

nitrogen wastes, broken down and excreted in urine. But in gouty patients, the process is sometimes faulty.

Among the famous said to have been tortured by gout are Kublai Khan, Alexander the Great, Goethe, Francis Bacon, Isaac Newton, Thomas Sydenham (the 17th century physician whose description of the disease has been unsurpassed), Charles Darwin, and Benjamin Franklin, who brought back from Paris what is still the most specific treatment—colchicine, first found in the meadow saffron of Asia Minor, a flower like the autumn crocus.

Some other purines—caffeine for example—are thought to be mild brain stimulants, and some researchers suggest that a high blood level of uric acid may have the same effect. Man and the higher apes are the only mammals with a high serum level of uric acid. Advocates of uric acid as a correlative of genius have suggested that the superior brains of the species may be the result of a mutation that eliminated the capacity to produce the enzyme lower mammals use to convert uric acid.

In the recent study, a collaboration between workers at Yale School of Medicine and the Institute for Social Research of the University of Michigan, blood samples from 155 high school and college boys were used. The researchers used statistical techniques to correlate blood levels of uric acid and cholesterol with an abundance of data on grades, test scores, vocational aims and other matters. These were available since these males had been a part of a nationwide study of adolescent boys: "Youth in Transition," published in 1967 by J. G. Bachmen and colleagues of the institute.

Uric acid is positively associated with over-achievement, high grades, college entry, participation in activities and speed in completing certain aptitude tests, Drs. Stanislav V. Kasl, George W. Brooks and Willard L. Rodgers report. Uric acid shows only a very weak correlation with I.Q. scores, but some association with independent attitudes that have caused mild "troubles with the family." It is negatively associated with anxiety about taking tests.

On the other hand, a high level of blood cholesterol is positively associated with anxiety before tests, the researchers say in the Aug. 17 and 24 issues of the *JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION*. They suggest that "subjects with strong test anxiety are those who have high fear of failure and who will, as a consequence, avoid achievement situations."

They also find that a high level of blood cholesterol seems to cancel out the effect of high uric acid in some elements of behavior—high grades are an example. □

FOUR TO THE MOON

Picking Apollo goals

The year after the moon landing has been an agonizing one for the National Aeronautics and Space Administration. An almost disastrous budget cut resulting in personnel losses and program alterations and the resignation of the agency's Administrator, Dr. Thomas O. Paine, added to the abort of Apollo 13, led many to doubt not only the chance of future space programs but the survival of the current one—Apollo.

There was no question that Apollo and lunar science would suffer, but no one was ready to speculate how much or in what way.

Now, following a month's review of space science options by the National Academy of Sciences (SN: 8/1, p. 93), a decision about Apollo is in the making. Dr. Paine and top officials are meeting with the Lunar and Planetary Boards and directors of Manned Space Flight to make a decision about the remaining seven Saturn 5 boosters earmarked originally for Apollo flights 14 through 20.

And it looks like the decision will be to fly only four more craft to the moon—Apollos 14, 16, 17 and 18 (with 19 still open), and do this before the launching of Skylab (SN: 7/25, p. 53). This would delay Skylab for about a year, from 1972 to 1973.

Change is not foreign to the much juggled Apollo program; one Apollo Saturn booster has already been earmarked for Skylab A. Before the abort of Apollo 13, and the subsequent three-month delay of Apollo 14, the schedule called for Apollos 13 through 17 to be launched before the fall of 1972; at that time three different flight crews would begin operations of Skylab. Then Apollo 18 and 19 would fly in 1974.

At a time when NASA had money and personnel to send up Apollos every two or three months, six-month intervals between lunar explorations seemed undesirable because of the effect on crews and costs. Now with budgetary and personnel cuts, NASA finds it cannot fly Apollos more frequently than at five- or six-month intervals. A longer stretch-out in the flight schedules, however, including the year and a half to sandwich in the flight of Skylab, is too long. And Dale Myers, Associate Administrator for Manned Space Flight, and Apollo Program Director Rocco Petrone may want to avoid such a delay by flying all the Apollos before Skylab. The reasoning behind this scheduling is that lengthy intervals reduce effectiveness all the way down the Apollo line—from the astronauts to production and test crews and launch personnel. Not only is it difficult to maintain high performance levels, but costs soar.



NASA

Myers: All Apollos before Skylab.

High performance requires stimulus, constant drive, a consistent work load. Without these, safety of the crew becomes a major problem.

In addition to the time lag to accommodate Skylab, that project itself introduces new concepts in ground support and communications training and operations. The workshop will be in continuous operation for months, compared to the 10-day lunar flights. In addition, flying the Apollos before Skylab would allow concentration on one flight-mode at a time. The previous plan to sandwich Skylab between Apollos would now be too costly for the reduced budget.

If the decision is made to fly only four more Apollos, several alternatives are open for the use of the two remaining Saturn boosters. They range from use as another Skylab (which would be called Skylab B), as a space station, or as a booster for the nuclear rocket, NERVA, to be tested near the end of this decade (SN: 5/2, p. 440).

Also, by using Apollo 15 hardware for other purposes, the last three lunar excursions would make use of the advanced series of spacecraft which can carry heavier surface and orbital scientific payloads, as well as the 600-pound lunar rover.

Lunar exploration in this decade beyond Apollo 18 may utilize new concepts and technology already under study. At the recent NAS review at Woods Hole, Mass., lunar scientists recommended that Apollo 18 (or 19, depending on the decision), be followed with the cheaper unmanned probes to the moon. These could include small lunar satellites to study from orbit lunar characteristics, such as mascons, which alter gravitational effects of spacecraft.

Another possibility for later explorations of the moon would be the use of

robots (SN: 7/25, p. 64). The scientists expressed interest in seeing the development of this capability, which would also have carry-over possibilities for use on other planets. □

EMISSIONS CONTROL

Restricting autos

So far, all efforts to curb the air pollution from automobiles have aimed directly at this goal. Either emission controls for the internal combustion engine, or new nonpolluting kinds of engines, have been the goals. Except for a few small-scale experiments, there has been little action to restrict the automobile itself.

Last week, Sen. Edmund Muskie's (D-Me.) air and water pollution subcommittee reported out a bill which might effectively ban automobiles from urban areas, or, at least, significantly reduce their numbers.

The bill takes a traditional approach of attacking the air pollution from automobiles rather than the automobile itself. It would establish national ambient air standards which various regional, state and local jurisdictions would have to meet with implementation plans.

But the standards are such that new car emission levels by 1975 would have to be 90 percent lower than now. Because it would take about 10 years for all automobiles to have emission controls with this degree of effectiveness, it would be necessary for the local jurisdictions to take other steps. A probable one would be to reduce the number of automobiles within urban areas, perhaps down to cities of 50,000 population. □

Autos and smog: Restriction ahead?

NAPCA



INTERFERON

Inducing the virus-fighter

In fighting off invading viruses the body is often in a race for time. If it can quickly muster enough antiviral interferon to protect cells from attacking viruses, infection will be thwarted. But if the interferon response is sluggish, viruses will gain an overwhelming advantage.

During the last decade, interferon, a native protein that forms the first line of defense against viruses of all types, has been the object of continually expanding research. Many investigators believe that eventually interferon will be to viral diseases what antibiotics are to bacteria infections. Their challenge is to find an effective and relatively simple way of artificially inducing interferon either to protect individuals against viral infections or to insure that those that do take hold are rapidly knocked out.

Recent work on a new inducer, the first to act orally, has excited interferon researchers. Says Dr. Thomas C. Merigan of Stanford University, "Experiments with this new compound, tilorone hydrochloride, provide an important opening, showing for the first time that a small, orally active molecule can induce interferon." Dr. Merigan, with his associate Dr. Erik DeClercq, has been testing the agent, which was developed by Drs. Russell Krueger, Gerald Mayer and their colleagues at the Wm. S. Merrell Co. in Cincinnati.

Tilorone hydrochloride, a fluorenone compound derived from coal tar, represents a new class of pharmacologic agents, and scientists predict that even if this initial chemical proves unsuitable for clinical use, similar agents produced by molecular tinkering may be valuable. From experiments with animals, the Merrell investigators first reported that tilorone hydrochloride appeared to be an interferon inducer. Studies by Drs. Merigan, DeClercq and others confirmed that finding, although its effect in man has yet to be demonstrated. According to Dr. Krueger, human trials of the new drug are under way but results are not yet available. Investigators are still working to determine doses needed to induce interferon in man, if, indeed, this drug is active in human beings.

Discussing tilorone hydrochloride, whose mechanism of interferon-induction is unknown, Dr. Krueger points out that it is molecularly unlike previously identified inducers. By and large, these are polynucleotides, molecules that structurally mimic the nucleic acid core of viruses. Among them, poly I:C (polyriboinosinic-polyribocytidylic acid) is perhaps the most thoroughly studied.

First developed in 1967 by Dr. Maurice R. Hilleman of the Merck Institute for Therapeutic Research in West Point, Pa. (SN: 8/19/67, p. 173), poly I:C has been shown to cure a potentially blinding eye infection (herpes simplex keratoconjunctivitis) in rabbits (SN: 1/18/69, p. 60). This year, Drs. Paul Fenje of the University of Toronto and Bosko Postic of the University of Pittsburgh used poly I:C successfully to induce protective and therapeutic levels of interferon in rabbits exposed to lethal doses of rabies virus. In limited cases, it is currently being tested in man.

But at least for the moment, poly I:C's uses are somewhat circumscribed. A large molecule with a molecular weight of upwards of 100,000, it has some toxicity and is active only when given by injection. Dr. Hilleman and others are exploring modifications of its structure which may enhance its effectiveness. Dr. Merigan observes that poly I:C may one day be useful for local therapy of virus infections by administering it specifically to the eye or respiratory tract, for example, and thereby avoiding systemic side effects.

To achieve high interferon levels throughout the system, however, tilorone hydrochloride or one of its descendants holds greater promise. In contrast to poly I:C, tilorone is a relatively small molecule with a molecular weight of 400. It is this feature that allows its absorption from the gastrointestinal tract. According to Dr. Merigan, whose work has shown it to be active in mice but not in chickens, tilorone is actually safer and more therapeutically active when given orally.

His experiments with mice demonstrate a 15-fold difference between the doses at which it is therapeutically effective as an interferon inducer and those at which it is highly toxic. Theoretically, at least, this provides a sufficiently wide margin of safety. Extrapolation of the mouse data to man, however, is risky. "We can't predict what will happen in man," Dr. Merigan declares. "We may find that therapeutic and toxic doses are very close or we may find an even greater margin than in the mouse."

Should tilorone become clinically available within the next few years, it could be put to work in a variety of circumstances. A pregnant woman exposed to rubella, for example, could be protected from infection. And, in situations in which large numbers of persons were in danger of being exposed to a virus during an epidemic, the pill could be downed as a prophylactic. □