small current in another circuit could have charged the batteries in a day (its designers thought it would take months), so the peril was not nearly so great as it might have been. But there are Mariner 10 veterans (who only brought that spacecraft through by the skin of its teeth), on the Viking team, and a little paranoia would be understandable in shepherding the most expensive unmanned vehicle ever flown. For now, the orbiters are A-OK and the landers are to be checked out in flight later this month. But no one is asleep at the switch. □

Neuroscience and human health

The annual meeting of the Society for Neuroscience was held in New York City last week. Over a thousand research papers were presented. Most of these papers, however, dealt with discrete areas of research. So it was refreshing when several scientists integrated some of this material and pointed out how it has made, and continues to make, practical contributions to mental and physical health.

Neuroscience's contributions to mental and physical health, as outlined by Fred Plum, a Cornell University Medical College neurologist, include learning how to prevent phenylketonuria (PKU) in newborns; finding an effective treatment for Parkinson's disease; improving anti-convulsant control of epilepsy so that it prevents brain damage and mental retardation; discovering medicines to control psychoses; controlling pain.

Although neuroscience has not yet found the causes for two major mental disorders—schizophrenia and manic depression—it has at least pinpointed some factors underlying them, Seymour S. Kety, a Harvard Medical School psychiatrist, reported. Recent neuroscience evidence, for example, has shown that manic depression occurs in families in association with color blindness and a specific blood group, both of which are known to be controlled by genes on the X chromosome. Although the association does not occur in all families with the disorders, where it does occur it follows a pattern so consistent that it cannot be explained on a nongenetic basis.

As for schizophrenia, a new neuroscience approach used over the past 10 years appears to have succeeded in separating genetic from environmental factors. The approach consists of studying adopted persons who share their genetic endowment with their biological relatives, but their environment with their adoptive family. In the several studies that have been completed to date, the results are consistent. Schizophrenia continues to run in families, but now its high prevalence is restricted to the genetic relatives of schizophrenics who have not shared their environments or life experiences. The adoptive relatives of schizophrenics who reared them and shared their environment show no more tendencies to schizophrenia than does the population at large.

Neuroscience is also contributing to mental and physical health, Kety pointed out, by unraveling the architecture and structure of the human brain. During the past 20 years, neuroscience has revealed that nerve cells send messages to each other through junctions called synapses, and that the messages are passed by chemical transmitters present at these synapses. A number of neurotransmitters have been identified and found to be associated with particular functions. For instance, serotonin seems to play a crucial role in sleep and wakefulness and in certain types of sexual activity. Acetylcholine has been found to be a crucial transmitter between nerve and muscle. "There are other transmitters, such as gamma amino butyric acid, certain amino acids and polypeptides discovered more recently, and many that are yet to be discovered," Kety said.

Many mental and physical disorders still cry out to be solved by neuroscience, of course. Two major ones, in Plum's view, are stroke and senility, which impair the lives of hundreds of thousands of older people. Brain tumors are also high on the list; their cause and treatment are now almost a total mystery. Still another vital, yet knotty challenge facing neuroscience, Plum says, is coming up with some way to accomplish nerve regeneration in patients with brain or spinal cord injury. □

The Golgi method and mental disorders

Although the biochemistry of many mental disorders has been worked out, their neuropathology has not. Now a New York City neuroscientist and his coworkers are starting to unravel the neurological aberrations underlying two major classes of mental conditions by resurrecting a 100-year-old technique—the Golgi method.

The conditions are profound, previously unexplained mental retardation that inflicts one to two million American children and Tay-Sachs and other neuronal storage diseases which are inherited and lead to mental retardation. The investigator is Dominick P. Purpora of Albert Einstein College of Medicine in the Bronx. He reported his team's findings last week at the annual meeting of the Society for Neuroscience in New York.

The Golgi method was devised by Camillo Golgi, an Italian pathologist, in 1873 for staining nervous tissue and thereby learning about the structure of the brain. He received a Nobel prize in 1906 for that work. The technique consists, essentially, of fixing brain tissue with a silver chromate solution. The compound penetrates entire neurons and makes them totally visible under the microscope. During subsequent years of the 20th century, however, the technique fell into disfavor for studying human brain neurons. Neuropathologists declared that it was too capricious. But in the past few years, several groups of American investigators have tried to see whether the technique might uncover the pathology of certain mental disorders. One group is headed by Miguel Marin-Padilla of Dartmouth Medical School; another, by Arnold and Madge Scheibel of UCLA; the third, by Purpora.

"We took a chance on it," Purpora explains, "because of total frustration in trying to use other staining techniques to study nerves in the infant brain. The reason was that these techniques only show up the cell body of the neuron, not its axon and dendrites. To our delight, the Golgi method worked for us whereas the other techniques did not."

Thanks to the method, Purpora and his team have found a significant nerve alteration in the brains of children with profound, previously unexplained mental retardation—a microstructural pathology that has been missed for decades. The alteration consists of a reduction in the number of dendritic spines or in the spines being long and thin. Dendrites, or rather the tiny spines on them, are what allow nerves to communicate with one another. A reduction in the number of these spines, Purpora believes, could explain why infants become profoundly retarded, because it would reduce communication among billions of nerve cells in the brain.

The brain neuropathology underlying Tay-Sachs and related diseases is different, the Golgi technique is revealing. It consists of the development of new, huge structures between the cell body and the axon of the neuron. Purpora and his colleagues have named these giant neuronal processes "meganeurites." Meganeurites have spine-like processes and synapses much like normal dendrites, so they could interfere with nerves' attempts to communicate with each other, and lead to mental retardation.

The basic cause of Tay-Sachs and related diseases is known to be an inherited enzyme deficieny (SN: 3/29/75, p. 211). It allows complex lipids and gangliosides to build up in the brain and body. "This abnormal accumulation," Purpora reports, "appears to stimulate the incorporation of some of the material into membranes forming meganeurites. At this point the meganeurites may also have receptors for attracting axons of other cells and give abnormal communication channels." □