# Semen protects against preeclampsia

A dangerous form of high blood pressure that strikes during pregnancy appears to be linked to the duration of the mother's sexual relationship with the father, a new study shows. The researchers believe that prolonged exposure to the father's semen helps trigger a protective response in the mother that later wards off this illness.

Doctors understand very little about what causes pregnancy-induced hypertension, including preeclampsia. Researchers know that the disorder most often affects women pregnant for the first time. But the new findings suggest that women who have just begun a sexual relationship with the father face the highest risk of this condition.

From February to July 1993, Pierre-Yves Robillard of the University Hospital of Pointe à Pitre, Guadeloupe, French West Indies, and his colleagues collected information from 957 women who had just delivered a baby in the hospital. The researchers gathered data about paternity by interviewing the mothers without their partners present.

The investigators noted that 102 of the women had developed pregnancy-induced hypertension. The majority had the mildest form of the disorder. However, 19 had progressed to preeclampsia, characterized by high blood pressure and protein in the urine. And two women had full-blown eclampsia, which can cause death.

The threat of preeclampsia increases significantly when pregnancy occurs within the first year of a sexual relationship, the researchers discovered. If a woman becomes pregnant within the first 4 months of such a partnership, her risk of developing preeclampsia is 12 times higher than if she had been with her partner for at least a year.

Although the incidence of preeclampsia declines in subsequent pregnancies, women who change their sexual partner reinstitute the risk of this disorder. In fact, such women are five times as likely to develop the condition as pregnant women who have remained with the father of their previous children, the team discovered. Robillard and his colleagues report their findings in the Oct. 8 LANCET.

Something in male ejaculate may help protect a woman from preeclampsia — if she's been repeatedly exposed to it, says David A. Clark of McMaster University in Hamilton, Ontario. Researchers don't know whether the sperm itself, the accompanying white cells, or the nourishing liquid called seminal plasma is responsible for the shielding effect.

Such a concept is not as far-fetched as it may sound. For example, scientists already know that substances from the father lead to a beneficial immune response in the mother that helps sustain a healthy placenta. In preeclampsia, blood flow through the placenta is inadequate. — *K.A. Fackelmann*

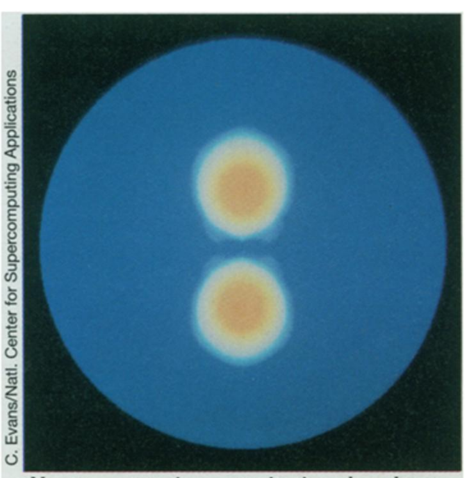
# Natural mass limit for neutron-star pairs?

Many stars that begin life as heavyweights die a spectacular death. Gravity squeezes the core of such stars so forcefully that protons and electrons fuse; the center becomes a ball of neutrons. A rebounding shock wave then moves out from the compact core, ejecting the star's outer layers in a colossal explosion called a supernova. Only the naked core remains, a blob of nuclear material with more mass than the sun packed into a sphere only 20 kilometers in diameter.

Welcome to the realm of neutron stars, in which a speck of material just big enough to cover the period at the end of this sentence weighs about 100,000 tons.

In theory, the mass of neutron stars ranges from one-tenth to about twice the mass of the sun. But astronomers have known for more than a decade that at least some of these stars — those that exist in pairs — have a much more restricted mass range. Now, a new analysis of neutron-star pairs supports the assertion that formation mechanisms, rather than such general considerations as the stability of superdense matter, limit the mass of such neutron stars.

In addition, says Lee Samuel Finn of Northwestern University in Evanston, Ill., knowing the masses of binary neutron stars will prove invaluable for analyzing observations with a set of gravitational



C. Evans/Natl. Center for Supercomputing Applications

*Neutron stars in a gravitational embrace.*

# Nobel for translator of cell messages

An array of chemicals orchestrates activities between and within cells. This week, a pair of molecular pharmacologists won a Nobel prize for their work identifying the family of agents responsible for relaying into cells the commands of hormones, drugs, and other external chemical messengers.

A 1971 Nobel prize honored the man who demonstrated that hormones work by carrying explicit commands to the outside of target cells. But before a cell can execute such a directive, something in the cell's barrier membrane must first convert that external command into the language of the "second messengers." These communicators are charged with relaying signals within the cell.

Martin Rodbell, retired from the National Institute of Environmental Health Sciences in Research Triangle Park, N.C., and Alfred G. Gilman at the University of Texas Southwestern Medical Center at Dallas share this year's Nobel Prize in Physiology or Medicine for identifying G proteins, which translate and integrate external signals for the cell's second messengers.

Fourteen years ago, Rodbell discovered that cellular communications relied on the presence of a molecule known as GTP (guanosine triphosphate). Seven years later, Gilman, then at the University of Virginia School of Medicine in Charlottesville, showed that GTP was located on the inner surface of cell membranes — bound to things that he termed G proteins.

Rodbell went on to study G proteins and how they interpret the cacophony of ambient signals for healthy functioning. (Faulty G proteins have recently been linked to disease, including cancer.) In his most recent work, Gilman has been teasing out the shape and function of G proteins and their targets.

National Institutes of Health Deputy Director Ruth L. Kirschstein says both men "made significant findings [on] how cells perceive and react in a coordinated way to the thousands of messages that bombard them. This Nobel prize underscores how important such basic studies are to understanding normal cell function and the diseases that result when cell processes go awry." — *J. Raloff* wave detectors now under construction.

Finn's study, detailed in the Oct. 3 PHYSICAL REVIEW LETTERS, examines existing data on four pairs of neutron stars. One star in each pair acts as a celestial lighthouse, beaming radio waves toward Earth at intervals so precise it rivals the steadiness of the best atomic clocks. Tightly bound by gravity, the other neutron star betrays its presence by periodically delaying or advancing the arrival of the radio signals beamed by the first.

Using radio telescopes to detect the signals, astronomers have determined the mass of each member of the neutron-star duos. All of them seem to be about 1.4 times as massive as the sun.

The four pairs represent a tiny fraction of the total number of neutron stars thought to have other neutron stars as partners. But according to Finn, his analysis of this small sample reveals with high statistical certainty that all binary neutron stars range between 1.01 and 1.6 times the mass of the sun.

The finding has several implications, Finn notes. One possibility is that nature's way of making neutron stars, typically in a supernova explosion, may simply not permit them to have more mass than his analysis indicates — whether or not they have a partner. In that case, the restricted mass range could help fine-tune theories about neutron-star formation, Finn says. Alternatively, he notes, the mass limits may not apply to neutron stars that lack a partner. However, scientists have no way of measuring the mass of isolated neutron stars.

The mass limits have additional significance, Finn says. The collision of two neutron stars represents a key source of gravity waves sought by the laser interferometer gravitational wave observatory (LIGO). This pair of detectors, to be located near Livingston, La., and in Hanford, Wash., is slated for completion in 1999. The intensity of the waves depends largely on the mass of the neutron stars, and "of all the sources of gravitational radiation that we can anticipate, this is the one that LIGO is most likely to see," he says. *—R. Cowen*

## Making light of sound in solitary bubbles

Trapped in an intense sound wave, a tiny gas bubble in water can emit a string of flashes bright enough to be visible in an undarkened room. Producing a startling sound-and-light show on an intriguingly small scale, this simple system serves as a remarkable microlaboratory for physics and chemistry.

Now, researchers have demonstrated that slight changes in the composition of the gas inside such a bubble can strongly influence the intensity and wavelengths of the light that escapes. For example, adding a small amount of argon, xenon, or helium to a nitrogen bubble substantially increases the intensity of ultraviolet light emission.

Physicists Robert Hiller, Keith Weninger, Seth J. Putterman, and Bradley P. Barber of the University of California, Los Angeles, describe their findings in the Oct. 14 SCIENCE.

When an intense sound beam travels through water, it creates microscopic cavities that immediately fill with gas originally dissolved in the liquid. Such bubbles alternately expand and contract in step with regular changes in the sound wave's pressure.

During the contraction phase, a bubble can collapse so violently and rapidly that it concentrates the sound energy sufficiently to heat the enclosed gas to temperatures exceeding 10,000 kelvins. The heated gas luminesces, giving off an extremely bright flash of visible and ultraviolet light lasting less than 50 picoseconds.

Although researchers have known about this effect — called sonoluminescence — since the 1930s, they still do not have a complete understanding of how it works (SN: 10/23/93, p.271). The experiments of Hiller and his coworkers represent one attempt to elucidate the process.

The researchers found that raising the noble gas content of a nitrogen bubble in water to 1 percent dramatically stabilizes the bubble's motion. It also increases the intensity of light emission by a factor of at least 10.

At the same time, the spectrum of light generated by a bubble depends strongly on the gas inside the cavity. A bubble containing argon produces ultraviolet light that peaks at a wavelength of 300 nanometers. However, a helium-laced bubble shows no such peak.

"Some exciting atomic physics may be occurring within the collapsing cavitation bubble that gives rise to [single-bubble sonoluminescence]," Lawrence A. Crum and Ronald A. Roy of the University of Washington in Seattle comment in the same issue of SCIENCE. "However, many of the results [Hiller and his colleagues] present are also anomalous and defy immediate explanation."

Clearly, further investigations are necessary to pin down how sonoluminescence occurs. At the same time, the new results suggest the possibility of using gas impurities for improved control of the characteristics of light emissions from collapsing bubbles. *— I. Peterson*

## Shuttle radar views erupting volcano

*Radar aboard the U.S. space shuttle Endeavour captured this false-color image of the Kliuchevskoi volcano in full eruption just 1 day after it roared to life Sept. 30 on Russia's isolated Kamchatka Peninsula.*

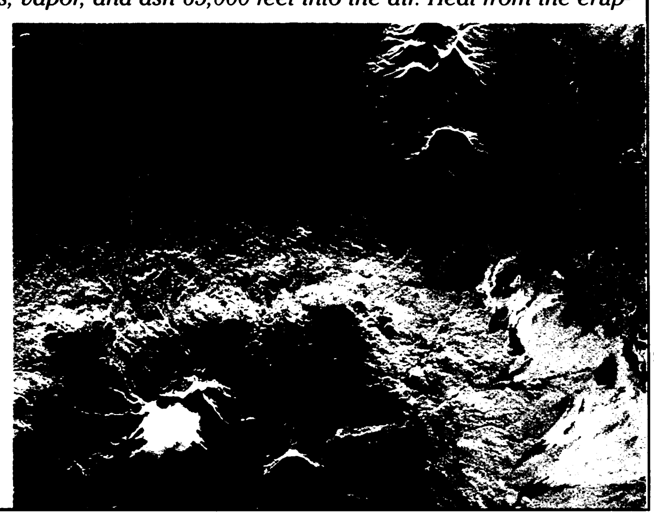
*Kliuchevskoi, the white peak surrounded by red (lower left), overlooks the Kamchatka River, which runs like a black squiggle across the image. The green, wrinkly mound (upper right) is a dormant volcano. The area pictured covers about 18 miles by 37 miles. One of the most active volcanic zones in the world, the region sits on the boundary between two colliding continental plates.*

*The yellowish green lines on the flanks of Kliuchevskoi denote lava flows, and they look surprisingly distinct, says David C. Pieri of NASA's Jet Propulsion Laboratory in Pasadena, Calif. "There's something different about those flows... it bears looking into," he says.*

*Kliuchevskoi shot gas, vapor, and ash 65,000 feet into the air. Heat from the eruption melted snow that triggered mud slides, which may threaten homes to the north.*

*Geoscientists find radar imaging techniques particularly useful for studying erupting volcanoes because they can penetrate clouds and show a volcano's topography clearly, says Pieri. However, the images do not reveal the plume or the heat coming from the volcano.*

— T. Adler



Calif. Institute of Technology/Jet Propulsion Lab.