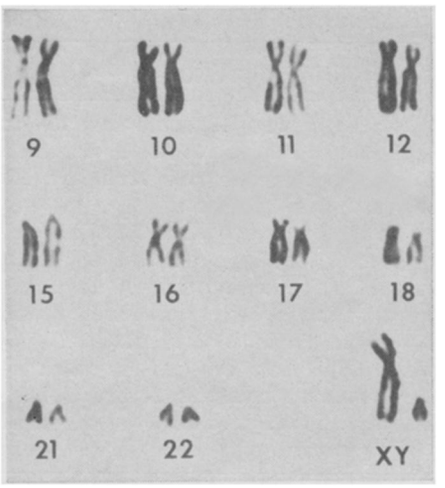

UC Medical Center

Male chromosome (bottom) tells all.

The three—Dr. Melvin M. Grumbach, chairman of the Medical Center's Department of Pediatrics, Dr. Felix A. Conte, a UC fellow in pediatric endocrinology, and Dr. Janina Walknowska, a cell geneticist who recently returned to the University of Cracow in Poland after working at UC on a fellowship—originally set out to explore the reasons why a mother fails to reject the fetus.

The baby represents a foreign body in the uterus, so a mother must somehow build up a tolerance. On this premise the investigators started a painstaking analysis of the blood of pregnant women to find out why. As they studied chromosome structures of lymphocytes —a class of white blood cells—they detected a few containing XY chromosomes, normally found only in males.

Of the 21 women whose blood contained these male cells, 19 later gave birth to boys. Two or more cells containing XY chromosomes were found in 10 of the women and they all bore male babies.

"The two false-positive results were in women where only one cell with XY chromosomes was found," says Dr. Grumbach. These could have persisted from an earlier pregnancy, he says.

As a control test, 2,000 cells from five normal nonpregnant females were analyzed, and none revealed XY chromosomes.

The results strongly suggest that fetal cells pass through the placental membrane into the mother's bloodstream, reports Dr. Grumbach, putting aside the theory of a placental barrier used for many years to explain why a baby was not rejected. If the placenta were a barrier and no cells could pass to the mother, then immune rejection would certainly not occur.

Though red blood cells are sometimes known to leak through to a mother's bloodstream, this is the first time that lymphocytes have been detected.

The transfer of lymphocytes carrying histocompatibility antigens — antigens capable of being accepted—to the maternal blood may be an important factor in permitting the mother to tolerate the fetus, says Dr. Grumbach.

During the past one and a half years the UC researchers, whose work has been partly supported by grants from the National Institutes of Health (NIH), have tediously examined more than 13,000 lymphocytes from 30 women. Six of the nine women in whom no XY chromosomes were found gave birth to girls. In the three women with male infants the doctors lacked enough cells for reliable analysis.

"We started out the study thinking a cell count of 400 would be enough to find an XY cell, if it were present," explains Dr. Conte. "But we soon upped this number to 700 and then to 1,200. The three cases where mothers delivered a male and we had reported no XY chromosomes were among the first studies." The group now feels the study of 1,200 cells will give a 95 percent chance of finding at least two cells with XY chromosomes.

Sex determination through samples of a pregnant woman's blood is direct in the case of male babies, and indirect, by a process of elimination, in the case of females. So far, predictions of males as early as 14 weeks after conception have proved correct.

While taking the blood sample from the woman is simple, the analysis is a different matter. It presently entails laborious examination of each cell. Computerization of chromosome analysis is essential if there is to be large-scale screening of cultures from pregnant women.

Teams at NIH, Yale and Atlanta, Ga., are working toward this goal, Dr. Grumbach says, but he has no forecast of when it will become a practicality or when application to sex determination could begin.

"From what I know of existing computerized medical processing, it should be fairly easy," says Dr. Conte. "The computer simply would scan the cell to distinguish the chromosomes by size. You have five small acrocentric chromosomes in the male and only four in the female.

"But then, of course, if you are going to go to the trouble of computer programming, you also want the program to tell you of cell abnormalities, such as an extra chromosome. The step that has to be taken—and hasn't been done yet—is to correlate abnormal cell findings or cell types with abnormal babies born. None of the group we studied had any abnormal births."

Finding an extra chromosome then might warrant taking a sample from the amniotic sac, which would give more cells to examine, he says.

BIOSAT

More vertebrates in space

The Biosatellite Program was established to study the effects of space on all types of life from its lowest to highest forms. Unlike the Manned Space Program, the Biosatellite venture has been riddled with failures. The most recent mishap came with the death of the astromonk Bonnie and termination of the planned 30-day Biosatellite 3 Project after only nine days (SN: 7/19, p. 96). The two prior space flights in the program carried plants and insects on three-day orbital voyages, but the first of these failed when a retro-rocket misfired. The second was successful.

The future of the Biosatellite Program was the subject of a meeting at Santa Cruz, Calif., of 40 space biologists. They will recommend heavier emphasis be placed on the study of man and vertebrates in space.

While a full report has not been drafted, the chairman of the meeting, Dr. Kenneth Thimann of the University of California at Santa Cruz, felt this would be one of the major decisions to come out of the conference. The two-week session, ending this week, was convened by the National Academy of Sciences at the request of the National Aeronautics and Space Administration. The group will make its formal report to the NAS in Washington next month, but its contents will not be made public until sometime in September, according to Dr. Thimann.

The scientists at the conference divided up to discuss the future of the program's five major areas of study: effects of space on biological rhythms; cells, plants and invertebrates in space; man and vertebrates in space; radiobiology, and animal orientation, direction finding and tracking.

"The group is looking at the program over the long range," says Dr. Thimann. "We are trying to determine in which areas there is an urgent need for more space work and where more ground work is needed first.

"I think the group will decide more space work is needed in the study of man and vertebrates along the lines of the Biosatellite 3 Project," Dr. Thimann predicts. "A similar decision will probably be made in the study of animal orientation, direction finding and tracking."

Dr. Thimann says there will probably be a call for additional work on the ground in cell and plant investigation, such as exposure to controlled environments and experience in a centrifuge to simulate weightlessness in space. He and other biologists have often said many ground studies can be just as fruitful as those in space.