the planet in question formed.

One set of Pioneer Venus instruments mass spectrometers — appears (although the mission is still young and another sensor is so far in disagreement) to offer preliminary indications that while Venus and earth may have similar total amounts of argon, Venus has a markedly greater proportion of the primordial isotopes. If true, it is still only part of a complex and yet-evolving picture with many interpretations, but one indication of the scope involved is suggested by Michael B. McElroy of Harvard University, who raises the question of the basic genetic differences among the inner planets.

Some past models of planetary formation have assumed that the solar system's worlds condensed from a roughly homogeneous mixture — that they were made from similar materials. Studies of Mars by the Viking spacecraft had shown a number of key elements such as nitrogen in proportions similar to earth's, and although primordial argon was much lower, McElroy says, alternate ideas were offered to rationalize the discrepancy. Perhaps, for example, when Mars condensed, the nitrogen from the primordial nebula was chemically or otherwise held within the planet more effectively than was the inert argon, letting the argon "outgas" first to form a primitive atmosphere. The early energetic solar wind could then have swept past the planet carrying off much of the argon so that it would be underrepresented in the atmosphere that emerged later (including the nitrogen) after the solar wind had "died down." Earth would not have showed such an effect, since its much stronger magnetic field would have held off the solar wind; Venus, however, already suspected of having a very weak field, would make an excellent test. The field is indeed extremely weak, as the Pioneer Venus orbiter's magnetometer is already confirming, yet some of the mass spectrometer data seem to show a rich supply of primordial argon. The inference, McElroy says, is that the preplanetary nebula may have been not homogeneous but graded, with the amounts of argon and other gases decreasing with distance from the sun. Venus, closest to the sun of the three inner planets with atmospheres, would thus retain the most primordial argon; earth would be in the middle, while Mars would have least of all — a neat sequence that fuller studies of the data may or may not support.

Another key element on Venus is sulfur, suspected to exist in various forms and believed by some to account for the dark streaks in computer exaggerated versions of ultraviolet images returned by the Mariner 10 spacecraft (since sulfur is an absorber of UV). Although early analyses this week were just beginning to reveal the possibly wide range of sulfur compounds in the atmosphere, even the first of the Pioneer Venus orbiter's UV images added interest by failing to show the dark markings, an indication that they may occur below an overlying haze layer.

Also intriguing, the descending probes revealed the atmosphere's particles and droplets to be grouped in several discrete size ranges — an odd finding made even stranger when all the particulates seemed to abruptly disappear below about 45 km, the bottom of the main haze layer. The thick yet surprisingly clear atmosphere beneath, says Robert Knollenberg of Particle Measuring Systems, Inc., is "immaculate."

A major part of the mission is plotting the hot atmosphere's dynamics — the ways in which the incoming solar heat and that trapped by the "greenhouse effect" are transported up, down and around the planet. Scientists this week were beginning to plug their new data into various proposed circulation systems, including elaborate patterns of convection cells and such concepts as "vertical jetstreams." Infrared data from orbit suggested the visible cloud tops in the polar regions to be warmer than those near the equator, prompting the speculation that the polar clouds are lower, driven down by descending air from lower latitudes. (Unfortunately, temperature readings from the probes' descents seemed strangely to become erratic below about 15-km's altitude, though the information is expected to be extractable from other sensors.)

Meanwhile, above the atmosphere, the planet's weak magnetic field lets the solar wind reach almost unimpeded to the ionosphere, an unearthlike relationship compared by one scientist to "spraying a billiard ball with a firehose." In parts of its ever-shifting orbit the orbiter is enabling the first steps in mapping new details of the interaction region's shape — the close passage of the solar wind past the planet, the shockwave sunward of the ionosphere's boundary — while elsewhere is unpredictable turbulence. A controversial possibility is that the "wind" may actually get close enough to affect the bulk atmosphere, such as in McElroy's highly tentative suggestion that the escape of hydrogen from the top of the atmosphere may be balanced by incoming hydrogen from the sun. Although Venus is virtually a waterless planet at its surface, perhaps such a hydrogen balance could contribute to keeping the atmosphere's minimal amount of water vapor in some sort of steady-state situation.

As for the surface of the planet, Pioneer Venus carries the one known eye that can "see" it from orbit: radar. A tiny swath of the surface is covered each day by the instrument, leading — after lengthy and careful processing — to both images (not photos, but representations of radar brightness) and elevations. Both components are necessary if scientists are to reduce the great uncertainty about the surface of Venus — just one of the many long-range goals of the Pioneer Venus mission. □

Indirect evidence for gravity waves

Physicists — and maybe the rest of the world — have waited many years for a direct confirmation of the existence of gravity waves (SN: 3/18/78, p. 169). The waves are predicted in Einstein's theory of general relativity and involve oscillating gravitational forces as light waves involve oscillating electric and magnetic forces.

Now, thanks to the only radio pulsar known to be a member of a binary star system, there is indirect evidence for gravity waves. Richard A. Taylor of the University of Massachusetts reported to the Texas Symposium on Relativistic Astrophysics meeting in Munich this week that a four-year monitoring of that pulsar by him, Peter M. McCulloch (on leave from the University of Tasmania) and Lee A. Fowler shows that the binary system is losing energy at a rate consistent with gravity wave emission. Theory says binary systems should emit gravity waves. The waves carry away energy, and the loss of energy means that the binary orbit shrinks. A narrower orbit means the pulsar goes around faster, and this orbital motion can be monitored because the pulsar emits sharply timed radio bleeps. □

Resistance is in the genes . . .

Insects become resistant to pesticides, bacteria become resistant to antibiotics and malignant cells become resistant to cancer drugs. A common mechanism may explain these frustrating developments and dictate principles for rational drug therapy.

Resistant in insects, bacteria and cells develops through survival of the organisms most capable of counteracting the drug. Robert T. Schimke and co-workers at Stanford University have analyzed the resistance of laboratory-grown mouse and hamster cells to methotrexate, a drug commonly used in treating malignancy. Generally the cells develop resistance by boosting their production of the enzyme dihydrofolate reductase (DHFR), inhibited by the antimalignancy drug. The resistant cells contain approximately 200 times as much DHFR as sensitive cells, and can survive in concentrations of methotrexate 3,000 times greater than the normal lethal level.

Genes are at the bottom of the sensitivity change, and it is a gross effect, the researchers find. The resistant cells contain approximately 200 times the normal number of DHFR genes, Schimke explains in the Dec. 8 SCIENCE.

The many copies of the DHFR gene are clustered in an expanded region of one chromosome in the resistant cell, Jack H.