quite rapidly now."

However, this may not necessarily be the case, according to Ryan at MIT. His group is the only one in the world now working on synthesizing functioning genes, although there are some others who are synthesizing nonfunctioning genes and strips of DNA that can function (SN: 12/13/75, p. 372). Ryan says that rapid progress in the synthesis of functioning genes is hindered by the the fact that "it is a tremendous amount of work." If it took the MIT team almost a decade to synthesize a gene only 207 base pairs long, how long would it take them to synthesize a gene 1,000 to 3,000 base pairs long, the size of a human gene, not to mention to unravel the nucleotide sequences of start-and-stop signals and to synthesize them as well? Unless there are some unexpectedly dramatic advances in biochemical methodology, he says, the synthesis of human genes won't take place for many more years. "You are talking about something my grandson might be doing," he says.

Fritz agrees: "Although it is possible that manmade genes may be used to correct genetic defects, that could be very far in the distant future." Still, he and other molecular biologists are confident that the synthesis of human genes will eventually be accomplished, and when that day finally comes, the technique will be used to help people with genetic diseases. The gene that makes human hemoglobin, for instance, might be synthesized, then injected into sickle-cell anemia patients, thereby replacing their defective hemoglobin and curing them of the disease. Or the gene that makes human insulin might be synthesized and, with the help of recombinant DNA techniques, inserted into the DNA of bacteria. The gene would then make insulin which could be harvested and used to treat diabetics.

Meanwhile, the MIT team will try to learn more about gene expression and how alterations in that expression might give rise to genetic diseases. As Fritz envisions, "We can now integrate specific changes in the structure of the gene and look at potential changes in its function. This has enormous implications for genetic defects in hereditary diseases where something in the gene control goes wild, and we don't know what parts of the gene are wrong." □

Acetylene in interstellar space

So many chemical compounds have been found in the gas and dust clouds of interstellar space that astronomers are beginning to feel that any compound they would like to think of could be found there if the means of finding it were available. Up to now, astronomers have mostly used the microwave range of the radio spectrum in their searches and so have been limited to compounds that have prominent resonance lines in that range. Now the discovery of acetylene (C_2H_2) by workers at the Kitt Peak National Observatory adds the possibility of systematically exploiting the infrared range of the spectrum.

The work was done by Don Hall and Stephen Ridgway of Kitt Peak with the assistance of Robert Wojslaw of Kitt Peak and Susan Kleinmann and Doreen Weinberger of the Massachusetts Institute of Technology. The acetylene was found in an area of the constellation Leo known as IR + 10° 216, a region of shells and an extended cloud of matter surrounding a very old carbon-rich star. Presumably the shells and cloud are matter thrown off by the star in its death throes.

The observation was made with Kitt Peak's 4-meter telescope, an instrument for visible-light observation, but also capable of infrared studies, and a Fourier transform spectrometer, which separates the wavelengths of the infrared and records the spectral characteristics of the source. This is a very new instrument.

Another important point is that the acetylene discovery was made in the middle of the afternoon. The stars cannot be seen clearly in the daytime because interference caused by sunlight scattering in the atmosphere blocks out their images. Infrared is much less subject to this scattering. So infrared observations can be done in the daytime, and the 4-meter Mayall telescope, one of the world's largest, now equipped with its Fourier transform spectrometer for infrared, can be kept working 24 hours a day. □

Occam's Razor: Viking's thin edge

William of Occam may turn out to be the unofficial patron saint of the Viking mission to Mars. *"Pluralitas,"* wrote the 14th-century Franciscan ranked by some as the last major medieval philosopher, *"non est ponenda sine necessitate."* Do not invent more hypotheses than are necessary; or, as it has come to be applied in more recent times, the simplest explanation that will fit the facts is probably the best bet. The idea has come to be known as Occam's Razor, and the man himself used it largely to shave off as unnecessary many of the split-hair, interfactional theories that continually rattled metaphysical thought and church-state relations throughout his life and times.

In science, perhaps even more than in theology, the Razor's role is often that of caveat, rather than of more general *modus operandi*. If you're having to stretch your present line of reasoning too far to explain what you're seeing, even if you have not yet been proved wrong, perhaps it's a sign that an alternative approach is closer to the truth. In Project Viking, with Mars providing new examples of the unexpected at every turn, old William's spirit is just starting to work out with the strop.

The most obvious example, though it's true in other fields as well, is the search for life. Two of the three experiments in the elaborate biology instrument are showing almost exactly what they ought to be showing if there are little Martians in there doing their metabolic thing. One problem is that the results suggest similarly energetic responses to two diametrically opposed chemical environments. A more fundamental issue, however, is that Viking's "biology" experiments are *not* designed to detect "life," whatever that is. They watch only for evidence of certain, extremely specific reactions that terrestrial experience says are usually among the list of life *processes*. It is the scientists' burden to push as close as possible to the knowledge of whether these reactions also represent life on Mars.

The first step—in fact it's virtually the only step—is to rule out all the possible nonbiologic ways of producing the same reactions. But for a virtually unknown planet, before they can be ruled out, they must first be conceived. And some of the proposals have been pretty exotic.

If Mars were more familiar—like earth, for example—Occam's Razor would already have been slashing away with abandon, inspired by a fresh crop of theories ranging from the plausible to the house-of-cards. But it takes time to draw enough useful guidelines to do a little cutting. A long, exponential growth curve in the labeled-release experiment, for example, would rule out a lot of present chemical possibilities on the kinetics of the release rate alone. (The LR instrument began looking at its latest sample on Aug. 28, and will continue to do so until solar conjunction shuts off communications with the lander early in November.) Occam's Razor opts for the simplest explanation that fits all the facts, and so far, the facts are simply too few.

Nonetheless, it's a useful tool. Viking's biology package may provide extremely strong evidence of life, perhaps even leading to a consensus, but it will never be able to provide absolute, 100-percent proof. Nor will a biologically oriented "wet chemistry" instrument (which would seek optically active amino acids), nor a multiple-reagent "integrated" biology instrument being considered for possible post-Viking missions. Even the various proposed automated missions to return a Martian soil sample to earth ("Andromeda Strain" considerations are a separate problem) could be less than conclusive, since the sample would be vibrated, exposed to alien materials, cut off for months from its native sunlight and deprived of its usual atmospheric interactions. The razor may still be needed to separate the reasonable from the merely conceivable.

It's possible, of course, even likely, that if the presence of life on Mars is definitely established, some will wonder in retrospect why the answer wasn't obvious. Hindsight could reveal that no inanimate chemistry imaginable should have been thought capable of producing such signs. Viking scientist Leslie Orgel of the Salk Institute, who labored for years as part of the effort to understand the formation of the building blocks of life, says, looking back, that one wonders why it wasn't easier. Given the knowledge of the necessary conditions, the long-sought result turned out to be almost unavoidable. For now, however, the razor must be a prime factor in deciding whether biology or chemistry is the easy way—even if the authors of some theories suffer a little sympathetic bleeding.

But then, William of Occam was controversial even in his own time. The chancellor of Oxford, where he was studying for his doctorate, accused him of heresy, and Pope John XXII himself called him on the carpet. But you can't keep a good razor down. □

Cell transplants for diabetes

Scientists have long visualized the day when diabetics whose pancreatic cells do not make insulin might receive an injection of pancreatic cells to correct the deficiency. Then the patients would once again be able to convert sugar to energy without difficulty and avoid diabetic coma, insulin shock, heart disease, kidney failure and other hazards and complications of the disease.

This hope has now become a near-reality for one diabetic, thanks to John S. Najarian, chairman of the Department of Surgery at the University of Minnesota Medical School in Minneapolis. He reported his successful application of this treatment approach last week at the Sixth International Congress of the Transplantation Society in New York City.

Back in the 1960s, several researchers conceived of the idea of taking cells that make insulin from the pancreas, so-called beta cells, mixing them with salt water and injecting them into the portal vein behind the pancreas in hopes that the cells would nest there and start making insulin. The technique was successfully used in animals by the late 1960s. After that, Najarian and his colleagues confirmed the results in animals and then, a year-and-a-half ago, tried the technique on seven diabetics.

The technique worked beautifully in one patient and has continued to do so for 18 months. Her need for injected insulin has been reduced by two-thirds. The technique also helped five of the other patients for nine weeks or so.

There are several major hurdles to getting the treatment to work in patients, Najarian explains. One is the difficulty of getting the cells targeted to the right site in one injection. Another is getting the patient's body not to reject the cells as foreign because they are from another person. The rejection problem did not exist in the animal experiments because donor and recipient animals were closely inbred, and it was minimized in Najarian's seven patients because all had received kidney transplants previously and were on immunosuppressive drugs.

Only when these challenges are better met will the techniques become widely available to diabetics with malfunctioning pancreases. And even then it is doubtful whether the technique will help those diabetics whose problem is not inadequate insulin production but rather something in their blood that antagonizes the action of insulin or a deficiency of insulin receptors on their insulin target cells (SN: 10/19/74, p. 248). □

One hand, one thumb: Test for depressives

It was 1899 when the German psychiatrist Emil Kraepelin introduced the term "manic-depressive psychosis" into the psychiatric vernacular. He described it as recurrent cycles of attacks of elation and depression, and pronounced it as being one of the two primary complexes of mental illness—the other is now known as schizophrenia—from which all others derive.

Studies spanning several decades have shown since then that some individuals experience only the "manic" part of manic depression, some only the depression (unipolar depression) and still others experience both types of reactions (bipolar manic depression). But researchers have not been able to prove that unipolar depression and bipolar manic depression are two distinct affective disorders—let alone give a consistent diagnosis for one or the other. Estimates of agreement between diagnosticians reach as low as 30 percent in various studies.

Through work on what they call the "Thumb Opposition Test," Erica Metzig, Steven Rosenberg and Mark Ast of the Bernard W. Schlesinger Foundation in New York and Steven D. Krashen of the University of Southern California have presented evidence (BIOLOGICAL PSYCHIATRY 11:313) supporting the hypothesis that depression is related to the left hemisphere of the brain, which is dominant in most human beings for language control (SN: 4/3/76, p. 218), while the mania of manic depression is related to the brain's minor or right hemisphere.

Since the body's right side is controlled by the left hemisphere of the brain, they found that left hemisphere depression would be associated with a slight loss of spontaneous movement of the body's right side. Right hemisphere mania would be associated with loss of spontaneous movement of the body's left side.

The test involves—what else?—the thumb. This digit has been anthropologically connected with having developed in direct parallel with the evolution of the human cerebral cortex, which is responsible for humans' superior cognitive functioning. The movement of thumb opposition, placing the thumb pad to the pad of any other finger, especially the little finger, is the most complex and refined in the entire body.

The researchers applied the test for the purpose of distinguishing a group of bipolar manic depressive patients from a similarly sized group of unipolar depressives. A control group of normal subjects also took the test. Twenty-eight of the 52 right-handed normals (approximately 50 percent) could more directly approximate the pad of the right thumb to that of the little finger. Because these subjects were right handed and showed right hand superiority, they were termed "pure dominant." The remainder were termed "cross dominant" since they had right hand preference but left side superiority in thumb opposition.

Of the 25 right handed, bipolar manic depressives, 21 were pure dominant. Of the 26 right handed, unipolar depressives, 17 were cross dominant. The results with the left handed groups were similar.

The findings demonstrate that even normal human beings show an unequal capacity for rotation between both thumbs. Consequently, people are left-and-right thumbed as well as being left-and-right handed. But compared with the control group's 50 percent split between pure dominant and cross dominant, the unipolar depressive patients showed a higher frequency of cross dominance, and the bipolar manic depressives showed greater pure dominant tendencies.

This suggests, say the researchers, that thumb opposition, together with handedness testing, may be capable of detecting the right or left hemisphere's vulnerability to unipolar depression or bipolar manic depression. They also feel that the two diseases may be directly linked to the right or left hemispheres of the brain—bipolar manic depression to the former and unipolar depression to the latter. Perhaps, they say, the tests may be used for early detection and diagnosis of the two seemingly distinct illnesses.

"Since manic depression and recurrent depression have been shown to have a high genetic component," explain the scientists, "the first application of the test would be to relatives of already afflicted patients. For relatives are at a high risk for these diseases compared to the rest of the population." □