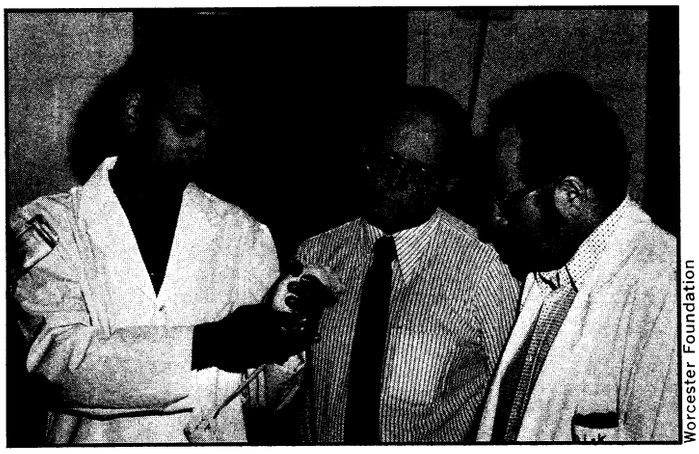

Worcester Foundation

Stern, Morgane and Resnick: Rodent studies demonstrate harmful effects of protein deprivation on the fetus and newborn.

slowest around the 13th day after birth, and then slowly returned to normal as the pups matured. Even though the responses returned to normal with maturity, the investigators believe the sluggish early responses to stimuli probably interfered with the animals' normal growth and development.

As for the behavioral effects of early protein deprivation, the Worcester scientists found that it enhanced the newborn rats' susceptiblity to seizure. They also found that the brains of these animals contained abnormally high levels of the nerve transmitter serotonin. This finding surprised them because past research has shown a strong link between seizures and low levels of serotonin. So they believe that serotonin cannot be a major determinant in seizures. They also found that these seizures could only be partly reversed by giving the rats adequate protein diets once they became adults. Thus, such damage appears to be irreparable.

The Worcester team has also shown that development of nerve cells in the cerebellum and hippocampus was retarded in the protein-deprived rats. The cerebellum is the area of the brain that controls movement; the hippocampus is the seat of memory.

These and past findings about the effects of early protein deprivation have practical implications for Americans, Morgane told SCIENCE NEWS. It appears that a mother need only be deprived of adequate protein right before and during pregnancy to harm the fetus she carries. And whereas the first 15 days of life are especially crucial for the rat's brain development, the last three months of pregnancy and the first year of life are crucial for humans' brain development. And many, if not all, of the harmful effects wrought during this period leave their marks for life.

It's quite possible—although exceedingly hard to prove—that many American children have learning and behavioral problems because they were deprived of necessary amounts of protein during fetal and neonatal life. □

Now you see it; Now you don't

Most people are familiar with the phenomenon of afterimages. If a person stares into the sun or at an intense light for any period of time, an afterimage will linger even though he or she may be looking away from the light source. Past research has shown that these images are not produced in the brain but originate in the eye itself.

Now two molecular scientists, Donald I. A. MacLeod and Mary Hayhoe, while working at Florida State University, have further pinpointed the site of afterimage production to be in the rods of the eye. Their findings are reported in the Sept. 27 SCIENCE.

When a person gazes at an object, the image is focused on the retina, somewhat like a newspaper photograph, as a series of points. The retina is made up of layers of rod and cone cells and each point of the image received corresponds to a rod or cone. Cones are best adapted for daylight, sharp stationary images and for color vision. The rods enable vision in dim light and are not color discriminative. When exposed to intense light, the cones take about five minutes to recover their sensitivity while rods take longer.

Prolonged afterimages occur when the visual pigments of the eye are bleached. The manner in which the afterimage appears depends upon the background it is viewed against. When the background is dark or the eyes are shut, the afterimage appears dimly against the dark background and is called the positive afterimage. When viewed against a bright background it appears dark and is called the negative afterimage. Afterimages against any unchanging background will fade within a few seconds. Generally a sudden change in background intensity will cause the afterimage to reappear.

MacLeod and Hayhoe found, however, that under some conditions a change in background will fail to revive the afterimage. In a series of experiments, they had an observer stare into a white light for 30 seconds. They found that for the first few minutes afterward, while the cones and rods remained insensitive, any change in background could revive the afterimage. But after seven or eight minutes, when the cones have recovered their sensitivity, the observer was able to locate a range of background intensities that failed to restore the afterimage. Above that range a negative afterimage would appear; below that range a positive image would appear.

In a second series of experiments, three totally colorblind persons (rod monochromats—persons for whom lights of different wavelengths appear identical to the rods) were asked to substitute background lights that are for them undistinguishable from the "condition" background. According to the researchers, the average radiances the rod monochromats chose were close to those chosen by the normal observers as having no effect on the afterimages. Thus only those backgrounds that are indistinguishable by rods (but very different for the cones) may be interchanged without reviving the afterimage. From this, MacLeod and Hayhoe deduce that the afterimages must be generated by the rods alone.

"During the first phase of recovery," MacLeod and Hayhoe conclude, "both rods and cones are locally insensitive and can generate afterimages. After seven minutes, the cones have recovered to the same fully dark-adapted sensitivity in the bleached area as in the rest of the retina. Being uniformly sensitive and uniformly stimulated, the cones cannot now create an afterimage, for they cannot signal a distinction between bleached and unbleached areas. Only the rods can now revive the afterimage, and they cannot revive it unless they detect the change of background." □

Early weapons to slay the mammoth

About 11,000 years ago in what is now the western United States, perhaps the first primitive North American hunters survived by hunting the fearsome mammoth. This extinct elephant had huge spiraling tusks often 10 feet long, and stood more than 12 feet high at the shoulder. It has always been difficult to understand how primitive men were able to down such giant prey.

Archaeologists Larry Lahren of the University of Calgary at Alberta and Robson Bonnichsen of the University of Maine at Orono report in the Oct. 11 SCIENCE the discovery of bone foreshafts in a burial site near Wilsal, Mont., and put forth a theory that