dead, including the team's leader Enrico Fermi, Arthur H. Compton and Leo Szilard. Among those to be honoured by the university this week will be Robert Duffield, director of the Argonne National Laboratory.

The enthusiasts for commercial exploitation of the nuclear reaction have, in the United States at least, further cause for celebration. This year marks the tenth anniversary of the first sale of electricity generated by a nuclear power station. (The Schippingport reactor in Pennsylvania, with a new core, is still serving Pittsburgh today.) The boom in orders for new power plants is continuing; twenty-six were made known in the first three-quarters of this year compared with twenty-three in the corresponding period last year. And the contract has just been signed for southern California's combined nuclear power and desalination plant, expected to be not only the world's biggest, but one of the cheapest in terms of the delivered cost of its desalted water.

Moreover, next week should see the first nuclear explosion sponsored jointly by the Atomic Energy Commission and private industry to test the peaceful (that is, commercial) possibilities of such explosives. Project Gasbuggy, as someone has thought fit to label it, will consist of a 26 kiloton explosion 4,000 ft. down in the sandstone formations near Farmington, New Mexico. The AEC and the El Paso Natural Gas Company want to see whether the blast can release the gas locked up in an otherwise unprofitable gas field. The AEC has at least six other commercial experiments scheduled—one to get at oil, another at copper. Conceivably some day the commission could be in such heavy demand as a blaster that it might have to contract out the business of setting off nuclear explosions to a private company.

## Discovery of X-rays

On November 8, 1895, W. C. Röntgen, professor of physics at Wurtzburg University, observed a phenomenon which led to his discovery of X-rays. Almost immediately after the discovery, applications blossomed at a remarkable rate, and some fell even within the ambit of the original discovery itself. Even today, when the importance of the rapid application of new ideas is widely appreciated, this rate of application is rarely if ever equalled. Dr D. Chilton of the Science Museum discussed the reasons for the rapid application of Röntgen's discovery in a paper to the history of science discussion group at the Royal Institution on November 15.

One reason for Röntgen's success seems to have been the remarkable speed at which he worked. Dr Chilton quoted from a speech by Professor Ewald—"Röntgen was a character who hated to part with an unfinished experiment by publishing it. He made the chance observation on November 8 and, working feverishly in the next six weeks, found nearly all the properties of X-rays which were to be known within the next ten years . . . Physicists and medicals alike tried to find out more about the properties of these rays than Röntgen had indicated in his ten-page pamphlet which he sent out to his friends as a New Year's gift." The reaction was certainly remarkable; Dr Chilton said that by the end of April 1896, there had been sixty-one references to X-rays in the pages of *Nature*, an average of three to four each week. By February 1, the *Lancet* was reporting that the invention was so far advanced that in Belgium it was being brought into practical use in the hospitals. This was just one month and three days after the first announcement of the discovery.

Other applications were also quickly realized, Dr Chilton said. Röntgen himself noted the way in which X-rays showed up lack of homogeneity in a metal structure, now the basis for industrial testing of metals. S. P. Thompson showed that gem stones and their glass imitations differ in their absorption of X-rays. All this, Dr Chilton said, was derived almost directly from Röntgen's first paper.

Röntgen's "chance observation" came when he was working on electric discharges within an evacuated glass tube. Working in a darkened room with the tube enclosed in black paper, he noticed that a film of barium platinocyanide, a well-known fluorescent material, showed a bright fluorescence whenever the tube was operating nearby. But if the discovery was a piece of luck, from then on Röntgen left nothing to chance.

## New Building at Teddington

Mr Robert Mellish, Ministei of Public Building and Works, cut the traditional sod on November 28 to mark the site of a new laboratoiy building at the Ministry of Technology's National Physical Laboratory at Teddington.

The laboratory, which will be known as Petavel Building after Sir Joseph Petavel, a former director of the NPL, should cost about £650,000. The NPL is already the third largest research establishment in Britain and the new three storey building will provide an extra 34,000 sq. ft. of laboratory space and 21,000 sq. ft. for offices. The main building will consist of a central reinforced concrete core containing the main staircase, lift and common services. Surrounding this will be the laboratories which, on each floor, will be divided into seven zones, each sub-divided into areas by low partitions. Although the laboratories will be without windows, thereby permitting an economical design for the engineering services, the artificial lighting and air conditioning will, however, provide a stable environment for research. The offices will be located on the perimeter of the building and will have natural light and ventilation.

Petavel Building, which should be completed by September 1969, is a departure from the normal type of research building. It has been essentially designed to meet the changing needs in research; as Mr Mellish put it, "Petavel Building is, we believe, a good answer to the request for a general purpose laboratory which would provide the conditions required for a wide range of the National Physical Laboratory's work and which would also be capable of modification to provide other conditions with a minimum of expense". The contractors began work on November 29, and it looks as if the ministry is determined to have the building finished on time.

## Protein from Petroleum

Interesting results have been obtained from experiments in which yeast cells have been used to produce protein concentrate from petroleum hydrocarbons. The pioneer work in this field was done at Lavera, France, and for the last five years the Shell BP group has been engaged in a research and industrial programme aimed at protein production on an industrial scale, chiefly at Grangemouth, Scotland.

Protein concentrates can be made by two processes: the product is an off-white, free flowing, tasteless powder which has a relatively high lysine content but which is low in methionine. One process starts with refined petroleum hydrocarbons and the other with gas or diesel oil. These unusual substrates are fermented by yeast cells grown in conditions of favourable $p$H and temperature and provided with adequate substrate and minerals. The fermented product is centrifuged and treated to produce a cream suitable for the drying stage. From each ton of hydrocarbon, a ton of protein concentrate is produced. This is suitable for use in animal foodstuffs and will possibly compete in food value and cost with more familiar protein concentrates such as fish meal and soya. Laboratory and early field-scale testing of the nutritional value of the product is being supplemented by toxicological studies using albino rats. Stringent safeguards have to be satisfied before the protein can be used for human consumption, but it has been suggested that it could be included in bread and biscuits. Furthermore, the protein can be extracted and coagulated to form a material with a structure resembling meat such as veal or chicken.

These results are shortly to be published in detail in the *Journal of General Petroleum*.

## A Ship from the Bottom

THE raising and restoration of the seventeenth century Swedish warship the Wasa is a strikingly brilliant piece of marine archaeology, and the small but informative Wasa Exhibition at the Science Museum in London does it justice. The exhibition, organized by the Wasa Museum and the Swedish National Maritime Museum under the auspices of the Swedish Institute, traces the history of the ship from its construction and sinking on its maiden voyage in 1628 to the location of the hull in 1956 and its recovery in 1961.

The Wasa, for some unknown reason, capsized and sank before it had left Stockholm harbour. Most of the heavy cannons were recovered in the seventeenth century by divers using the most primitive of diving bells and the ship was then forgotten. In 1956, however, it was relocated at a depth of 100 feet, completely silted up with mud, and the Swedish Government decided to raise it. This posed enormous technical difficulties which have been brilliantly overcome. The exhibition shows with models and photographs how the hull was lifted in seventeen stages until it was at a depth of 60 feet and finally raised to the surface in April 1961.

Once on the surface, 1,000 cubic metres of mud was removed and sifted, yielding about 24,000 objects including clothing (see illustration), food, coins, sails and utensils. From these an authentic picture of life aboard a seventeenth century warship can be reconstructed. The woodwork of the hull was remarkably well preserved as several photographs and replicas show. Fortunately, the salinity in the Baltic is too low for wood boring animals such as Teredo and this more than anything else accounts for the good state of the woodwork.

Preservation of the hull is an enormous task which is still going on. It is the largest water-logged object ever to be preserved and the Swedish authorities are sparing neither time nor expense to make sure it is done properly. To prevent the wood from shrinking as it dries out it is being impregnated with polyethylene glycol. All the movable parts are being stewed in a 60 per cent solution at 60° C and then carefully dried. The main bulk of the hull—190 feet long—is being continuously sprayed with polyethylene glycol solution and this operation will not be completed until 1971. It will then be dried out under carefully controlled humidity and eventually all the pieces reassembled.



The seaman's clothing on this model was recovered from the hull of the Wasa. (*Science Museum photograph.*)

The exhibition, which whets the appetite for the real thing, will stay in England until 1969 during which time it will be shown at most provincial museums. Similar exhibitions are touring North America, Australasia and the continent of Europe.

## Irradiating Food

SOME estimates indicate that as much as 20 per cent of the world food supply is wasted by spoilage—in some areas this figure may reach 50 per cent. Clearly any technique for reducing this waste would be welcome, which explains the considerable interest in food preservation by irradiation. One investigation of this sort is being carried out under an agreement between the Austrian Atomic Energy Agency, the European Nuclear Energy Agency and the International Atomic Energy Agency. The work is done at the Reactor Centre at Seibersdorf in Austria, and the project has just published details of progress up to the end of 1966.