taken by many women during pregnancy."

In his report at the AAAS meeting, Yaffe described the drug's effects on the offspring of the phenobarbital treated rats:

- From the end of weaning to the maximum growth spurt in adulthood, the rats in the treatment group were significantly smaller than the control animals.
- A delay in vaginal opening times for female offspring occurred at the onset of puberty.
- In adulthood, just one-third of the female offspring had regular menstrual cycles, compared with 100 percent of the controls.
- Such abnormal cycles were associated with infertility in 60 percent of the females.
- Estrogen concentrations were higher before puberty and during adulthood in treated animals' offspring; progesterone concentrations were also higher before puberty.

While it is not known exactly how phenobarbital interacts with the fetus to produce such abnormalities in later life, Yaffe suggests that the drug somehow alters the "thermostatic setting" of the neuroendocrine system. "Something reaches the brain of the fetus," he says, producing a "permanent effect."

Phenobarbital, Yaffe notes, is an "old drug" that has been accepted and used for years as a sedative and anti-anxiety medication, although Valium (diazepam) has replaced it as the most widely used anti-anxiety drug. Although it was determined years ago that phenobarbital presented no apparent danger of gross anatomical malformation to most unborn babies, Yaffe suggests that few researchers have tested it or many other psychoactive drugs for more subtle, delayed effects from small dosages during pregnancy.

One study that has examined such possible effects of morphine and methadone was performed recently at the University of Vermont. Researchers there gave single doses of one of the drugs to male rats one day before mating them with female rats. Despite waiting one day — "when you think the drug is no longer present," Yaffe says — investigators found the offspring of the treated male rats had "markedly decreased survival rates," he says. Other, similar results have also been seen in animal experiments with caffeine, the painkiller Darvon and other substances, he says. Yaffe speculates that the morphine or methadone may still be present in the animal's seminal fluid one day later or may somehow alter the sperm.

He is cautious about directly applying such study results to human pregnancies, but at the same time suggests that his work and that of others could have human implications. "The rats were given the drug [phenobarbital] late in pregnancy, beyond the period when they could lead to malformations [in offspring]," he says. Extrapolated to the human pregnancy period, the dosage given to the rats would be approximately equivalent to a woman taking very small doses of the drug for three to four weeks in her third trimester.

Yaffe is already planning a similar investigation of the possible long-term effects of Valium upon offspring. "Any psychoactive drug might have an effect," he says. "There are some grounds for concern. The task of assuring the public of [drug] safety is even more difficult than it was before." □

Now — asteroid-caused extinctions

By a process of elimination, a 10-kilometer-diameter asteroid has been chosen most likely to have caused the death of the dinosaurs and other organisms 65 million years ago. The Cretaceous-Tertiary extinction, which is believed to have wiped out 50 percent of the plant and animal genera on earth, is the most recent of five mass extinctions that can be detected in the sedimentary record. It has been attributed to everything from an ice age to a supernova.

Seven months ago, Luis Alvarez, Walter Alvarez and co-workers reported evidence that the cause of the mass extinction was "more extraterrestrial than terrestrial" (SN: 6/2/79, p. 356). Since then, they have ruled out the popular supernova theory and discarded most other extraterrestrial events. At the AAAS meeting, they reported their observations best fit the following scenario: A 10-kilometer-diameter asteroid hit the earth with the force of 100 megatons of TNT, producing a crater 175 km in diameter. Pulverized rock from the asteroid and the crater filled the stratosphere with dust and blocked sunlight from the planet for three to five years. Photosynthesis halted; land plants and marine plankton went dormant or died. With the base of their food chain gone, animals that could not adapt to a diet of nuts, seeds and decayed plants vanished.

Then, say the researchers, the asteroid dust settled to earth. Eons later, Alvarez and co-workers believe they have found that layer of dust. In a layer of clay found in limestones from Gubbio, Italy, and Stevns Klint, Denmark, Alvarez and co-workers found 30 and 160 times, respectively, the amount of the element iridium found in other layers. In both cases, the jump in iridium exactly coincides with the time of the extinctions. Iridium is an element that can only have an extraterrestrial origin because all the earth's iridium is concentrated at its core. Small amounts of the element drift in from space and some is added in large doses by meteors.

The most obvious explanation for the excess iridium is a supernova that destroyed life by a burst of cosmic radiation. Such an explosion should have left a predictable amount of plutonium 244, an isotope with a half-life of 83 million years, and a certain ratio of iridium 191 to iridium 193. But, as preliminary results suggested last spring, the researchers found no evidence for either. In addition, the requisite supernova would have had to explode about one-tenth of a light year away, more than 40 times closer than the nearest star is today. That possibility, say the researchers, is "vanishingly small." The scientists similarly found problems with other extraterrestrial explanations, such as oxygen depletion by passage through a gaseous nebula or an encounter with Jupiter.

Though no appropriately sized crater has been found, the asteroid theory is supported by several lines of evidence. For example, the calculated number of times the earth might have encountered an asteroid of the proposed size is plausible — about every 100 million years. In addition, the debris from the impact should have deposited a clay layer in sedimentary rock that is chemically different from adjacent layers. Such a layer is found in their samples, the researchers say. It is the layer that contains the excess iridium. Confirmation of the theory, say the scientists, depends on finding iridium excesses that mark other mass extinctions. □

Chemical analogies between the stars

The chemistry of the interstellar molecular clouds, so far as it is known, does not include a large variety of elements. Most of the interstellar molecules are made of just four elements from the first two rows of the periodic table: hydrogen, carbon, nitrogen and oxygen. The most important exception to this rule is sulfur, according to R. A. Linke and M. A. Frerking of Bell Telephone Laboratories in Holmdel, N.J., and Patrick Thaddeus of the Goddard Institute for Space Studies in New York, writing in the ASTROPHYSICAL JOURNAL (Vol. 234, p. L139).

Sulfur is particularly interesting because sulfur compounds form analogs of oxygen compounds, one oxygen atom being replaced by a sulfur atom in the given structure. This characteristic fits the two newest interstellar sulfur compounds identified by these three astronomers in the cloud Sagittarius B2: methyl mercaptan (CH_3SH), the analog of methyl alcohol (CH_3OH), and isothiocyanic acid (HNCS), the analog of isocyanic acid (HNCO). With six atoms, methyl mercaptan is the "most complicated sulfur molecule yet detected in space." Linke, Frerking and Thaddeus also point out that methyl mercaptan is a malodorous gas familiar on earth as a product of organic metabolism and that sort of effluent. It is also used industrially in the manufacture of a number of organic compounds, "in particular the amino acid methionine."

The last remark is a reference to the sort of organic compounds every observer would dearly love to find in interstellar