

lates itself automatically as the outside temperature changes.

If the temperature is dropped below freezing (32 degrees Fahrenheit), however, the researchers found that the hamster will increase its metabolism three-fold or more and even awaken. This may account for the fact that hibernators are not found far north of the Arctic Circle.

Once in hibernation, all mammals curl into a tight ball with their heads tucked beneath their tails. Their hair remains erect effecting maximum insulation against loss of body heat. In this state all bodily processes are slowed to a minimum.

In many respects the hibernator is in a period of immunity from disease, aging and other dangers. If such an animal is subjected to a lethal dose of radiation during hibernation, for example, it does not die or show ill effects. In the same way, if a cancer is transplanted in a hibernating animal, the animal will not succumb. There is a "but," however, and it is, when the hibernator awakens it will die from radiation poisoning or cancer.

### Lively Sleep

Up to the present it was thought that hibernating animals do not age in their dormant state. Recent experiments by a graduate student working with Dr. Lyman, however, indicate that some growth is taking place.

Poke a hibernator and get an arousal! This is not an immediate reaction, however. Stimulated arousal occurs in the same manner as natural arousal. In the hamster the awakening process takes about three hours. It starts with a quickening of respiration, followed by a rise in the heart rate. In less than two hours, Dr. Lyman has found, the respiratory rate is over 100, the heart rate is up to 550 beats per minute, twice its normal rate, and the body temperature is 86 degrees Fahrenheit. An hour later its breathing and heart are normal and its body temperature is 98 degrees Fahrenheit.

Commenting on the arousal process, Dr. Lyman says that "only death can stop the animal from struggling to regain its homeothermic temperature."

Hibernating mammals cannot be kept hibernating forever, even experimentally. The longest continuous period of hibernation was reported by a French researcher, C. Kayser, who recorded a 114-day dormancy for a common dormouse. The usual period of hibernation is considered to be much shorter than this.

### International Study

Interest in hibernation has increased since the end of World War II. Studies are currently being undertaken in many laboratories in the United States and in France, Finland, Sweden and Russia. On May 13, hibernation experts from throughout the world gathered in Boston to compare notes and discuss their recent findings.

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### PUBLIC HEALTH

## Lung Cancer Total High

► SOME 31,000 persons in the United States will be stricken with lung cancer this year.

Of this number, 26,000 will be males and 5,000 will be women. The recovery rate for this disease is below five percent.

No one knows just what causes this disease, but one famous theory holds that smoking tobacco products produces cancer.

Within the past few years, the lung-cancer-smoking controversy has flared like the smoldering end of a cigarette at each puff.

For instance, Dr. Alton Ochsner, surgeon at the Ochsner Clinic in New Orleans, points out that the incidence of lung cancer has increased proportionately to the increase in cigarette sales in this country.

"It is my firm conviction that every heavy smoker will develop lung cancer — unless heart disease or some other sickness claims him earlier," Dr. Ochsner says in *Today's Health*, a publication of the American Medical Association. The article carries the notation that the House of Delegates of the AMA has not taken a position on the possible relationship between smoking and lung cancer, due to the considerable difference of opinion among medical authorities.

Four other lung cancer experts recently

met and decided further research is required before anything definite can be said about the possible link between smoking and lung cancer. These four, three of whom are smokers, were Dr. Seymour M. Farber, chief of the University of California's Tuberculosis and Chest Service; Dr. Carlo Sirtori of Milan, Italy; Dr. Bernard Pierson, France; and Dr. Anton Sattler, Vienna, Austria.

The experts have stressed that lung cancer is becoming the number one killer among males more than 40 years of age. Lung cancer in the U. S. has increased 400 times in the past 30 years, Dr. Farber said.

However, none would attribute the increasing death rate to smoking. Dr. Farber suggests that perhaps the fact that men have to work in smoke-filled cities and factories may have a key role in the development of lung cancer.

A two to six year study of 6,000 persons who showed no symptoms of lung cancer initially was conducted by Dr. David A. Cooper of the University of Pennsylvania. At the end of the investigation period, 86 of the 6,000 had developed lung cancer. Of these victims, 85 were smokers, Dr. Cooper said.

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### OCEANOGRAPHY

## Renew Deep Ocean

► THE TIME NEEDED for deep ocean water to renew itself is at least 300 years.

Dr. Henry Stommel of Woods Hole Oceanographic Institution, Woods Hole, Mass., said his mathematical model of circulation patterns in the world's oceans gave the 300-year figure. Actual measurements, he reported to the National Academy of Sciences meeting in Washington, indicate the complete turnover of all the ocean below 6,600 feet may take as long as 1,800 years.

Dr. Stommel said the mathematical ocean model was devised with Dr. Allan Robinson of Harvard University. He reported that his theory also predicts the existence of a large northward flowing deep current over the Tonga Kermadec Trench in the western South Pacific off New Zealand. This current supplies the entire Pacific Ocean with deep water. Exploration is underway to determine whether this predicted ocean current actually exists or not.

Another deep ocean current, flowing southward under the Gulf Stream, is also indicated from the model. Dr. John C. Swallow of the National Institution of Oceanography, Sussex, England, reported his direct measurements of this deep current to the Academy symposium on the deep sea.

Dr. F. F. Koczy of the University of Miami Marine Laboratory, Coral Gables, Fla., said measurements of the distribution

of radium showed that the total surface layer of the Atlantic Ocean is renewed by bottom water in about 300 years. In the Pacific, however, it takes about 1,500 years for the surface waters to be replaced completely by deep water.

Dr. Stommel reported that the mathematical model he developed with Dr. Robinson followed publication of a "pioneering study" by Dr. P. S. Lineykin of the State Oceanographical Institute in Moscow. The Russian scientist attempted to explain the full three-dimensional field of current, temperature and density in an ocean acted upon simultaneously by wind and heating.

After studying this paper, Dr. Stommel and his Woods Hole colleagues concluded the Russian model was applicable only to rather small-scale seas and lakes, like the Caspian Sea, but did not apply to the large-scale oceans. Both the Moscow and American scientists suggested in 1957 preliminary versions of a model similar to the one Dr. Stommel reported.

The new model, Dr. Stommel said, allows oceanographers to compute the vertical distribution of the currents in the ocean and the vertical temperature-density structure as a result of the combined action of wind stress and of heating and cooling. In order to make these computations, a hypothetical quantity that describes the vertical mixing of ocean water had to be introduced.

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