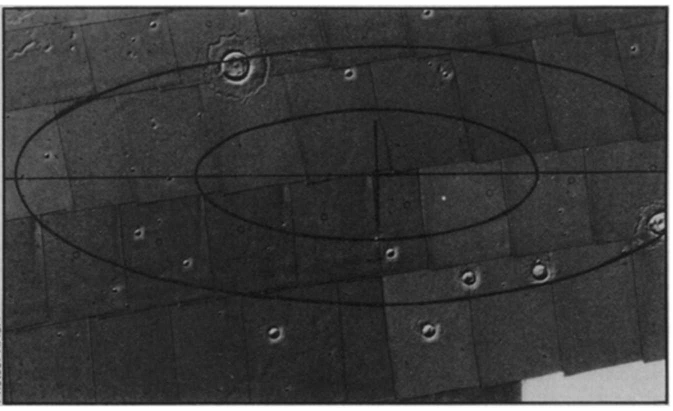
Viking Flight: On the sediment trail

Photos: NASA

Plateau's steep south and tapered north tell site story.



New site for first U.S. Landing on Mars: Bland but safe.

Mars has overturned a lot of theories, and left others languishing for want of data. Fortunately, when the Viking spacecraft team was desperately looking for an alternative place to land the first U.S. vehicle ever sent to the surface of the Red Planet, one key theory proved right on the money: Where there's a source, there's a sink.

A source and a sink for sediments. The original site was on the southeastern edge of the huge Chryse plain, near the mouths of several of the channels that seem so likely to have carried rushing water onto the plain in the ancient Martian past. Too near, as it turned out. Viking's photographs (SN: 7/3/76, p. 4) revealed that the turbulent effects of the water (or whatever it was) had chewed up the site terrain, uprooting boulders, cutting rivers, exposing knobs of bedrock and eroding islands. In seeking an alternative spot, mission scientists including geophysicist Robert B. Hargraves of Princeton, noted that the sediment stirred up by all that activity had to be going *somewhere,* covering up the rough spots and progressively smoothing the way. The logical choice was farther in toward the center of Chryse, where the channel streams would have widened and slowed down, depositing their sediments in the process.

The theory paid off. Aiming Viking's cameras to the northwest, the scientists soon discovered an island-like feature whose southern edge—facing the channels—showed all the signs of a steep, water-worn shoreline, while its northern edge, although rougher, seemed to taper off onto the plain. "It looks," said orbiter imaging team leader Michael H. Carr of the U.S. Geological Survey, "as though the geologic model which pushed us in this direction is holding up." Each series of photos showed successively gentler terrain. The riverbeds expired, the pitting disappeared, even the jutting knobs receded into the surface layer. Finally, the scientists chose their landing site—"about as smooth a spot as we've seen on the planet," according to site-selection head Harold Masursky. It was even suitably distant from any large impact craters, which have a disconcerting habit of throwing boulders (invisible from orbital height) to a distance of many times the crater's diameter.

The site, at 23.4° N by 43.4° W, lies about 580 kilometers west-northwest of the original, scarcely 90 kilometers from Chryse's shallow central depression. The only remainder of the exotic terrain left behind is a single, tiny knob less than 10 kilometers across, about 75 kilometers away—"the last of our friends from the southern region," Masursky says. The knob is also the only signpost left to indicate that the area was once flooded enough so that the sediments reached it—although, Masursky warns, the tempting layer of river wastes may be covered with a layer of volcanic ejecta. This is far from being a tragedy—a look at the stuff of the inner Mars would be a fair trade for surface deposits—but it will take the lander's soil analysis to be sure. The declining factor in the final pinpointing (though it could still change if later photos belie the early information) was a detailed "hazard probability analysis" by James A. Cutts and other team members showing that the move to the new site dropped the chances of Viking's landing on a hazardous spot from about 10 percent to as little as 1.5 percent. An additional plus is that the site is as much as a kilometer lower than the original one, offering a denser atmosphere of about 8 millibars pressure, a promising condition for past concentrations of water.

The site looked so promising that the cautious Viking planners decided to drop three days of observations. Together with two more days gained by advancing an orbit-change maneuver, the decision restored five days of precious surface time to the Viking lander from the previous delayed date, important to lengthy biological and other analyses. The landing is now set for Saturday, July 17, at 3 a.m., PDT. The first picture from the Martian surface should be back on the earth 47 minutes later.

The primary site for the second landing in September is dominated by a surprisingly regular array of cracks forming a pattern of polygonal cells, each about 20 to 30 kilometers across. They could be simple volcanic fissures, or the result of shrinkage from cooling, or cracks caused by tectonic uplift of the surface, Masursky suggests. Carr points out a possible analogy with the so-called "polygonal ground" known in the terrestrial Arctic, created when frozen water melts into tiny fissures, then freezes again, widening the openings, then remelts as the cycle starts anew. The "supersafe" backup site for Viking 2 chosen long ago, in case the first lander should crash, is about 50 kilometers from a spectacular canyon 2 kilometers deep, according to Mariner 9 photos. Viking has shown it to have a fascinating diversity from a huge sand dune at its base (leading into a feature called Gangis Chasma), to the remnants of crisscrossing avalanches on its face, with signs of extreme erosion. While Viking's cameras were photographing the planet, the heat-mapper and water-detector aboard the orbiting craft were also at work. Virtually the entire effort has been directed at ensuring a safe landing, but last week the heat-mapping team made a discovery that has prompted officials to devote portions of five more of Viking's once-daily orbits to checking it out: Unexpected cold. The only major constituent directly detected in the Martian atmosphere is carbon dioxide. The best estimate of a mean surface pressure so far (not directly measured, but calculated from radio occultation measurements) is 6.1 millibars. At that pressure, the lowest possible temperature that would not cause the CO_2 to freeze out as a snow of dry ice, says team leader Hugh H. Kieffer of the University of California at Los Angeles, is −193°F. Yet twice, in the vicinity of the Martian south pole, the heat-mapper reported temperatures as low as −216°F. The likeliest explanation, says Kieffer, seems to be that the CO_2 is diluted by some inert gas that simply won't freeze out at those temperatures—another indication of the already inferred presence of argon. Argon has been estimated to comprise up to 35 percent of the air of Mars, but the polar temperatures measured by Viking would indicate that the inert component comprises as much as 80 percent of the *local* atmosphere, Kieffer says, causing a substantial depletion over the rest of the planet. The huge quantity of the inert component, he says, comes from the fact that about a third of the atmosphere takes part in the freezing out that forms the winter polar cap. The total pressure drop (including CO_2) over the planet should be only a small amount, he points out, since the cap in the opposite hemisphere is melting at roughly the same time, but more slowly. ☐

Insulin: Before and beyond

Scientists have known that the hormone insulin is made from a larger protein—proinsulin. Now it appears that proinsulin itself is derived from a still larger protein. This discovery should help in the eventual isolation and characterization of the gene or genes that makes these proteins and ultimately insulin, opening new approaches to the treatment of diabetics or to the mass production of insulin for such treatment.

Only recently has it become possible to isolate large amounts of the islets of Langerhans, the tissue of the pancreas that makes insulin. Such isolation, in turn, permits the preparation of small amounts of messenger RNA's, the molecules that translate gene messages into proteins. These mRNA's can then be placed in the test tube and primed into making proteins. What are the proteins made by these mRNA's? Shu Jin Chan, Pamela Keim and Donald F. Steiner, biochemists at the University of Chicago, attempted to find out, using isolated islets from rats.

As they report in the June Proceedings of the National Academy of Sciences, the initial protein made by these mRNA's is not proinsulin, but a still larger protein. It has a molecular weight of 11,500 daltons—about 2,500 daltons larger than proinsulin. They call the larger protein "preproinsulin."

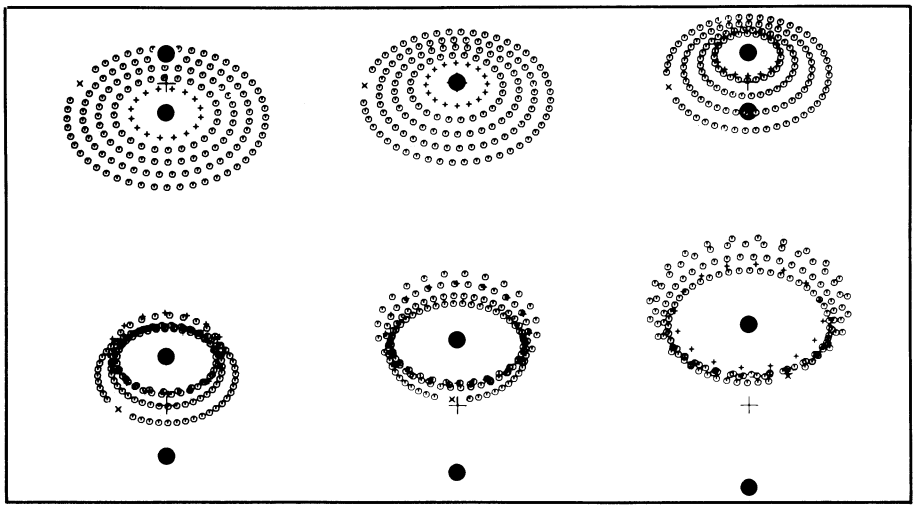
The positive identification of the mRNA's which make preproinsulin, proinsulin and eventually insulin, the investigators believe, should facilitate the isolation and characterization of the genetic material involved in their production. The gene or genes could then be synthesized, opening new doors to the treatment of diabetics or to the mass production of insulin.

For instance, Walter Fiers of the University of Ghent, one of the first researchers to unravel the chemical composition of a real gene that dictates the production of a protein (SN: 1/6/73, p. 12), suggests that the synthetic gene or genes might be incorporated into the islets of Langerhans of diabetics to make the insulin they lack. Whether the gene or genes would make the desirable preproinsulin, proinsulin and insulin they need is not known. But it is now possible to get a synthetic DNA sequence to make proteins in a living cell, thanks to the new techniques of recombinant DNA engineering (SN: 6/19/76, p. 389).

Recombinant DNA engineering may also eventually allow the rapid mass production of preproinsulin, proinsulin and insulin in bacteria. Such products could then be used to treat diabetics. Such rapid, large-scale production "could be important because we just barely have enough insulin available for our needs today," attests James M. Moss, a diabetes authority at Georgetown Medical School. Livestock sources of insulin used for treatment are decreasing, whereas the number of diabetics is increasing. ☐

A ring galaxy and how to make it

Among the notables in Halton C. Arp's (Hale Observatories) collection of "peculiar galaxies" is this photograph of a ring galaxy never before published. In a keynote address at the recent American Astronomical Society meeting, Alar Toomre of MIT discussed this and other cosmic oddities. His theoretical work deals with them in terms of "interacting galaxies." His hypothesis for the ring galaxy describes it as the remains of a "collision" in which a massive body (large dot) passes through the disk of another galaxy. The theoretical sequence of events is pictured below where even the displacement of the remnant galactic nucleus is predicted.



Milwaukee project: Nine-year follow-up

The IQs of seemingly retarded children reared in the worst city slums can be increased by an average of 33 points. This surprising finding was made in 1971 by Rick Heber and his colleagues from the University of Wisconsin (SN: 7/10/71, p. 24). Forty children had been selected. Twenty received intensive educational intervention and made impressive gains when compared with control children who had not received special education. But these children were less than four years old at the time, and the question was: Will these gains hold up—especially after the children enter school? The answer is: Yes.

Heber has followed the progress of the children who took part in what is now known as the Milwaukee Project. At nine