Oxytocin: Potential treatment for Autism

By JAMES OTTAR GRUNDVIG

Finding a cure for autism will succeed with a global, interdisciplinary, coordinated endeavor. To unlock the roots of the disorder and treat autistic persons will require the merging of the three rivers that feed the research pool: science at the medical and institutional level, government funding and sponsorship, and the advocacy of the autism community.

It will be a long road that will take a few advanced treatments, combined with several more tertiary ones, and early intervention to succeed. As with many types of cancer, there will be cures—many of them—that will combat, reduce, or eliminate the ailments and deficits that make up the autism spectrum disorders (ASD) umbrella.

That was the core message I took from Dr. Eric Hollander, chair of the advisory board of the International Center for Autism Research & Education (ICare4Autism), when I interviewed him on a crisp winter day.

For the past two decades, Hollander has exemplified dedication to unravel the mysteries of autism. His research into the neurological division of spectrum kids has been an interdisciplinary collaborative process in the scientific community. Like most medical research, it involved years of conducting studies and reporting on their findings.

What he focused on, however, seemed at first glance mundane: oxytocin, also known as the "love hormone," and how it related to autism. But sometimes a small, overlooked detail can lead to something bigger. Even the abstract concept of trust biochemically has roots in concrete cause and effect.

Oxytocin is a peptide—a chain of amino acids that make up proteins—natural to the brain in most mammals.

"Oxytocin is synthesized into the brains limbic systems, which govern emotions. It stimulates social memories; reinforces reward," Hollander said. "My research into oxytocin came from translational research, the study of oxytocin in animals and how it might be applied or translated to humans."

The first studies on oxytocin were conducted on voles, rodents related to lemmings. The research broke voles into two types, which Hollander calls "those that were asocial and those that were very social with strong pair bonds." The asocial voles would protest with a lot of vocalization, Hollander said, but if they were injected with oxytocin, this kind of behavior would decrease.

Further tests were done on other animals in laboratory settings during the 1990s, and the results were coherent with that on voles. Then, Hollander started experiments exploring the potential benefits of oxytocin on autism in humans.

"Oxytocin enhanced social memory," he said zealously. "It surprised us how well it worked."

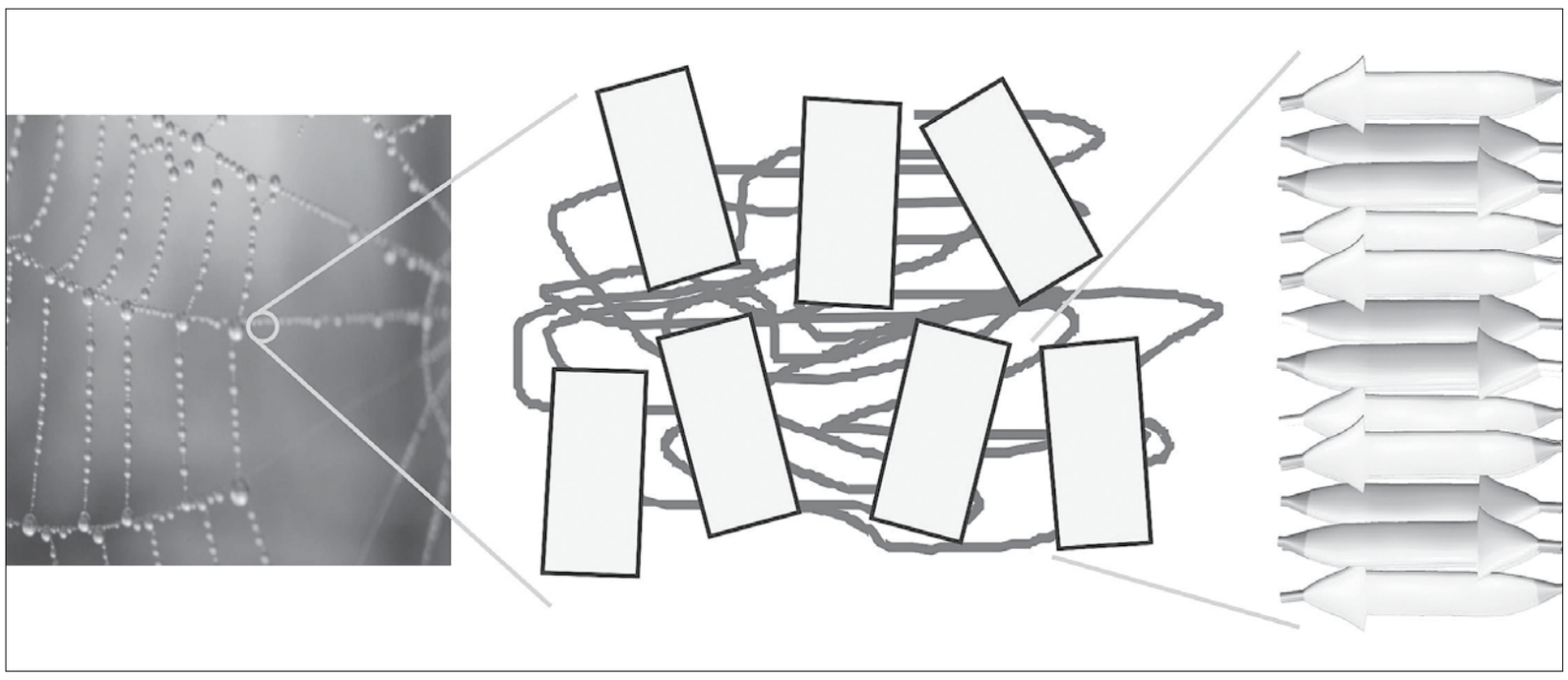
The wonder with the hormone is that it appeared to do more than merely take an asocial individual and make that person gregarious. Hollander mentioned a recent study where young autistic adults were given oxytocin therapy. On top of improved social cognition, their stereotyped behaviors (also known as stimming), repetitive movements like body rocking, were lessened.

"The improvements were preserved for a two-week period on a single dose," Hollander said.

Hollander plans to conduct more studies to "expand the database in the young adults with autism," he said. "We need to acquire evidence by the studies that oxytocin treatment works."

This summer, he will take the show on the road to Jerusalem at the ICare4Autism 2010 International Autism Conference. He is also chairman of the science advisory board for the nonprofit organization.

James Ottar Grundvig is a writer living in New York City who has an autistic child.



STRUCTURE OF SILK: The filled regions are the key cross-linking domains in silk's beta-sheet crystals, which are only a few nanometers in size. The strength of silk is controlled by how much force these cross-linking domains can take. COURTESY OF M.J. BUEHLER/MIT

Spider silk reveals a paradox of super-strength

National Science Foundation

Since its development in China thousands of years ago, silk from silkworms, spiders, and other insects has been used for high-end, luxury fabrics as well as for parachutes and medical sutures. Now, National Science Foundation-supported researchers are untangling some of its most closely guarded secrets and explaining why silk is so super-strong.

Researchers at the Massachusetts Institute of Technology's Center for Materials Science and Engineering say the key to silk's pound-for-pound toughness, which exceeds that of steel, is its beta-sheet crystals, the nano-size cross-linking domains that hold the material together.

Markus Buehler, the Esther and Harold E. Edgerton Associate Professor in MIT's department of civil and environmental engineering, and his team recently used computer models to simulate exactly how the components of beta-sheet crystals move and interact with each other. They found that an unusual arrangement of hydrogen bonds—the "glue" that stabilizes the beta-sheet crystals—plays an important role in defining the strength of silk.

They found that hydrogen bonds, which are among the weakest types of chemical bonds, gain strength when confined to spaces on the order of a few nanometers in size. Once in close proximity, the hydrogen bonds work together and become extremely strong. Moreover, if a hydrogen bond breaks, there are still many hydrogen bonds left that can contribute to the material's overall strength, due to their ability to "self-heal" the beta-sheet crystals.

The researchers conclude that silk's strength and ductility—its ability to bend or stretch without breaking—results from this peculiar arrangement of atomic bonds. They say that controlling the size of the area in which hydrogen or other chemical bonds act can lead to significantly enhanced properties for future materials, even when the initial chemical bonds are very weak.

The journal Nature Materials reported the findings online March 14.

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Technological fixes can have serious consequences

By DAVID SUZUKI with FAISAL MOOLA

In 1962, Rachel Carson galvanized a global environmental movement with her book Silent Spring. Before she wrote about the unexpected consequences of pesticides – including bioaccumulation of toxic molecules up the food chain – scientific innovations such as DDT dazzled us with their promise of greater control over the forces impinging on our lives.

We often look to technological fixes without acknowledging our ignorance about how the world works, and then we end up trying to correct the unexpected problems that result. When we began to use CFCs in large amounts, scientists had no idea they might affect the ozone layer. Salmon farms seemed like a good idea, but no one anticipated parasitic sea-lice outbreaks that would harm wild salmon.

Scientists find clever ways to tease out information about our world. And everywhere we look, we discover new challenges because our knowledge is so primitive. Accumulating toxic pollutants in air, water, soil, and our bodies; vanishing species; loss of nutrients in topsoil; ocean degradation – all these provide warnings that human numbers, consumption, and activity are undermining the very things that keep us alive.

Climatologists have accumulated a powerful set of observations and models pointing to fossil-fuel use as the cause of global warming. Obviously, the solution is to reduce the amount of greenhouse gases we create so the biosphere can sop up the rest.

Some imaginative suggestions would allow us to continue to burn fossil fuels without reduction: giant umbrellas in space to shield the Earth from the sun, aerosols of sulphide to mimic volcanic emissions that reflect sunlight, and so on. Two that have attracted attention are carbon seeding in oceans and carbon capture and sequestration on land.

The first involves putting iron into the oceans to fertilize waters where the lack of carbon limits algae growth. In the lab, it has been shown that adding this carbon to Antarctic Ocean water, for example, leads to massive increases in the algal populations. Companies have been formed on the promise that putting carbon into oceans to induce algal blooms will help absorb carbon dioxide from the atmosphere. Now, in a paper in the prestigious journal Proceedings of the National Academy of Sciences USA, scientists report that this process can cause the blooming of plants that produce deadly neurotoxins. Oops.

The second suggestion is carbon capture and sequestration. Prime Minister Stephen Harper has avoided discussion about the serious impacts of climate change on Canada and the economic implications of failing to reduce emissions. Instead, government policy is based on the fear that reducing emissions will be economically destructive, so we will wait instead for the development of methods to pump carbon dioxide into the ground.

This technique is based on an observation that when carbon dioxide is pumped into depleted wells so that more oil can be recovered, the CO_2 doesn't come back out. This has led to a hope that we can capture much of the CO_2 from smokestacks, coal plants, and the tar sands and simply inject it into the ground – out of sight, out of mind.

But wait. While we once thought that life petered out at bedrock, we now know that life exists up to three kilometres underground. Bacteria from deep underground are so different from anything we know aboveground that we need entire new categories to describe them. Scientists estimate that the weight of all the organisms underground is greater than the weight of all life above it, including whales, trees, and people! Scientists know very little about the role these organisms play in transfer of heat from magma or the flow of nutrients and water in the subterranean world, yet we are contemplating pumping millions of tonnes of CO_2 into that mysterious world.

I once asked Tullis Onstott of Princeton University, one of the world's top experts on underground life, what effect CCS might have on them. His reply? "I don't know, but the methanogens will love it."

"What are methanogens?" I asked. He said they take up carbon dioxide and produce methane, a greenhouse gas 22 times more potent than carbon dioxide!

We have so many ways to reduce our emissions and to save money and resources by becoming more efficient. Yet we avoid doing them on the hope of a totally untried technological promise that could have enormous negative consequences. Does this make sense?

Take David Suzuki's Nature Challenge and learn more at www.davidsuzuki.org.

Mystery behind half-male, half-female chickens

By HELENA ZHU
Epoch Times Staff

Why are some birds male on one side and female on the other? This question has puzzled scientists for centuries, but it will no longer.

A group of researchers from the Roslin Institute at the University of Edinburgh conducted a study involving rare, naturally occurring chickens with white (male) plumage on one side and brown (female) plumage on the other.

For centuries, it was thought that sex chromosomes in birds determined whether a testis or an ovary forms, and then the hormones would control sexual traits.

The researchers, however, identified differences between male and female cells that control the development of sexual traits. They have named the phenomenon cell autonomous sex identity (CASI).

"This research has completely overturned what we previously thought about how sexual characteristics were determined in birds," said lead researcher Dr. Michael Clinton in a press release.

"We now believe that the major factors determining sexual development are built into male and female cells and derive from basic differences in how sex chromosome genes are expressed. Our study opens a new avenue for our understanding of sexual development in birds.

"It also means we must now reassess how this developmental process occurs in other organisms. There is already some evidence that organs such as the heart and brain are intrinsically different in males and females and birds may provide a model for understanding the molecular basis for these gender differences."

The findings, published in the journal Nature, could also lead to improvements in poultry production through indentifying some of the molecular differences between male and female cells, which could lead to better tests for sexing embryos prior to hatching.

The group will now study the molecular mechanisms underlying the differences between male and female cells, with a grant of 800,000 pounds from the Biotechnology and Biological Sciences Research Council (BBSRC), the U.K.'s leading biosciences agency.

Rapid response oceanographic expedition sent to Chile

National Science Foundation

Scientists funded by the National Science Foundation (NSF) and affiliated with the Scripps Institution of Oceanography (SIO) at the University of California at San Diego are undertaking an expedition to explore the rupture site of the 8.8-magnitude Chilean earthquake.

The quake is one of the largest in recorded history.

The scientists hope to capitalize on a unique scientific opportunity to capture fresh data from the event. They will study changes in the seafloor that resulted from movements along faults and submarine landslides.

The "rapid response" expedition, called the Survey of Earthquake And Rupture Offshore Chile, will take place aboard the research vessel Melville.

The Melville was conducting research off Chile when the earthquake struck.

"This rapid response cruise is a rare opportunity to better understand the processes that affect the generation and size of tsunamis," said Julie Morris, NSF division director for Ocean Sciences. "Seafloor evidence of the quake will contribute to understanding similar earthquake regions worldwide."

An important aspect of the rapid response mission involves swath multibeam sonar mapping of the seafloor to produce detailed topographic maps. Data from mapping the earthquake rupture zone will be made public soon after the research cruise ends, Morris said.

The new data will be compared with pre-quake data taken by scientists at Germany's Leibniz Institute of Marine Sciences (IFM-GEOMAR).

Several years ago, IFM-GEOMAR researchers conducted a detailed multibeam mapping survey off Chile. Their data will be valuable for comparisons with the new survey to expose changes from the earthquake rupture, say researchers.

"We'd like to know if the genesis of the resulting tsunami was caused by direct uplift of the seabed along a fault, or by slumping from shaking of sediment-covered slopes," said Dave Chadwell, an SIO geophysicist and chief scientist of the expedition.

"We will look for disturbances in the seafloor, including changes in reflectivity and possibly shape, by comparing previous data with the new [rapid response] data."

The rapid response cruise is possible because the vessel Melville is currently in Chilean waters, where a research team has been conducting an investigation of the geology and biology of the Chilean margin.

"This is a unique case in which we have the shipboard assets, the scientific agenda, and the funding all in place," said Bruce Appelgate, associate director for Ship Operations and Marine Technical Support at SIO. "The earthquake was a tragedy for the people of Chile, but we hope this opportunity enables important new discoveries that can help us plan for future events."

The logistical details of undertaking the expedition are enormous and constantly evolving due to uncertainties regarding transportation infrastructure in Chile.

Port facilities are limited due to widespread earthquake devastation, making fueling and provisioning the ship difficult.

Chadwell and SIO scientist Peter Lonsdale, along with graduate students Jared Kluesner and Ashlee Henig, and Scripps Geological Data Center analyst Aaron Sweeney, will be aboard Melville for the eight-day expedition.

The scientists, along with Scripps researchers Mike Tryon and Mark Zumberge, also will deploy depth sensors on the seafloor to record possible abrupt vertical motions over the next year.

The U.S. scientists will be joined by Chilean researchers Juan Díaz and Matias Viel González from Universidad Católica in Valparaíso, as well as scientists from IFM-GEOMAR.