ferent frequencies. This system requires fewer channels than an assigned frequency unit. An incoming call is recognized by a unique two-tone code; outgoing calls are placed using a push button format.

Indonesia's new "Palapa" satellite represents an important experiment in the improvement of telecommunications for developing countries. The country has a unique communications problem—it is the world's largest archipelago, with 130-million inhabitants spread over 13,000 islands. Today there are only 250,000 telephones in the whole country, mostly concentrated in urban areas.

Beginning August 17, Indonesia's 31st Independence Day, commercial telephone and television service is scheduled to begin via the Palapa satellite, and within two years the total number of phones in the country is expected to more than double to 650,000. The satellite has 12 transponders, each capable of carrying 500 two-way telephone conversations, one color television channel, or various combinations of data and teletype transmission. Already a second satellite is scheduled for launch in 1977.

The $71 million project should produce a number of immediate benefits. A national educational television network is planned that will extend elementary education to 85 percent of Indonesia's 7-to-12-year-old students. Domestic industry will grow as remote crews are sent to explore the nation's vast natural resources, while remaining in touch with their home bases. And benefits to other countries in the area should also result as Indonesia leases some of the satellite's capacity to its neighbors. □

Falcons—A happy ending

The years of patient research and husbandry by Cornell University ornithologists are at last paying off, as dozens of peregrine falcons were released this week in six states to repopulate habitats where the species had been entirely wiped out. Pesticides and auto exhaust had killed off the peregrines east of the Mississippi by the early 1960s, but environmental action has now made the area once more habitable.

The falcon work was pioneered by Thomas J. Cade and his associates at Cornell University (SN: 9/8/73, p. 158), where new techniques had to be discovered for breeding the birds in captivity and then training them to survive on their own. Care was taken to simulate natural nesting sites and allow the birds to form lifetime mating pairs. Conditioning the falcons for life in the wild was accomplished through a refined version of the ancient art of falconry, in which a human trainer oversees the young predator's long period of trial and error in hunting.

Previous releases of smaller numbers of birds illustrated other problems involved in reestablishing the lost population. The first birds released were shot by people who disliked the whole idea; so, with one exception, the locations of this year's releases will not be announced. Also, locations will be chosen with some care to protect the young falcons from their natural enemies—last year two of the freed birds were killed by Great Horned Owls.

But previous trials have indicated that the ornithologists were correct in their theory that was critical to the success of the mission—that the birds would not migrate north of their birthplace and would not head south with the onset of winter. Should they have flown to Latin American countries where pesticides are still used indiscriminately, their survival would again have been jeopardized. Instead, the falcons seem to head toward the East Coast during winter months to prey on migrating waterfowl.

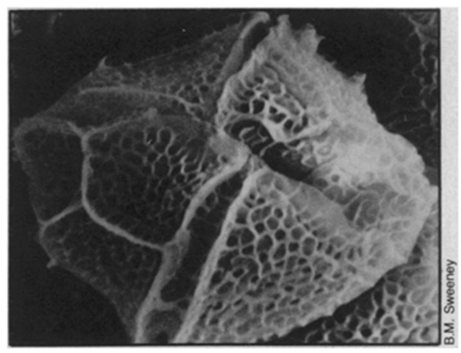
Some 30 peregrines will be released this year, in New York, New Hampshire, Pennsylvania, New Jersey, Maryland and Colorado, where they will join about a dozen birds that have survived previous releases. By next year, Cade's breeding facility (nicknamed Peregrine Palace) is expected to hatch close to 100 falcons for return to the wild. □

Switched-on membranes: Internal clocks

Flowers open and close, oysters wake and sleep, dogs scratch at the back door for afternoon walks, each following a circadian rhythm or internal biological clock. Humans have circadian rhythms, too, for sleeping, eating and other body functions—rhythms that can be disrupted by air travel, night shifts and irregular hours. An active search for the biochemical basis of internal timekeeping has been prompted by both scientific curiosity and a desire to control these uncomfortable disruptions in human cycles. A significant clue to that biochemical question has now been reported.

Biologists from the University of California at Santa Barbara, Marina Adamich, Philip C. Laris and Beatrice M. Sweeney, report evidence of membrane changes linked with circadian timekeeping in the June 17 NATURE. They chose a single-celled marine dinoflagellate called *Gonyaulax polyedra* for their experimental organism. Although, as a cause of red tide it has a bad reputation, (and is nearly unpronounceable, besides) it turned out to be a good choice for a number of reasons: Its bioluminescence (the famous, eerie glow, offshore at night), photosynthesis and cell division are all governed by circadian cycles. It is easy to grow in the laboratory. And as a unicellular organism, its internal clock cannot be linked to other cells or tissues.

Previous theories predicted that ions passing back and forth through membranes in a feedback cycle might generate regular, selfsustained oscillations and thus "timekeeping." Physical membrane changes had been seen in *Gonyaulax* and other organisms, but Sweeney's group is the first to actually demonstrate chemical potential changes that fluctuate with circadian cycles.



Gonyaulax polyedra: Membrane testing.

The team grew *Gonyaulax* in an alternating 12 hour, light-dark schedule—then switched the cells to constant low intensity light during the experimental measurement period so the light changes themselves could not exert oscillating effects. They couldn't, for a number of reasons, measure changes in potassium ion concentrations across the cell membrane directly with electrodes. They used, instead, an ion carrier dye, valinomycin, that fluoresces when potassium concentrations are high in the cell's liquid medium. By adding potassium, measuring dye fluorescence changes, then comparing the results when the same amount of potassium is added during different times in the cell's circadian cycle, the team established that there are membrane potential changes during circadian timekeeping—a step toward someday controlling internal clocks. □