Magellanic Clouds: Then there were 3

When European mariners first ventured into the southern oceans, they found not only lands and peoples previously unknown to Europe, they found also a sky that Europeans had not seen. A prominent feature of that southern sky are the Magellanic Clouds, so called because the first report of them came to Europe from the voyage of Ferdinand Magellan.

Astronomical observation has established that the Magellanic Clouds are galaxies, and galaxies fortunately placed for astronomers' purposes. These small galaxies are satellites of our own galaxy. At 150,000 light-years they may not be the nearest other galaxies to our own, but they are the nearest clearly visible ones. Since Magellan's day astronomers have counted two Magellanic Clouds, the Large and the Small. Now it looks as though there may be three. Don Mathewson, director of the Australian National University's Mt. Stromlo Observatory, and co-worker Vincent Ford reported this finding at the recent symposium on the structure of the Magellanic Clouds at Tübingen, West Germany, sponsored by the International Astronomical Union.

The Magellanic Clouds are much studied because astronomers can easily distinguish and study individual stars and other features in them. They can thus provide astronomers with a certain confidence that the laws of stellar evolution and galactic dynamics worked out from within our own galaxy are also valid elsewhere.

One of those laws relates a given star's velocity to its location with respect to the center of its galaxy in a smoothly varying way. Stellar velocities as measured in the Small Magellanic Cloud do not seem to follow this law. They vary in quite a scrambled way. Astronomers have engaged in puzzled controversy over this for years.

Mathewson's proposal rests on observations done at the Parkes radio telescope and two optical telescopes, and on a computer program worked out by researchers at Nagoya University in Japan. The problem can be solved, Mathewson says, if the observed stars are separated into two galaxies that lie on the same line of sight from earth and so look as if their stars were all jumbled together. Mathewson calls this the solution of a complex "jigsaw."

In this view the Small Magellanic Cloud thus becomes two; these observers call the third galaxy the Mini Magellanic Cloud Remnant. The SCM and the MMCR are about the same size. They lie about 30,000 light-years from each other and are moving apart at about 40 kilometers per second. *—D.E. Thomsen*

Sodium signal reassessment

The molecular scenario for a signal traveling along a nerve cell membrane is being revised as a result of a new technique. The textbook image of the process stems from 1952 studies on unusually large nerve cell fibers from squid. Now scientists working with mammalian cells propose an alternative description that they say will simplify the task of understanding an essential element of the nervous system.

The nervous system's basic signal, carrying information along the meters of nerve fibers that course to and from the brain and integrate messages within the brain, is the opening and closing of ion channels. The most important of these is the sodium channel, which allows sodium ions to flow into a nerve cell, changing the electrical charge distribution across its membrane. This electrical change spreads, triggering the opening of sodium channels further along the way. At any point on the nerve cell membrane the number of open channels increases rapidly at the start of the signal and then falls more gradually.

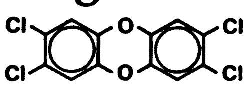
Imagine a dike that begins to leak when the sea reaches a certain level. It is patrolled by a battalion of Dutch boys who plug the holes. The traditional view of sodium channels can be envisioned as leaks that all begin at about the same time. The eventual slowing of the water flow reflects the rate at which the boys get to the holes. According to the revised explanation, new leaks continue to occur at varying times after the sea rises, and each is rapidly plugged by a vigilant boy.

Flow of sodium ions through hundreds of individual sodium channels was observed by Richard W. Aldrich, David P. Corey and Charles F. Stevens of Yale University in New Haven, Conn. They used the recently developed patch clamp technique (SN: 11/7/81, p. 295). Previous experiments had measured the flow of ions through many channels simultaneously.

"Many channels are opening for the first time during the process that normally would be described as inactivation," Aldrich and colleagues say in the Dec. 1 Nature. "At any time during the [signal], current is flowing through channels that only recently opened for the first time." The mean open time for a channel is only 0.5 milliseconds, then most channels assume an inactivated state.

Hans Meves of the University of Saarlandes in Saar, West Germany, says, "What is not clear is whether these new findings on mammalian preparations reflect a difference between mammalian and other sodium channels or whether a complete change in our thinking about sodium channels in general will now become necessary." *—J.A. Miller*

Sunny prospect for dioxin degradation?



Dioxin molecule

In terms of dioxin cleanup, "soil is the most difficult substrate to deal with," says environmental toxicologist Donald Crosby. But small-scale experiments he performed more than a decade ago point to what may become a preferred soil-decontamination strategy, he told participants of "Dioxins in the Environment," a conference last week in East Lansing, Mich. In fact, the technique he has investigated is among the simplest and least expensive options proposed for dioxin thus far: Let the sun shine on it.

Soil studies performed in Crosby's laboratory at the University of California at Davis showed that ultraviolet (UV) light detoxifies dioxin. "You can use sunlight," he told Science News, "and for outdoor contamination, that is certainly preferable." Alternatively, an artificial UV source, such as a mercury-arc lamp, can be substituted. "Generally, the breakdown reaction in sunlight or under UV light takes place in a matter of hours," Crosby said. However, because only surface dioxin exposed to UV is detoxified, complete decontamination requires turning over the soil daily until tests show soil levels to be negligible.

Crosby has focused on 2, 3, 7, 8 TCDD — one of the most prevalent and toxic members of the dioxin family. In this species, chlorine atoms reside at what chemists call the molecule's 2, 3, 7 and 8 positions. Crosby says his research indicates ultraviolet light causes each of these chlorines in a sequence to be replaced by hydrogen. "As each chlorine is removed, the resulting product is not only less toxic, but also much more biodegradable," he says. "We have taken the reaction far enough to see all the chlorines gone and the rings completely disrupted."

What is the Environmental Protection Agency's preferred strategy for cleaning dioxin-tainted soil? "We don't have one," says Michael Cook, the agency's dioxin-management coordinator. "We'll probably have to go to storage [of contaminated soil] until we decide what's best." High-temperature incineration is one option being considered; though never tested, Cook said, "We suspect it would do quite well, but be very costly." EPA is also studying chemical dechlorination (SN: 4/23/83, p. 262).

However, UV decomposition of dioxin "merits study in conjunction with these," notes Michael Dellarco of EPA's Office of Research and Development. He says that is why EPA is currently planning preliminary field trials with UV. *—J. Raloff*