SCIENCE NEWS

Science Service, Washington, D. C.

THE MOST PROFITABLE INVESTMENT OF THE FEDERAL GOVERNMENT

BY WATSON DAVIS

Managing Editor, Science Service

SCIENTIFIC research conducted by the Federal Government is its most profitable investment. Among the millions and the billions for wars, past, present and future, for post offices, for Congress, for prohibition enforcement, for Indians, for interest on the public debt, for RFC and other dollar transfusions to the financial structure, for relief, for reforestation, there are items of a few thousands and hundreds of thousands of dollars for scientific research.

The U. S. Department of Agriculture scientists are finding new uses for familiar farm products, fighting soil erosion, improving livestock, protecting plants and crops, and safeguarding the ordinary consumer against bad food and drugs. In far off China or the tropics, explorers of the department roam to bring back strange plants that help our farmers. Within our country's borders, entomologists are combating the insect menace.

U. S. Geological Survey geologists are mapping and surveying the mineral domain that the machine age may not die of starvation. U. S. Coast and Survey ships and engineers are surveying our coasts to safeguard commerce and shipping.

Out in that group of Washington laboratories, not near the oratory of Congress, there are men and women of the U. S. Bureau of Standards staff studying the rainbow of chemical elements, developing new facts about heat, stressing steel and newer metals, perfecting standards, methods and processes of incalculable value to industry and pursuing a thousand other useful scientific tasks.

Astronomers at the U. S. Naval Observatory observe the stars in order that our watches and clocks may have the correct time. Meteorologists of the U. S. Weather Bureau observe and forecast the weather for farmers, aviators and city folks. U. S. Bureau of Mines engineers by experiments, practical and theoretical, safeguard and develop the mines of the nation.

The appropriations for such scientific research functions of the federal government are the best investments made by the government. The returns to the public in terms of percentage run to figures like 50,000 per cent. instead of the conventional 6 per cent. that bankers have popularized.

True, the profits do not flow back into the U. S. Treasury directly as dollars. The profits are made not by Uncle Sam but by the American public. That is fitting for the business of the government is not to make money, but to undertake functions that benefit the whole people.

Scientific research is often a long-time investment, with the benefits going to our children and their children. It is a safe investment. Unlike bonds of maturity in the year 2000 or later, issued to pay for rails that even now are rusting away, the money spent for fundamental scientific research is a secure investment that will continue to pay public service dividends down through the ages.

If you think of the budget of the U. S. Government as a gigantic pie, the slice that is eaten to provide scientific research and service, which is perhaps the most profitable of its many activities, is so small that it can barely be seen. Of the federal dollar, less than $\frac{1}{8}$ths of a cent is expended for the constructive scientific research and service conducted to the profit of the whole nation.

This 85 hundredths of one per cent. (based on the 1931–32 expenditures) includes all the administrative, clerical and other routine expenses in connection with the government's scientific work. If the salaries of the scientists themselves and the money expended for apparatus, etc., were considered alone, the item would be much smaller, so minute that it would be difficult to find it among the millions upon millions of dollars that pass through Uncle Sam's pocketbook. Obviously the federal budget can never be balanced by eliminating any or all of the scientific work of the Federal Government.

The crippling of an essential scientific investigation or service here and another there may give a feeling of righteousness and go through the motions of cutting down government expenditures, but it will not balance the budget or materially lift the tax burden. The effect will be hardship on the farmer, the manufacturer or the consumer in later years when the much greater direct tax of undone scientific research will be felt.

Not only will the ultimate consumer and future generations lose, but Uncle Sam himself will find his day-to-day routine governmental activities made more expensive if the scientists are fired. In addition to fundamental and applied scientific research, the federal scientific bureaus perform tests that assure that the government gets its money's worth in purchasing supplies, erecting buildings, etc.

If a total is obtained of all the money spent by the government for all kinds of research, education and developmental work, not just scientific research and service, it is found that only 2.7 per cent. of the U. S. expenditures is accounted for. Who then eats Uncle Sam's budget pie?

Wars, past and future, gobble 75.2 per cent. of the federal budget. Warships, soldiers, veterans, interest and retirement of debts from past wars, and their incidentals consumed $3,758,000,000 of the United States 1931–32 expenditures. Compare this cost of warfare and national defense with $42,000,000 for scientific work, both research and service, in 1931–32. Of the 1934 budget presented to Congress last fall, less than $35,000,000 is devoted to scientific research and service.

The legislative, executive and judicial functions of the Federal Government consumed 12.6 per cent. of the 1932 expenditures, and public works in 1931–32 were responsible for 9.5 per cent. of the expenditures.

Meeting the annual bill for profitable scientific research in the United States budget is a relatively small matter from a financial standpoint. The complete elimination of the annual federal investment in scientific research, which is unthinkable, would not help materially in "balancing the budget." The annual *per capita* cost is only about 30 cents. The *per capita* cost of all federal government activities runs from $30 to $40 per year, depending upon what year is taken.

You, as one of 122,000,000 Americans, make your profitable investment in federal scientific research when you smoke five packages of cigarettes (federal tax six cents a package) use thirty gallons of gasoline in your auto (federal tax one cent a gallon); drink two gallons of beer (federal tax $5 a barrel of 31 gallons).

The total cost of scientific research and service in the many government departments is estimated at $34,768,000 in the 1934 budget submitted to Congress last fall. Since then this budget has been deeply cut, of course. The actual federal science expenditures in the peak year 1931–32 were only about $40,000,000.

This bill for some $40,000,000, which will pay immense profits both now and to future generations, could be met by: The cost of a single modern trans-ocean express steamer; the money needed to build four cruisers; one tenth of the annual U. S. tobacco tax; one third of the "pay of the army," which does not include supplies or civilian hire expenditures of the U. S. Army. Less than a tenth of the savings made by President Roosevelt in the veterans economy measures now being put into effect.

For Uncle Sam's annual investment in scientific research and service, for the 30 cents you as a citizen contribute indirectly each year, you and your children will get many dollars of real profit in every-day living, now and in the future. Figures show that typical research projects return profits of some 50,000 per cent., that is $150 for your 30 cents. And the most beneficial returns are those that can not be computed in mere dollars and cents.

Science has revolutionized the modern world. All about us are essentials and luxuries that are newly arisen from the minds of scientists and their laboratories. Millions upon millions of dollars have been created by science for industry.

Important in the progress of science have been the labors of scientists, working day after day for modest salaries in the federal departments of agriculture, commerce, interior, etc., without avaricious thought of personal gain.

As the nation waxed rich, both in money and comfort and health, did it invest an increasing amount of its wealth in scientific research? Did it plow into its science fields, like a good farmer, adequate fertilizer for future years?

Industry has to a large extent been convinced by bountiful returns that applied scientific research pays and pays well. As income to industry rose after the World War, allotments for research increased, but not perhaps as rapidly as the increase in national income. And as the depression began to take its toll upon business, the research staffs were not fired but in most cases they were preserved and even strengthened.

There has been a new rush in research to create new products and materials to replace those affected by the depression, to develop new and cheaper methods of utilizing old materials and making staple articles. Costs have been held within limited budgets through the science and ingenuity of the research staff. Surveys made by the National Research Council show that industry is continuing to a large extent its scientific research activities.

In the reorganization of the federal government now in progress, the same spirit should rule. The cost of all scientific research and its auxiliary services in the federal government is only about $35,000,000 (based on 1934 budget) and this is a mere fraction, seven eighths of one per cent., of the total budget.

In fact, all the educational, research and developmental work of the government consumes only about three per cent. of the federal cost. A smaller percentage is devoted to constructive education, research and development work now than before the World War. In 1910, 5.1 per cent. was spent for "education, research and development." In 1915 it was 5.4 per cent. In 1920 it dropped to 1.3 per cent. due to war costs. Since 1925 it has hovered between 2.5 and 3.2 per cent.

Compare this with the national income of the whole nation, not government expenditures. Figures by the National Bureau of Economic Research show that the national income in 1910 and 1915 was $31,000,000,000 to $37,000,000,000 in round billions, whereas from 1925 to 1930 it varied from about $80,000,000,000 to $90,000,000,000.

FUNCTIONS OF THE ADRENAL GLAND

IMPORTANT new functions of the vital adrenal glands, concerned with vitamin utilization and milk production, were reported by Drs. Frank A. Hartman, J. E. Lockwood and K. A. Brownell, of the University of Buffalo, at the meeting in Cincinnati of the Federation of American Societies for Experimental Biology.

At previous meetings, members of the federation have heard the Buffalo investigators describe the life-saving cortin which they extracted from the cortex part of the two small glands that lie just above the kidneys. Cortin has saved the lives of sufferers from Addison's disease, an ailment in which the adrenal glands are diseased and fail to produce enough cortin themselves for the body's needs. Animals deprived of their adrenal glands quickly die, but their lives may be prolonged indefinitely by administration of cortin.

Experiments were reported suggesting that adrenal cortical extract, possibly cortin itself, helps the body to utilize vitamins C and B_1. A substance that is necessary for the production of milk has been separated from cortical extract. They call this new hormone cortilactin.

The discovery of the relation of cortin to vitamin utilization came about when microscopic changes were found in adrenal gland cortex of animals getting too little of certain vitamins in their diets. This suggested that extra

demands were being made on the glands to make up for the vitamin deficiency.

When an extract containing cortin was given to guinea-pigs on vitamin C deficient diets, the onset of scurvy was delayed. The extract was prepared in such a way that none of the vitamin, which itself prevents scurvy, could have been present. Injection of this extract also delayed the onset of nerve symptoms due to deficiency of vitamin B_1 in the diet.

Apparently this function of the adrenal gland cortex is so important that provision is made for one gland to produce more of the substance concerned in vitamin utilization in case of injury to the other gland. This extra production on the part of the remaining, healthy gland is continued for about five weeks after disease or injury has put the other out of action.

Discussing the milk-producing hormone, cortilactin, Dr. Hartman and associates explained that cortin alone does not have this action. Mother rats that have no adrenal glands can not raise litters of young, even with enough cortin to keep the mothers themselves healthy and fat. Cortilactin must be added.

INHERITANCE AND GLANDS IN THE CONTROL OF GROWTH

CONSTITUTIONAL, inherited factors have more to do with type of body build than secretions of the body's powerful, growth-controlling glands, it appears from breeding experiments with dogs reported by Dr. Charles R. Stockard, of Cornell University Medical College, at the meeting in Cincinnati of the American Association of Anatomists.

Secretions of certain glands, notably pituitary and thyroid, are known to affect growth because when too much or too little of the powerful hormones are secreted the results may be seen in dwarfs, giants and other abnormal bodily forms.

While admitting the power of the glands over growth, Dr. Stockard believes his experiments show that the gland secretions are quite unable to regulate growth in opposition to the inherited constitution of the individual.

"For illustration," he said, "ordinary persons may not respond in their growth reactions to pituitary modification in the same manner as do those inheriting acromegaly."

Acromegaly is a disease in which the bones and the soft parts of the hands, feet and face are enlarged. The disease is associated with over-function of the pituitary gland.

According to Dr. Stockard's theory, over-functioning of the pituitary would not produce the enlarged bones typical of acromegaly in the ordinary person, but only in persons inheriting acromegaly.

Dr. Stockard has for many years engaged in breeding experiments with dogs and has learned much of how various traits are inherited. By crossing various breeds, he has found which characteristics are dominant characters that will appear in every generation, and which are due to glandular conditions.

ITEMS

A SPECIAL balloon now under construction in Leningrad will be used by Soviet investigators in an attempt to set a new altitude record by penetrating into the stratosphere, in order to study electric and magnetic phenomena, cosmic rays and solar energy in the upper reaches of the atmosphere. The closed passenger car, which will be attached to the balloon, will have walls 10 mm (two fifths of an inch) thick. It is being constructed of a specially strong non-magnetic alloy which has been perfected by a group of specialists working under the guidance of Engineer Vasionko.

DEFINITE evidence of an anti-growth factor in the parathyroid gland has recently been found by Drs. C. J. Eastland, N. Evers and J. H. Thompson, working at Kings College, University of London, and the Royal College of Surgeons. These investigators treated fresh parathyroid gland in a special way and obtained an extract which had a harmful effect on the growth of rats, according to a report in *The Biochemical Journal*. Six rats were used as controls, and six were given daily injections of a small measured amount of the extract, other conditions being the same for both groups of rats. The factor which retarded the growth was destroyed by treatment with hydrogen peroxide.

BITTER rubberweed, a plant belonging to the aster family, has been growing into a serious problem to sheep raisers in a part of western Texas, according to A. B. Clawson, physiologist of the Bureau of Animal Industry. Due apparently to over-use of the grazing land and to climatic factors, the weed has been increasing in abundance while good forage plants have been growing scarcer, with the result that the poor sheep have been driven to this poisonous food. It is estimated that 75,000 of them died in an area of 6,000 square miles during the winters of 1929–30 and 1930–31. The cause of the sheep losses was not at first known, but because of the abundance of the bitter rubberweed in the affected area it was placed under suspicion, and an investigation by scientists of the U. S. Department of Agriculture resulted in its conviction. The plant is known to botanists as *Actinea odorata*.

SEVERAL of the larger German cities are solving part of their depression problems by a hook-up of garbage-burning plants and greenhouses. Unemployed men are given jobs building greenhouses and running the incinerators. Ashes from the burned garbage are used as fertilizer, and heat from the incinerators keeps the greenhouses warm. Plants that thrive on high-potash fertilizers, like tomatoes, cucumbers and cut flowers, are grown in the greenhouses. H. A. Kirsch, a Berlin engineer who describes the projects in *Die Umschau*, states that employment in building will be given to about 25,000 men, and that for running the finished establishment two or three thousand families can be crossed off the rolls of those receiving public aid. The projects are expected to be self-liquidating, in that they will supply large quantities of high-grade fresh vegetables that have hitherto had to be imported.