

How Infections Threaten the Fetus and Newborn

Bacteria and viruses can inflict lasting damage on unborn and newborn children. Pediatricians are attempting to deflect the dangers.

by Joan Arehart-Treichel

Throughout the United States, and in other countries too, thousands of newborn infants suffer from one or a combination of devastating medical problems—mental retardation, autism, learning disabilities, heart disease, muscle atrophy, bone deformations, precocious puberty, cataracts, glaucoma, deafness, diabetes, scarring of the skin. Still other victims of these problems die shortly after birth, or fail to breathe the sweetness of life at all. . . .

These children reflect a worldwide threat that physicians are becoming increasingly aware of—how viruses, bacteria or protozoal parasites can infect fetuses and neonates and inflict them with lasting damage. Fortunately progress is being made toward understanding the danger these infectious agents pose and countering it. This was brought home at a recent symposium on the problem in New York City. The symposium was sponsored by the National Foundation-March of Dimes and New York University School of Medicine, and was attended by 1,200 pediatricians and pediatric nurses. However, numerous aspects of the problem remain to be solved.

The major infectious threats to the fetus and newborn, or at least those that are well documented, include: rubella virus (German measles), cytomegalovirus, herpes simplex virus, hepatitis B virus, varicella zoster virus, syphilis bacterium, gonorrhea bacterium, toxoplasmosis parasite. More tenuous threats include the polio virus, flu virus, coxsackie virus, echoviruses and some others.

These infectious agents can attack various tissues, organs and systems of the body with sweeping or narrow-focused vigor, thus leading to different kinds of damage from one infant to another. But if there is any part of the body that the agents favor, it is the brain and central nervous system.

Sometimes the agents attack the brain with such vehemence that they gouge large holes in it, as in the case of Group B strep infections. Sometimes the agents lead to profound retardation, as in the case of rubella and cytomegalovirus in-



Photos: March of Dimes

fections. Still other times the agents exert subtle and long-range damage, especially to the central nervous system, which develops rapidly in the fetus and newborn. Charles A. Alford, a pediatrician and microbiologist with the University of Alabama Medical Center, studied children over two years of age who had been infected with toxoplasmosis before birth. As he feared, the youngsters had lower I.Q.'s than their matched controls. They also had hearing and visual problems. "Many of them," Alford laments, "will undoubtedly be failures."

The routes by which the infectious agents assault the fetus are complex and not altogether understood. The first requirement, it seems, is that a mother be infected, and that the infection strikes at a critical stage of pregnancy. Hepatitis B virus infections, for instance, rarely pose a danger to a fetus if the mother is infected early in pregnancy, according to Arie J. Zuckerman, a virologist with the University of London. But if a mother is infected during the middle of pregnancy, the danger to the fetus stands around 10 percent. And if the mother is infected toward the end of pregnancy, the danger to the fetus increases to 76 percent.

Even if an infectious agent strikes at a critical stage of pregnancy, though, this does not necessarily mean that it will also infect the fetus. And even if the fetus is infected, it may not necessarily be damaged. Louis Z. Cooper, a pediatrician with Columbia College of

Physicians and Surgeons, cites the case of twin girls born to a mother who had rubella during pregnancy. One of the twins is deaf and has heart disease as the result of rubella infection. Yet the other twin escaped damage altogether. "In 1967," James B. Hanshaw, a pediatrician with the University of Rochester, reports, "we recovered cytomegalovirus from 130 newborns, far more than we would have anticipated in the 1950's. Fewer than five percent of the infants, however, had symptoms which suggested the presence of disease." As Samuel L. Katz of Duke University Medical Center points out, some women with polio during pregnancy have given birth to infants with polio. Others have not.

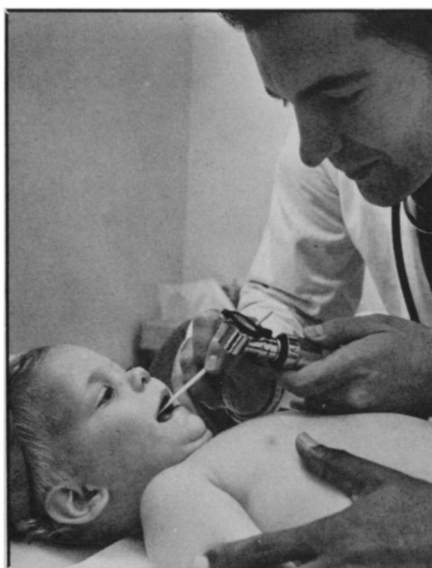
How can a fetus be infected and escape damage? "There are many determinants," Katz replies, "none of which has been fully explored."

The routes by which infectious agents get to newborns are also numerous. One is via the mother's vagina during delivery, especially if cell membranes in the vagina burst and let loose a flood of infectious organisms. André J. Nahmias, a pediatrician with Emory University School of Medicine, cites the case of a husband who acquired a herpes simplex virus infection in Vietnam. When he returned home, he passed the infection on to his wife through intercourse. His wife became pregnant. She gave birth to an infant with a herpes infection. The infant died a week after birth.

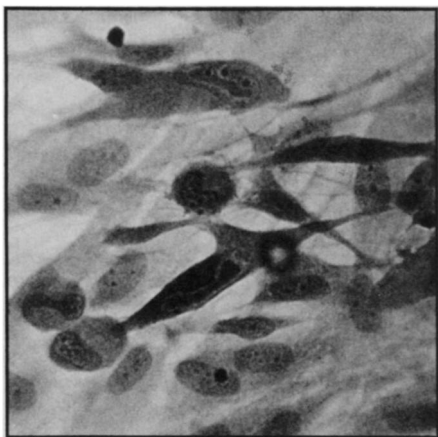
Still another common route by which infectious agents attack newborns is in the hospital nursery. "Once," Katz recalls, "we delivered a pair of twins to a mother with polio. The nursery was prepared for them. They were placed in isolettes. Their diapers were handled with caution. Other infants in the nursery were monitored for polio virus. Even with these precautions, all the infants in the nursery were secreting polio virus within three weeks. Think what nursery spread of viruses and bacteria must be like under normal conditions!"

And then there is a chance, tenuous

at best, that a mother might pass infectious agents to her newborn through breast-feeding. Cytomegalovirus has been recovered from breast milk, David Lang, a pediatrician with Duke University Medical Center, reports. Authorities on infections of the fetus and newborn are not suggesting that women not breast feed their infants, however, since breast milk contains numerous immune fighters that can help newborns fight dangerous infections. The immune fighters that have been identified include antibodies, lymphocytes, macrophages and lysozymes (enzymes that can break down bacteria). Breast milk also contains *Escherichia coli* bacteria that can colonize a newborn's intestinal tract and help fight off harmful bacteria. "The whole breast milk story, from an immunological viewpoint, is just opening up," declares John D. Nelson, a pediatrician with the University



Toddler examined for CMV infection.



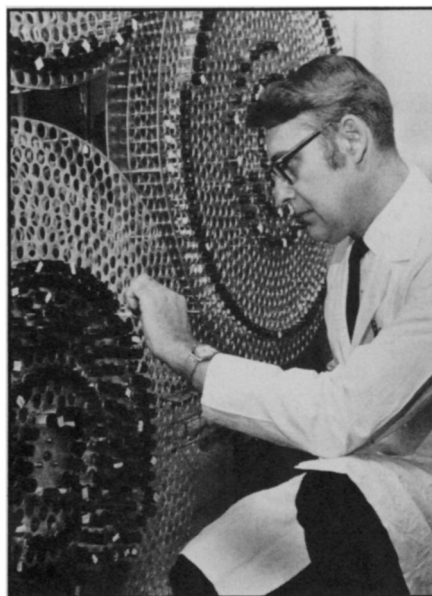
Cells invaded by cytomegalovirus.

of Texas Southwestern Medical School.

Nearly as confounding as tracing the routes by which dangerous infections reach the fetus or newborn is determining which fetuses or newborns have been hit. At present physicians are able to culture viruses or bacteria from pregnant women. They can also determine whether pregnant women contain antibodies to specific viruses or bacteria, which can mean a recent infection. They can also extract a sample of the amniotic fluid that bathes the fetus and analyze it for dangerous viruses or bacteria. The problem, however, is that pregnant women often do not suspect they are infected. Nor do their physicians. Thus they are not tested for the infections.

It would be ideal, of course, to screen pregnant women routinely for viruses, bacteria or protozoa that can damage their fetuses. But such massive screening would be immensely expensive and would tie up diagnostic laboratories that already have their hands full with other kinds of diagnostic tests.

Although diagnosing infections in newborns is somewhat easier than in



Alford with CMV cultures in drum.



Victim of rubella birth defects.

fetuses, pediatricians have their problems here too. "When you see a baby in distress," Catherine M. Wilfert of Duke University Medical Center explains, "it may or may not be an infection." Neonatal herpes simplex infections are often misdiagnosed because they resemble other viral or bacterial infections, Nahmias points out. "There is no absolute test for congenital syphilis," admits Larry H. Taber, a pediatrician at the Baylor College of Medicine.

Nor does accurate diagnosis in a newborn necessarily mean that it will be spared damage. Although antibiotics are effective against life-threatening infections in newborns, it is a question of whether the antibiotics will reach vulnerable tissues in time. This is the view of Martha Yow, a pediatrician at Baylor. "And even if we develop an appropriate antiviral agent for infants with cytomegalovirus infections," Hanshaw anticipates, "it may not help them."

Thus, the real hope for the fetus and newborn in escaping dangerous infections lies in preventive measures—massive vaccinations of women before they become pregnant, and of people who carry the threatening agents. Some striking advances are being made in this direction. Since the rubella vaccine was licensed for use in the United States in 1969, 55 million Americans have been vaccinated. As a result, a rubella epidemic on the order of the 1964 one seems to have been averted and the number of infants born with rubella defects is decreasing. Throughout the United States from 1966 to 1969, for example, there were 47,500 cases of rubella. In 1974, the cases were down to 11,836. In New York City in 1964, there were 1,500 infants born with rubella-caused birth defects. In 1974, the number was down to 10.

Vaccines against several more of the threatening organisms are also expected to be marketed in the next several years. On March 19, Robert Purcell of the National Institute of Allergy and Infectious Diseases and Maurice R. Hilleman of the Merck Institute announced that the hepatitis B vaccines they have developed look good in primates and should be ready for clinical trials soon. (Much of the basic research that led to these vaccines was conducted by Saul Krugman of the New York University School of Medicine, a moderator at the March of Dimes symposium.) A vaccine for cytomegalovirus looks promising, Lang reports. But there is still a question of whether it is attenuated enough to not cause overt disease. Nahmias and his co-workers, as well as the Merck, Sharp and Dohme Research Laboratories, are working on a herpes simplex vaccine. But it is not yet near the clinical trial stage. □