molecules that have trouble attaching to the greasy cell membrane," Rine explains. "The protein requires a little dab of grease to attach." Upon detecting functional similarities between a yeast sex hormone and the yeast form of ras, the researchers hypothesized that farnesyl provides the missing dab of grease at the tail end of the ras protein.

Research reported by British investigators in the June 30 CELL confirms the location of farnesyl's attachment to ras. And a study by scientists at the La Jolla (Calif.) Cancer Research Foundation, to appear in an upcoming PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, chemically identifies farnesyl as the grease dab. Rine told SCIENCE NEWS his group plans to search for the enzyme that enables farnesyl to attach to ras. Once the enzyme is identified, he says, researchers might be able to develop drugs that inhibit it.

A more basic challenge, comments Nobel laureate Michael S. Brown, a cholesterol researcher at the University of Texas Southwestern Medical Center in Dallas, is to determine whether the link between cholesterol synthesis and the *ras* oncogene is "a mere evolutionary fact without deeper significance" or nature's way of activating oncogenes. *– R. Cowen*

## Lethal look-alike unmasked, examined

A widespread protozoan infection called toxoplasmosis strikes humans and many other warm-blooded animals, including an estimated 40 percent of all cats. Though many of those infected live symptom-free, others suffer spontaneous abortion, severe illness and even death (SN: 2/13/88, p.102).

Now, a leading toxoplasmosis investigator reports data showing that another, long-unrecognized protozoan – able to parasitize many of the same hosts – has for decades masqueraded as a particularly virulent form of the more familiar *Toxoplasma gondii*.

Fourteen months ago, parasitologist Jitender P. Dubey identified and named *Neospora caninum*, isolated from the stored tissues of 10 dogs that had succumbed to a virulent toxoplasmosis-like disease. Working at the Agricultural Research Service in Beltsville, Md., he eventually grew *Neospora* in his lab. Last November, he showed it could induce severe toxoplasmosis-like disease in dogs. Says Dubey, "We now believe at least 4 percent of dogs are infected."

By infecting laboratory animals with *Neospora*, he has produced severe toxoplasmosis-like paralysis and death in cats, rats, mice and gerbils over the past year. Since February, Dubey has found the same *Neospora* in tissues from eight calves and one sheep. He described his ongoing work last week at the American Veterinary Medical Association meeting in Orlando, Fla.

Although *Neospora* can infect any tissue, Dubey says, "it is most commonly found in the brain and spinal cord," as is *Toxoplasma*. The two microbes look similar, except that *Neospora* cysts have a far thicker outer wall. *Neospora* also induces production of unique antibodies in its hosts – a finding Dubey and colleague David S. Lindsay employed in designing diagnostic assays. One such test permits researchers to identify *Neospora* in tissues that have been stored for decades. A newer test involves mixing a special dye with antibodies harvested from rabbits infected with a suspect microbe. If the dye fluoresces, *Neospora* is confirmed.

Most questions about this protozoan's life cycle, prevalence and susceptibility to treatment remain unanswered. "We also don't know whether it is infectious to people," Dubey notes. "But given its similarity to *Toxoplasma*" – which infects an estimated 35 percent of the U.S. population – "there is at least a potential for it." *Toxoplasma* can cause central nervous system ailments including paralysis, blindness and retardation.

In future studies, Dubey's group will focus on abortion rates in infected cattle. They also plan to investigate how *Neospora* spreads. Toxoplasmosis can result from eating the raw or undercooked flesh of infected animals, or even touching the mouth with hands or utensils that have touched such meat. Feces from cats – the only animals known to shed *Toxoplasma's* highly infective oocytes, or immature eggs – is another source of the infection. Dubey, who 20 years ago identified the essential role cats play in *Toxoplasma's* life cycle, says his experiments with *Neospora* have now virtually ruled out cats as its primary host. *– J. Raloff*

## Clues to an ancient upside-down ocean

Picture an ice cream cake covered with a pool of hot fudge sauce. This is the way the ocean is organized, with buoyant warm water floating atop cold, denser layers. Scientists have considered such an arrangement a permanent feature of the ocean, but new evidence from the seafloor might turn this image on its head for certain times in the geologic past.

Researchers from the University of California, Santa Barbara, say their findings hint that 40 million years ago, warm, salt-rich water filled the deep ocean while cooler water covered the upper layers. "People have thought about the possibility of warm, saline deep water for years," says James P. Kennett. "These are the first data hinting that we may be onto something important."

Kennett and Lowell D. Stott found evidence for an upside-down ocean in sediment cores drilled from the Maud Rise near Antarctica. They measured the relative amounts of different oxygen isotopes locked within the calcium carbonate shells of tiny animals that fall to the seafloor after death. Oxygen isotope ratios indicate the water temperature during the animal's life.

Isotope ratios at two sites with different depths suggest the lower site was significantly warmer than the upper site at least as far back as the middle Eocene period, 46 million years ago. After many fluctuations, the ocean flipped to a more modern style around 28 million years ago, the researchers proposed last week at the meeting of the International Geological Congress in Washington, D.C.

From these data, Kennett and Stott infer that the entire ocean circulation ran backwards during the Eocene. Today, the bottom water forms at the poles, where air and ice cool the surface water and make it dense enough to sink. The cold bottom currents flow toward the equator.

The researchers say the deep water of the Eocene ocean formed not at the poles but primarily in the northern midlatitudes. During this period, a large ocean called the Tethys separated Eurasia from Africa and Arabia. With its high evaporation rates and scant precipitation, the shallow Tethys generated warm water so dense with salt that it sank to form the bottom layer, say Kennett and Stott. Ancient Antarctica, much warmer than today, spawned the cool water that filled in the upper layer of the ocean, according to their theory. The reverse circulation would have broken down when plate tectonics began pushing Africa and Arabia toward Eurasia, closing off the Tethys. Turning off the tap of warm water flowing to the poles would have helped cool Antarctica.

Kennett and Stott's interpretation may be flawed, argues Gerta Keller of Princeton (N.J.) University. She says investigators studying the same cores think the chemistry of the calcium carbonate from the Maud Rise may have changed over the eons – a finding that would limit the mineral's veracity as an indicator of past temperatures.

Many scientists are warming to the idea that bottom water once formed in the Tethys region. The question is whether this water was warmer or colder than the upper layers. Even if the Maud Rise isotope ratios represent true records, the case for an upside-down ocean will require more data from other sites. *– R. Monastersky*