Proteins linked to synaptic 'memory'

Several investigators have noted that when individual neurons are given brief but intense bursts of high-frequency electrical stimulation, their electrical properties change and chemical transmissions across their connecting synapses increase for hours or days. This process, known as long-term potentiation and readily demonstrated in cells from a small brain structure called the hippocampus, may play a crucial role in the formation of memories.

Stanford University School of Medicine researchers report that the protein kinases – several related substances involved in the regulation of chemical messengers and their receptors in neurons – are key to the chemical mechanisms underlying long-term potentiation.

Physiologist Roberto Malinow and his colleagues used two protein-kinase-inhibiting substances to study long-term potentiation in rat hippocampus cells. When either of the two substances – sphingosine or a synthetic compound called H7 – is applied to hippocampal synapses shortly before high-frequency stimulation, long-term potentiation is blocked, the investigators note in the Oct. 27 NATURE.

But sphingosine, which subdues the activity of two protein kinases, does not dampen the increased electrical charge associated with long-term potentiation when applied immediately after the stimulation. In contrast, H7 – which interferes with the activity of additional protein kinases – inhibits long-term potentiation even after high-frequency stimulation clearly establishes the effect. Surprisingly, the researchers add, when H7 degrades after several hours, there is an almost complete recovery of the original long-term potentiation.

The results indicate a "sphingosine-sensitive process" is critical to induce long-term potentiation, the researchers suggest, whereas an unidentified protein kinase affected by H7 is crucial for its maintenance.

Unfortunately, writes biologist Mary B. Kennedy of the California Institute of Technology in Pasadena in an accompanying comment, both sphingosine and H7 are insufficiently specific to distinguish among the several known protein kinases. Even if the critical protein kinases are pinned down, says Kennedy, much remains to be explained about long-term potentiation. There are now indications that one class of postsynaptic receptors involved in this process releases a chemical messenger able to travel back and forth across the synapse.

"Other entirely new messenger systems may be awaiting discovery," Kennedy concludes. – *B. Bower*

A mother's vaccine to protect baby too

Group B streptococcus (GBS) bacteria can sicken and kill newborns. Now researchers are testing a promising vaccine given to pregnant women in the hope that maternal antibodies passed on to the developing fetus will protect it from GBS infection during the first months of life outside the womb.

"This is the first time pregnant women have been immunized with a vaccine to prevent group B streptococcal infection," comments Richard A. Insel, a pediatrics professor at the University of Rochester (N.Y.). The vaccine was tested by Carol J. Baker from the Baylor College of Medicine in Houston and her colleagues, who describe their results in the Nov. 3 NEW ENGLAND JOURNAL OF MEDICINE.

About 11,000 neonatal GBS cases are reported annually in the United States; up to 3,000 infants die from GBS-associated pneumonia, meningitis and other infections. Even infants who survive can be left with lifelong disabilities such as mental retardation and hearing loss. GBS also affects an estimated 48,000 new mothers each year, infecting the bloodstream or caesarean incisions after delivery.

Though the trauma of delivery makes these women vulnerable, most other adults with a fully functional immune system experience no trouble with the bacteria. Infants are at risk because they are born with an underdeveloped immune system and depend on the mother's antibodies for protection. But some pregnant women lack GBS antibodies, and others don't have enough to protect the developing fetus. Public health authorities have long speculated that a maternal vaccine would prevent illness in both mother and baby.

Baker and her colleagues tested that theory by giving a GBS vaccine to 40 pregnant women, 35 of whom had insufficient GBS antibodies. The vaccine increased antibody levels in 63 percent of the mothers. Of the 25 babies born to women who responded to the vaccine, 80 percent had protective antibody levels at 1 month of age and 64 percent had them at 3 months.

The researchers made the vaccine from the coat surrounding the bacteria. "There were no systemic reactions to it," says Dennis L. Kasper from Harvard Medical School in Boston, a coauthor who developed the vaccine.

The study is a pilot, Baker stresses. A larger trial is needed to measure the vaccine's effectiveness and its safety for both mother and fetus. – *K. Fackelmann*