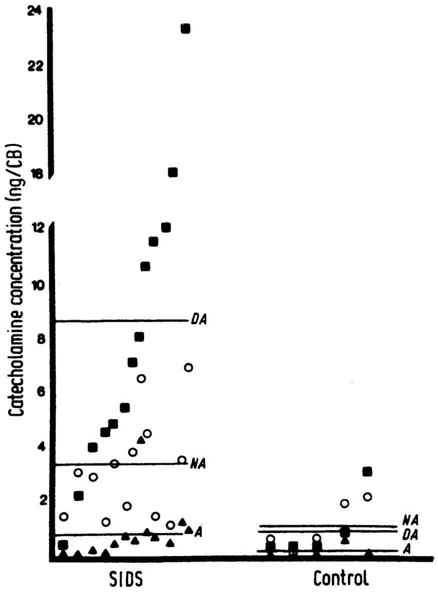
Infant death tied to dopamine excess

Canadian researchers report they have found a dramatic biochemical difference in the bodies of children who died from sudden infant death syndrome (SIDS), compared with infants who died from other causes. The finding, the first of its kind, according to the scientists, suggests that infants at high risk for SIDS may manufacture the brain chemical transmitter dopamine at abnormally high levels. "Strikingly" elevated amounts of dopamine were found in the SIDS victims' carotid bodies—tissue that adjoins the primary arteries supplying the head and that is crucial in the mediation of respiration and oxygen balance.

Hypothetically, if the results are borne out, a child at risk might be treated with dopamine-blocking drugs as a preventive measure, but the researchers say it is far too early to consider doing that. "Just because [dopamine] is abnormal does not necessarily mean it's a primary cause," says D. G. Perrin of the department of pathology at the Hospital for Sick Children in Toronto, where the research was conducted. "It may be a secondary cause [a result of some other abnormality]. We want to look at the whole respiratory pathway; we may be heading in the right direction—I hope we are."



Of the three catecholamines studied, dopamine (DA, represented by solid squares) was strikingly high in SIDS victims. Horizontal lines show mean values of each neurochemical (circles = noradrenaline/NA; triangles = adrenaline/A).

The cause or causes of SIDS, which claims around 10,000 infants between 2 months and 4 months of age each year in the United States, has remained elusive despite intensified study in recent years (SN: 9/8/84, p. 152). "We're still not sure if SIDS victims are a homogeneous group or not," Perrin says.

In their report in the Sept. 8 LANCET, Perrin and his colleagues examined the carotid bodies of 13 SIDS babies and five infants who died from other causes. All but two of the SIDS babies had dopamine levels far in excess of those in the controls. Dopamine's effect on the carotid bodies, they report, "results in a decrease in... the frequency of respiration" and "appears to inhibit the carotid bodies' response to hypoxia [a deficiency in oxygen]."

All SIDS deaths involve the mysterious cessation of breathing during sleep.

In addition, the finding is not inconsistent with the theory that SIDS may reflect a learning or memory deficit, says Lewis P. Lipsitt, director of the Child Study Center at Brown University in Providence, R.I., and a proponent of that theory. "There must be some kind of congenital deficit to begin with, then comes the learning deficit," he says. The dopamine factor is "reasonable," says Lipsitt. "Dopamine is involved in both the memory processes and in Alzheimer's disease."

Perrin says his group will begin looking for anatomical changes in the brain's respiratory centers that might tie in with their dopamine findings. —*J. Greenberg*

A mathematical surprise: Proving the Bieberbach conjecture

A remarkable coincidence and seven years of largely unrecognized and unrewarded effort have led a mathematician to solve one of the most famous problems in mathematics. Until Louis de Branges of Purdue University in West Lafayette, Ind., recently proved that it was true, this problem, known as the Bieberbach conjecture, had challenged mathematicians for almost 70 years.

"The proof really caught us all by surprise," says Peter L. Duren of the University of Michigan in Ann Arbor and author of a recent book on the subject. "Many 'proofs' of the conjecture have been announced over the years, and this one seemed so unlikely to work out."

The Bieberbach conjecture is a statement about the coefficients of power series that represent analytic functions with certain properties. Analytic functions play an important role in calculus and the solving of differential equations. One set of these functions takes points, represented by complex numbers (z) found within a region bounded by a circle whose radius is one unit of length, and designates new values for these points according to an equation in the form of a power series: $f(z) = a_1z + a_2z^2 + a_3z^3 + a_4z^4 + \ldots$ German mathematician Ludwig Bieberbach, after studying particular examples, guessed that for all functions of this type, each coefficient, a_n, must be less than or equal to n and more than or equal to $-n$. For example, the fifth coefficient in the power series for a particular function of this type would be between 5 and -5. Until de Branges's work, the conjecture was known to be true only up to the sixth coefficient. De Branges showed that it was true for all coefficients.

Last March, de Branges sent out his proof, as part of a 350-page manuscript for a book on power series, to about a dozen mathematicians so that the proof could be verified. "Every one of them wrote back and said that they would not be able to read it at the time," says de Branges.

Explains Duren, one of the recipients of the manuscript, "We were frankly skeptical that he had done it." De Branges had a history of announcing proofs of important theorems that turned out to be wrong, says Duren. "It was also a heavy burden on the reader to dig it out of the manuscript, and when we started to read it, we found that there were some small errors."

By coincidence, de Branges was scheduled to go to the University of Leningrad in June. It happened that "the man [I. M. Milin] most suited to read this proof was there," says de Branges. In his proof, de Branges had proven a conjecture proposed by Milin, which in turn implied the truth of the Bieberbach conjecture.

"The Russians deserve a lot of credit for listening to him and for boiling it down to something that was intelligible," says Duren. Other mathematicians then were able to examine the proof closely and to confirm its validity.

"Of course, everyone is studying the proof now," says Duren, "and trying to understand what makes it work and to see whether it can be used for other things. It certainly has shaken up the people who work in the field."

"It's not obvious how the field is going to evolve at this point," says de Branges. "This problem has been so difficult that people have based their careers and research on issues contained in small parts of this problem. They have to make a major overhaul of their research objectives in the light of the new situation."

For de Branges, the achievement has brought new recognition. "During the time I was working on the Bieberbach conjecture, my prestige was rather low," he says. "My work wasn't recognized for about five years. It looked like I wasn't doing anything." —*I. Peterson*