the Chalmers Foundation, Swedish Heart Lung Foundation, Torsten Söderberg's Foundation, IngaBritt och Arne Lundbergs Foundation, AFA Insurances, the Swedish Research Council, and the Swedish Foundation for Strategic Research.

Olympians Live Longer Than General Population ... But Cyclists No Survival Advantage Over Golfers

Dec. 13, 2012 — Olympic medallists live longer than the general population, regardless of country of origin, medal won, or type of sport played, finds a study in the Christmas issue published on bmj.com today.

A second study comparing athletes who trained at different physical intensities, found that those from high or moderate intensity sports have no added survival benefit over athletes from low intensity sports. But those who engage in disciplines with high levels of physical contact, such as boxing, rugby and ice hockey, are at an increased risk of death in later life, the data show.

An accompanying editorial adds that everyone could enjoy the "survival advantage" of elite athletes by just meeting physical activity guidelines.

In the first study, researchers compared life expectancy among 15,174 Olympic athletes who won medals between 1896 and 2010 with general population groups matched by country, sex, and age.

All medallists lived an average of 2.8 years longer -- a significant survival advantage over the general population in eight out of the nine country groups studied.

Gold, silver and bronze medallists enjoyed roughly the same survival advantage, as did medallists in both endurance and mixed sports. Medallists in power sports had a smaller, but still significant, advantage over the general population.

The authors say that, although their study was not designed to determine why Olympic athletes live longer, "possible explanations include genetic factors, physical activity, healthy lifestyle, and the wealth and status that come from international sporting glory."

In the second study, researchers measured the effect of high intensity exercise on mortality later in life among former Olympic athletes.

They tracked 9,889 athletes with a known age at death, who took part in at least one Olympic Games between 1896 and 1936. Together they represented 43 disciplines requiring different levels of exercise intensity and physical contact.

After adjusting for sex, year of birth and nationality, they found that athletes from sports with high cardiovascular intensity (such as cycling and rowing) or moderate cardiovascular intensity (such as gymnastics and tennis) had similar mortality rates compared with athletes from low cardiovascular intensity sports, such as golf or cricket.

However, the researchers did find an 11% increased risk of mortality among athletes from disciplines with a high risk of body collision and with high levels of physical contact, such as boxing, rugby and ice hockey, compared with other athletes. They suggest this reflects the impact of repeated collisions and injuries over time.

In an accompanying editorial, two public health experts point out that people who do at least 150 minutes a week of moderate to vigorous intensity physical activity also have a survival advantage compared with the inactive general population. Estimates range from just under a year to several years.

But they argue that, compared with the successes that have been achieved in tobacco control, "our inability to improve physical activity is a public health failure, and it is not yet taken seriously enough by many in government and in the medical establishment."

"Although the evidence points to a small survival effect of being an Olympian, careful reflection suggests that similar health benefits and longevity could be achieved by all of us through regular physical activity. We could and should all award ourselves that personal gold medal," they conclude.

Key Gene for Brain Development

Dec. 13, 2012 — About one in ten thousand babies is born with an abnormally small head. The cause for this disorder -- which is known as microcephaly -- is a defect in the development of the embryonic brain. Children with microcephaly are severely retarded and their life expectancy is low. Certain cases of autism and schizophrenia are also associated with the dysregulation of brain size.

The causes underlying impaired brain development can be environmental stress (such as alcohol abuse or radiation) or viral infections (such as rubella) during pregnancy. In many cases, however, a mutant gene causes the problem.

David Keays, a group leader at the IMP, has now found a new gene which is responsible for Microcephaly. Together with his PhD-student Martin Breuss, he was able to identify TUBB5 as the culprit. The gene is responsible for making tubulins, the building blocks of the cell's internal skeleton. Whenever a cell moves or divides, it relies on guidance from this internal structure, acting like a scaffold.

The IMP-researchers, together with collaborators at Monash University (Victoria, Australia), were able to interfere with the function of the TUBB5 in the brains of unborn mice. This led to massive disturbances in the stem cell population and impaired the migration of nerve cells. Both, the generation of large numbers of neurons from the stem cell reservoir and their correct positioning in the cortex, are essential for the development of the mammalian brain.

To determine whether the findings are also relevant in humans, David Keays collaborates with clinicians from the Paris-Sorbonne University. The French team led by Jamel Chelly, examined 120 patients with pathological brain structures and severe disabilities. Three of the children were found to have a mutated TUBB5-gene.

This information will prove vital to doctors treating children with brain disease. It will allow the development of new genetic tests which will form the basis of genetic counseling, helping parents plan for the future. By understanding how different genes cause brain disorders, it is hoped that one day scientists will be able to create new drugs and therapies to treat them.

The new findings by the IMP-researchers are published in the current issue of the journal *Cell Reports.* For David Keays, understanding the function of TUBB5 is the key to understanding brain development. "Our project shows how research in the lab can help improve lives in the clinic," he adds.

Pursuing Literary Immortality Illuminates How the Mind Works

Dec. 13, 2012 — The initial excitement of hearing a new song fades as it's replayed to death. That's because the brain naturally functions as a kind of ticking time bomb, obliterating the thrill for artistic sounds, images and words by making them familiar over time.

So the artist, musician or author's challenge is to create a work that retains a freshness, according to Case Western Reserve University's Michael Clune, in his new book, *Writing Against Time* (Stanford University Press). And, for the artist, musician or writer, creating this newness with each work is a race against "brain time."

Clune explains how neurobiological forces designed for our survival naturally make interest in art fade. But the forces don't stop artists from trying for timelessness.

While the phenomenon is true for all art, the assistant professor of English focuses on the intersection of literature and science, describing what writers can do to block or slow that natural erosion over time. Clune's builds on his interest in how the brain destroys a lasting enjoyment of art. He has written about and reported on the topic in the neuroscience journal, Behavioral and Brain Sciences.

The brain gradually defeats that initial excitement with boredom that Clune describes as "this dull feeling that your senses have died."

As writers fight to ward off the reader's boredom with striking new forms, metaphors, and images, the brain works just as fast to extinguish it.

"We are evolutionarily designed so that we focus on new objects and ignore familiar ones," Clune says. "When the mind confronts a new object, our perception is intense and vivid, but it soon dies with familiarity. Every minute, this feeling fades as the mind grasps the object."

Many writers in the Romantic tradition are animated by an impossible ambition to indefinitely extend that intensity. Clune writes about the strategies some literary greats have used to slow the brain's familiarity and create a never-fading image. Vladimir Nabokov's literary images imitate the look of an addictive sexual object. Neuroscience, Clune says, has shown that levels of the neurotransmitter dopamine, which is linked to pleasure, are similar to the first shot of heroin and the first look at artwork.

"Where science can learn from literature is that it's not recreating the feeling of the first experience of the drug encounter, but that initial imagery associated with the intensity," he says.

Poet John Keats and philosopher Immanuel Kant were able to create a blueprint for a kind of melody that remains in short-term memory but resists being encoded in long-term memory, where it becomes habitual and the freshness fades.

For example, in Keat's Hyperion, the poet writes about a string of successive notes heard as one. "It will stay fresh, vivid and intense when encountered again and again," Clune says.

Poet John Ashberry has been able to overcome the mind's natural boredom by creating poetic images that imitate artifacts from an unknown or nonexistent culture. Out of context, and without a sense of shape, it keeps the mind active in searching but never finding, says Clune. The artifact combines an inkling of familiarity with the unknown, but just enough to keep the mind alert and aware of the object.

Literary immortality is also achieved by immersing the reader in an extraordinary experience outside the realm of their reality. George Orwell's *1984*, for example, creates that kind of fictional world.

Vagueness also can works to keep the mind active. It isn't about a good or complicated plot in the story, Clune says, adding that the mind gives up its natural inclination to turn information into a memory when that information is too strange.

Clune found that empathy in writing also is a time-stopper, allowing readers to step inside an experience unlike his or her own.

Scientists have an opportunity to learn from writers' insights into this neurobiological time, Clune says.

Study Promoting Coffee Drinking Benefits Needs More Research, Says Dentist

Dec. 13, 2012 — A recent study from the American Cancer Society purports that heavy coffee drinkers may reduce risk of dying from mouth and throat cancer by half but one dentist is not raising a coffee cup in support. "I do not recommend that my patients drink coffee," says Martin Hogan, DDS, Loyola University Health System. "The study does suggest benefits but I would like to see more studies done to prove this correlation."

Coffee, along with tea and red wine, is a top cause of damage to tooth enamel.

"As with any study, there are always variables that are not documented, such as alcohol consumption and tobacco use which are top causes of oral cancer," said the dentist who regularly assists in the diagnosis of oral cancer and works with oncological patients at Loyola. According to Hogan, risks for oral/pharyngeal cancers include alcohol consumption, smoking, chewing tobacco, biological factors such as fungi, viruses such as HPV (especially strain 16 for oral cancers) and physical factors including exposure to UV radiation and exposure to x-rays.

Many patients dismiss the early signs of oral cancer and do not report symptoms until the cancer has spread to other parts of the body. "Oral cancer signs range from chronic sores in the mouth that do not heal to difficulty swallowing and many patients do not think they are a big enough deal to seek medical attention," says Hogan.

Common signs of oral/pharyngeal cancer include:

- A sore or lesion in the mouth that does not heal within two weeks
- A lump or thickening in the cheek
- A white or red patch on the gums, tongue, tonsil, or lining of the mouth
- A sore throat or a feeling that something is caught in the throat
- Difficulty chewing or swallowing
- Difficulty moving the jaw or tongue
- Numbness of the tongue or other area of the mouth
- Swelling of the jaw that causes dentures to fit poorly or become uncomfortable
- Chronic hoarseness

The growing trend of sugary drinks also is taking a toll on oral health. "Sports drinks and soda are also big offenders of dental disease and actually are less damaging if they are consumed at one sitting as opposed to continuously sipping on the drinks over the course of an afternoon," he says. "Sipping prolongs the exposure of the teeth to the sugary and/or acidic liquids and increases the damage to the teeth."

Want Your Baby to Learn? Research Shows Sitting Up Helps

For babies, sitting up, either by themselves or with assistance, plays a significant role in how infants learn. (Credit: © ryanking999 / Fotolia)

Dec. 11, 2012 — From the Mozart effect to educational videos, many parents want to aid their infants in learning. New research out of North Dakota State University, Fargo, and Texas A&M shows that something as simple as the body position of babies while they learn plays a critical role in their cognitive development.

The study shows that for babies, sitting up, either by themselves or with assistance, plays a significant role in how infants learn. The research titled "Posture Support Improves Object Individuation in Infants," co-authored by Rebecca J. Woods, assistant professor of human development and family science and doctoral psychology lecturer at North Dakota State University, and by psychology professor Teresa Wilcox of Texas A&M, is published in the journal *Developmental Psychology*®.

The study's results show that babies' ability to sit up unsupported has a profound effect on their ability to learn about objects. The research also shows that when babies who cannot sit up alone are given posture support from infant seats that help them sit up, they learn as well as babies who can already sit alone.

"An important part of human cognitive development is the ability to understand whether an object in view is the same or different from an object seen earlier," said Dr. Woods. Through two experiments, she confirmed that 5-and-a-half- and 6-and-a-half-month-olds don't use patterns to differentiate objects on their own. However, 6-and-a-half-month-olds can be primed to use patterns, if they have the opportunity to look at, touch and mouth the objects before being tested.

"An advantage the 6-and-a-half-month-olds may have is the ability to sit unsupported, which makes it easier for babies to reach for, grasp and manipulate objects. If babies don't have to focus on balancing, their attention can be on exploring the object," said Woods.

In a third experiment, 5-and-a-half-month-olds were given full postural support while they explored objects. When they had posture support, they were able to use patterns to differentiate objects. The research study also suggests that delayed sitting may cause babies to miss learning experiences that affect other areas of development.

"Helping a baby sit up in a secure, well-supported manner during learning sessions may help them in a wide variety of learning situations, not just during object-feature learning," Woods said. "This knowledge can be advantageous, particularly to infants who have cognitive delays who truly need an optimal learning environment."

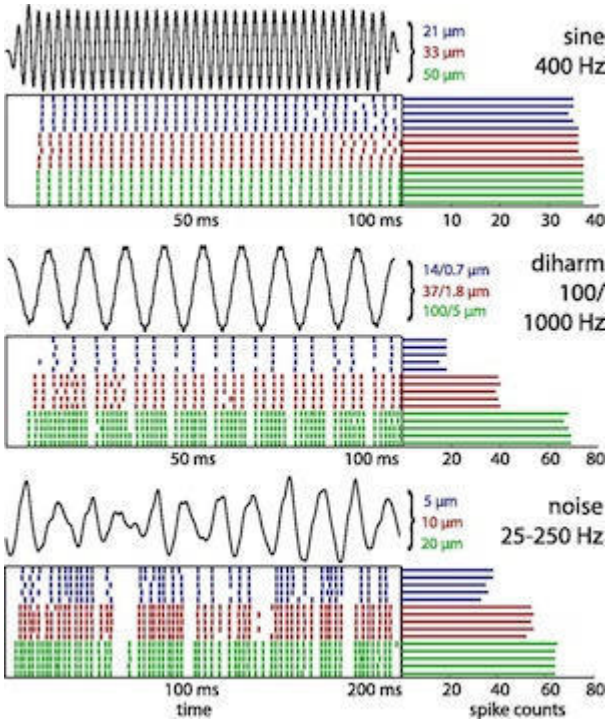
The research was supported in part by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health, under grants HD-36741 and HD-46532 awarded to Dr. Wilcox. Additional research funding was provided by National Institute of Health grant P20 RR016471 from the IdeA Networks of Biomedical Research Excellence (INBRE) program of the National Center for Research Resources awarded to Dr. Woods. NDSU undergraduate and graduate students assisted in data collection for the study.

Research at The Infant Cognitive Development Lab at NDSU focuses on cognitive abilities in infants that are related to attention and memory. The lab is associated with the Center for Visual

and Cognitive Neuroscience at NDSU, which is devoted to increasing understanding of the ways that information is perceived and processed by the brain.

NDSU is recognized as one of the nation's top 108 research universities with very high research activity as named by the Carnegie Commission on Higher Education. As a student-focused, land grant, research institution, NDSU is listed in the Top 100 research universities in the U.S. for R&D in psychology, social sciences, computer science, chemistry, physical sciences, and agricultural sciences, based on FY11 research expenditures reported to the National Science Foundation.

How Our Sense of Touch Is a Lot Like the Way We Hear



Responses of an afferent to different stimuli. (Credit: Image courtesy of University of Chicago Medical Center)

Dec. 11, 2012 — When you walk into a darkened room, your first instinct is to feel around for a light switch. You slide your hand along the wall, feeling the transition from the doorframe to the painted drywall, and then up and down until you find the metal or plastic plate of the switch. During the process you use your sense of touch to develop an image in your mind of the wall's surface and make a better guess for where the switch is.

Sliman Bensmaia, PhD, assistant professor of organismal biology and anatomy at the University of Chicago, studies the neural basis of tactile perception, or how our hands convey this information to the brain. In a new study published in the Journal of Neuroscience, he and his

colleagues found that the timing and frequency of vibrations produced in the skin when you run your hands along a surface, like searching a wall for a light switch, play an important role in how we use our sense of touch to gather information about the objects and surfaces around us.

The sense of touch has traditionally been thought of in spatial terms, i.e. receptors in the skin are spread out across a grid of sorts, and when you touch something this grid of receptors transmits information about the surface to your brain. In their new study, Bensmaia, two former undergraduates, and a postdoctoral scholar in his lab -- Matthew Best, Emily Mackevicius and Hannes Saal -- found that the skin is also highly sensitive to vibrations, and that these vibrations produce corresponding oscillations in the afferents, or nerves, that carry information from the receptors to the brain. The precise timing and frequency of these neural responses convey specific messages about texture to the brain, much like the frequency of vibrations on the eardrum conveys information about sound.

Neurons communicate through electrical bits, similar to the digital ones and zeros used by computers. But, Bensmaia said, "One of the big questions in neuroscience is whether it's just the number of bits that matters, or if the specific sequence of bits in time also plays a role. What we show in this paper is that the sequence of bits in time does matter, and in fact for some of the skin receptors, the timing matters with millisecond precision."

Researchers have known for years that these afferents respond to skin vibrations, but they studied their responses using so-called sinusoidal waves, which are smooth, repetitive patterns. These perfectly uniform vibrations can be produced in a lab, but the kinds of vibrations produced in the skin by touching surfaces in the real world are messy and erratic.

For this study, Bensmaia and his team used a vibratory motor that can produce any complex vibration they want. In the first experiment, they recorded afferent responses to a variety of frequencies in rhesus macaques, whose tactile nervous system closely resembles humans. In the second part, a group of human subjects reported how similar or different two particular frequencies felt when a probe attached to the motor touched their skin.

When the team analyzed the data recorded from the rhesus macaques, they found that not only did the nerve oscillate at the frequency of the vibrations, but they could also predict how the human subjects would perceive vibrations based on the neuronal responses to the same frequencies in the macaques.

"In this paper, we showed that the timing of spikes evoked by naturalistic vibrations matters, not just for artificial stimuli in the lab," Bensmaia said. "It's actually true for the kinds of stimuli that you would experience in everyday life."

What this means is that given a certain texture, we know the frequency of vibrations it will produce in the skin, and subsequently in the nerve. In other words, if you knew the frequency of silk as your finger passes over it, you could reproduce the feeling by stimulating the nerves with that same frequency without ever touching the fabric.

But this study is just part of ongoing research for Bensmaia's team on how humans incorporate our sense of touch into more sophisticated concepts like texture, shape, and motion.

Researchers could someday use this model of timing and frequency of afferent responses to simulate the sensation of texture for an amputee by "replaying" the vibrations produced in an artificial limb as it explores a textured surface by electrically stimulating the nerve at the corresponding frequencies. It could also be used for haptic rendering, or producing the tactile feel of a virtual object on a touchscreen (think turning your iPad into a device for reading Braille, or controlling robotic surgery).

"We're trying to build a theory of what makes things feel the way they feel," Bensmaia said. "This is the beginning of a story that's really going to change the way people think about the somatosensory system."

Need to Move Soon? Don't Trust Your Emotions

Dec. 11, 2012 — Consumers are more likely to make emotional instead of objective assessments when the outcomes are closer to the present time than when they are further away in the future, according to a new study in the *Journal of Consumer Research*.

"The proximity of a decision's outcome increases consumer reliance on feelings when making decisions. Feelings are relied upon more when the outcome is closer in time because these feelings appear to be more informative in such situations," write authors Hannah H. Chang (Singapore Management University) and Michel Tuan Pham (Columbia University).

From which snack to buy to which apartment to rent, we base many of our decisions on either feelings or objective assessment. The option that appeals more to our feelings is often not the one that "makes more sense." When do consumers rely more on their feelings than objective assessments? And how does the proximity of the decision outcome influence consumer decision-making? For example, when looking for an apartment to rent, some consumers may decide which apartment to rent only a week before moving in, while others may decide several months in advance.

In one study, college students were asked to imagine that they were about to graduate, had found a well-paying job, and were looking for an apartment to rent after graduation. They were then given a choice between an apartment that appeals more to their feelings (a smaller, prettier apartment with better views) and an option that is objectively better (a bigger, more conveniently located apartment). Compared to college juniors and those who imagined graduating a year later, college seniors and those who imagined graduating and moving into an apartment next month were more likely to choose the former option.

"Companies should consider the time between consumer decision-making and consumption. When consumers will be deciding immediately prior to consumption (choosing an entrée at a

restaurant or a mobile phone plan), companies should focus on messages that appeal to consumers' feelings. When they will be deciding well in advance (choosing a retirement plan or booking flights), companies should focus less on emotional appeals and instead emphasize messages that appeal to objective assessments," the authors conclude.

Need to Move Soon? Don't Trust Your Emotions

Dec. 11, 2012 — Consumers are more likely to make emotional instead of objective assessments when the outcomes are closer to the present time than when they are further away in the future, according to a new study in the *Journal of Consumer Research*.

"The proximity of a decision's outcome increases consumer reliance on feelings when making decisions. Feelings are relied upon more when the outcome is closer in time because these feelings appear to be more informative in such situations," write authors Hannah H. Chang (Singapore Management University) and Michel Tuan Pham (Columbia University).

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Battling Brittle Bones With … Broccoli and Spinach?

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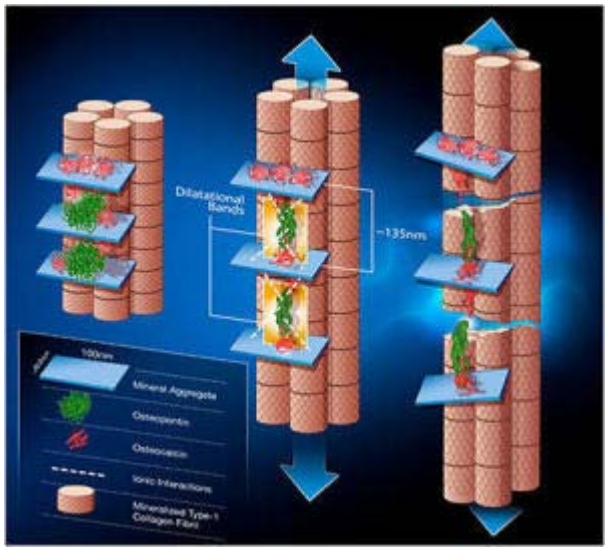

Engineering researchers at Rensselaer Polytechnic Institute pinpoint the origin of bone fractures. (Credit: Image courtesy of Rensselaer Polytechnic Institute (RPI))

Dec. 11, 2012 — A new study from engineering researchers at Rensselaer Polytechnic Institute shows, for the first time, how the little-understood protein osteocalcin plays a significant role in the strength of our bones. The findings could lead to new strategies and therapeutics for fighting osteoporosis and lowering the risk of bone fracture.

Funded by the U.S. National Institutes of Health, the study details how fractures in healthy bones begin with the creation of incredibly tiny holes, each measuring only about 500 atoms in diameter, within the bone's mineral structure. In the case of a slip, trip, or fall, the force of the impact on a bone physically deforms a pair of joined proteins, osteopontin and osteocalcin, and results in the formation of nanoscale holes. These holes, called dilatational bands, function as a natural defense mechanism, and help to prevent further damage to the surrounding bone. However, if the force of the impact is too great -- or if the bone is lacking osteopontin, osteocalcin, or both -- the bone will crack and fracture.

The multi-university study, led by Deepak Vashishth, head of the Department of Biomedical Engineering at Rensselaer, is the first to give evidence of fracture at the level of bone's nanostructure. Partnering with Rensselaer on the study were Villanova University, the Hospital for Special Surgery in New York, and Yale University.

"This study is important because it implicates, for the first time, the role of osteocalcin in giving bone the ability to resist fracture," Vashishth said. "Since osteocalcin is always the point of fracture, we believe that strengthening it could lead to a strengthening of the overall bone."

Long known but little understood, the protein osteocalin has been produced by and present in animal bones since before the dawn of humanity. Recently, abnormalities in ostoecalcin production have been associated with Type 2 diabetes as well as problems in reproductive health.

Vashishth's new study, however, is the first to explain the structural and mechanical importance of osteocalcin in bone.

Now that osteocalcin is known to participate in bone fracture, new strategies for strengthening the bond between osteocalin and osteopontin can be investigated, Vashishth said. Augmenting the body's natural supply of osteocalcin, for example, could be one possible strategy for treating osteoporosis and other conditions leading to increased fracture risk, he said. Osteocalin must be in its carboxylated form to get absorbed into bone, and the protein is carboxylated by vitamin K. Vashishth said future studies could investigate the relation between vitamin K intake, osteocalcin, and bone strength.

"Currently, all of the advice for treating osteoporosis is related to calcium. We believe there's more to the story than just calcium, and the results of this new study raise an important question about vitamin K. Leafy green vegetables are the best source of vitamin K -- wouldn't it be great if eating spinach and broccoli was not only healthy, but also good for your bones? We plan to investigate this link in future," Vashisth said.

Results of the new study, titled "Dilatational band formation in bone," were recently published online by *Proceedings of the National Academy of Sciences*, and will appear in an upcoming print edition of the journal.

Emotion in Voices Helps Capture Listener's Attention, but in the Long Run the Words Are Not Remembered as Accurately

Dec. 11, 2012 — Does the emotion in our voice have a lasting effect? According to Annett Schirmer and colleagues from the National University of Singapore, emotion helps us recognize words quicker and more accurately straight away. In the longer term however, we do not remember emotionally intoned speech as accurately as neutral speech. When we do remember the words, they have acquired an emotional value; for example words spoken in a sad voice are remembered as more negative than words spoken in a neutral voice.

The study, looking at the role of emotion in word recognition memory, is published online in Springer's journal, Cognitive, Affective & Behavioral Neuroscience.

In anger, sadness, exhilaration or fear, speech takes on an urgency that is lacking from its normal even-tempered form. It becomes louder or softer, more hurried or delayed, more melodic, erratic or monotonous. And this emotional speech immediately captures a listener's attention. Schirmer and colleagues' work looks at whether emotion has a lasting effect on word memory.

A total of 48 men and 48 women listened to sadly and neutrally spoken words and were later shown these words in a visual test, examining word recognition and attitudes to these words. The authors also measured brain activity to look for evidence of vocal emotional coding.

Their analyses showed that participants recognized words better when they had previously heard them in the neutral tone compared with the sad tone. In addition, words were remembered more negatively if they had previously been heard in a sad voice.

The researchers also looked at gender differences in word processing. They found that women were more sensitive to the emotional elements than men, and were more likely than men to recall the emotion of the speaker's voice. Current levels of the female sex hormone estrogen predicted these differences.

Schirmer and team conclude: "Emotional voices produce changes in long-term memory, as well as capturing the listener's attention. They influence how easily spoken words are later recognized and what emotions are assigned to them. Thus voices, like other emotional signals, affect listeners beyond the immediate present."

Threatening Objects Appear Closer

Dec. 11, 2012 — We're more likely to see threatening objects as closer than they really are, a misperception that may fuel us to act in ways to avoid dangerous situations, psychology researchers at New York University and Cornell University have found.

Their findings appear in *Psychological Science*, a journal of the Association for Psychological Science.

Previous studies have found that, when faced with a threat, our body responds in certain ways that enable us to act quickly when faced with a threat: heart rate, blood pressure, and levels of the stress hormone cortisol all increase. But some research suggests that the body may also demonstrate its preparedness through certain perceptual biases.

The study's three researchers -- Emily Balcetis, an assistant professor in NYU's Department of Psychology, Shana Cole, an NYU doctoral student, and David Dunning, a Cornell professor of psychology -- sought to understand this process and put forth what they call the "threat-signal hypothesis." It posits that we need to become increasingly prepared to act as a threat gets closer, so we're best served by misperceiving objects as being closer to us the more threatening they are. Specifically, the hypothesis suggests that we should misperceive threatening objects as closer than non-threatening objects that evoke equally strong and negative responses, such as disgust.

The researchers tested their hypothesis through a pair of studies.

In the first, Balcetis and colleagues recruited 101 college students to participate in a study supposedly about attitudes toward "island life." After entering the room, the students stood 156 inches away from a live tarantula that was placed on a tray on a table. The students reported how threatened and disgusted they felt at that moment and estimated the distance to the tarantula.

The results showed that the more threatened participants felt, the closer they estimated the tarantula to be. However, a different effect emerged when considering the effect of disgust. The more disgusted they felt, the further away they estimated the tarantula to be.

To pin-point the specific effect of threat, the researchers conducted a second study in which they experimentally manipulated participants' experiences of threat and disgust and compared the effects to a case when they felt no emotions.

They recruited 48 female college students to participate in a study on "impressions." When they arrived, the participants met a male student (a confederate in the experiment) they had never seen before.

Each participant was randomly assigned to watch one of three videos. Participants in the threat condition watched a video in which the male student talked about his love of guns, how he hunted as a hobby, and how he experienced feelings of pent-up aggression. Participants in the disgust condition watched a video in which the same male student talked about having done disgusting things to customers' orders while working in a fast food restaurant. Finally, participants in the neutral condition watched a video in which the male student talked about the classes he was taking next semester in a neutral manner.

After watching the video, the participants were brought back into the room with the male student they just saw in the video, who sat 132 inches away from them. To get a measure of their physiological arousal, the researchers recorded each participant's heart rate immediately before the interaction. The participants rated how "threatening" and how "disgusting" they felt the male student was at that moment. They also estimated how many inches separated them from the male student.

The results showed that the female students who watched the threatening video estimated that the male student was closer (average 55.0 cm) than the students who watched either the disgusting (average 78.4 cm) or the neutral video (average 73.9 cm). This relationship held even after the participants' heart rate was taken into account.

In both studies, feelings of threat -- but not disgust -- were consistently related to participants' estimates of distance, providing further evidence in support of the threat-signal hypothesis.

"Although fear and disgust are both negative and intense emotions, they differ in the amount of immediate action they call for," the researchers explain. "Both fear and disgust may be associated with avoidance tendencies, but fear typically necessitates active mobilization to withdraw from or dispel potential threats, whereas disgust does not."

Epigenetics May Underlie Homosexuality, Study Finds

Dec. 11, 2012 — Is homosexuality genetic? It's a long-running debate.

Now researchers at the University of Tennessee, Knoxville, say they've found a clue that may unlock the mystery. It lies in something called epi-genetics -- how gene expression is regulated by temporary switches.

A working group at the National Institute for Mathematical and Biological Synthesis (NIMBioS), based at UT, used mathematical modeling that found the transmission of sex-specific epi-marks may signal homosexuality.

According to the study, published online today in *The Quarterly Review of Biology*, sex-specific epi-marks, which are "erased" and thus normally do not pass between generations, can lead to homosexuality when they escape erasure and are transmitted from father to daughter or mother to son.

"Previous studies have shown that homosexuality runs in families, leading most researchers to presume a genetic underpinning of sexual preference," said Sergey Gavrilets, paper co-author, joint professor of math and ecology and evolutionary biology and NIMBioS's associate director for scientific activities. "However, no major gene for homosexuality has been found despite numerous studies searching for a genetic connection."

Epi-marks may be the trigger they've been searching for.

Epi-marks constitute an extra layer of information attached to our genes' backbones that regulates their expression. While genes hold the instructions, epi-marks direct how those instructions are carried out. They are usually produced anew each generation, but recent evidence demonstrates that they sometimes carry over between generations.

Sex-specific epi-marks produced in early fetal development protect each sex from the substantial natural variation in testosterone that occurs during later fetal development. Different epi-marks protect different sex-specific traits from being masculinized or feminized.

The researchers found homosexuality can occur in opposite-sex offspring when the sex-specific epi-marks are carried on to another generation.

"We discovered when these epi-marks are transmitted across generations from fathers to daughters or mothers to sons, they may cause reversed effects, such as the feminization of some traits in sons, such as sexual preference, and similarly a partial masculinization of daughters," said Gavrilets.

In their study, the researchers integrated evolutionary theory with recent advances in the molecular regulation of gene expression and androgen-dependent sexual development to produce a biological and mathematical model that delineates the role of epigenetics in homosexuality.

"The study solves the evolutionary riddle of homosexuality, finding that 'sexually antagonistic' epi-marks, which normally protect parents from natural variation in sex hormone levels during fetal development, sometimes carry over across generations and cause homosexuality in opposite-sex offspring," said Gavrilets.

The mathematical modeling demonstrates that gene coding for these epi-marks can easily spread in the population because they always increase the fitness of the parent but only rarely escape erasure and reduce fitness in offspring.

"Transmission of sexually antagonistic epi-marks between generations is the most plausible evolutionary mechanism of the phenomenon of human homosexuality," said Gavrilets.

The paper is co-authored with William Rice, a professor at the University of California, Santa Barbara, and Urban Friberg, a professor at Uppsala University in Sweden.

NIMBioS brings together researchers from around the world to collaborate across disciplinary boundaries to investigate solutions to basic and applied problems in the life sciences. It is sponsored by the National Science Foundation, the U.S. Department of Homeland Security and the U.S. Department of Agriculture, with additional support from UT. For more information, visit http://www.nimbios.org.

Epigenetics May Be a Critical Factor Contributing to Homosexuality, Study Suggests

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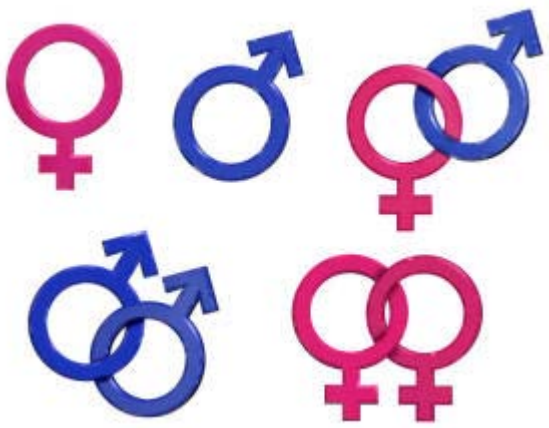


New research suggests that epigenetics is a critical factor contributing to the long-standing puzzle of why homosexuality occurs. (Credit: iStockphoto)

Dec. 11, 2012 — Epigenetics -- how gene expression is regulated by temporary switches, called epi-marks -- appears to be a critical and overlooked factor contributing to the long-standing puzzle of why homosexuality occurs.

According to the study, published online today in *The Quarterly Review of Biology*, sex-specific epi-marks, which normally do not pass between generations and are thus "erased," can lead to homosexuality when they escape erasure and are transmitted from father to daughter or mother to son.

From an evolutionary standpoint, homosexuality is a trait that would not be expected to develop and persist in the face of Darwinian natural selection. Homosexuality is nevertheless common for men and women in most cultures. Previous studies have shown that homosexuality runs in families, leading most researchers to presume a genetic underpinning of sexual preference. However, no major gene for homosexuality has been found despite numerous studies searching for a genetic connection.

In the current study, researchers from the Working Group on Intragenomic Conflict at the National Institute for Mathematical and Biological Synthesis (NIMBioS) integrated evolutionary theory with recent advances in the molecular regulation of gene expression and androgen-dependent sexual development to produce a biological and mathematical model that delineates the role of epigenetics in homosexuality.

Epi-marks constitute an extra layer of information attached to our genes' backbones that regulates their expression. While genes hold the instructions, epi-marks direct how those instructions are carried out -- when, where and how much a gene is expressed during development. Epi-marks are usually produced anew each generation, but recent evidence demonstrates that they sometimes carry over between generations and thus can contribute to similarity among relatives, resembling the effect of shared genes.

Sex-specific epi-marks produced in early fetal development protect each sex from the substantial natural variation in testosterone that occurs during later fetal development. Sex-specific epi-marks stop girl fetuses from being masculinized when they experience atypically high testosterone, and vice versa for boy fetuses. Different epi-marks protect different sex-specific traits from being masculinized or feminized -- some affect the genitals, others sexual identity, and yet others affect sexual partner preference. However, when these epi-marks are transmitted across generations from fathers to daughters or mothers to sons, they may cause reversed effects, such as the feminization of some traits in sons, such as sexual preference, and similarly a partial masculinization of daughters.

The study solves the evolutionary riddle of homosexuality, finding that "sexually antagonistic" epi-marks, which normally protect parents from natural variation in sex hormone levels during fetal development, sometimes carryover across generations and cause homosexuality in opposite-sex offspring. The mathematical modeling demonstrates that genes coding for these epi-marks can easily spread in the population because they always increase the fitness of the parent but only rarely escape erasure and reduce fitness in offspring.

"Transmission of sexually antagonistic epi-marks between generations is the most plausible evolutionary mechanism of the phenomenon of human homosexuality," said the study's co-author Sergey Gavrilets, NIMBioS' associate director for scientific activities and a professor at the University of Tennessee-Knoxville.

The paper's other authors are William Rice, a professor at the University of California, Santa Barbara, and Urban Friberg, a professor at Uppsala University in Sweden.

People Prefer Leaders With More Masculine Voices, Even in Feminine Leadership Roles

Dec. 12, 2012 — Male and female leaders with masculine voices are preferred by both men and women. However, even in leadership roles that are typically held by women, both sexes prefer women leaders with low-pitched voices, according to research published December 12 in the open access journal *PLOS ONE* by Rindy Anderson from Duke University and Casey Klofstad from the University of Miami.

Though earlier studies have shown that people prefer leaders with more masculine voices, this research adds a caveat: What happens when the leadership position is one that is typically held by women, or perceived as more feminine, such as being a school board member or president of a parent-teacher association?

In hypothetical elections for such positions, the researchers asked people to listen to the phrase "I urge you to vote for me this November" spoken by two voices that differed only in their pitch. They found that both men and women preferred female candidates with masculine voices. Men also preferred men with masculine voices but women did not discriminate between the male voices they heard. According to the authors, their results suggest that the influence of voice pitch on perceptions of leadership capacity is consistent across different domains of leadership and independent of social context.

Klofstad explains, "We often do not consider how our biology can influence our decision making. The results of this study show that voice pitch -- a physiological characteristic -- can affect how we select our leaders."

Nature Nurtures Creativity After Four Days of Hiking

Dec. 12, 2012 — Backpackers scored 50 percent better on a creativity test after spending four days in nature disconnected from electronic devices, according to a study by psychologists from the University of Utah and University of Kansas.

"This is a way of showing that interacting with nature has real, measurable benefits to creative problem-solving that really hadn't been formally demonstrated before," says David Strayer, a co-author of the study and professor of psychology at the University of Utah.

"It provides a rationale for trying to understand what is a healthy way to interact in the world, and that burying yourself in front of a computer 24/7 may have costs that can be remediated by taking a hike in nature."

The study by Strayer and University of Kansas psychologists Ruth Ann Atchley and Paul Atchley was scheduled for publication Dec. 12 in *PLOS ONE*, an online journal published by the Public Library of Science.

Don't the results seem obvious?

"Writers for centuries have talked about why interacting with nature is important, and lots of people go on vacations," says Strayer. "But I don't think we know very well what the benefits are from a scientific perspective."

The study involved 56 people -- 30 men and 26 women -- with an average age of 28. They participated in four- to six-day wilderness hiking trips organized by the Outward Bound expedition school in Alaska, Colorado, Maine and Washington state. No electronic devices were allowed on the trips.

Of the 56 study subjects, 24 took a 10-item creativity test the morning before they began their backpacking trip, and 32 took the test on the morning of the trip's fourth day.

The results: people who had been backpacking four days got an average of 6.08 of the 10 questions correct, compared with an average score of 4.14 for people who had not yet begun a backpacking trip.

"We show that four days of immersion in nature, and the corresponding disconnection from multimedia and technology, increases performance on a creativity, problem-solving task by a full 50 percent," the researchers conclude.

However, they note that their study was not designed to "determine if the effects are due to an increased exposure to nature, a decreased exposure to technology or the combined influence of these two factors."

While earlier research has indicated nature has beneficial effects, "it's

equally plausible that it is not multitasking to wits' end that is associated with the benefits," Strayer says.

The results were controlled for age differences between the groups that took the test before and during the backpacking trip, because "as you get older, you have greater verbal abilities," Strayer says.

The 'Gentle, Soft Fascination' of Nature

The researchers cited earlier studies indicating that children today spend only 15 to 25 minutes daily in outdoor play and sports, that nature-based recreation has declined for 30 years, and that the average 8- to 18-year-old spends more than 7.5 hours a day using media such as TV, cell phones and computers.

They also cite earlier work on "attentional restoration theory," which holds that modern technology and multitasking place demands on our "executive attention" -- the ability to switch among tasks, stay on task and inhibit distracting actions and thoughts -- and that nature is effective in replenishing such abilities.

"Our modern society is filled with sudden events (sirens, horns, ringing phones, alarms, television, etc.) that hijack attention," the psychologists wrote. "By contrast, natural environments are associated with gentle, soft fascination, allowing the executive attentional system to replenish."

Earlier work has showed that going on a hike can improve proofreading, the ability to see a certain optical illusion and the ability to repeat digits backwards after hearing a list of digits. But Strayer says none of those abilities provide a standard measure of executive attention or creativity.

Strayer says he and the Atchleys did a trial run for the study in May 2010 by trying a variety of creativity tests on themselves during a five-day backpacking trip in southern Utah's Grand Gulch. Outward Bound trips for the study then were conducted during the summer of 2010.

The researchers decided on a decades-old test known as the Remote Associates Test, or RAT, that is a standard measuring tool for creative thinking and problem-solving. These abilities are believed to arise in the same prefrontal cortex area of the brain that is overtaxed buy constant demands on our attention in our technological environment.

In this untimed test, participants get 10 sets of three words. For each set they must come up with a fourth word that is tied to the other three. For example, an answer to SAME/TENNIS/HEAD might be MATCH (because a match is the same, tennis match and match head).

Unlike other studies, where subjects were tested in labs after brief periods outdoors, "the current study is unique in that participants were exposed to nature over a sustained period and they were still in that natural setting during testing," the researchers write.

Too Big or Just Right? Optimal Circle of Friends Depends On Socioeconomic Conditions

Dec. 12, 2012 — Some people like to have a few close friends, while others prefer a wider social circle that is perhaps less deep. These preferences reflect people's personalities and individual

circumstances -- but is one approach to social networks "better" than the other? New research suggests that the optimal social networking strategy depends on socioeconomic conditions.

Researchers Shigehiro Oishi of the University of Virginia and Selin Kesebir of the London Business School explore the benefits of social networking strategies in two studies published in *Psychological Science*, a journal of the Association for Psychological Science.

"In the age of Facebook, many Americans seem to opt for a broad, shallow networking strategy. Yet, cross-cultural research has shown that having many friends is not always viewed positively outside the United States," Oishi and Kesebir write.

One reason that Americans may prefer a large social network, the researchers surmise, is because Americans move around a lot. Thus, it may make sense to spread time and resources across many friends to minimize the loss of any one friend moving away.

Another important factor may be the economic conditions at a given time. When times are prosperous, your friends are less likely to need much help, whether it's covering a hospital bill or providing babysitting, and so a broad network of friends is easy to maintain. But when times aren't as flush, having more friends might incur huge costs in terms of both time and resources.

With this in mind, Oishi and Kesebir predicted that a broad, shallow networking strategy would be optimal for people living in a residentially mobile, economically favorable context. A narrow, deep networking strategy, on the other hand, would be optimal if people tend to stay in one place and economic conditions aren't as favorable.

In the first study, they created a model that simulated the benefits individuals receive from their social network under various socioeconomic conditions. The researchers were able to simulate people who have different numbers of friends at different levels of friendship and they were also able to account for the investment required by each type of friendship.

As they predicted, they found that having a small social network with deep ties to friends is advantageous when friends are not likely to move away and the economy is unstable. Regardless of economic conditions, having a broad social network with weak ties to friends is advantageous when friends are likely to move away.

Oishi and Kesebir conducted a second study to investigate whether this pattern of results would hold up in the real world.

They recruited 247 Americans to participate in an online survey through Amazon's Mechanical Turk. The survey was designed to parallel the computer simulation from the first study. The participants were asked to list three different kinds of friends: very close, close, and distant. In order to get a sense of the participants' social networking strategy, the researchers asked them to imagine that their time, energy, and money were limited to 60 points and to distribute the points among their three types of friends.

They also assessed participants' subjective well-being through a combination of three measures: life satisfaction, experiences of positive emotions, and lack of experiences of negative emotions.

Finally, the researchers used census data to obtain information about residential mobility and median family income in each zip code.

The findings from the second study echoed those of the first study. In zip codes that were residentially stable and relatively low income, participants who had a narrow, deep friendship strategy reported greater well-being than those who had a broad, shallow friendship strategy. Notably, the broad, shallow strategy was associated with subjective well-being in all three of the other economic conditions (low income-unstable, high income-stable, high income-unstable).

Oishi and Kesebir argue that these two studies provide clear evidence for the role of socioeconomic factors -- such as residential mobility and economic security -- in determining the most adaptive networking strategy.

"As residential mobility decreases and economic recession deepens in the United States, the optimal social-networking strategy might shift from the broad but shallow to the narrow but deep, even in a nation known best for the strength of weak ties," the researchers conclude.

Stress Resilience, Susceptibility Traced to Neurons in Reward Circuit

Dec. 12, 2012 — A specific pattern of neuronal firing in a brain reward circuit instantly rendered mice vulnerable to depression-like behavior induced by acute severe stress, a study supported by the National Institutes of Health has found. When researchers used a high-tech method to mimic the pattern, previously resilient mice instantly succumbed to a depression-like syndrome of social withdrawal and reduced pleasure-seeking -- they avoided other animals and lost their sweet tooth. When the firing pattern was inhibited in vulnerable mice, they instantly became resilient.

"For the first time, we have shown that split-second control of specific brain circuitry can switch depression-related behavior on and off with flashes of an LED light," explained Ming-Hu Han, Ph.D., of the Mount Sinai School of Medicine, New York City, a grantee of NIH's National Institute of Mental Health (NIMH). "These results add to mounting clues about the mechanism of fast-acting antidepressant responses."

Han, Eric Nestler, M.D., Ph.D., of Mount Sinai, and colleagues, report on their study online, Dec. 12, 2012, in the journal *Nature*.

In a companion article, NIMH grantees Kay Tye, Ph.D., of the Massachusetts Institute of Technology, Cambridge, Mass., and Karl Deisseroth, M.D., Ph.D., of Stanford University, Stanford, Calif., used the same cutting-edge technique to control mouse brain activity in real time. Their study reveals that the same reward circuit neuronal activity pattern had the opposite

effect when the depression-like behavior was induced by daily presentations of chronic, unpredictable mild physical stressors, instead of by shorter-term exposure to severe social stress.

Prior to the new studies, Han's team suspected that a telltale pattern -- rapid firing of neurons that secrete the chemical messenger dopamine in a key circuit hub -- makes an animal vulnerable to the depression-like effects of acute severe stress, and that slower firing supports resilience. But they lacked direct, real-time evidence.

To pinpoint cause-and-effect, they turned to a research technology pioneered by Deisseroth, called optogenetics. It melds fiber optics and genetic engineering to precisely control the activity of a specific brain circuit in a living, behaving animal. Genetically modified viruses are used to inject light-reactive proteins, borrowed from primitive organisms like algae, to make the circuitry similarly light-responsive.

The researchers had previously shown that neurons in the reward circuit hub deep in the brain, called the ventral tegmental area (VTA), fire at normal rates in social stress-resilient mice, but at high rates in social stress-susceptible mice. So they embedded an LED-lit optical fiber aimed at the VTA circuitry of genetically modified resilient mice to convert them into susceptible mice by triggering high firing rates.

Normally, it takes 10 days of repeated encounters with a dominant animal -- an experimental procedure called social defeat stress -- to induce depression-related behaviors. Even after that, some mice emerge seemingly unscathed. But these resilient animals -- in which the reward circuit had been genetically modified for optogenetic control -- instantly succumbed to a long-lasting depression-like syndrome after light pulses triggered neural activity mimicking the high firing rates seen in the susceptible animals.

In subsequent experiments, using similar optogenetic strategies, the researchers discovered that inhibiting the reward circuit activity pattern in stress-susceptible mice instantly converted them into stress-resilient animals. The reward circuit projects from the VTA to an area in the center front of the brain, called the nucleus accumbens. This study suggests that dopamine neurons firing at high rates in this specific circuit projection encode a signal for susceptibility to depression induced by acute, severe stress. By contrast, a circuit projection from the VTA to the prefrontal cortex, in the top front of the brain (see diagram), was found to serve an opposite function.

Depression in humans often stems from milder stressors over longer periods of time. Tye and Deisseroth used optogenetics to probe reward circuit workings related to depression-like behaviors in rodents exposed to stressors like white noise, crowded housing, or continuous darkness or illumination. Exposure to some of these milder stressors lasted 10 weeks, compared to the 10-days of social defeat stress.

"We sought to mimic gradual, stress-induced transitions to depressed-like states, as are often seen clinically," explained Deisseroth, who is a practicing psychiatrist as well as a neuroscientist.

In contrast to the Han-Nestler results after social defeat stress, following 10 weeks of unpredictable chronic mild stress, optogentically inducing high firing rates in VTA dopamine neurons instantly reversed such depression-like behaviors induced by chronic mild stressors -- and vice versa. Also opposite to the social defeat stress findings, optogenetically inhibiting VTA dopamine neurons induced depression-like states.

"The variable effects that stressors of different types induce in the dopamine system may point to the need for distinct treatment strategies for patients whose depressions stem from different types of experiences," said Tye, who is leading a research group studying the neural underpinnings of motivational and emotional processing.

When Tye and Deisseroth infused agents that block binding of the chemical messenger glutatmate in the nucleus accumbens, they produced an antidepressant response -- mice struggled more to escape the stressor. They note that this is consistent with the effects of the fast-acting antidepressant ketamine, which similarly blocks glutamate.

While optogenetics is providing insights into rapid antidepressant mechanisms, the technique is not suitable for treatment of depression in humans.

"These stunning demonstrations that depression-like states can literally be switched on and off underscore that context -- stressor type and intensity -- is pivotal in the workings of the neurons and circuit implicated," said NIMH Director Thomas R. Insel, M.D. "These new, precise circuit breakers are advancing our understanding of how specific brain pathways regulate behavior."

More Than 3,000 Epigenetic Switches Control Daily Liver Cycles

Dec. 10, 2012 — When it's dark, and we start to fall asleep, most of us think we're tired because our bodies need rest. Yet circadian rhythms affect our bodies not just on a global scale, but at the level of individual organs, and even genes.

Now, scientists at the Salk Institute have determined the specific genetic switches that sync liver activity to the circadian cycle. Their finding gives further insight into the mechanisms behind health-threatening conditions such as high blood sugar and high cholesterol.

"We know that genes in the liver turn on and off at different times of day and they're involved in metabolizing substances such as fat and cholesterol," says Satchidananda Panda, co-corresponding author on the paper and associate professor in Salk's Regulatory Biology Laboratory. "To understand what turns those genes on or off, we had to find the switches."

To their surprise, they discovered that among those switches was chromatin, the protein complex that tightly packages DNA in the cell nucleus. While chromatin is well known for the role it plays in controlling genes, it was not previously suspected of being affected by circadian cycles.

Panda and his colleagues, including Joseph R. Eckercircadian cycles, holder of the Salk International Council Chair in Genetics, report their results December 5 in *Cell Metabolism.*

Over the last ten years, scientists have begun to discover more about the relationship between circadian cycles and metabolism. Circadian cycles affect nearly every living organism, including plants, bacteria, insects and human beings.

"It's been known since the early eighteenth century that plants kept in darkness still open their leaves in 24 hour cycles. Similarly, human volunteers also maintain circadian rhythms in dark rooms. Now we're determining the regulatory processes that control those responses," says Ecker, who was recently elected a fellow of the American Association for the Advancement of Science for his work on the genetics of plant and human cells.

Panda offers an example of human circadian influenced behavior that is painfully familiar to all parents of newborns: Why do infants wake up in the middle of the night? It isn't because they aren't yet "trained" to a regular schedule, but because their internal circadian clocks haven't even developed.

"Once the clock is developed, the infant can naturally sleep through the night," Panda says. "On the other end of the scale, older people with dementia have sleep problems because their biological clock has degenerated."

In the case of humans and other vertebrates, a brain structure called the suprachiasmatic nucleus controls circadian responses. But there are also clocks throughout the body, including our visceral organs, that tell specific genes when to make the workhorse proteins that enable basic functions in our bodies, such as producing glucose for energy.

In the liver, genes that control the metabolism of fat and cholesterol turn on and off in sync with these clocks. But genes do not switch on and off by themselves. Their activity is regulated by the "epigenome," a set of molecules that signal to the genes how many proteins they should make, and, most importantly from the circadian point of view, when they should be made.

"We know that when we eat determines when a particular gene turns on or off, for example, if we eat only at nighttime, a gene that should be turned on during the day will turn on at night," Panda says.

For this reason, the epigenome is of particular interest for health, since we can control when we eat. An earlier study from Panda's lab, published last May in Cell Metabolism, suggested that we should observe a 16-hour fast between our evening and morning meals.

"In response to natural cycles, our body has evolved to make glucose at nighttime," Panda says. "But if on top of that you eat, you're creating excess glucose and that damages organs, which leads to diabetes. It's like over-charging a car battery. Bad things will happen."

In short, while we can't control what genes we're born with, we do have some influence over what they do. Nevertheless, the interplay between genome and epigenome is extremely complex.

Panda, Ecker and their colleagues, including the paper's co-first authors Salk postdoctoral researchers, Christopher Vollmers and Robert J. Schmitz, did their studies in mice. In the mouse liver, they discovered more than 3,000 epigenomic elements, which regulate the circadian cycles of 14,492 genes. Comparing the mouse genome to the human genome, they find many of the same genes.

"Now that we know where the switches are, it brings us one step closer to understanding the mechanism of gene regulation," says Panda, "For example, it helps us restrict our search for other factors to particular regions of the genome. In other words, at least we now know to search in Alaska, rather than Australia. But Alaska's still a big place."

Other researchers on the study were: Jason Nathanson and Gene Yeo, of the University of California, San Diego

The work was supported by the Blasker Science and Technology Grant Award from the San Diego Foundation; the National Institutes of Health; the Mary K. Chapman Foundation; the Howard Hughes Medical Institute; the Gordon and Betty Moore Foundation; and the Pew Scholars Program in Biomedical Sciences.

Conservatives Can Be Persuaded to Care More About Environmental Issues When Couched in Terms of Fending Off Threats to 'Purity'

Dec. 10, 2012 — When it comes to climate change, deforestation and toxic waste, the assumption has been that conservative views on these topics are intractable. But new research from the University of California, Berkeley, suggests that such viewpoints can be changed after all, when the messages about the need to be better stewards of the land are couched in terms of fending off threats to the "purity" and "sanctity" of Earth and our bodies.

A UC Berkeley study has found that while people who identified themselves as conservatives tend to be less concerned about the environment than their liberal counterparts, their motivation increased significantly when they read articles that stressed the need to "protect the purity of the environment" and were shown such repellant images as a person drinking dirty water, a forest filled with garbage, and a city under a cloud of smog.

Published Dec. 10 in the online issue of the journal *Psychological Science,* the findings indicate that reframing pro-environmental rhetoric according to values that resonate strongly with conservatives can reduce partisan polarization on ecological matters.

"These findings offer the prospect of pro-environmental persuasion across party lines," said Robb Willer, a UC Berkeley social psychologist and coauthor of the study. "Reaching out to

conservatives in a respectful and persuasive way is critical, because large numbers of Americans will need to support significant environment reforms if we are going to deal effectively with climate change, in particular."

Researchers conducted a content analysis of more than 200 op-eds published in such newspapers as *The New York Times*, *USA Today* and *The Wall Street Journal*, and found the pro-environmental arguments were most often pitched in terms of moral obligations to care about the natural environment and protect it from harm, a theme that resonates more powerfully with liberals, they added, than with conservatives.

They hypothesized that conservatives would be more responsive to environmental arguments focused on such principles as purity, patriotism and reverence for a higher authority. In their study, the authors specifically tested the effectiveness of arguments for protecting the purity of the environment. They said the results suggest they were on the right track:

"When individuals view protecting the environment as a moral issue, they are more likely to recycle and support government legislation to curb carbon emissions," said Matthew Feinberg, a postdoctoral fellow in psychology at Stanford University and lead author of the study which he conducted while at UC Berkeley.

Scientific consensus on the existence of warming global land and ocean temperatures -- attributed in large part to human activities that produce greenhouse gas emissions -- continues to grow and influence public opinion, especially with such extreme weather events as Hurricane Sandy. A recent Rasmussen poll reported that 68 percent of Americans view climate change as a "serious problem," compared to a 2010 Gallup poll in which 48 percent of Americans said they thought global warming was exaggerated.

In the first experiment, 187 men and women recruited via several U.S. Craigslist websites rated their political ideology on a scale of "extremely liberal" to "extremely conservative." They then rated the morality of such activities as recycling a water bottle versus throwing it in the garbage. The results of that experiment, and a similar one conducted on 476 college undergraduates, showed that liberals are more prone to viewing sustainability as a moral issue than are conservatives.

Next, researchers conducted a content analysis of pro-environmental videos on YouTube and more than 200 op-eds in national newspapers, sorting them under the themes of "harm/care," which they expected to resonate more with liberals, and "purity/sanctity," which they predicted would appeal more to conservatives. They found that most pro-environmental messages leaned strongly toward liberal moral concerns.

In the last experiment, 308 men and women, again recruited via Craigslist, were randomly assigned to read one of three articles. The harm/care-themed article described the destruction wreaked on the environment by humans and pitched protection of the environment as a moral obligation. Images accompanying the text were of a forest with tree stumps, a barren coral reef and drought-cracked land, which are more typical of the visuals promoted by pro-environmental groups.

The purity/sanctity-themed article stressed how pollution has contaminated Earth and people's bodies, and argued for cleaning up and purifying the environment. To enhance those themes and elicit disgust, the accompanying images showed a person drinking filthy water, a city under a cloud of pollution and a forest full of garbage. The neutral article talked about the history of neckties.

Participants were then asked to rate how strongly they felt certain emotions, including disgust, in response to what they'd read. Next, they reported how strongly they agreed or disagreed with such statements as "It is important to protect the environment," "I would support government legislation aimed at protecting the environment" and 'I believe humans are causing global warming."

Overall, the study found that the purity-themed message inspired conservatives to feel higher levels of disgust, which in turn increased their support for protecting the environment.

Possible Clue to Children's Early Antisocial Behavior

Dec. 10, 2012 — Both nature and nurture appear to be significant factors in early antisocial behaviors of adopted children, a Wayne State University researcher believes.

Christopher Trentacosta, Ph.D., assistant professor of psychology in the College of Liberal Arts and Sciences, recently examined data from 361 linked triads (birth mother, adoptive parents, adopted child) in order to assess externalizing behavioral problems such as aggression and defiance when children were 18, 27 and 54 months of age.

The triads were part of the Early Growth and Development Study (EGDS), a nationwide, prospective study of birth parents and adoptive families that is supported by grants from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, the National Institute on Drug Abuse and the National Institute of Mental Health -- all part of the National Institutes of Health -- to Trentacosta's colleagues at the Oregon Social Learning Center and the Pennsylvania State University. The EGDS is aimed at investigating how families can help their children develop to their fullest potential.

In "Examining the Interplay of Birth Mothers' and Adoptive Parents' Antisocial Behavior in Predicting Growth in Externalizing Problems During Early Childhood," adoptive parents' antisocial behavior played an important role in the development of children's externalizing problems. His study was presented at the 2012 meeting of the Behavior Genetics Association in Edinburgh, Scotland.

That finding may not come as a surprise to researchers who have studied environmental precursors to such behavior. However, Trentacosta said a great deal of other research that examined sets of twins holds that genetic factors play a role as well.

Part of the problem with environmental studies, he said, is that the people providing the parenting are the same ones providing the genes. Using an adoption design, Trentacosta said, allows researchers to disentangle genetics from environmental influences by collecting data from both birth and adoptive parents.

His team found that adoptive parents reporting on their own antisocial behaviors predicted children's initial level of externalizing at 18 months, suggesting a direct environmental connection.

"That can be tricky, however, because it is those same parents reporting on the child's behavior," Trentacosta said, "so we aggregated both parents' reports to increase confidence somewhat. But even with the reporting limitation, there is something to be said for the environmental piece, at least initially."

His team's main finding is that there is an interaction between birth mother characteristics and adoptive parent antisocial behavior that is especially problematic for growth in externalizing behavior problems across early childhood. "Compared to birth mothers with lower levels of antisocial behavior, children of birth mothers with higher levels of antisocial behavior showed steep growth in externalizing problems when raised by adoptive parents with higher levels of antisocial behavior," Trentacosta said. "Both genetic characteristics and environment matter, but it's especially the combination of the two that seems to make a difference over time."

Trentacosta believes further study of the next age group, 54 to 72 months, may help to better determine the most salient predictors of externalizing behavior levels by the time children reach school age.

Previous research has shown that such behaviors typically decrease across the preschool years and as children transition to elementary school. A logical next step, he said, would be to assess behavior levels from the cohort used in his work as the children get older to obtain a more complete picture of how genetic and environmental considerations play out across development.

"Behaviors that start out at fairly normative levels but still more than most can cause problems for children as they get to school age," Trentacosta said. "For prevention purposes, it's helpful if we can identify these children earlier and possibly get extra help for these families."

How Our Nerves Regulate Insulin Secretion

Dec. 10, 2012 — The autonomic nervous system, which is the part of the nervous system beyond conscious control, plays an important role in the release of insulin from beta cells in the endocrine part of the pancreas. The process by which this occurs has been a mystery, since it is difficult to give detailed study to such an inaccessible organ. However, researchers at Karolinska Institutet in Sweden have now managed to graft beta cells into the eyes of mice in order to study them in a living organism over a prolonged period of time. As a result, the group and a team of colleagues from the University of Miami have gained detailed knowledge of how the autonomic nervous system regulates beta-cell insulin secretion.

For this study, a technique of transplanting beta cells to the anterior chamber of the mouse eye was used. This technique was previously developed by Professor Per-Olof Berggren's group at Karolinska Institutet. In the anterior chamber of the eye the beta cells receive a supply not only of blood vessels, but also of nerves from the sympathetic and parasympathetic system, which constitute the autonomic nervous system. Put simply, the sympathetic nervous system can be said to prepare us for flight; one way it does this is to boost our energy by reducing insulin release and increasing glycogen, and consequently blood glucose. The parasympathetic nervous system operates in the reverse direction when we are at rest.

Now, the teams from Karolinska Institutet and the University of Miami have shown for the first time how the autonomic nervous system controls the beta cells and influences the regulation of blood glucose in living animals.

Using fluorescent markers for different types of nerves in combination with advanced microscopy, the researchers were able to probe the animals' eyes to study in detail the contact between the nerves and the beta cells. When the pupil contracted on exposure to light, the animals' blood glucose levels plummeted as a direct result of the stimulation of the parasympathetic nervous system. Conversely, when the pupil dilated in darkness and activated the sympathetic nervous system, their blood glucose levels rose. They also managed to influence the animals' blood glucose levels by inhibiting or stimulating each set of nerves with different substances applied directly into the eye.

"We now understand the fundamentals of how insulin secretion works and is affected by the autonomic nervous system," says Per-Olof Berggren. "The next step is to see if it works in the same way in people with diabetes or if there are defects in the signalling relevant to the disease pathogenesis."

The study was financed by grants the American Diabetes Research Institute Foundation, the National Institutes of Health (NIH), the Juvenile Diabetes Research Foundation (JDRF), the Swedish Research Council, the Novo Nordisk Foundation, Skandia, the Swedish Diabetes Association, the Erling-Persson Family Foundation, the Söderberg Foundations, the Stichting af Jochnick Foundation and the National Research Foundation of Korea.

'Commitment-Phobic' Adults Could Have Mom and Dad to Blame

Dec. 10, 2012 — Afraid to commit to a relationship? According to new research from Tel Aviv University, it could be just one more thing to blame on your parents.

A study of the romantic history of 58 adults aged 22-28 found that those who avoid committed romantic relationships are likely a product of unresponsive or over-intrusive parenting, says Dr. Sharon Dekel, a psychologist and researcher at the Bob Shapell School of Social Work.

Dr. Dekel and her fellow researcher, Prof. Barry Farber of Columbia University, found that 22.4 percent of study participants could be categorized as "avoidant" when it came to their relationships, demonstrating anxiety about intimacy, reluctance to commit to or share with their partner, or a belief that their partner was "clingy," for example. Overall, they reported less personal satisfaction in their relationships than participants who were determined to be secure in their relationships.

The goal of the study, published in the *Journal of Nervous and Mental Disease*, was to address the widespread research debate on "avoidant attachment" -- whether such behavior is due to innate personality traits, such as being more of a loner, or is a delayed reaction to unmet childhood needs. Dr. Dekel and Prof. Farber found that while both secure and avoidant individuals expressed a desire for intimacy in relationships, avoidant individuals are conflicted about this need due to the complicated parent-child dynamics they experienced when young.

Taking lessons from childhood

The premise of their study, says Dr. Dekel, is based on attachment theory, which posits that during times of stress, infants seek proximity to their caregivers for emotional support. However, if the parent is unresponsive or overly intrusive, the child learns to avoid their caregiver.

The researchers believe that adult relationships reflect these earlier experiences. When infantile needs are met in childhood, that person approaches adult relationships with more security, seeking intimacy, sharing, caring, and fun, says Dr. Dekel. The researchers labelled these relationships "two-adult" models, in which participants equally share desires with their partner. Avoidant individuals, however, are more likely to adopt an "infant-mother" intimacy model.

When they enter relationships, there is an attempt to satisfy their unmet childhood needs, Dr. Dekel explains. "Avoidant individuals are looking for somebody to validate them, accept them as they are, can consistently meet their needs and remain calm -- including not making a fuss about anything or getting caught up in their own personal issues."

The tendency to avoid dependence on a partner is a defense mechanism rather than an avoidance of intimacy, she adds.

Hope for the commitment-phobic?

It's important to study this group further because beyond their severely diminished ability to conduct satisfying romantic relationships, they are also less happy in their lives and are more likely to suffer illnesses than their secure counterparts, notes Dr. Dekel. Psychologists need a better understanding of what these insecure individuals need, perhaps through more sophisticated neurological studies, she suggests.

There is also the question of whether or not these attachment styles are permanent. Dr. Dekel believes that there are some experiences which can help people develop more secure relationship styles.

There are hints that after experiencing a traumatic event, survivors show a greater ability and desire to form closer relationships, Dr. Dekel observed in a previous study in the *Journal of Psychological Trauma,* completed during her post-doctoral work with Prof. Zahava Solomon. As an expert in the field of trauma recovery and post-traumatic growth who has worked with patients in Israel and abroad to overcome traumatic events, she is beginning to study this phenomenon in greater depth.

Caffeinated Coffee May Reduce the Risk of Oral Cancers

Dec. 10, 2012 — A new American Cancer Society study finds a strong inverse association between caffeinated coffee intake and oral/pharyngeal cancer mortality. The authors say people who drank more than four cups of caffeinated coffee per day were at about half the risk of death of these often fatal cancers compared to those who only occasionally or who never drank coffee. The study is published online in the *American Journal of Epidemiology*. The authors say more research is needed to elucidate the biologic mechanisms that could be at work.

Previous epidemiologic studies have suggested that coffee intake is associated with reduced risk of oral/pharyngeal cancer. To explore the finding further, researchers examined associations of caffeinated coffee, decaffeinated coffee, and tea intake with fatal oral/pharyngeal cancer in the Cancer Prevention Study II, a prospective U.S. cohort study begun in 1982 by the American Cancer Society.

Among 968,432 men and women who were cancer-free at enrollment, 868 deaths due to oral/pharyngeal cancer occurred during 26 years of follow-up. The researchers found consuming more than four cups of caffeinated coffee per day was associated with a 49 percent lower risk of oral/pharyngeal cancer death relative to no/occasional coffee intake (RR 0.51, 95% confidence interval [CI] 0.40-0.64). A dose-related decline in relative risk was observed with each single cup per day consumed. The association was independent of sex, smoking status, or alcohol use. There was a suggestion of a similar link among those who drank more than two cups per day of decaffeinated coffee, although that finding was only marginally significant. No association was found for tea drinking.

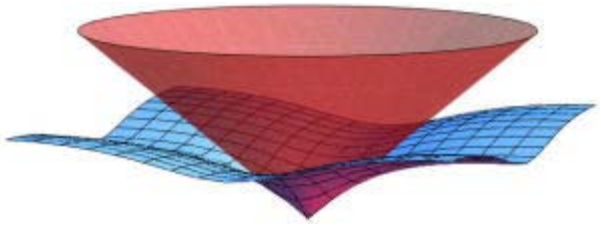
The findings are novel in that they are based specifically upon fatal cases of oral/pharyngeal cancer occurring over a 26-year period in a population of prospectively-followed individuals who were cancer-free at enrollment in Cancer Prevention Study II.

"Coffee is one of the most widely consumed beverages in the world, and contains a variety of antioxidants, polyphenols, and other biologically active compounds that may help to protect against development or progression of cancers," said lead author Janet Hildebrand, MPH. "Although it is less common in the United States, oral/pharyngeal cancer is among the ten most common cancers in the world. Our finding strengthens the evidence of a possible protective effect of caffeinated coffee in the etiology and/or progression of cancers of the mouth and

pharynx. It may be of considerable interest to investigate whether coffee consumption can lead to a better prognosis after oral/pharyngeal cancer diagnosis."

Do We Live in a Computer Simulation Run by Our Descendants? Researchers Say Idea Can Be Tested

enlarge



The conical (red) surface shows the relationship between energy and momentum in special relativity, a fundamental theory concerning space and time developed by Albert Einstein, and is the expected result if our universe is not a simulation. The flat (blue) surface illustrates the relationship between energy and momentum that would be expected if the universe is a simulation with an underlying cubic lattice. (Credit: Martin Savage)

Dec. 10, 2012 — A decade ago, a British philosopher put forth the notion that the universe we live in might in fact be a computer simulation run by our descendants. While that seems far-fetched, perhaps even incomprehensible, a team of physicists at the University of Washington has come up with a potential test to see if the idea holds water.

The concept that current humanity could possibly be living in a computer simulation comes from a 2003 paper published in *Philosophical Quarterly* by Nick Bostrom, a philosophy professor at the University of Oxford. In the paper, he argued that at least one of three possibilities is true:

- The human species is likely to go extinct before reaching a "posthuman" stage.
- Any posthuman civilization is very unlikely to run a significant number of simulations of its evolutionary history.
- We are almost certainly living in a computer simulation.

He also held that "the belief that there is a significant chance that we will one day become posthumans who run ancestor simulations is false, unless we are currently living in a simulation."

With current limitations and trends in computing, it will be decades before researchers will be able to run even primitive simulations of the universe. But the UW team has suggested tests that

can be performed now, or in the near future, that are sensitive to constraints imposed on future simulations by limited resources.

Currently, supercomputers using a technique called lattice quantum chromodynamics and starting from the fundamental physical laws that govern the universe can simulate only a very small portion of the universe, on the scale of one 100-trillionth of a meter, a little larger than the nucleus of an atom, said Martin Savage, a UW physics professor.

Eventually, more powerful simulations will be able to model on the scale of a molecule, then a cell and even a human being. But it will take many generations of growth in computing power to be able to simulate a large enough chunk of the universe to understand the constraints on physical processes that would indicate we are living in a computer model.

However, Savage said, there are signatures of resource constraints in present-day simulations that are likely to exist as well in simulations in the distant future, including the imprint of an underlying lattice if one is used to model the space-time continuum.

The supercomputers performing lattice quantum chromodynamics calculations essentially divide space-time into a four-dimensional grid. That allows researchers to examine what is called the strong force, one of the four fundamental forces of nature and the one that binds subatomic particles called quarks and gluons together into neutrons and protons at the core of atoms.

"If you make the simulations big enough, something like our universe should emerge," Savage said. Then it would be a matter of looking for a "signature" in our universe that has an analog in the current small-scale simulations.

Savage and colleagues Silas Beane of the University of New Hampshire, who collaborated while at the UW's Institute for Nuclear Theory, and Zohreh Davoudi, a UW physics graduate student, suggest that the signature could show up as a limitation in the energy of cosmic rays.

In a paper they have posted on arXiv, an online archive for preprints of scientific papers in a number of fields, including physics, they say that the highest-energy cosmic rays would not travel along the edges of the lattice in the model but would travel diagonally, and they would not interact equally in all directions as they otherwise would be expected to do.

Brown Adipose Tissue Has Beneficial Effects On Metabolism and Glucose Tolerance

Dec. 10, 2012 — Joslin Diabetes Center scientists have demonstrated that brown adipose tissue (BAT) has beneficial effects on glucose tolerance, body weight and metabolism. The findings, which may lead to new treatments for diabetes, appear in the upcoming issue of the *Journal of Clinical Investigation*.

Unlike the more prevalent white adipose tissue (WAT or white fat) which stores fat, BAT (or brown fat) **burns fat to produce heat. Studies in mice and humans have suggested that BAT also plays a role in regulating body weight and metabolism**. This has made BAT the focus of considerable interest among scientists and pharmaceutical companies who are investigating ways to use BAT as a treatment for obesity.

The Joslin researchers were interested in learning whether BAT is involved in glucose metabolism and uncovering the mechanisms underlying BAT's effects on metabolism and body weight. The study involved the transplantation of BAT from male donor mice into the visceral cavities of mice which were fed a standard or high-fat diet.

By eight to twelve weeks following transplantation, the BAT-transplanted mice fed a normal diet showed improved glucose tolerance, increased insulin sensitivity, lower body weights and decreased fat mass. Three control groups, which had a WAT transplant, a glass bead implant or surgery without transplantation, did not show any metabolic improvements. "We were able to establish that BAT transplantation affects metabolism. This study provides further evidence that **BAT is a very important metabolic organ** and a potential treatment for obesity-related diseases such as diabetes, metabolic syndrome and insulin resistance," says lead author Kristin I. Stanford, PhD, a postdoctoral fellow in the Section on Integrative Physiology and Metabolism.

The mice fed a high-fat diet also exhibited **beneficial effects from BAT transplantation, including improved glucose metabolism, decreased body weight and a complete reversal of insulin resistance resulting from excess fat consumption**. Previous studies of BAT transplantation in mice, which transplanted BAT in a different location and had a shorter duration, did not show beneficial effects.

The transplanted BAT affected metabolism throughout the body by increasing levels of circulating Interleukin-6 (IL-6). The researchers also found that BAT transplantation increased norepinephrine and FGF-21. IL-6 has been shown in previous studies to increase energy production and decrease body weight. When the researchers transplanted BAT from donor mice genetically engineered not to produce IL-6, the mice who received the transplants showed no metabolic improvements. "This is the first study to demonstrate that an increase in BAT significantly increases levels of circulating IL-6. It suggests that an increase in BAT-derived IL-6 improves glucose metabolism throughout the body," says senior author Laurie J. Goodyear, PhD, head of the Section on Integrative Physiology and Metabolism.

The researchers are following up on the study by "looking into other ways BAT may have beneficial metabolic effects and further investigating the functions of IL-6 and other BAT-derived hormones," says Dr. Goodyear. Dr. Stanford is studying the relationship between BAT and type 1 diabetes (T1D), based on data from a collaborator that suggests that BAT may help control glucose in T1D.

Dr. Goodyear and the research team are very interested in using their findings to develop new therapies for diabetes. "We hope that manipulating BAT will help people with type 1 and type 2 diabetes," says Dr. Goodyear.

Study co-authors include: Roeland J. W. Middelbeek, Kristy L. Townsend, Ding An, Eva B. Nygaard, Kristen M. Hitchcox, Kathleen R. Markan, Kazuhiro Nakano, Michael F. Hirshman, Yu-Hua Tseng, all of Joslin Diabetes Center.

The study was funded by the National Institutes of Health.

New Strategy to Prevent or Halt Periodontal Disease

Dec. 7, 2012 — Periodontitis, a form of chronic gum disease that affects nearly half of the U.S. adult population, results when the bacterial community in the mouth becomes unbalanced, leading to inflammation and eventually bone loss. In its most severe form, which affects 8.5 percent of U.S. adults, periodontitis can impact systemic health.

By blocking a molecular receptor that bacteria normally target to cause the disease, scientists from the University of Pennsylvania have now demonstrated an ability in a mouse model to both prevent periodontitis from developing and halt the progression of the disease once it has already developed.

The study, published in the Journal of Immunology, was led by Toshiharu Abe, a postdoctoral researcher in the Department of Microbiology in Penn's School of Dental Medicine. Abe works in the lab of George Hajishengallis, a professor in the department who was a senior author on the paper. The co-senior author was John D. Lambris, the Dr. Ralph and Sallie Weaver Professor of Research Medicine in the Department of Pathology and Laboratory Medicine in Penn's Perelman School of Medicine. Kavita B. Hosur and Evlambia Hajishengallis from Penn Dental Medicine also contributed to the research, as did Penn Medicine's Edimara S. Reis and Daniel Ricklin.

In previous research, Hajishengallis, Lambris and colleagues showed that Porphyromonas gingivalis, the bacterium responsible for many cases of periodontitis, acts to "hijack" a receptor on white blood cells called C5aR. The receptor is part of the complement system, a component of the immune system that helps clear infection but can trigger damaging inflammation if improperly controlled.

By hijacking C5aR, *P. gingivalis* subverts the complement system and handicaps immune cells, rendering them less able to clear infection from the gum tissue. As a result, numbers of *P. gingivalis* and other microbes rise and create severe inflammation. According to a study published last year by the Penn researchers, mice bred to lack C5aR did not develop periodontitis.

Meanwhile, other studies by the Penn group and others have shown that Toll-like receptors, or TLRs -- a set of proteins that also activate immune cell responses -- may act in concert with the complement system. In addition, mice lacking one form of TLR called TLR2 do not develop bone loss associated with periodontitis, just like the C5aR-deficient mice.

In the new study, the Penn team wanted to determine if the synergism seen by other scientists between the complement system and TLRs was also at play in this inflammatory gum disease.

To find out, they injected two types of molecules, one that activated C5aR and another that activated TLR2, into the gums of mice. When only one type of molecule was administered, a moderate inflammatory response was apparent a day later, but when both were injected together, inflammatory molecules increased dramatically -- soaring to levels higher than would have been expected if the effect of activating both receptors was merely additive.

This finding suggested to the scientists that the Toll-like receptor signaling was somehow involved in "crosstalk" with the complement system, serving to augment the inflammatory response. Turning that implication on its head, they wondered whether blocking just one of these receptors could effectively halt the inflammation that allows *P. gingivalis* and other bacteria to thrive and cause disease.

Testing this hypothesis, the researchers synthesized and administered a molecule that blocks the activity of C5aR, to see if it could prevent periodontitis from developing. They gave this receptor "antagonist," known as C5aRA, to mice that were then infected with *P. gingivalis*. The C5aRA injections were able to stave off inflammation to a large extent, reducing inflammatory molecules by 80 percent compared to a control, and completely stopping bone loss.

And when the mice were given the antagonist two weeks after being infected with *P. gingivalis*, the treatment was still effective, reducing signs of inflammation by 70 percent and inhibiting nearly 70 percent of periodontal bone loss.

"Regardless of whether we administered the C5a receptor antagonist before the development of the disease or after it was already in progress, our results showed that we could inhibit the disease either in a preventive or a therapeutic mode," Hajishengallis said. This is significant for extending these findings to a potential human treatment, as treatments would most likely be offered to those patients already suffering from gum disease.

Because not all cases of periodontitis are caused by *P. gingivalis*, the research team also wanted to see whether C5aRA could effectively prevent or treat the disease when it arose due to other factors. To do so, they placed a silk ligature around a single molar tooth in a group of mice. The obstruction not only blocked the natural cleaning action of saliva, but also enabled bacteria to stick to the ligature itself, resulting in a massive accumulation of bacteria. This microbial build-up rapidly leads to periodontitis and bone loss, within just five days in the mice.

The researchers then injected the gum tissue adjacent to the ligated molar tooth with C5aRA in some of the mice, and gave the other mice a control.

"These mice that got the C5a receptor antagonist developed at least 50 percent less inflammation and bone loss compared to an analog of C5a receptor antagonist which is not active," Hajishengallis said.

This result gives the researchers greater confidence that the C5aRA treatment could be effective against periodontitis in general, not just those cases caused by *P. gingivalis* bacteria.

The team is now working to replicate their success in mice in other animal models, an important step toward extending this kind of treatment to humans with gum disease.

"Our ultimate goal is to bring complement therapeutics to the clinic to treat periodontal diseases," Lambris said. "The complement inhibitors, some of which are in clinical trials, developed by my group are now tested in various periodontal disease animal models and we hope soon to initiate clinical trials in human patients."

Abuse During Childhood Linked to Adult-Onset Asthma in African-American Women

Dec. 7, 2012 — According to a new study from the Slone Epidemiology Center (SEC) at Boston University, African-American women who reported suffering abuse before age 11 had a greater likelihood of adult-onset asthma compared to women whose childhood and adolescence were free of abuse.

The study, which is published online in the *Journal of Allergy and Clinical Immunology*, was led by Patricia Coogan, DSc, senior epidemiologist at SEC and associate professor of epidemiology at the Boston University School of Public Health.

This study followed 28,456 African-American women, all of whom are participants in the Black Women's Health Study, between 1995-2011. They completed health questionnaires and provided information on physical and sexual abuse during childhood up to age 11 and adolescence, ages 12-18.

The results indicate that the incidence of adult-onset asthma was increased by more than 20 percent among women who had been abused during childhood. The evidence was stronger for physical abuse than for sexual abuse. There was little indication, however, that abuse during adolescence was associated with the risk of adult-onset asthma.

"This is the first prospective study to show an association between childhood abuse and adult-onset asthma," said Coogan. "The results suggest that chronic stress contributes to asthma onset, even years later." The hypothesized mechanism linking childhood abuse to asthma incidence is stress and its physiological consequences, particularly effects on the immune system and on airway development.

According to 2010 statistics from the United States Department of Health and Human Service's (HHS) National Child Abuse and Neglect Data System, approximately 695,000 children aged 0-17 were identified as neglected or abused by state Child Protective Service agencies, and 22 percent of neglected or abused children were African-American. National statistics show that asthma is more prevalent in African-Americans.

"Given the high prevalence of asthma and of childhood abuse in the United States, the association is of significant public health importance," Coogan added.

The Black Women's Health Study (BWHS) is the largest follow-up study of the health of African American women in the United States. Led by researchers at the Slone Epidemiology Center, the BWHS has followed 59,000 African-American women through biennial questionnaires since 1995 and has led to a better understanding of numerous health conditions that disproportionately affect African-American women.

Funding for this study was provided by the National Institute of Health's National Heart, Lung, and Blood Institute (grant award #HL107314) and the National Cancer Institute (grant award #CA058420).

Skills That Make Us a Good Partner Make Us a Good Parent

Dec. 6, 2012 — Being a good partner may make you a better parent, according to a new study. The same set of skills that we tap to be caring toward our partners is what we use to nurture our children, researchers found.

The study sought to examine how caregiving plays out in families -- "how one relationship affects another relationship," says Abigail Millings of the University of Bristol, lead author of the work published online this week in *Personality and Social Psychology Bulletin*. "We wanted to see how romantic relationships between parents might be associated with what kind of parents they are."

Previous research had looked at similar caregiving processes within romantic relationships or between parents and children, but rarely for both groups. "Our work is the first to look at romantic caregiving and parenting styles at the same time," Millings says.

Looking at 125 couples with children aged 7 to 8 years, the study, carried out at the University of East Anglia, examined a few factors: the way the couples are attached toward each other; the parenting styles they use with their children; and their "caregiving responsiveness." Caregiving responsiveness is the "capacity to be 'tuned in' to what the other person needs," Millings says. "In romantic relationships and in parenting, this might mean noticing when the other person has had a bad day, knowing how to cheer them up, and whether they even want cheering up." And, she says, it's not "just about picking you up when you're down, it's also about being able to respond appropriately to the good stuff in life."

They found that a common skill set underpins caregiving across different types of relationships, and for both mothers and fathers. "If you can do responsive caregiving, it seems that you can do it across different relationships," Millings says. Surprisingly, however, the researchers found that how you care toward your partner does not relate to how your partner behaves as a parent.

Millings also underscores that the data do not yet speak to what causes our caregiving toward our partners to be mirrored in our caregiving for our children, or if it's the other way around. "It might be the case that practicing being sensitive and responsive -- for example, by really listening and by really thinking about the other person's perspective -- to our partners will also help us to improve these skills with our kids," she says. "But we need to do more research to see whether the association can actually be used in this way."

And she points out that parents can have great relationships with their children without having a partner. Her team would therefore like to explore how caregiving and parenting relate to one another in other family structures. If they find that improving caregiving responsiveness in one relationship does indeed improve relationship functioning elsewhere, it may be possible to use this idea to design a self-help program that enables people to improve their own relationships.

New Antidepressant Acts Very Rapidly and Is Long Lasting

Dec. 6, 2012 — A first-of-its-kind antidepressant drug discovered by a Northwestern University professor and now tested on adults who have failed other antidepressant therapies has been shown to alleviate symptoms within hours, have good safety and produce positive effects that last for about seven days from a single dose.

The novel therapeutic targets brain receptors responsible for learning and memory -- a very different approach from existing antidepressants. The new drug and others like it also could be helpful in treating other neurological conditions, including schizophrenia, bipolar disorder, anxiety and Alzheimer's disease.

The results of the phase IIa clinical trial were presented today (Dec. 6) at the 51st Annual Meeting of the American College of Neuropsychopharmacology in Hollywood, Fla.

Also this week a paper reporting some of the background scientific research that provided the foundation for the clinical development of GLYX-13 was published by the journal *Neuropsychopharmacology*.

The compound, called GLYX-13, is the result of more than two decades of work by Joseph Moskal, research professor of biomedical engineering at Northwestern's McCormick School of Engineering and Applied Science and director of the University's Falk Center for Molecular Therapeutics.

"Our study showed that this compound is capable of eliciting a robust and rapid antidepressant effect without the typical side effects seen with other drugs that also modulate the NMDA receptor," said Moskal, who is founder and chief scientific officer of the Evanston-based biotechnology company Naurex Inc., which conducted the clinical study.

GLYX-13 works by modulating the NMDA (N-methyl-D-aspartate) receptor in the brain, as do current NMDA receptor antagonists such as ketamine, but GLYX-13 does not have their serious and limiting side effects, such as hallucinations and schizophrenia-like effects. (An antagonist is a substance that inhibits the physiological action of another.)

Moskal and his team have figured out a new way to target the NMDA receptors that maintains the positive antidepressant properties while eliminating the negative side effects.

In clinical trials administered at 12 sites across the country, a single dose of GLYX-13 resulted in significant reductions in depression symptoms among subjects who had shown little improvement with previous drugs. (Subjects had failed treatment with one or more antidepressant agents.)

The positive effects of GLYX-13 were evident within 24 hours and lasted an average of seven days. The effect size, a measure of the magnitude of the drug's antidepressant efficacy, at both these times after a single dose was nearly double the effect size seen with most other antidepressant drugs after four to six weeks of repeated dosing.

Side effects of GLYX-13 were mild to moderate and were consistent with those observed in subjects receiving a placebo.

GLYX-13 is a four-amino acid peptide that modulates one of a large family of glutamate receptors, the NMDA (N-methyl-D-aspartate) receptor, in the brain. NMDA receptors play a key role in regulating synaptic plasticity -- the quality of the connection between neurons -- and thus are important in regulating learning and memory functions.

GLYX-13 is administered intravenously. Moskal said Naurex also is working on an oral drug with similar properties and potential.

Moskal hopes that these positive GLYX-13 results and the research efforts of his team and colleagues will help shepherd in more research and grant support for studying the role of the glutamate-mediated processes in neuropsychiatric disorders.

"While the results we are seeing with GLYX-13 are very encouraging, I believe the most important research is yet to come," Moskal said. "We have only scratched the surface of the therapeutic potential of the glutamatergic system."

GLYX-13 currently is undergoing a phase IIb clinical trial at 20 sites across the United States. This trial is evaluating repeated doses of the drug.

The Neuropsychopharmacology paper is titled "GLYX-13, an NMDA Receptor Glycine-Site Functional Partial Agonist, Induces Antidepressant-Like Effects Without Ketamine-Like Side Effects."

The research was supported by grants from the Ralph and Marian Falk Medical Research Trust, the Hope for Depression Research Foundation and the National Institutes of Health (grants MH094835, NS044421 and DA01442).

Northwestern University has exclusively licensed the intellectual property rights related to the therapeutics developed by Joseph Moskal while at the University to Naurex Inc. Northwestern also has a small equity position in Naurex.

Hatching Order Influences Birds' Behavior

Dec. 7, 2012 — The hatching order of birds influences how they behave in adult life according to research from the Lancaster Environment Centre. Dr Ian Hartley and Dr Mark Mainwaring (LEC) are the authors of the study in *Animal Behaviour*, which looked at how the birds' behaviour was affected by the way their parents cared for them as hatchlings.

They found that the youngest members of zebra finch broods are more adventurous than their older siblings in adult life.

Dr Hartley said that the study showed for the first time that hatching order influences birds' "behavioural repertoires" in adulthood.

Hatching eggs over a period of time, rather than all at once, is known as "hatching asynchrony" and occurs when eggs are incubated as soon as they are laid. For a zebra finch, this means that birds born up to four days apart can share the same nest and must compete for food.

The researchers experimentally controlled hatching synchrony within clutches, so that some clutches hatched simultaneously, while others hatched over a period of days. They then tested the behaviour of over one hundred offspring as adults. They found the youngest birds from asynchronously hatched clutches explored their environment more widely.

They measured how explorative the zebra finches were by recording how many times they visited bird feeders within an unfamiliar test aviary. They found that the youngest offspring in a brood approached the feeders significantly more often than their peers within a 30 minute period.

Researchers wanted to know how the method of rearing affected the behaviour of offspring beyond the nest, once they were living as independent adult birds. The results have implications for understanding how environmental stability might influence behaviours, and how flexible animals might be at coping with environmental change

Paradox of Aging: The Older We Get, the Better We Feel?

Dec. 7, 2012 — Presently, there are about 40 million Americans over the age of 65, with the fastest-growing segment of the population over 80 years old. Traditionally, aging has been viewed as a period of progressive decline in physical, cognitive and psychosocial functioning, and aging is viewed by many as the "number one public health problem" facing Americans today.

But this negative view of aging contrasts with results of a comprehensive study of 1,006 older adults in San Diego by researchers from the University of California, San Diego School of Medicine and Stanford University. Results of the Successful Aging Evaluation (SAGE) study -- comprising a 25-minute phone interview, followed by a comprehensive mail-in survey -- will be published in the December 7 online issue of the *American Journal of Psychiatry*.

"While there is a growing public health interest in understanding and promoting successful aging, until now little published research has combined measures of physical health with cognitive and psychological assessments, in a large and randomly selected sample," said principal investigator Dilip V. Jeste, MD, Estelle and Edgar Levi Chair in Aging, Distinguished Professor of Psychiatry and Neurosciences, and director of UC San Diego's Stein Institute for Research on Aging, and the current President of the American Psychiatric Association (which was not involved in this study).

The SAGE study included adults between the ages of 50 and 99 years, with a mean age of just over 77 years. In addition to measures which assessed rates of chronic disease and disability, the survey looked at more subjective criteria such as social engagement and participants' self-assessment of their overall health.

"Sometimes the most relevant outcomes are from the perspective of the subjects themselves," said Jeste.

The study concludes that resilience and depression have significant bearing on how individuals self-rate successful aging, with effects that are comparable to that of physical health. "Even though older age was closely associated with worse physical and cognitive functioning, it was also related to better mental functioning," said co-author Colin Depp, PhD, associate professor of psychiatry at UC San Diego School of Medicine.

After adjusting for age, a higher self-rating of successful aging was associated with higher education, better cognitive function, better perceived physical and mental health, less depression, and greater optimism and resilience.

Participants were asked to rate the extent to which they thought they had "successfully aged," using a 10-point scale and using their own concept of the term. The study found that people with low physical functioning but high resilience, had self-ratings of successful aging similar to those of physical healthy people with low resilience. Likewise, the self-ratings of individuals with low physical functioning but no or minimal depression had scores comparable to those of physically healthy people with moderate to severe depression.

"It was clear to us that, even in the midst of physical or cognitive decline, individuals in our study reported feeling that their well-being had improved with age," Jeste said. This counterintuitive increase in well-being with aging persisted even after accounting for variables like income, education and marriage.

Jeste suggests there's a take-away message for clinicians, which is that an optimistic approach to the care of seniors may help reduce societal ageism. "There is considerable discussion In public forums about the financial drain on the society due to rising costs of healthcare for older adults -- what some people disparagingly label the 'silver tsunami.' But, successfully aging older adults can be a great resource for younger generations," he said.

The findings point to an important role for psychiatry in enhancing successful aging in older adults. "Perfect physical health is neither necessary nor sufficient," Jeste said. "There is potential for enhancing successful aging by fostering resilience and treating or preventing depression."

Additional contributors to this study include Gauri N. Savla, PhD, Wesley K. Thompson, PhD, Ipsit V. Vahia, MD, Danielle K. Glorioso, MSW, A'verria Sirkin Martin, PhD, Barton W. Palmer, PhD, David Rock, BA, and Shahrokh Golshan, PhD, UC San Diego; and Helena C. Kraemer, PhD, professor of biostatistics in psychiatry at Stanford University.

This work was supported, in part, by NIMH grants T32 MH-019934 and P30 MH-066248, by NIH National Center for Research Support grant UL1 RR-031980, by the John A. Hartford Foundation, and by the Sam and Rose Stein Institute for Research on Aging.

Cognitive Behavioural Therapy Can Reduce Depression in Those Haven't Responded to Antidepressants

Dec. 6, 2012 — Antidepressants are the most widely used treatment for people with moderate to severe depression. However, up to two thirds of people with depression don't respond fully to this type of treatment. New findings, published in *The Lancet*, have shown cognitive behavioural therapy (CBT)*, provided in addition to usual care, can reduce symptoms of depression and help improve patients' quality of life.

This is the first large-scale trial to test the effectiveness of CBT -- a type of talking psychotherapy -- given in addition to usual care that includes antidepressants. The National Institute for Health Research Health Technology Assessment (NIHR HTA) Programme-funded CoBalT study aimed to determine the best 'next step' treatment for people whose depression had not responded to medication alone.

The CoBaIT team, comprising researchers from the Universities of Bristol, Exeter and Glasgow, recruited 469 patients aged 18- to 75-years with treatment-resistant depression for the randomised controlled trial. Patients were split into two groups: 235 patients continued with their

usual care from the GP, which included continuing on antidepressant medication, and 234 patients were treated with CBT in addition to usual care from their GP. Researchers followed-up 422 patients (90 per cent) at six months and 396 (84 per cent) at 12 months to compare their progress.

At six months, 46 per cent of those who received CBT in addition to usual care had improved, reporting at least a 50 per cent reduction in symptoms of depression, compared to 22 per cent of those who continued with usual care alone. This beneficial effect was maintained over 12 months.

The findings demonstrate that CBT provided in addition to usual care including antidepressant medication is an effective treatment that reduces depressive symptoms, and improves the quality of life in patients whose depression has not responded to the most common first-line treatment for depression in primary care.

Dr Nicola Wiles, the study's lead author and a Senior Lecturer in the University of Bristol's School of Social and Community Medicine, said: "Antidepressants are often the first-line treatment for depression -- a major public health problem with the World Health Organisation estimating that over 300 million people are affected globally. However, in many countries, access to psychological treatments such as CBT is limited to people who can afford to pay, or those with health insurance. These findings emphasise the importance of increasing the availability of psychological therapy. While there have been initiatives to increase access to such treatments in both the UK and Australia, worldwide initiatives are rare, and even in the UK many people who have not responded to antidepressants do not get psychological treatment. Our study suggests that by investing in psychological services it is possible to reduce the significant burden to patients and healthcare systems that is associated with non-response to antidepressant medication.

"Furthermore, it is important to acknowledge that while we found CBT was an effective treatment for this patient group, not everyone who received CBT improved. It is therefore essential that we invest in further research in this area to investigate alternative treatment options, both pharmacological and non-pharmacological, for the significant number of patients whose depression does not get better following treatment with antidepressants."

Willem Kuyken, Professor of Clinical Psychology at the University of Exeter, added: "This trial provides further evidence that psychological treatments like cognitive therapy can provide substantive and lasting help to people who suffer depression. The Mood Disorders Centre, one of the participating sites, aims to make evidence-based psychological approaches as accessible as possible to people suffering depression. This trial demonstrates that people with complex and longstanding needs who have not responded to antidepressants can derive substantive and lasting benefit from CBT delivered by well trained therapists. Showing that 40 per cent of people who had been in cognitive therapy were largely free of symptoms at 12 months is really important because it bodes well for their longer-term recovery."

John Campbell, Professor of General Practice at the University of Exeter Medical School, commented: "Depression is a very common illness, encountered frequently by GPs and their

patients. While drug treatments can be very effective, not all patients will respond well to treatment. For some patients, the experience of depression can be particularly difficult. We were delighted that so many patients, GPs, and practices helped us with this research. The results we present today show that for some patients, the addition of a 'talking therapy' such as CBT can be very effective in treating the depression and helping resolve disabling symptoms. GPs and their patients can take real encouragement from these findings which provide real support for the use of CBT in patients where other treatments may have failed."

Chris Williams, Professor of Psychosocial Psychiatry at the University of Glasgow, added: "This research is also of great importance because it used a CBT intervention alongside treatment with antidepressants. It confirms how these approaches -- the psychological and physical -- treatments can complement each other. It was also encouraging because we found the approach worked to good effect across a wide range of people of different ages and living in a variety of settings."

Emer O'Neill, Chief Executive of Depression Alliance, the leading UK charity for people affected by depression, added: "Over the last few years there has been a significant improvement in lifting the stigma associated with depression, and the services available to help treat it.

"However, this marks just the beginning as for many years our members have been asking for access to a wide range of peer-support services. We are delighted to see this research as it now provides the evidence that a range of treatments such as cognitive behavioural therapy and medication is vital to continuing this success."

Women With Higher Carotenoid Levels Have Reduced Risk of Breast Cancer

Dec. 6, 2012 — Women with higher circulating carotenoid levels are at a reduced risk of breast cancer according to a study published December 6 in the *Journal of the National Cancer Institute*

Carotenoids, which are micronutrients found in fruits and vegetables, have been found to have anticarcinogenic properties. Previous experimental studies have shown that carotenoids inhibit the tumor progression and reduce proliferation of estrogen receptor-positive (ER+) and estrogen receptor-negative (ER-) breast cancers. Despite the inverse association between carotenoids and breast cancer in prior studies, the specific carotenoid has differed across multiple studies.

In order to determine the associations that specific carotenoids have with breast cancer, A. Heather Eliassen, Channing Division of Network Medicine, Department of Medicine, Brigham & Women's Hospital and Harvard Medical School, and colleagues, conducted a pooled analysis of eight cohort studies, which gathered over 80% of the world's published prospective data on plasma or serum carotenoids and breast cancer. The analysis included 3,055 case subjects and 3,956 matched control subjects. Participant carotenoid levels were recalibrated to a common standard to explain laboratory differences as well as to examine the differences across populations.

The researchers found that in over 3,000 case subjects, there were statistically significantly inverse associations between circulating levels of individual and total carotenoids and breast cancer risk, with a stronger finding in ER- breast cancers. "The inverse associations we observed among ER− tumors highlight carotenoids as one of the first modifiable risk factors for this poor prognosis tumor type," the authors write, adding that while some evidence has shown that carotenoids inhibit the growth of ER+ breast cancers as well, it's possible that its effect is hidden by hormone related associations which overpower other risk factors. Still, the researchers feel that, "A diet high in carotenoid-rich fruits and vegetables offers many health benefits, including a possible reduced risk of breast cancer."

Hearing Positive Verbs Can Induce Unconscious Physical Response

ScienceDaily (Dec. 5, 2012) — Hearing a verb related to physical action automatically increases the force with which people grip objects, but has no effect on their physical reaction if the word is presented in the negative form, according to research published December 5 in the open access journal *PLOS ONE* by Pia Aravena and colleagues from the L2C2, Institute of Cognitive Sciences (CNRS/UCBL), France.

Volunteers in the study were asked to hold a grip sensor as they heard a variety of verbs related to manual actions, like 'throw' or 'scratch', in different sentence structures. The researchers observed a significant increase in the strength of participants' grip when words were presented in an affirmative sentence, but no such reaction when the same action words were presented in a negative context, such as 'don't throw'.

Several previous studies have explored how the brain processes negative sentence structures like "The door is not open," but this is among the first research studies to explore the effects of this sentence-dependent context on language-induced motor activity. "These findings could open possibilities for the evaluation and rehabilitation of motor and language disorders" says Aravena.

Clinical Trial Tests If Rice Bran Can Reduce Incidence of Cancer

ScienceDaily (Dec. 5, 2012) — A recent University of Colorado Cancer Center review in the journal *Advances in Nutrition* shows that rice bran offers promising cancer prevention properties. Meanwhile, an ongoing clinical trial is testing the effectiveness of rice bran in preventing the recurrence of colon cancer.

"While I have been trained as a molecular toxicologist, I am excited about the opportunities to deliver bioactive, cancer fighting compounds with food, and this has led to my focus now primarily on the multiple drug-like characteristics of rice bran," says Elizabeth P. Ryan, PhD, CU Cancer Center investigator, assistant professor in the Department of Environmental and

Radiological Health Sciences at the CSU Animal Cancer Center, and the review's senior author. "There's a delicate balance of bioactive components in rice bran that together show anti-cancer activity including the ability to inhibit cell proliferation, alter cell cycle progression and initiate the programmed cell death known as apoptosis in malignant cells," Ryan says.

Ryan and colleagues show that bioactive rice bran derived small molecules include, but are not limited to polyphenolics, ferulic acid, tricin, β-sitosterol, γ-oryzanol, tocotrienols/tocopherols, and phytic acid.

"We're working now to tease apart the ratios of these active molecules required for bioactivity and mechanisms. Previous attempts to isolate one or another compound have been largely unsuccessful and so it looks now as if rather than any one compound giving rice bran its chemopreventive powers, it's the synergistic activity of multiple components in the whole food that should be studied."

Work with cancer cell lines and animal models shows that the bioactive components of rice bran act not only within cancer cells but *around* the cells to create conditions in the surrounding tissues that promote the function of healthy cells while inhibiting the function of cancer cells. This tissue microenvironment activity includes mediating chronic inflammation that provides a ripe landscape for cancer. Ryan and colleagues including Tiffany Weir, PhD, and Rajesh Agarwal, PhD, are collaborating to evaluate how rice bran may also help to promote an anti-cancer immune response and modulate gut microbiota metabolism for protection against cancer.

"There are well over 100,000 varieties of rice in the world, many with their own unique mix of bioactive components and so one major challenge is to discover the optimal composition for chemoprevention. Another challenge is ensuring that people consistently receive the required daily intake amount or 'dose' needed to demonstrate these chemo-protective effects. That said, rice is an accessible, low-cost food in most places of the world, and so work with rice bran as a dietary chemopreventive agent has the potential to impact a significant portion of the world's population," Ryan says.

Ryan has taken the next step in the evolution of rice bran from diet to prescription, in the form of an ongoing clinical trial testing its chemopreventive effectiveness in a population of colon cancer survivors.

Patients With Severe Back Pain Who Quit Smoking Report Less Pain Than Patients Who Continue to Smoke

ScienceDaily (Dec. 5, 2012) — For years, research has shown a link between smoking and an increased risk for low back pain, intervertebral (spine) disc disease, and inferior patient outcomes following surgery. A new study, published in the December 2012 *Journal of Bone and Joint Surgery* (JBJS), also found that smokers suffering from spinal disorders and related back pain,

reported greater discomfort than spinal disorder patients who stopped smoking during an eight-month treatment period.

Nearly all adults will be seen at some time by a physician for back pain or other painful spinal disorders. As smoking has been identified as a modifiable risk factor for chronic pain disorders, researchers reviewed the smoking history and monitored the reported pain of more than 5,300 patients with axial (back) or radicular (leg) pain from a spinal disorder, treated surgically or non-surgically, over an eight-month period.

At the time of entry into care, patients who had never smoked and prior smokers reported significantly less back pain than current smokers and those who had quit smoking during the study period. Current smokers reported significantly greater pain in all visual analog scale (VAS) pain ratings -- worst, current and average weekly pain -- when compared with patients who had never smoked.

Other Key Findings:

- Those who quit smoking during the course of care reported greater improvement in reported back pain than those who continued to smoke.
- The mean improvement in VAS pain ratings was clinically significant in nonsmokers.
- The group that continued smoking during treatment had no clinically significant improvement in reported pain.
- Using the Oswestry Disability Index (the most commonly used outcome measure for low back pain assessment), greater mean improvement was observed in patients who had never smoked when compared to current smokers.

"We know that nicotine increases pain," said study author Glenn R. Rechtine, MD, University of Rochester Department of Orthopaedics. "In this study, if you quit smoking during treatment, you got better. If you continued to smoke, there was statistically no improvement, regardless of the treatment you had. Smoking is bad for you. Basically, the likelihood to improve your care -- surgical or non-surgical -- was dramatically decreased if you are a smoker.

"This study supports the need for smoking cessation programs for patients with a painful spinal disorder given a strong association between improved patient reported pain and smoking cessation," said Dr. Rechtine.

Extraverted Gorillas Enjoy Longer Lives, Research Suggests

ScienceDaily (Dec. 5, 2012) — An international team of researchers looked at the role of personality by studying 298 gorillas in North American zoos and sanctuaries for over 18 years.

The gorillas' personalities were assessed by keepers, volunteers, researchers and caretakers who knew the gorillas well. Their personality was scored with measures adapted from techniques for studying people and other primates.

Researchers found that out of four personality traits -- dominance, extraversion, neuroticism and agreeableness -- extraversion, which was associated with behaviours such as sociability, activity, play and curiosity, was linked with longer survival.

The study found that the link between extraversion and survival was not affected by age or gender, rearing condition or how many times the gorilla had moved location.

Researchers say these findings are consistent with studies in people which found that extraverts tend to live longer.

The study, carried out on western lowland gorillas is important in understanding how the relationship between personality and longevity of life evolved.

Dr Alex Weiss, of the University of Edinburgh's School of Philosophy, Psychology and Language Sciences, said: "These findings highlight how understanding the natural history of personality is vital to insuring the continued health and well-being of humans, gorillas and other great apes."

The collection of personality data in 1994 was funded by Zoo Atlanta, the Georgia Institute of Technology, and a Lincoln Park Zoological Society's Dr Scholl's Graduate Research Fellowship.

Workings of the Brain: After 100 Years, Understanding the Electrical Role of Dendritic Spines

ScienceDaily (Dec. 5, 2012) — It's the least understood organ in the human body: the brain, a massive network of electrically excitable neurons, all communicating with one another via receptors on their tree-like dendrites. Somehow these cells work together to enable great feats of human learning and memory. But how?

Researchers know dendritic spines play a vital role. These tiny membranous structures protrude from dendrites' branches; spread across the entire dendritic tree, the spines on one neuron collect signals from an average of 1,000 others. But more than a century after they were discovered, their function still remains only partially understood.

A Northwestern University researcher, working in collaboration with scientists at the Howard Hughes Medical Institute (HHMI) Janelia Farm Research Campus, has recently added an important piece of the puzzle of how neurons "talk" to one another. The researchers have

demonstrated that spines serve as electrical compartments in the neuron, isolating and amplifying electrical signals received at the synapses, the sites at which neurons connect to one another.

The key to this discovery is the result of innovative experiments at the Janelia Farm Research Campus and computer simulations performed at Northwestern University that can measure electrical responses on spines throughout the dendrites.

"This research conclusively shows that dendritic spines respond to and process synaptic inputs not just chemically, but also electrically," said William Kath, professor of engineering sciences and applied mathematics at Northwestern's McCormick School of Engineering, professor of neurobiology at the Weinberg College of Arts and Sciences, and one of the paper's authors.

Dendritic spines come in a variety of shapes, but typically consist of a bulbous spine head at the end of a thin tube, or neck. Each spine head contains one or more synapses and is located in very close proximity to an axon coming from another neuron.

Scientists have gained insight into the chemical properties of dendritic spines: receptors on their surface are known to respond to a number of neurotransmitters, such as glutamate and glycine, released by other neurons. But because of the spines' incredibly small size -- roughly 1/100 the diameter of a human hair -- their electrical properties have been harder to study

In this study, researchers at the HHMI Janelia Farm Research Campus used three experimental techniques to assess the electrical properties of dendritic spines in rats' hippocampi, a part of the brain that plays an important role in memory and spatial navigation. First, the researchers used two miniature electrodes to administer current and measure its voltage response at different sites throughout the dendrites.

They also used a technique called "glutamate uncaging," a process that involves releasing glutamate, an excitatory neurotransmitter, to evoke electrical responses from specific synapses, as if the synapse had just received a signal from a neighboring neuron. A third process utilized a calcium-sensitive dye -- calcium is a chemical indicator of a synaptic event -- injected into the neuron to provide an optical representation of voltage changes within the spine.

At Northwestern, researchers used computational models of real neurons -- reconstructed from the same type of rat neurons -- to build a 3D representation of the neuron with accurate information about each dendrites' placement, diameter, and electrical properties. The computer simulations, in concert with the experiments, indicated that spines' electrical resistance is consistent throughout the dendrites, regardless of where on the dendritic tree they are located.

While much research is still needed to gain a full understanding of the brain, knowledge about spines' electrical processing could lead to advances in the treatment of diseases like Alzheimer's and Huntington's diseases.

"The brain is much more complicated than any computer we've ever built, and understanding how it works could lead to advances not just in medicine, but in areas we haven't considered yet," Kath said. "We could learn how to process information in ways we can only guess at now."

Where 'Where It's At' Is at in the Brain

ScienceDaily (Dec. 5, 2012) — A new study in the journal *Neuron* suggests that the brain uses a different region than neuroscientists had thought to associate objects and locations in the space around an individual. Knowing where this fundamental process occurs could help treat disease and brain injury as well as inform basic understanding of how the brain supports memory and guides behavior.

Where are you?

Conventional wisdom in brain research says that you just used your hippocampus to answer that question, but that might not be the whole story. The context of place depends on not just how you got there, but also the things you see around you. A new study in *Neuron* provides evidence that a different part of the brain is important for understanding where you are based on the spatial layout of the objects in that place. The finding, in rats, has a direct analogy to primate neuroanatomy.

"Understanding how and where context is represented in the brain is important," said study senior author Rebecca Burwell, professor of psychology and neuroscience at Brown University. "Context, or the place in which events occur, is the hallmark of episodic memory, but context is more than a place or a location. This room, for example, has a window, furniture, and other objects. You walk into a room and all that information helps you remember what happened there."

Pinpointing where the brain puts together objects and places to form a context could also matter for treating traumatic brain injuries or neuropsychiatric diseases, such as schizophrenia and depression, that involve that part of the brain, said Burwell, who is also affiliated with the Brown Institute for Brain Science.

"We know that contextual representations are disrupted in mental disorders, particularly schizophrenia and depression," Burwell said. "Individuals with these disorders have trouble using context to plan actions or choose appropriate behaviors."

Part of the funding for the study came from a defense department grant aimed at laying the basic neuroscience framework for ultimately repairing traumatic brain damage.

Ratting out dogma

The particular region of Burwell's interest is called the postrhinal cortex, or POR, in rats. It is directly analogous to the parahippocampal cortex, or PHC, in primates including humans. Neuroscientists already credit the POR, and the PHC, with a significant role in encoding spatial context, mainly by providing spatial information to the hippocampus ("There is a wall five feet to the left"), but they have presumed that another brain region, the perirhinal cortex (PER), provides the hippocampus with information about objects ("I see a fish sculpture").

"The dogma is that this spatial and nonspatial information is segregated," Burwell said. That is, until those two streams of information are finally integrated by the hippocampus ("The fish sculpture is on the left-hand wall shelf.").

But previous research has shown that the PER and POR talk directly to each other. Also, damage to either of those brain regions results in rats that become confused about context. For those, and other reasons, Burwell's team hypothesized that the POR links objects to places to encode spatial context upstream of the hippocampus.

"That's what we think is happening in the POR," she said. "It's integrating information about place and information about objects to characterize the spatial layout of a local context."

That object in that place

To find out, the authors surgically inserted electrodes near dozens of POR neurons in each of five rats. The rats were trained to perform a series of experimental tasks in a simple bowtie-shaped "maze." Each time, they had to choose between a pair of images (objects) projected into two corners (places) of the maze floor. When the rats moved to the "correct" object, they were rewarded with sips of 2% fat chocolate milk.

The researchers found that neurons in the POR responded in patterns of electrical activity, or "spiking," not only when the rats looked at objects or scurried to places, but also when specific objects (like one associated with a reward) turned up in specific places. That is, neurons often spiked when a particular object appeared in a particular corner.

The rats even exhibited a specific neural response for "egocentric" movements. In other words, the rats' POR neurons didn't just account for object location in an objective "this side of the maze or that side" sense, but also for a self-specific "on my left or on my right" basis, indicating that the POR considers space relative to the self, regardless of where a particular object might be in the room.

Networks of POR neurons also tended to fire rhythmically at a specific frequency, called "theta," that neuroscientists think coordinates long-distance communication across the brain.

"It was a surprise to see this whopping theta in the POR," Burwell said.

Theta rhythm was particularly strong when rats chose an unrewarded object. Burwell said that indicates the POR may be responsible for telling other parts of the brain when the wrong choice of object and place has been made.

"The POR," Burwell said, "is not just a relay station for spatial information."

It appears to be much more.

In addition to Burwell, the paper's authors are former lab member, Sharon Furtak, now at California State University-Sacramento, and collaborator, Omar Ahmed, formerly at Brown and now at Massachusetts General Hospital.

The Defense Advanced Research Projects Agency (grant N66001-10_C-2010), the National Science Foundation (grant IOB-0522220) and the National Institutes of Health (grants T32-MH019118 and F32-MH084443) supported the research.

Many Maps of the Brain

ScienceDaily (Dec. 6, 2012) — Your brain has at least four different senses of location -- and perhaps as many as 10. And each is different, according to new research from the Kavli Institute for Systems Neuroscience, at the Norwegian University of Science and Technology.

The findings, published in the 6 December 2012 issue of *Nature*, show that **rather than just a single sense of location, the brain has a number of "modules" dedicated to self-location**. Each module contains its own internal GPS-like mapping system that keeps track of movement, and has other characteristics that also distinguishes one from another.

"We have at least four senses of location," says Edvard Moser, director of the Kavli Institute. "**Each has its own scale for representing the external environment, ranging from very fine to very coarse. The different modules react differently to changes in the environment**. Some may scale the brain's inner map to the surroundings, others do not. And they operate independently of each other in several ways."

This is also the first time that researchers have been able to show that a part of the brain that does not directly respond to sensory input, called the association cortex, is organized into modules. The research was conducted using rats.

Technical breakthroughs

A rat's brain is the size of a grape, while the area that keeps track of the sense of location and memory is comparable in size to a small grape seed. This tiny area holds millions of nerve cells.

A research team of six people worked for more than four years to acquire extensive electrophysiological measurements in this seed-sized region of the brain. New measurement techniques and a technical breakthrough made it possible for Hanne Stensola and her colleagues to measure the activity in as many as 186 grid cells of the same rat brain. A grid cell is a specialized cell named for its characteristic of creating hexagonal grids in the brain's mental map of its surroundings.

"We knew that the 'grid maps' in this area of the brain had resolutions covering different scales, but we did not know how independent the scales were of each other," Stensola said. "We then discovered that the maps were organized in four to five modules with different scales, and that each of these modules reacted slightly differently to changes in their environment. This

independence can be used by the brain to create new combinations -- many combinations -- which is a very useful tool for memory formation."

After analysing the activity of nearly 1000 grid cells, researchers were able to conclude that the brain has not just one way of making an internal map of its location, but several.

Perhaps 10 different senses of location

Institute director Moser says that while researchers are able to state with confidence that there are at least four different location modules, and have seen clear evidence of a fifth, there may be as many as 10 different modules. He says, however, that researchers need to conduct more measurements before they will have covered the entire grid-cell area. "At this point we have measured less than half of the area," he says.

Aside from the time and challenges involved in making these kinds of measurements, there is another good reason why researchers have not yet completed this task. The lower region of the sense of location area, the entorhinal cortex, has a resolution that is so coarse or large that it is virtually impossible to measure it.

"The thinking is that the coordinate points for some of these maps are as much as ten metres apart," explains Moser. "To measure this we would need to have a lab that is quite a lot larger and we would need time to test activity over the entire area. We work with rats, which run around while we make measurements from their brain. Just think how long it would take to record the activity in a rat if it was running back and forth exploring every nook and cranny of a football field. So you can see that we have some challenges here in scaling up our experiments."

New way to organize

Part of what makes the discovery of the grid modules so special is that it completely changes our understanding of how the brain physically organizes abstract functions. Previously, researchers have shown that brain cells in sensory systems that are directly adjacent to each other tend to have the same response pattern. This is how they have been able to create detailed maps of which parts of the sensory brain do what.

The new research shows that a modular organization is also found in the highest parts of the cortex, far away from areas devoted to senses or motor outputs. But these maps are different in the sense that they overlap or infiltrate other. It is thus not possible to locate the different modules with a microscope, because the cells that work together are intermingled with other modules in the same area.

"The various components of the grid map are not organized side by side," explains Moser. "The various components overlap. This is the first time a brain function has been shown to be organized in this way at separate scales. We have uncovered a new way for neural network function to be distributed."

A map and a constant

The researchers were surprised, however, when they started calculating the difference between the scales. They may have discovered an ingenious mathematical coding system, along with a number, a constant. (Anyone who has read or seen "The Hitchhiker's Guide to the Galaxy" may enjoy this.) The scale for each sense of location is actually 42% larger than the previous one.

"We may not be able to say with certainty that we have found a mathematical constant for the way the brain calculates the scales for each sense of location, but it's very funny that we have to multiply each measurement by 1.42 to get the next one. That is approximately equal to the square root of the number two," says Moser.

Maps are genetically encoded

Moser thinks it is striking that the relationship between the various functional modules is so orderly. He believes this orderliness shows that the way the grid map is organized is genetically built in, and not primarily the result of experience and interaction with the environment.

So why has evolution equipped us with four or more senses of location?

Moser believes the ability to make a mental map of the environment arose very early in evolution. He explains that all species need to navigate, and that some types of memory may have arisen from brain systems that were actually developed for the brain's sense of location.

"We see that the grid cells that are in each of the modules send signals to the same cells in the hippocampus, which is a very important component of memory," explains Moser. "This is, in a way, the next step in the line of signals in the brain. In practice this means that the location cells send a different code into the hippocampus at the slightest change in the environment in the form of a new pattern of activity. So every tiny change results in a new combination of activity that can be used to encode a new memory, and, with input from the environment, becomes what we call memories.

The article is a part of doctoral research conducted by Hanne and Tor Stensola, and has been funded through an Advanced Investigator Grant that Edvard Moser was awarded by the European Research Council (ERC).

Research Identifies a Way to Block Memories Associated With PTSD or Drug Addiction

ScienceDaily (Dec. 5, 2012) — New research from Western University could lead to better treatments for Post-Traumatic Stress Disorder (PTSD) and drug addiction by effectively blocking memories. The research performed by Nicole Lauzon, a PhD candidate in the laboratory of Steven Laviolette at Western's Schulich School of Medicine & Dentistry has revealed a common mechanism in a region of the brain called the pre-limbic cortex, can control the recall of memories linked to both aversive, traumatic experiences associated with PTSD and rewarding memories linked to drug addiction. More importantly, the researchers have discovered

a way to actively suppress the spontaneous recall of both types of memories, without permanently altering memories.

The findings are published online in the journal *Neuropharmacology*.

"These findings are very important in disorders like PTSD or drug addiction. One of the common problems associated with these disorders is the obtrusive recall of memories that are associated with the fearful, emotional experiences in PTSD patients. And people suffering with addiction are often exposed to environmental cues that remind them of the rewarding effects of the drug. This can lead to drug relapse, one of the major problems with persistent addictions to drugs such as opiates," explains Laviolette, an associate professor in the Departments of Anatomy and Cell Biology, and Psychiatry. "So what we've found is a common mechanism in the brain that can control recall of both aversive memories and memories associated with rewarding experience in the case of drug addiction."

In their experiments using a rat model, the neuroscientists discovered that stimulating a sub-type of dopamine receptor called the "D1" receptor in a specific area of the brain, could completely prevent the recall of both aversive and reward-related memories. "The precise mechanisms in the brain that control how these memories are recalled are poorly understood, and there are presently no effective treatments for patients suffering from obtrusive memories associated with either PTSD or addiction," says Lauzon. "If we are able to block the recall of those memories, then potentially we have a target for drugs to treat these disorders."

"In the movie, 'Eternal Sunshine of a Spotless Mind,' they attempted to permanently erase memories associated with emotional experiences," adds Laviolette. "The interesting thing about our findings is that we were able to prevent the spontaneous recall of these memories, but the memories were still intact. We weren't inducing any form of brain damage or actually affecting the integrity of the original memories."

Baby's Health Is Tied to Mother's Value for Family

ScienceDaily (Dec. 3, 2012) — The value that an expectant mother places on family -- regardless of the reality of her own family situation -- predicts the birthweight of her baby and whether the child will develop asthma symptoms three years later, according to new research from USC.

The findings suggest that one's culture is a resource that can provide tangible physical health benefits.

"We know that social support has profound health implications; yet, in this case, this is more a story of beliefs than of actual family support," said Cleopatra Abdou, assistant professor at the USC Davis School of Gerontology.

Abdou studied 4,633 socioeconomically disadvantaged white, black and Hispanic women, gauging their "familism," or, more specifically, their beliefs about familial roles and responsibilities, using a questionnaire. Familism was determined by responses to statements such as, "Single moms can do just as well as married parents," or "It is better for children if their parents are married."

Abdou then tracked the health of their children and found that, for every one-point increase in familism, there was a 71-gram increase in birthweight independent of a whole host of other factors -- including the gender of the infant or whether the mother was married. (For context, average birthweight in the U.S. is around 7.5 pounds, or roughly 3,400 grams. Low birthweight, typically defined as under 5.5 pounds or 2,500 grams, has been linked to health problems later in life.) Higher familism also predicted lower rates of asthma in the children up to three years later.

Though one might expect to see healthier children from mothers who reported strong family support, familism is a cultural measure that exists outside of an individual's actual circumstances.

"Cultural beliefs and ideals can be distinct from one's present reality. Familism is about beliefs and ideals within families. That's why familism is referred to as a cultural resource. The cultural resource of familism appears to favorably impact both reproductive health in mothers as well as critical markers of physical health in offspring. That is, the transmission of health from one generation to another," Abdou said.

Abdou's findings were published online on Nov. 9 in the journal *Social Science & Medicine*, in an article coauthored by Tyan Parker Dominguez of USC and Hector F. Myers of UCLA.

The results may shed light on the so-called "Hispanic Paradox" or "epidemiologic paradox," first documented in 1986 by Markides and Coreil, which found that immigrant populations in the United States tend to be relatively healthy compared to their peers, despite being poorer.

In general, poorer populations tend to be less healthy than wealthier ones. The epidemiologic paradox diminishes over time, with immigrant populations becoming less and less healthy as they start assimilating into American culture.

Abdou theorizes that U.S.-born populations, in addition to immigrant populations, can benefit in terms of mental and physical health from strong cultural resources, a theory that is supported by this study. Her work continues to probe the connections between health and culture in diverse populations in the United States and the Middle East.

Gender and Race: How Overlapping Stereotypes Affect Our Personal and Professional Decisions

ScienceDaily (Dec. 3, 2012) — Racial and gender stereotypes have profound consequences in almost every sector of public life, from job interviews and housing to police stops and prison terms. However, only a few studies have examined whether these different categories overlap in their stereotypes. A new study on the connections between race and gender -- a phenomenon called gendered race -- reveals unexpected ways in which stereotypes affect our personal and professional decisions.

Within the United States, Asians as an ethnic group are perceived as more feminine in comparison to whites, while blacks are perceived as more masculine, according to new research by Adam Galinsky, the Vikram S. Pandit Professor of Business at Columbia Business School. Further research by Galinsky shows that the fact that race is gendered has profound consequences for interracial marriage, leadership selection, and athletic participation.

The first study conducted by Galinsky and his colleagues Erika Hall of Kellogg School of Management and Amy Cuddy of Harvard University directly tested whether race was gendered. Eighty-five participants of various backgrounds completed an online survey in which they evaluated either the femininity or masculinity of certain traits or attributed those traits to Asians, whites, and blacks. "The stereotype content for blacks was considered to be the most masculine, followed by whites, with Asians being the least masculine," Galinsky wrote in the study, soon to appear in *Psychological Science*. "Thus, we found a substantial overlap between the contents of racial and gender stereotypes." A separate study, in which participants were subliminally exposed to a word related to race before reacting to words perceived as masculine or feminine, showed that the association between racial and gender stereotypes exists even at an implicit level.

Their next set of studies demonstrated that these associations have important implications for romantic relationships. Within the heterosexual dating market, men tend to prefer women who personify the feminine ideal while women prefer men who embody masculinity. Galinsky showed that men are more attracted to Asian women relative to black women, while women are more attracted to black men relative to Asian men. Even more interesting, the more a man valued femininity the more likely he was attracted to an Asian women and the less likely he was attracted to an black women. The same effect occurred for women, with attraction to masculinity driving the differential attraction to black men and Asian men.

These interracial dating preferences have real-world results, Galinsky found. He analyzed the 2000 US Census data and found a similar pattern among interracial marriages: among black-white marriages, 73 percent had a black husband and a white wife, while among Asian-white marriages, 75 percent had a white husband and an Asian wife. An even more pronounced pattern emerged in Asian-black marriages, in which 86 percent had a black husband and an Asian wife.

The effects of gendered races extend to leadership selection and athletic participation, further research showed. In a study in which participants evaluated job candidates, Asians were more likely to be selected for a leadership position that required collaboration and relationship building, traits typically perceived as feminine. Black candidates were more likely to be chosen for positions that required a fiercely competitive approach, typically seen as masculine.

A final study analyzed archival data from the National Collegiate Athletic Association's (NCAA) Student-Athlete Ethnicity Report, which breaks down the racial composition of 30 different collegiate sports (NCAA, 2010) from 2000-2010 for Divisions I, II, and III. Galinsky and his colleagues found that the more a sport was perceived to be masculine the greater the relative number of black to Asian athletes who played that sport at the collegiate level, with blacks more likely to participate in the most masculine sports.

"This research shows that the intersection of race and gender has important real-world consequences," Galinsky concluded. "Considering the overlap between racial and gender stereotypes -- our gendered race perspective -- opens up new frontiers for understanding how stereotypes impact the important decisions that drive our most significant outcomes at work and at home."

Research Explores Markers of Depression from Childhood to Adulthood

ScienceDaily (Dec. 3, 2012) — Although several studies have followed the course of depression throughout the lifespan, the characteristics of depression at different developmental stages haven't been clearly identified. New research published in *Clinical Psychological Science*, a journal of the Association for Psychological Science, presents a unique longitudinal investigation of depression across four critical developmental periods from childhood to adulthood.

To better understand the developmental course of Major Depressive Disorder (MDD), Paul Rohde of the Oregon Research Institute and colleagues analyzed data collected from individuals participating in the Oregon Adolescent Depression Project.

Using these data, the researchers were able to compare and contrast the presentation of MDD across four developmental periods: childhood (5.0-12.9 years), adolescence (13.0-17.9 years), emerging adulthood (18.0-23.9 years), and adulthood (24.0-30.0 years).

Interviewers assessed participants for symptoms of depression at each of the four time points. The participants also completed follow-up evaluations that assessed the onset and duration of all major psychiatric disorders since the previous time point.

MDD recovery was defined as 8 or more consecutive weeks of no or minor symptoms and MDD recurrence was defined as meeting full MDD criteria following recovery. Both of these definitions are in line with consensus definitions in the field.

The interviewers conducting the diagnostic assessments were carefully selected, trained, and supervised. Each one of the interviewers had a degree in a mental health discipline and had completed a 70-hour course in diagnostic interviewing.

Rohde and colleagues examined data from 816 participants who had completed the questionnaires and interviews at all four time points.

By age 30, 51% of the sample had experienced an episode of MDD. Among the participants who developed one episode of MDD, more than half (53%) had at least one recurrent MDD episode by age 30. Being female was a consistent predictor of a first incidence of MDD in all four of the developmental periods but did not significantly predict recurrence.

First incidence and recurrent episodes of MDD were lower in childhood than in adolescence, emerging adulthood, or adulthood. While MDD during childhood was infrequent, episodes that occurred in this early developmental period lasted significantly longer than those episodes that occurred in the subsequent three periods. As the researchers expected, having an episode in one developmental period was associated with a significantly increased risk of having an episode in subsequent periods.

The researchers found that rates of suicide attempts were significantly higher in adolescents than in either the emerging adult or adult periods, which had similar rates. Among the participants who had a history of MDD through age 30, about 19% had at least one suicide attempt by the fourth time point.

MDD was associated with both anxiety and substance use disorders in all four developmental periods.

The researchers note that, to their knowledge, this is the first study to examine the markers of MDD across these four developmental periods.

Rohde and colleagues argue that this study makes an important contribution to our understanding of how depression emerges and develops over time because it provides critical information about the prevalence, duration, course, patterns of co-occurrence, and longer-term consequences of depression across four markedly diverse developmental periods.

Co-authors on this study include Peter Lewinsohn, John Seeley, and Jeff Gau of the Oregon Research Institute and Daniel Klein of Stony Brook University.

This research was supported in part by grants from the National Institute of Mental Health (MH40501 and MH50522) and the National Institute on Drug Abuse (DA12951) awarded to Peter Lewinsohn.

Male Chimpanzees Choose Their Allies Carefully

ScienceDaily (Dec. 3, 2012) — The ability of male chimpanzees to form coalitions with one another in order to direct aggression at other male chimpanzees has certain benefits. A new study by Ian Gilby at Duke University in North Carolina and his colleagues has further revealed that it may not just be the coalition that is important, but who the coalition is with that determines future success.

Their study finds that male chimpanzees with central positions in the coalitionary network were most likely to father offspring and increase in rank. Specifically, those who formed coalitions with males who did not form coalitions with each other were the most successful. Their work is published in the Springer journal *Behavioral Ecology and Sociobiology*.

Coalitionary aggression is when at least two individuals jointly direct aggression at one or more targets. Aggression and coalition formation between males is important for attaining a higher dominance in many animal species. The most dominant males are more likely to mate and therefore, sire offspring. Males with high coalition rates are more likely to mate more often than expected for their rank.

Gilby and his colleagues studied data from wild chimpanzees gathered over 14 years from the Kasekela community in Gombe National Park in Tanzania. They wanted to test the hypothesis that male coalitionary aggression leads to positive benefits via increased dominance rank and improved reproductive success. Of the four measures they used to characterize a male's coalitionary behavior, the only one that was related to both of these factors was 'betweenness' -- a measure of social network centrality -- which reflects the tendency to make coalitions with other males who did not form coalitions with each other. The only non-alpha males to sire offspring were males that had the highest 'betweenness' scores. These males were also more likely to increase in rank, which is associated with higher reproductive success.

The researchers postulate that this shows that male chimpanzees may recognize the value of making the 'right' social connections. By choosing their coalition partners carefully, they are demonstrating an ability to recognize the relationships of others.

The authors conclude that "…our data suggest that there are consequences to the recognition of third party relationships. As such, it represents an important step toward a more complete understanding of the adaptive value of social intelligence and the evolution of co-operation." They add that further observation is required to fully explain the study's findings.

Origin of Intelligence and Mental Illness Linked to Ancient Genetic Accident

ScienceDaily (Dec. 2, 2012) — Scientists have discovered for the first time how humans -- and other mammals -- have evolved to have intelligence.

Researchers have identified the moment in history when the genes that enabled us to think and reason evolved.

This point 500 million years ago provided our ability to learn complex skills, analyse situations and have flexibility in the way in which we think.

Professor Seth Grant, of the University of Edinburgh, who led the research, said: "One of the greatest scientific problems is to explain how intelligence and complex behaviours arose during evolution."

The research, which is detailed in two papers in *Nature Neuroscience*, also shows a direct link between the evolution of behaviour and the origins of brain diseases.

Scientists believe that the same genes that improved our mental capacity are also responsible for a number of brain disorders.

"This ground breaking work has implications for how we understand the emergence of psychiatric disorders and will offer new avenues for the development of new treatments," said John Williams, Head of Neuroscience and Mental Health at the Wellcome Trust, one of the study funders.

The study shows that intelligence in humans developed as the result of an increase in the number of brain genes in our evolutionary ancestors.

The researchers suggest that a simple invertebrate animal living in the sea 500 million years ago experienced a 'genetic accident', which resulted in extra copies of these genes being made.

This animal's descendants benefited from these extra genes, leading to behaviourally sophisticated vertebrates -- including humans.

The research team studied the mental abilities of mice and humans, using comparative tasks that involved identifying objects on touch-screen computers.

Researchers then combined results of these behavioural tests with information from the genetic codes of various species to work out when different behaviours evolved.

They found that higher mental functions in humans and mice were controlled by the same genes.

The study also showed that when these genes were mutated or damaged, they impaired higher mental functions.

"Our work shows that the price of higher intelligence and more complex behaviours is more mental illness," said Professor Grant.

The researchers had previously shown that more than 100 childhood and adult brain diseases are caused by gene mutations.

"We can now apply genetics and behavioural testing to help patients with these diseases," said Dr Tim Bussey from Cambridge University, which was also involved in the study.

Childhood Trauma Leaves Mark On DNA of Some Victims: Gene-Environment Interaction Causes Lifelong Dysregulation of Stress Hormones

ScienceDaily (Dec. 2, 2012) — Abused children are at high risk of anxiety and mood disorders, as traumatic experience induces lasting changes to their gene regulation. Scientists from the Max Planck Institute of Psychiatry in Munich have now documented for the first time that genetic variants of the *FKBP5* gene can influence epigenetic alterations in this gene induced by early trauma.

In individuals with a genetic predisposition, trauma causes long-term changes in DNA methylation leading to a lasting dysregulation of the stress hormone system. As a result, those affected find themselves less able to cope with stressful situations throughout their lives, frequently leading to depression, post-traumatic stress disorder or anxiety disorders in adulthood. Doctors and scientists hope these discoveries will yield new treatment strategies tailored to individual patients, as well as increased public awareness of the importance of protecting children from trauma and its consequences.

Many human illnesses arise from the interaction of individual genes and environmental influences. Traumatic events, especially in childhood, constitute high risk factors for the emergence of psychiatric illnesses in later life. However, whether early stress actually leads to a psychiatric disorder depends largely on his or her genetic predisposition.

Research Group Leader Elisabeth Binder of the Max Planck Institute of Psychiatry examined the DNA of almost 2000 Afro-Americans who had been repeatedly and severely traumatised as adults or in childhood. One-third of trauma victims had become ill and was now suffering from post-traumatic stress disorder. The risk of developing post-traumatic stress disorder rose with increasing severity of abuse only in the carriers of a specific genetic variant in the *FKBP5* gene. FKPB5 determines how effectively the organism can react to stress, and by this regulates the entire stress hormone system. The scientists hoped to cast light on the mechanisms of this gene-environment interaction by comparing modifications of the DNA sequence of victims who had not become ill with that of those who had.

The Munich-based Max Planck scientists were then able to demonstrate that the genetic *FKBP5* variant does make a physiological difference to those affected, also in nerve cells. Extreme stress and the associated high concentrations of stress hormones bring about what is called an epigenetic change. A methyl group is broken off the DNA at this point, causing a marked increase in *FKBP5* activity. This lasting epigenetic change is generated primarily through childhood traumatisation. Consequently, no disease-related demethylation of the *FKBP5* gene was detected in participants who were traumatised in adulthood only.

Torsten Klengel, a scientist at the Max Planck Institute of Psychiatry, explains the findings of the study as follows: "Depending on genetic predisposition, childhood trauma can leave permanent epigenetic marks on the DNA, further de-repressing *FKBP5* transcription. The consequence is a permanent dysregulation of the victim's stress hormone system, which can ultimately lead to psychiatric illness. Decisive for victims of childhood abuse, however, is that the stress-induced epigenetic changes can only occur if their DNA has a specific sequence."

This recent study improves our understanding of psychiatric illnesses which arise from the interaction of environmental and genetic factors. The results will help tailor treatment particularly for patients who were exposed to trauma in early childhood, thereby greatly increasing their risk of illness.

Men and Women Explore the Visual World Differently

ScienceDaily (Nov. 30, 2012) — Everyone knows that men and women tend to hold different views on certain things. However, new research by scientists from the University of Bristol and published in PLoS ONE indicates that this may literally be the case.

Researchers examined where men and women looked while viewing still images from films and pieces of art. They found that while women made fewer eye movements than men, those they did make were longer and to more varied locations.

These differences were largest when viewing images of people. With photos of heterosexual couples, both men and women preferred looking at the female figure rather than the male one. However, this preference was even stronger for women.

While men were only interested in the faces of the two figures, women's eyes were also drawn to the rest of the bodies -- in particular that of the female figure.

Felix Mercer Moss, PhD student in the Department of Computer Science who led the study, said: "The study represents the most compelling evidence yet that, despite occupying the same world, the viewpoints of men and women can, at times, be very different.

"Our findings have important implications for both past and future eye movement research together with future technological applications."

Eye movements are a tool used to collect visual information, which then colours an individual's perception of the world. Equally, when individuals have different interpretations of the world, this in turn affects the information they seek and, consequently, the places they look.

The researchers suggest that men and women look at different things because they interpret the world differently. The pictures preferred by women were the same pictures that produced the most distinct 'looking patterns'. Similarly, the pictures with the largest scope for a difference in

interpretation -- those with people -- also produced the largest differences between where men and women looked.

One perceptual sex difference in particular -- women's increased sensitivity to threat -- may explain a further finding. People's eyes are drawn to the most informative regions of an image while also being repelled from areas that carry possible threat or danger, for example the sun. Faces are a paradoxical example of a region that is both highly informative and potentially threatening, particularly if eye contact is made.

While men made direct eye contact with faces in the pictures; especially when primed to look for threat, women averted their gaze downward slightly towards the nose and mouth of these faces. The researchers claim that this may be due to women being more sensitive to the negative consequences of making direct eye contact and will, therefore, shift their gaze downward, towards the centre of the face.

Novel Studies of Gene Regulation in Brain Development May Mean New Treatment of Mental Disorders

ScienceDaily (Nov. 30, 2012) — A team of researchers at the University of California, San Diego and the Institut Pasteur, Paris has come up with a novel way to describe a time-dependent brain development based on coherent-gene-groups (CGGs) and transcription-factors (TFs) hierarchy. The findings could lead to new drug designs for mental disorders such as autism-spectrum disorders (ASD) and schizophrenia.

In the paper, published November 22 as an online-first publication in the journal *Genes, Brain and Behavior*, the researchers identified the hierarchical tree of CGG-TF networks that determine the patterns of genes expressed during brain development and found that some "master transcription factors" at the top level of the hierarchy regulated the expression of a significant number of gene groups.

Instead of a taking the approach that a single gene creates a single response, researchers used contemporary methods of data analysis, along with the Gordon supercomputer at the university's San Diego Supercomputer Center (SDSC), to identify CGGs responsible for brain development which can be affected for treatment of mental disorders. The team found that these groups of genes act in concert to send signals at various levels of the hierarchy to other groups of genes, which control the general and more specific (depending of the level) events in brain structure development.

"We have proposed a novel, though still hypothetical, strategy of drug design based on this hierarchical network of TFs that could pave the way for a new category of pharmacological agents that could be used to block a pathway at a critical time during brain development as an effective way to treat and even prevent mental disorders such as ASD and schizophrenia," said

lead author Igor Tsigelny, a research scientist with SDSC, as well as the university's Moores Cancer Center and Department of Neurosciences. "On a broader scale, these findings have the potential to change the paradigm of drug design."

Using samples taken from three different regions of the brains of rats, the researchers used Gordon and SDSC's BiologicalNetworks server to conduct numerous levels of analysis, starting with processing of microarray data and SOM (self-organizing maps) clustering, before determining which gene zones were associated with significant developmental changes and brain disorders.

Researchers then conducted analyses of stages of development and quick comparisons between rat and human brain development, in addition to pathway analyses and functional and hierarchical network analyses. The team then analyzed specific gene-TF interactions, with a focus on neurological disorders, before investigating further directions for drug design based on analysis of the hierarchical networks.

Tsigelny's collaborators included Valentina L. Kouzentsova (SDSC and Moores), Michael Baitaluk (SDSC); and Jean-Pierre Changeux, with the Institut Pasteur, in Paris, France. Changeux also is a Skaggs distinguished visiting professor in pharmacology at UC San Diego (2008) and a member of the foreign faculty at UC San Diego's Kavli Institute for Brain and Mind. In addition to SDSC and its computational resources, support for the research paper, called A Hierarchical Coherent-Gene-Group Model for Brain Development, was provided by National Institutes of Health grant # GM084881 for Baitaluk.

Working Couples Face Greater Odds of Intimate Partner Violence

ScienceDaily (Nov. 29, 2012) — Intimate partner violence is two times more likely to occur in two income households, compared to those where only one partner works, a recent study at Sam Houston State University found.

The study, conducted by Cortney A. Franklin and Tasha A. Menaker and supported by the Crime Victims' Institute, was titled, "Differences in Education/Employment Status and Intimate Partner Victimization." It looked at the impact of education levels and employment status differences among heterosexual partners on intimate partner victimization. While differences in education levels appeared to have little influence on intimate partner violence, when both partners were working, intimate partner violence increased.

"When both male and females were employed, the odds of victimization were more than two times higher than when the male was the only breadwinner in the partnership, lending support to the idea that female employment may challenge male authority and power in a relationship," said Franklin and Menaker.

The study was based on telephone interviews with 303 women who identified themselves as either currently or recently in a serious romantic relationship. Based on the Fourth Annual Texas Crime Victimization Survey, a total of 67 percent of these women, who ranged in age from 18 to 81, reported some form of physical or psychological victimization by their partner during the preceding two year period. These actions included having something thrown at them; being pushed, grabbed or shoved; slapped, hit, kicked or bitten; or threatened with a gun or knife.

The study found that more than 60 percent of women in heterosexual working couples reported victimization, while only 30 percent of women reported victimization in cases when only the male partner was employed.

"When women are home-bound through their role as domestic workers, they lack connections to co-workers and the social capital that is produced through those connections, in addition to wages, job prestige, resources, and thus, power. In turn, they must rely solely on their male partner for financial sustenance and can benefit from the distinction that his employment brings the couple," said Franklin and Menaker. "Those women who work outside the home have access to these tangible and intangible assets, which may devalue or, in some cases, even undermine the contributions and provisions supplied by male-only employment."

The study also explored other factors that may contribute to intimate partner violence, including witnessing violence by a parent during childhood, accepting the use of violence in adult relationships, and experiencing relationship distress, such as problems generated by money, chores, social activities or sexual relations. Distress in the relationship and witnessing intimate partner violence during childhood increased the odds of victimization.

Finally, the study found that Hispanic women were significantly less likely than white females to report intimate partner violence and that older women of all races/ethnicities were less likely to be victimized than younger women. As a result of these findings, Franklin and Menaker recommended that clinicians who treat victims of intimate partner violence develop specific strategies to address these risk factors and cultural differences. The study also suggested that clinicians should target youth who have witnessed violence during childhood with additional programming for better methods of conflict resolution among adults in intimate relationships.

The full study is scheduled to be published in the journal, *Violence Against Women*, in the near future.