they fuse to form helium-3. The mass of helium-3 is less than the combined mass of a proton and a deuteron, and the difference—5.4 million electron volts—is available as energy. This energy of fusion is the same energy that is released by the sun or during thermonuclear reactions.

Another way of looking at the reaction was described as follows. The mu meson holds the deuteron and proton together as if in a tiny box until they fuse. Thus fusion does not take place in ordinary molecules because the volume of the box is 10 million times larger.

In order to test their hypothesis, the physicists added artificially concentrated deuterium to the naturally occurring deuterium already in the bubble chamber. As was expected, there was an increase in the fraction of photographs in which there was an ejected mu or a gap at the end of a mu. Two pictures out of 10,000 showed a chain reaction two links long—where a single mu catalyzed two nuclear reactions before decaying.

After the experiments were completed, a colleague pointed out that in the 1954 *Proceedings of the Academy of Sciences of the U.S.S.R.* a theoretical physicist, Ya. B. Zel'dovitch, had already predicted a similar, though somewhat simpler, reaction.

The term *catalyzed nuclear reaction* was selected because of the comparison with what happens in chemistry, where a catalyst is used to speed up a reaction but is not itself used up in the reaction. A catalyzed nuclear reaction is similar to a thermonuclear reaction in that the same nuclear fusion reactions are common to both, but the conditions of the surroundings are quite different. Thermonuclear reactions take place only at extremely high temperature—in stars or hydrogen bombs—between nuclei propelled together by the great heat; a mu meson can pull nuclei together and catalyze a nuclear reaction at any temperature.

One of the great problems of controlled thermonuclear reactions lies in the need to maintain enormous heat in a confined system. Known materials melt at such temperatures, and investigations are under way to make "pinch containers" in which the hot materials do not touch the sides of the container. The difficulty is that the present containers leak.

National Health Survey

The U.S. Public Health Service has announced that a pilot test study under the new National Health Survey program will begin on 28 Jan. in Charlotte, N.C. The National Health Survey is being undertaken under legislation enacted by Congress last summer. The new law authorizes the Surgeon General of the Public Health Service to make continuing annual surveys and special studies of this country's population to determine the extent of illness and disability and gather related information. The last previous such federal survey was conducted 20 years ago.

The initial action in Charlotte will test a number of aspects of a questionnaire that is being developed for national use at a later date. Interviewing will be conducted by the Bureau of the Census, which is to perform this advance test and other field work on the survey. Data to be collected will include statistics on the number, age, sex, and occupation of persons suffering from diseases, injuries, or handicapping conditions; medical care received; the length of time that these people have been prevented from carrying on their usual occupations or activities; and the economic and other impacts of such conditions.

Sesquicentennial of Geodetic Survey

The Coast and Geodetic Survey plans a series of public events this year to celebrate its 150th anniversary. The survey was established in February 1807 under President Jefferson as the Government's first technical bureau. It has grown to the point where it now conducts official basic surveys of land areas and coastal waters of the United States and its possessions.

Its common services include tide tables for navigators, bathers, and fishermen; aeronautical charts for fliers; nautical charts for mariners; and starting points for surveyors. Admiral H. Arnold Karo is the director.

The anniversary program will be marked by the issuance of a special postage stamp. Plans are underway for sesquicentennial dinners, open house celebrations at survey headquarters, field offices and aboard ships, and for meetings of scientific and professional societies.

Teller on the Use of Nuclear Weapons

Edward Teller, nuclear physicist, discussed the moral issue involved in the use of nuclear weapons in a recent issue of the Air Force Association's monthly magazine *Air Force*. Teller stated that it would be "a considerable mistake for us to accept the idea that nuclear weapons are, on a moral plane, of a different nature from conventional weapons."

He noted that the U.S.S.R. had been exploiting the fact that the only use of atomic weapons in war so far had been against the civilian populations of Hiroshima and Nagasaki, Japan. He commented that "Russian propaganda has exploited this theme and has made it difficult, perhaps for the time being impossible, to make use of nuclear weapons, even in situations where such use would be logical and justified."

Rabies Treatment

The effectiveness of serum plus vaccine in preventing rabies in a group of persons who were severely bitten by a rabid wolf in Iran last year, and in similar less extensive experiences, was accepted as clear demonstration of the usefulness of the method by the Third World Health Organization Expert Committee on Rabies which recently met at the Pasteur Institute in Paris.

The meeting had historic interest inasmuch as it was at the institute that Pasteur introduced rabies vaccination for human beings more than 70 years ago.

This important step forward resulted from international collaboration, coordinated by WHO. The committee members, whose laboratories are situated in India, Iran, Israel, Spain, France, and the United States, have been working together on problems of rabies control since 1950.

The new approach involves providing basic protection by giving very small doses of chicken embryo vaccine, or a few doses of ordinary nervous tissue vaccine, followed by a single booster dose of vaccine rather than by the long schedule (14 to 21 days) of inoculations now performed.

Recently developed vaccines prepared from chicken embryos were found to confer long-term protection on dogs by only a single inoculation and were demonstrated to be useful also for cattle. It was stressed by the committeee that it is not only necessary to vaccinate dogs but also to control stray animals.

Rabies in wildlife, particularly in foxes, jackals, and wolves, is a problem in many countries. It also exists in insectivorous bats in areas of North America, and it has long been established that rabies is transmitted to men and animals in Latin America by blood-sucking bats. The finding of rabies in insectivorous bats in Yugoslavia indicates that this problem is not confined to the Western Hemisphere. Wild animal reservoirs present special difficulties, and it was agreed that extraordinary measures must be evolved to combat them.

The committee also suggested the establishment and use of an international standard reference serum and vaccine for countries throughout the world, so that procedures will be more uniform, and the potency of antirabic substances will be assured at time of use.

It also outlined forms for case reporting and case histories, to improve statis-