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## A new class of moons

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One of the more subjective complaints about the Apollo program used to be that all those astronauts tramping around on the moon changed it from a friendly light in the sky to a dull ball of rock. A closer look at the natural satellites of the worlds in the solar system, however, reveals that even in scientific terms they are far more diverse.

In a general way, the objects of the solar system that are near the sun are primarily rocky, while the more distant ones are icy. Superimposed upon that pattern is another that reflects the individual thermal histories of the planets and their effects upon each planet's moons. Even in the chilly regime from Saturn out to the edge of the solar system there are variations; near-infrared reflectance studies have suggested that the satellites of the outer planets fall into at least five distinct categories, representing surface compositions of water ice, rock, evaporite salts, methane ice and a mixture of water ice with some neutrally reflective substance.

Now a team of University of Hawaii researchers has concluded that there is yet a sixth category, different from all the rest and representing a surface composition so far unidentified. Furthermore, Saturn, Uranus and Neptune all seem to have satellites that belong in the new group.

The new category, whose near-IR "signature" falls roughly between those of bare rock and the ice-and-something mixture, includes Saturn's moon Hyperion, two moons—Titania and Oberon—of Uranus, and Neptune's large satellite Triton. The categories are defined by their relative reflectances in four near-IR bands known as H, J, K and L (1.60, 1.25, 2.2 and 3.5 microns, respectively). The new category, according to Dale P. Cruikshank, Carl B. Pilcher and David Morrison, who made their study as visiting scientists at Kitt Peak National Observatory in Arizona, is characterized by neutral reflectance between J and H and rapidly decreasing reflectance at K and L.

In a report to be presented at the meeting of the American Astronomical Society's Division for Planetary Sciences in Honolulu, the authors confirm that the four satellites in question "do not show the JHK signatures of the frosts of water, methane or ammonia ice. Neither do they have the colors of such previously observed nonvolatile surfaces as those of Io, Callisto or the dark side of Iapetus." And all of this is "in spite of their greatly differing sizes and distances from the sun."

The five categories related to likely surface compositions, according to the authors, are: evaporite salts (Io); rock (Callisto and the bright side of Iapetus); water ice or frost and some neutral mate-

rial (Ganymede, Enceladus, Tethys, Dione, Rhea and the dark side of Iapetus); dominant water ice or frost (Europa and the rings of Saturn), and methane ice or frost (the planet Pluto). Not all of these assigned compositions are certain, how-

ever, the authors point out, and some objects have yet to be categorized. Identifying their surface materials, they say, "is of crucial significance to the refinement of models of planet and satellite formation from the solar nebula." □

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## Innovative education: Little effect

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A recently-released study sponsored by the U.S. Office of Education found "no evidence" that new teaching techniques or more individualized instruction improved academic performance of pupils. The study has stirred some protests over its methodology and conclusions, but it is also likely to revive calls for a "back to basics" approach to schooling.

Called Project LONGSTEP, the three-year study involved 30,000 students in 80 schools spread across nine widely scattered states. The American Institutes for Research, of Palo Alto, Calif., conducted the study, which inquired into the effectiveness of such innovative techniques as team teaching, independent study, use of paraprofessionals, redesigning of schools and incorporation of films and programmed teaching machines.

The initial report of findings covers students who started out in the first, fourth and sixth grades, whose progress was fol-

lowed for three years. Standardized achievement tests were given to determine their rate of progress. The researchers conclude that none of the innovations examined seemed to make much difference in the progress of the students.

One variable, however, did make a difference—the amount of time spent on a subject, particularly in the lower grades. Second graders who spent more time reading, not surprisingly, learned to read better than those who spent less time.

The researchers caution that their study "should not be viewed as a sweeping criticism of the concepts of innovation or individualization," but that they should remind educators that "innovation *per se* will not necessarily produce dramatic effects on student achievement." Some critics of the study say it did not measure the benefits to disadvantaged children and that factors such as creativity were ignored. □

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## New clue to Legionnaires' disease

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Last summer, a mysterious disease struck 180 persons who attended an American Legion convention in Philadelphia and killed 29 of them (SN: 8/14/76, p. 102). Since then, many causes of the disease have been pursued by the Center for Disease Control in Atlanta and other investigators, but none of them has panned out. Among those investigated were a flu virus; ornithosis, a viral disease transmitted by bird droppings; rabbit fever; Lassa fever, a deadly tropical viral disease; Marburg disease, an African viral malady and nickel poisoning or poisoning by traces of other toxic metals.

Now another lead is being pursued that looks somewhat more promising than those considered to date—parrot fever. This rare illness (psittacosis) is caused by an intracellular parasite with an unusual life cycle. It was suspected at the beginning of the epidemic because it is one of the few infectious diseases known to induce high fevers and severe pneumonia in humans. Characterized by a delayed onset, lack of secondary spread and a high death rate, it seems comparable to the unknown illness in Philadelphia. However, the CDC publicly ruled out the possibility of the disease two days later, because of unsuccessful efforts to isolate the parasite that causes it, chlamydia.

Nonetheless, testing for parrot fever continued at CDC labs and several other labs throughout the United States. It looks

as if the persistence has paid off. The National Animal Disease Center in Ames, Iowa, has reported that blood samples from three afflicted Legionnaires showed signs of recent infection by chlamydia.

This time chlamydia apparently reacted with chlamydial antibodies in the blood of disease victims. The observed antibody levels were relatively low, says Leslie Page, the chlamydia authority who supervised the tests. But the study results showed antibody levels rising and falling, a sign of recent infection, and heavy treatment of patients with antibiotics might explain the generally low antibody levels.

What's more, the animal disease center tested blood taken from Sheila Moriber Katz, a Philadelphia pathologist who became seriously ill with a pneumonialike disease after studying tissue samples from three victims of the Legionnaires' illness. The blood samples from Katz were tested by three techniques, and all three were clearly positive for parrot fever.

Page recommends that blood tests be performed on as many as 100 victims of the Legionnaires' disease and also on 100 Legionnaires who attended the convention but who did not become ill. If the prevalence of chlamydial antibodies in the two groups is significantly different, he says, it might be possible to draw some conclusions about whether parrot disease was the true culprit. □