

BIOLOGY

Glimmer on fertilization

A flash of light from specially prepared fish eggs adds to the evidence that the dramatic metabolic changes after fertilization involve calcium movement within an egg. Calcium had been previously implicated by experiments where eggs were artificially activated without sperm (SN: 11/23/74, p. 327). Now Ellis B. Ridgway of the Medical College of Virginia and John C. Gilkey and Lionel F. Jaffe of Purdue University have actually seen the calcium concentration change in eggs during normal fertilization.

Ridgway and collaborators used the transparent eggs of medaka, a freshwater fish. They injected the eggs with a chemical that emits light when it combines with calcium ions. Eggs then gave off a "resting glow," which the researchers detected with a photomultiplier. Minutes after sperm was placed near an egg, light emission began increasing, reaching a peak of about 10,000 times the resting value and then returning to the base level. From their observations, reported in the February PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, Ridgway and co-workers infer that a sperm normally induces a small, localized rise in calcium concentration, which triggers an explosive calcium release from structures within the egg.

Reliably near-sighted monkeys

Good news for Mr. Magoo. Scientists may soon be able to analyze the mechanism of nearsightedness. Research on myopia has been severely limited because there was no good animal model, but now a simple, effective technique to obtain near-sighted monkeys is reported in the March 3 NATURE.

Researchers studying the development of connections between nerve cells in the eye and brain frequently suture together lids of one eye of an experimental animal for a period just after birth. Harvard neurobiologists Torsten Wiesel and Elio Raviola noticed that the closed eye became shortsighted. In further experiments they found that the length of the eye, from front to back, was up to 21 percent longer in the closed, than in the normal, eye. The degree of myopia increased with duration of eye closure, and the youngest animals were most sensitive. The induced myopia, which was independent of whether the other eye was open or closed, persisted for years after the lids were allowed to open.

Gonorrhea bacteria prove promiscuous

Public health officials are alarmed by the worldwide spread of a gonorrhea-causing bacteria that produces an enzyme able to destroy penicillin. B.I. Eisenstein and colleagues at the University of North Carolina School of Medicine have for the first time demonstrated that the gene for penicillin breakdown can be transferred between mating bacteria, either from one gonococcus to another or from gonococci to other species. Gene exchange by mating is considerably more efficient than the type of exchange previously recognized in these bacteria.

The researchers report in the March 11 SCIENCE that for two different strains of gonococci, a small ring of DNA, a plasmid, carries the gene for the enzyme that destroys penicillin. Only one of the two strains, however, was able to transfer the gene by mating. That strain also contains a larger plasmid, which may mediate the transfer.

Many plasmids carry drug-resistance factors, so these results are not surprising. But they raise the possibility that gonococci may acquire other drug-resistance genes by interaction of their plasmids with other plasmids. It is also conceivable that gonococcal plasmids may introduce penicillin resistance into bacteria that cause other diseases such as meningitis.

EARTH SCIENCES

Irrigation effects on rainfall

Seven years ago a government meteorologist set forth a new and controversial hypothesis that widespread irrigation in the Great Plains was enhancing summer rainfall in the area (SN: 12/27/69, p. 599). Reaction from scientists ranged from strong disbelief to cautious, tentative approval.

Now a two-year study supported by the National Science Foundation has provided strong support for the theory. The research was conducted by Paul T. Schickedanz of the Illinois State Water Survey under the direction of Stanley A. Changnon Jr. To separate irrigation effects from the climatic variability over space and time he used a multivariate statistical technique known as factor analysis.

"These results provided strong evidence of irrigation-related anomalies [increased rainfall] during the irrigated months," Schickedanz concludes in a 105-page final report to NSF. There was no evidence for any enhanced rainfall during nonirrigated months. The study shows irrigation-linked summer rainfall increases ranging from 19 to 35 percent, depending on location and size of area. Kansas, Nebraska and a large part of Texas were studied. The rain increase associated with the irrigation effect varied from 14 to 26 percent in June, 59 to 91 percent in July and 15 to 26 percent in August.

Of several possible mechanisms that could produce greater rainfall over irrigated regions, Schickedanz believes the most likely candidate is a "land-sea breeze effect" due to lowered temperature in the irrigated regions. The key factor is the presence of a cool, moist dome over the irrigated area.

The National Weather Service meteorologist whose theory is supported by this research, Lothar A. Joos, now retired, considers the finding important:

"To my knowledge the area affected is the largest in the world where man's intervention, whether inadvertent or planned (as in cloud seeding), has been shown to have increased rainfall to such a degree. Any thoughtful person is free to speculate on the implications of such knowledge."

A paper summarizing Schickedanz's research will be submitted to the JOURNAL OF APPLIED METEOROLOGY.

Younger age for end of the Eocene

A new and more accurate determination of the age of the boundary between the Eocene and Oligocene geological epochs finds that the boundary is approximately 3 million years younger than most earlier estimates. The new determination yields a maximum age of 34.4 ± 0.5 million years. The most common previously reported age was 37.5 million years.

The date for the boundary was determined largely as a result of a fortuitous occurrence in a core sample from the Caribbean Sea of a layer of microtektites. The microtektite layer corresponds with a marked change in the animal microfossils at the lower boundary of a particular zone in the core directly underlying the Eocene-Oligocene boundary. Microtektites are tiny glass spherules of debated origin that have fallen through the atmosphere onto the earth from time to time in the past. These particular examples are clearly associated with the North American microtektite strewnfield, which has been well dated by both the potassium-argon and fission track methods. Thus the microtektite layer represents a well-dated level that provides a means of dating fossil boundaries in the core.

Based on the tektites' age and radiolarian stratigraphy, researchers Florentin Maurasse of Lamont-Doherty Geological Observatory and Billy Glass of the University of Delaware have determined that the maximum age of the Eocene-Oligocene boundary is 34.4 ± 0.5 million years. Their report is in the Proceedings of the 7th Caribbean Geological Conference.