

sulfate particles (SN: 3/4/72, p. 151). This conceivably could become an even larger problem in Eastern industrial cities where there is less smog but a great deal more sulfur dioxide than in Los Angeles.

Making all of these problems more difficult to deal with is a paucity of reliable data. Current measurement systems, says the report, are largely aimed at the kinds of gross gauging of emissions and of ambient air quality mentioned earlier. ". . . Major gaps exist in instrumentation for sampling and measuring the characteristics of particulate pollution." Needed is a nationwide monitoring system ". . . able to describe particle size, shape, concentration, composition, and light-scattering potential and the carrier-gas characteristics associated with the emission source."

The NAE report says that to achieve all this, as well as to do necessary research and development to develop more efficient control devices, will require particulate R&D expenditures by the Environmental Protection Agency about 10 times the current \$500,000 (the amount spent in fiscal 1972). In addition, the NAE panel says there should be cooperative programs jointly funded by EPA and the industries involved.

The NAE report acknowledges frankly and describes candidly the immense technical problems associated with particulate pollution in a way that was rare in official reports a few years ago. But apart from its recommendation that industry contribute at least some money to the large R&D effort required, the new report is like the earlier ones in that it scarcely touches on economic questions. □

## Collisions at 205 GeV: Twice as many particles

If a physicist were asked what he expected to see when a proton with 200 billion electron-volts energy (200 GeV) struck a stationary proton, one of the first items in his reply would be "lots of secondary particles." This expectation is quite borne out by the early analyses of the first experiment at the National Accelerator Laboratory at Batavia, Ill. A group of 19 physicists report in the Aug. 21 *PHYSICAL REVIEW LETTERS* that on the average eight secondary particles per collision were produced at 205 GeV, and some collisions produced as many as 22. The average is nearly twice that for 28-GeV protons. Analysis continues to see what species are among the secondaries and what light their production may throw on the many theoretical questions about the behavior of matter and basic physical laws at such high energy. □

## A genetic linkage in manic-depressive illness

Heredity has long been thought to be a contributing factor in the development of manic-depressive illness. Results from studies of families and twins pointed strongly to a possible genetic transmission of the disease, but the hypothesis could not be proved until a definite mode of transmission was demonstrated. Four years ago George Winokur, Vasant Tanna, Theodore Reich and Paula Clayton, working at Barnes Hospital in St. Louis, showed that one form of manic depression could possibly be transmitted via the X chromosome. Color blindness, known to be transmitted on the X chromosome, and manic-depressive illness were consistently associated in two families that were studied.

Ronald R. Fieve and Joseph Fleiss of the New York State Psychiatric Institute and Julien Mendlewicz of the University of Brussels now have strong



*Fieve: Manic-depressive psychosis is a disorder characterized by severe mood swings. Some forms of it may be transmitted via a sex chromosome.*

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evidence that manic-depressive illness is transmitted via the X chromosome. Last week in Copenhagen at a meeting of the International College of Neuropsychopharmacology they reported on a study of 80 diagnosed manic-depressive patients. Studies of the patients' families revealed a close linkage association in seven families who had both the color-blind marker and the manic-depressive illness.

A second line of evidence for the theory was reported in a separate paper. Fieve and Mendlewicz found six families in which manic-depressive illness and the Xg<sup>a</sup> blood group occurred in successive generations. The Xg<sup>a</sup> blood group is a well-known genetic marker that is also transmitted via the X chromosome.

The evidence is now convincing, says Fieve, but it does not mean that all cases of manic-depressive illness are transmitted by the X-linked gene. The disease itself is divided into three main subtypes. Two are called unipolar.

They include patients whose illnesses are only depressive or only manic. The third subtype, called bipolar, includes patients who have had both manic and depressive episodes. All of the families studied with the X linkage are of the bipolar subtype. And they may be only a subtype of that subtype.

But at least for those persons who have the family history and the X linkage there is now a known mode of transmission that separates them from other manic-depressive types. Once this is established, explains Fieve, these individuals could be subjected to a variety of biochemical tests in the hope of finding one or more defective enzymes or possible abnormal secondary metabolites in the spinal fluid, blood or urine. If a specific enzyme deficiency is operative, it is conceivable that early intervention (diet or drug) could prevent the onset of the illness. Regardless of whether such advances are possible, lithium carbonate has now been shown to be effective in treatment of manic and depressive phases of the disease.

Fieve, who was a pioneer in the use of lithium to treat manic-depression, says a person can be stabilized on the drug for life with an 80 to 85 percent chance that there will be no or only minor recurrences of the disease. This treatment, he says, should eventually replace electroconvulsive therapy.

Winokur, now at the University of Iowa in Iowa City, agrees that Fieve's work shows specifically that a large percentage of manic-depressive illness is transmitted in the X-linked fashion. "This puts the locus for manic-depressive or bipolar psychosis somewhere on the short arm of the X chromosome," he says. Like Fieve, he believes this work should be a model for the studies of other mental illnesses. The next step, he says, is to do linkage studies on depressive patients.

Fieve also intends to look for genetic markers or other evidence of genetic transmission in the unipolar diseases. He believes the same model should be followed in looking at schizophrenic