Substance P halts nerve degeneration

Of the many proteins in the brain, one of the more many-faceted is substance P. It was recently found to serve as a chemical messenger between nerves and to send pain signals through the spinal cord (SN: 6/27/81, p. 407). And now it also looks promising as a treatment for nerve degeneration in the brain, G. Jonsson and H. Hallman of the Karolinska Institute in Stockholm report in the Jan. 1 SCIENCE.

Jonsson and Hallman gave some newborn rats 6-hydroxydopamine (6-OHDA). This toxic chemical is known to destroy the implantation of certain nerves in the brain — a situation more or less comparable to nerve degeneration. They gave other newborn rats injections of substance P, and still another group 6-OHDA followed by injections of substance P. The rats were then killed so that the effects of 6-OHDA and substance P on the nerves in their brains could be determined.

As expected, 6-OHDA destroyed the innervation of certain nerves in the brains of those rats that had received it alone. Substance P, in contrast, had no significant effect on the nerves in the brains of the rats that had gotten only it. However, of those rats that had received 6-OHDA followed by substance P, the nerve-damaging effects of 6-OHDA in the brain were significantly countered by substance P.

A treatment for premature puberty

Although premature puberty can have adverse psychosocial effects and may also affect adult stature, there has been no adequate treatment for it. Now, however, one appears to have been found, Florence Comite of the National Institute of Child Health and Human Development in Bethesda, Md., and colleagues report in the Dec. 24 NEW ENGLAND JOURNAL OF MEDICINE. It is an analog of luteinizing hormone-releasing hormone (LHRH), one of the hormones secreted by the hypothalamus below the brain.

Puberty is known to be switched on by LHRH, which in turn leads to the release of gonadotropic hormones from the pituitary. The release of these hormones stimulates secretion of sex hormones, which in turn brings about the sexual changes characteristic of puberty such as breast development or the growth of pubic hair. But if LHRH or an analog thereof is given to humans, various investigators have found, it has a paradoxical effect — it at first stimulates the release of gonadotropic hormones, but then switches them off. So Comite and her team thought that an analog of LHRH might prove to be an effective treatment for premature puberty and treated five girls with the disorder with it daily for eight weeks. As they report, it worked, significantly decreasing the patients' secretion of gonadotropic hormones and estrogen.

UV light and cataracts

Because ultraviolet light is able to obscure the lens of the eye and because cataracts consist of a clouding of the lens of the eye, Fred Hollows and David Moran of the Prince of Wales Hospital/University of New South Wales, Australia investigated whether ultraviolet light might be able to cause cataracts. They studied the ultraviolet light exposure and vision of 64,000 Aborigines and of 41,000 non-Aborigines.

And as they report in the Dec. 5 LANCET, there was a highly significant link between cataract prevalence and ultraviolet light exposure among the Aborigines, showing that ultraviolet light can sometimes cause cataracts. Such a link, however, did not exist among non-Aborigines, which the researchers believe can be explained by the fact that non-Aborigines protect their eyes from too much ultraviolet light with housing and sunglasses.

No fractional charge on mercury

Physicists generally believe that electric charge is quantized. That is, all electric charges are integral multiples of the charge on the electron. Less than the electron charge is not allowed, nor are fractions between integers.

No theory mandates this quantization of charge. Belief in it is empirical. No experiment has exhibited fractional charges. Or, better, no experiment *had* ever exhibited fractional charges. There has been one exception in recent years, a long-running experiment done at Stanford University, under the direction of William Fairbank. Fairbank and co-workers have found a number of fractional charges on tiny niobium balls, and they keep reporting more and more.

What makes the Fairbank experiment even more puzzling is that other attempts to do much the same thing have failed to find fractional charge. The latest is reported in the Dec. 7 PHYSICAL REVIEW LETTERS by Christopher L. Hodges of the University of California at Riverside and Peter Abrams and eight others of San Francisco State University. They examined about 100,000 mercury drops and found no fractional charges.

Earlier attempts by different groups to find fractional charges on oil drops and iron balls have also failed. No serious errors of concept, execution or procedure have been publicly alleged against any of the experiments. Except for a suggestion that there is something unusual about niobium, there is no explanation for the discrepancy.

The question is doubly important because quarks, the basic units out of which subatomic particles are supposed to be built, are predicted to have fractional charge. But the fractional charges of quarks are not supposed to show themselves. Quarks are supposed to be unbreakably bound inside objects that have unit charge or zero. If quarks are showing themselves free as well as fractionally charged in the Fairbank experiment, that is a double violation of previously accepted physics.

Macroscopic laser quantum

Quantum effects generally belong to the microscopic world, the domain of atoms and smaller. A few macroscopic quantum effects have been observed, however, mostly in such things as the behavior of vortices in extremely cold, superfluid liquids. Such macroscopic quantum effects are of interest not only for themselves but as visible proof for minds that still may not be reconciled that quantum effects really do exist.

Now comes a macroscopic quantum effect in a laser. It is reported in the Dec. 28 PHYSICAL REVIEW LETTERS by P. Lett, W. Christian, Surendra Singh and L. Mandel of the University of Rochester in Rochester, N.Y. The effect takes place in what is called a homogeneously broadened two-mode ring laser. This is a dye laser in which the lasing dye is circulated around a cell. This particular kind of ring laser has within it traveling waves vibrating according to two different modes and competing to control the emission of the photons that are the light put out by the laser. The two modes compete to the point that one occasionally suppresses the other.

The theoretical explanation is that the two modes are metastable, which means basically that they last until something triggers their disappearance. That something seems to be a quantum fluctuation in the total lasing system that first suppresses one mode and then the other, switching the laser's output from one to the other abruptly.

Lett and co-workers did an experiment with a laser made of rhodamine-6G dye, in which they analyzed the laser's light for photons of one of the modes. They found that the probability peaks for zero and maximum amplitude for that mode came just where the quantum-fluctuation theory predicted them.