SCIENCE

VOL. 96 — FRIDAY, NOVEMBER 13, 1942 — No. 2498

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 — Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

NATIONAL SURVIVAL THROUGH SCIENCE[1]

By Dr. HARRY N. HOLMES

OBERLIN COLLEGE

WHEN I speak of national survival through science I refer not only to the vital aid of science in winning this war, but also to its great service in the difficult years that follow. To the pessimists who believe that the Allies will lose and that the United States will finally be forced, by economic strangulation, to yield to Hitler's orders I am compelled to say that under such throttling our chief hope of survival as a free nation will lie in the resourcefulness of our scientists.

The profound influence on our civilization of anesthetics and antiseptics, the steam engine, the electric dynamo and motor, the telegraph, telephone and wireless, the cotton gin, Portland cement, the pig-iron furnace and steel mill, refrigeration and the motor car convinces every thoughtful person that this is a scientific civilization. To be truly cultured you must have some understanding of the achievements, the methods and the possibilities of scientific research.

Centuries ago recovery from great disasters such as plague, famine, flood, war and oppression was slow —fatally slow for some nations.

Medical science can now check pestilence in most of its forms, although it did not check the world epidemic of virulent flu in 1918 until millions of lives were lost. The encouraging fact to-day is that science learns from every disaster, be it yellow fever, typhus, the bubonic plague, an earthquake or a great flood on the Yellow River in China or on our own Mississippi.

Typhus fever has killed 200,000,000 people in

[1] Presidential address delivered at the one hundred and fourth meeting of the American Chemical Society, Buffalo, September 7, 1942.

Europe and Asia during recorded time and it is again threatening Europe in the war areas. The body louse that carries it is said to have done more than the Russian winter to defeat Napoleon. We are told that Hitler is in great fear of a typhus epidemic in his armies. The American and British armies have quantities of an effective serum.

Malaria, carried by a vicious type of mosquito, weakened ancient Greece and Rome and helped bring them to their fall. Very recently you read that MacArthur's army in the Bataan peninsula had so little quinine that their resistance to the Japs was tragically weakened by malaria.

When the mosquito carrying yellow fever interfered with the digging of the Panama Canal, it was too much. General Gorgas and his medical staff got rid of the mosquito.

At this moment we learn of many scattered cases of the terrible black plague in the west, a plague with a high percentage of mortality for which there is as yet no known cure. Fleas, carried by rats, squirrels and rabbits, transmit the disease. To add to our problems, we now learn that birds, picking up rabbit fur as nest material, are spreading Rocky Mountain spotted fever.

The tide of medical battles ebbs and flows, but the "men in white" always gain ground. They even make side forays against laziness, once a sin, proving that much of it is caused by infected teeth, hookworm, malaria, hay fever, a deficiency of vitamins C and B_1, and other understandable troubles. We hesitate to call this a new distinction between virtue and vice.

Famines force modern improvements in irrigation and flood control, stimulate the attack on crop diseases, force extension of transportation and may lead to planned redistribution of populations and to birth control. "Modern science," said Vice-President Wallace, "when devoted whole-heartedly to the general welfare has in it potentialities of which we do not dream."

The present disaster of a world war calls upon every resource, material, mental and spiritual, if we are to survive as a free people. To say that we were ill prepared in a military way is not enough. Our natural resources, which we viewed with complacency, had led us to prodigal extravagance. Forests disappeared and were seldom replaced. Antiquated farming methods permitted rains to wash away rich topsoil and depleted or ruined great areas by unwise cropping. The plowing of marginal grass lands of the West helped create the Dust Bowl, now being improved by contour tillage, deeper plowing and use of alternate strip cultivation.

Our most alarming extravagance, it seems, has been in the use of mineral wealth. Since 1900 world consumption of mineral resources has exceeded that of all previous ages. This acceleration can not continue indefinitely. Recovery of scrap metal must become part of a carefully planned national economy. Substitution of products derived from the soil such as wood, laminated plywood and certain plastics can help in conservation of metals.

Power will not be produced indefinitely from coal and petroleum, so we will ultimately rely upon water power, alcohol from grain and potatoes, perhaps hydrocarbons from cellulose, the world's greatest crop. Direct conversion of solar energy into heat or electricity is still in the infant experimental stage—not much more than a scientific dream.

Coal may last a thousand years, but I can well remember that twenty-five years ago prophets of doom predicted exhaustion of our petroleum reserves in fifteen or twenty years. To-day some of these authorities give us twenty years more of petroleum bliss. No matter how accurate such prophecies may be, it behooves us to conserve petroleum. Even before this war, the United States annually produced nearly 1,250,000,000 barrels, two thirds of the entire world output.

When the chemist, Burton, introduced the cracking process about 1914, doubling the yield of gasoline from every barrel of crude oil, he literally made two blades of grass grow where one grew before. Without this process—and its continuing development—you would suffer gasoline rationing in times of peace or pay a higher price while the poorer motorists did without.

All the gasoline produced in this country in 1900 would operate our motors for just one hour to-day. Much of that barrel of oil of the gay nineties was almost a drug on the market; kerosene, axle grease and paraffin wax being the most desired fractions. The refiner of fifty years ago never dreamed that heavy machines, high-speed machines, autos and airplanes would force brilliant research in lubrication. It is well known that Germany's inferior lubricants from her synthetic liquid fuels became so stiff in the Russian winter that many of her motor vehicles refused to start after once stopping. In this respect the Russians, with superior lubricants from petroleum, had a great military advantage.

Nor did the early refiners expect the navies of the world to become oil burners or that diesel engines would be invented to utilize cheap and heavy fuels for internal combustion, ultimately to drive submarines. Invention of the internal combustion engine started a revolution in petroleum refining and opened a vast market for gasoline. The demand for the greater power to be had under higher compression in the engine stimulated the chemist, Thomas Midgley, Jr., to introduce tetraethyl lead as an anti-knock agent, now accepted as a matter of course. Do not overlook the important fact that obtaining more power from each gallon of gasoline is a valuable aid in conservation of petroleum resources.

Now comes the demand of military aviation for 100-octane fuel, as measured by Midgley's anti-knock yardstick, a demand that is being met—in the United States but not in Germany. Such high-octane gasoline is proving to be one of our most powerful offensive weapons since our enemies have little of it, must depend mainly upon 90-octane fuel for their combat planes. Our own super-product gives us 25 per cent. more power with resulting greater speed of take-off, rise and flight. Bombers with such fuel have greater range and can carry more bombs. This priceless weapon was produced in the United States at the rate of 50,000 barrels per day as of January 1, 1942. The air force unblushingly suggests 200,000 barrels to take care of the allied air armadas. The extraordinarily competent petroleum chemists and engineers sigh but expect to produce the volume needed.

Admittedly war is terrible, but it does stimulate scientific research. "It's an ill wind that blows nobody good." The necessities of World War I, especially in respect to the dyestuffs and medicines previously imported from Germany, gave this country the most powerful chemical industry in the world.

TNT or trinitrotoluene is the great bombing weapon, but its manufacture depends upon the output of toluene. Up to a year or two ago all our toluene came from coal, by way of the byproduct coke oven, perhaps 20,000,000 gallons in a year. The incredible demands for TNT, one or two billion pounds annually, depend upon five or ten times this supply of toluene. The ever-resourceful chemist came to the rescue with a process for the production of toluene in huge quantities from petroleum.

So enormous is the growing appetite of modern Mars that even leading scientists underestimated many of our needs. For example, at the beginning of 1941 this country had a capacity of 300,000 tons of fixed air nitrogen and 180,000 tons more in the form of ammonia from coke ovens. The public in general may not realize that, by the Haber process, we combine the free nitrogen of the air with hydrogen to form ammonia which is then converted into nitric acid, the basis of practically all high explosives. In spite of estimates by some scientists close to this subject that our fixed nitrogen capacity was adequate, we were forced to double this capacity within a year.

Responsible government officials failed to begin early enough, when sea lanes were open, to accumulate adequate stockpiles of strategic raw materials essential to the national defense. Not until 1940 did we begin to import for stockpiles those essential materials not produced at all or in insufficient amounts within our continental borders. The Navy was confident that Japan could not capture the East Indies and that rubber, tin and tungsten supplies were assured. Now the ferocity of German submarine attacks and the scarcity of shipping cut down to an alarming extent vital importations of other products from South America, Africa and Asia.

Priorities have been applied to such a long list of supplies that when the pinch becomes more painful the public may express its resentment in a blind and bitter reaction against our government. Yet what fraction of this public would have thought that copper, a drug on the market after the last war and produced within our own boundaries to the extent of 1,000,000 tons in 1941, would be withdrawn from public use. Or that our steel production, greater than that of all our enemies combined, would prove to be inadequate.

The unexpected enormous expansion of air forces inevitably caught us short of aluminum and magnesium in spite of a wise doubling of production within two or three years by the Aluminum Company of America. As late as 1939 our annual output of magnesium was only 6,700,000 pounds, but now requirements for 1943 are set at the astronomical figure of 725,000,000 pounds.

To the surprise of many, the 700,000 tons of chlorine produced in 1941, an all-time record, proved so inadequate that the paper manufacturers, accustomed to using it for bleaching, were confronted with chlorine rationing. Chlorine is a military substance needed for manufacture of mustard and other war gases, of anti-freeze liquids for planes, of ethyl gasoline, one plastic, neoprene rubber, grease solvents (tanks must be degreased before use), chlorinated waxes for tarpaulins, chlorinated rubber and a resin coating for a ship's magnetic belt. Fortunately production of chlorine is now approaching demand.

Did the poet Tennyson have in mind the spraying of mustard gas from airplanes when he wrote the following lines in "Locksley Hall"?

> For I dipped into the future, far as human eye could see,
> Saw the vision of the world, and all the wonder that would be;
>
> Saw the heavens fill with commerce, argosies of magic sails,
> Pilots of the purple twilight, dropping down their costly bales;
>
> Heard the heavens fill with shouting, and there rained a ghastly dew
> From the nations' airy navies grappling in the central blue;
>
> Far along the world-wide whisper of the south-wind rushing warm,

With the standards of the peoples plunging thro' the thunder-storm;
Till the war-drum throbb'd no longer, and the battle-flags were furled
In the Parliament of man, the Federation of the world.

Stainless steel, containing nickel and chromium, is absolutely necessary for armor plate and for important industrial construction. I blush to admit that I was one of those confident that Canada, producing 90 per cent. of the world's nickel, could satisfy our war needs. She has the ore, but plant expansion is necessarily slow, and now we are forced to invest $20,000,000 in an effort to develop the very low-grade nickel ores of Cuba.

The chromium situation was most alarming until recently. We produced little, imported 500,000 tons of chrome ore annually from Turkey, Rhodesia, South Africa, the Philippines, Russia and Cuba. The stockpile was low and we were worried until discovery of a very large deposit of low-grade ore in Montana and working out of a successful process of concentrating the ore reassured us.

Since antimony for type metal no longer comes from China, and only limited amounts from Mexico, it is disquieting to learn that this type metal is to be used for the cores of bullets. The War Production Board is seizing the plates of the earlier editions of my own text-books. What a comforting thought to an author. After his fickle public deserts him, the product of his pen kills Japs and Germans. This gives real meaning to the old adage, "The pen is mightier than the sword."

Shortage of certain fatty oils posed a serious problem. There isn't enough linseed oil for paints and linoleum, nor tung oil from China, nor coconut oil to give extra lathering quality to soap. No more cork can come from Spain, Portugal and North Africa. We wish that great forests of cork oaks had been planted in California, a suitable place, when Leland Stanford considered the project. Plantings are about to begin, with no effect on the present emergency.

A small silk industry would be useful to-day in order to supply fabric for parachutes and powder bags for the large guns. Perhaps some special forms of nylon and cotton may meet this need, but the facts are not made public. There isn't enough formaldehyde to make plastics or plastic glues for laminated wood structures and for certain new types of explosives. And we can't import quebracho tanning extract from Argentina fast enough to tan all the leather for the army's shoes. Fortunately we know how to utilize the hemlock bark of the northwest for this purpose, although it is not yet being done. Manila hemp for rope, Indian jute for burlap bags, graphite from Madagascar and Ceylon, wool from Argentina and scores of other products give us genuine concern for they all have military value.

Let me quote a salty remark from Dr. Esselen: "Exploded completely is the complacent isolationist idea that this country has all the needed national resources. All that will save us is the national resourcefulness of our scientists." Having placed a few of our serious problems before you, it is now in order to tell something more of our efforts to solve them. The general public expects the research chemist to keep *two jumps ahead of national disaster*. This is quite in line with a recent advertisement startling the reader with the words, "Wanted. Men to Perform Miracles!"

A scientific miracle is certainly called for to save the alarming rubber situation. With only an ordinary year's supply in our stockpile, 350,000 tons of reclaimed rubber possible for this year and an equal amount for next year, very little instead of 97 per cent. of our supply coming from the East Indies and only 30,000 to 50,000 tons of imports from South America and Liberia possible for 1942, the situation is serious. The Army, Navy and Air Forces must have huge quantities of good rubber or they will lose this war.

The only hope, and it is a very promising hope, is that the chemist and the engineer will make synthetic rubber at the amazing rate of 500,000 tons or even 1,000,000 tons yearly, before it is too late. We know how to make synthetic rubbers, several of them, but time is of the essence after a tragically late start and metals for plant construction are seriously limited in quantity. Credit must be given to the du Pont Company for its production of neoprene rubber some years ago, but its higher cost limited the output to the specialty market where unusual oil resistance was desired. Expansion of neoprene plants has proceeded rapidly for the past year and 1943 production may reach 40,000 tons. It will find use in military tires. Thiokol, made for several years by the Dow Chemical Company from ethylene chloride and sodium polysulfide (therefore from petroleum, salt and sulfur) was looked upon as a rather inferior elastic material. Now it suddenly enters the war picture. Several forms of thiokol are possible and the best, Type N (using propylene chloride), has been found suitable for tire retreads. By January, 1943, the production rate will be 30,000 tons per year—enough to retread 12,000,000 tires with a life expectation of more than 5,000 miles. Better yet, this company has tested complete experimental tires of thiokol up to a life of nearly 10,000 miles at very moderate speed.

Butyl rubber, developed only recently by the Standard Oil Company of New Jersey, is another second-class substitute of great importance. Although its life in tires may be only 15,000 to 18,000 miles at thirty-five miles per hour, such tires will take workmen to defense plants and help maintain other essential civilian transportation. It is made from isobutylene, a material that the Standard of New Jersey now secures in quantity from petroleum refining by a new process that permits simultaneous production of very high octane gasoline. A little isoprene or other dienes, 2 per cent., is required as a copolymer. The government program calls for 130,000 tons of butyl rubber in 1943.

Buna S, however, is the type of synthetic rubber selected by the government for a concentrated production drive. By this process the German chemists imitated nature, which hooked together isoprene units in long elastic chains to form natural rubber. The chemist, in fact, went nature one better and hooked together (polymerized) molecules of butadiene and styrene as copolymers to form a new elastic product of good quality for civilian tires, Buna S. The Standard Oil Company of New Jersey secured American rights to the process and probably improved it. Buna S at present needs admixture with a little natural rubber in the side walls of tires to decrease the heat of flexing. It is rumored that 80 per cent. of Germany's synthetic rubber tires collapsed during their first eastern "blitz" attack because of failure to mix natural rubber in side-wall material.

The great problem is to make enough butadiene, for the styrene is readily made from coal. The chemist has a choice of processes: to make butadiene from certain products of the petroleum refinery, from starch (grain or potato) or from acetylene. Russia elects potato starch as the basic raw material, converting it into alcohol and, by a catalytic process, converting the alcohol into butadiene. We have greatly improved the Russian process and there is powerful pressure from farm interests to make this our official method. Claims of quicker production, lower costs and use of less critical metal in construction fill the air with controversy. However, the oil companies began their work earlier, have contracts, conversion plants built or building, so the situation is not quite the same as if both methods were to start "from scratch." To complicate decisions comes announcement by our Department of Agriculture that the Northern Regional Laboratory at Peoria, Illinois, has a pilot plant producing butylene glycol from grain starch by use of a special ferment and converting this glycol into butadiene.

The government allocation of materials and money would be a simple matter if we had plenty of steel and copper. As it is, the official plans for annual production of synthetic rubber[2] are currently set at:

700,000 tons of Buna S
(of this 500,000 tons from petroleum refinery sources
and 200,000 " " grain)
130,000 tons of Butyl rubber
40,000 " " Neoprene
30,000 " " Thiokol
900,000 " total

Engineers generally estimate a year and a half or more as the time required to build and test a large Buna S plant based on petroleum fractions. By the end of 1942 our capacity may approach the 100,000 ton rate. Possibly by the end of 1943 this rate will reach 500,000 tons, yet predictions are hazardous. In any event, the driving public will get little comfort before 1944.

If airplanes are to turn the tide of victory our way, there must be no lack for plane construction of aluminum and magnesium. Fortunately for the aluminum program, President Roosevelt was far-sighted years before the war in pushing on a reluctant public construction of enormous water power projects along the Tennessee and Columbia rivers. Direct war needs of aluminum this year total 1,200,000,000 pounds and the demand in 1943 will rise to 2,000,000,000 pounds, almost five times as much as we produced two years ago. If Germany should capture the Greenland cryolite deposit, the only one in the world, it might seem that our Achilles heel had been cut, for melted cryolite is the bath in which aluminum oxide is electrolyzed. Fortunately we know how to make synthetic cryolite from our own fluorspar, soda and sulfuric acid. It is also reassuring to learn of plans to rework the red mud of aluminum ore residues. It is already ground and at hand.

Up to the present time magnesium has also required great electric power, but four or five new plants are under construction to use the new Pigeon ferrosilicon process. The basic idea is to use hot silicon to steal the oxygen from magnesium oxide. Ferrosilicon, already an important commercial product used in the steel industry, is preferred because it is cheaper than silicon alone. Lime is added to remove the silicon dioxide formed. The Dow Chemical Company, pioneer in the American magnesium industry, formerly used salt brines as a source, but for more than a year it has been using the limitless waters of the ocean.

It must be discouraging to this alert company, after raising their 1939 production of 6,700,000 pounds to a 50,000,000 pound rate on January 1, 1942, to be informed from Washington that this is mere "chicken feed," that nothing less than 400,000,000 pounds will serve 1942. If that figure is met (and it will not be),

[2] The Baruch committee report calls for annual production of 1,100,000 tons of all kinds of synthetic rubber, including 845,000 tons of Buna S; 132,000 tons of Butyl rubber; 69,000 tons of Neoprene; 60,000 tons of Thiokol. It is also recommended that 30,000 tons be added to the former allotment of Buna S to the farm.

that voracious War Production Board calmly plans to double this vast total for the next year.

Substitution is a good slogan for scientists grappling with the problem of shortages. It may well be applied to mercury which we are producing at such a rate for Britain and ourselves that early exhaustion of our very limited ore deposits is threatened. We once thought that mercury fulminate was the only good detonator for shells, yet lead azide is effective and is slowly displacing the fulminate. The ordnance department refused for a time to use anything but brass for shells because of its ideal expansion and contraction with heat changes. Meanwhile Germany, with limited amounts of copper, gave up brass as shell material and adopted a suitable type of steel. After some research our ordnance requirements included steel shells.

Smokeless powder is still made by the process used in World War I, although there is a modern American process using half the time, much less money and less alcohol. The powder so made is said to be suitable only for projectiles of 75 millimeters or less in diameter. Britain has been buying very large quantities from this company, but as yet no satisfactory business arrangements have been concluded with our own ordnance department.

One of the chemist's greatest contributions to the group of substitutes is the plastic in its numerous forms. Waterproof plastic glues make possible laminated wood parts for airplanes and for many purposes where metals were previously used. This reminds me that recently I observed prodigal use of brass railings in the elevators and stairways of a very new government building in Washington. What an unfortunate example to the country at large. Handsome and useful railings of laminated wood could have been used instead of precious brass. Why not replace such railings now and use the brass for military purposes? If the President's rubber doormat could be seized for the common good it would seem possible to start a brass raid in all our cities and a bronze statue raid wherever artistic beauty is lacking. Metal door knobs do not last long in Germany. Tin is so necessary for bronze, bearing metals and for tin cans that the announcement of a new bearing metal alloy containing only one per cent. of tin instead of the standard 83.5 per cent. is very welcome.

One of the good results of this war will be a higher standard of public health. The diet of our armed forces is excellent, supplying plenty of energy, minerals and vitamins. In fact, vitamins might reasonably be seized as contraband of war. Germany is acutely aware of the value of vitamin supplements to aviators, parachute troops and other special combatants. Britain gives free vitamin capsules to her soldiers and carrot juice to her aviators to cure possible cases of night blindness. Right now she is trying to buy all the vitamin C she can get from us. Since a deficiency in this vitamin from any cause weakens the soldier and it is now known that it is lost in heavy perspiration, we may infer that fruit juices or actual synthetic vitamin C must be required for fighters in North Africa or the tropics.

A few years ago I showed that toxic lead destroys some of the vitamin C in the bodies of workmen exposed to lead hazards. It now seems certain that toluene, benzene and TNT dust have similar ill effects. Workmen in munition plants need a diet reinforced with fruit juice, tomato juice or tablets of this vitamin. In some plants this is now being tried. The known toxicity of ZnO fume when brass is melted may well show in destruction of vitamin C. Recent reports of tetryl poisoning, with such symptoms as nausea and loss of appetite suggest a trial of B_1 and C.

We seem to have enough enemies at present, yet we have not won the insect war. The insects are winning costly victories, destroying every year $2,000,000,000 worth of crops and other materials. L. O. Howard, former chief of the United States Bureau of Entomology, once said: "If human beings are to continue to exist they must first gain mastery over insects. Life may develop into a struggle between man and insects." The botanist who breeds resistant strains of plants and the chemist who prepares insect poisons serve as man's shock troops in this everlasting fight.

The weapons of World War II and the processes of essential war industry have become so scientific that it seems almost unfair to ask men trained in West Point, Annapolis and other military institutes to make vital decisions on scientific research problems. Yet that is the system. Military men decide, with advice, no doubt, what war problems are worth investigation by our official scientific bodies. This is a bottleneck because there is no place in the curriculum of our great military institutes for research training. Perhaps research appreciation could be taught in the routine courses in chemistry and physics. (To be fair it should be recorded that efforts are now being made to improve the bottleneck situation).

Our war efforts are being hampered by the drafting of chemists, even of graduate students who, in another year or two, would receive their research training. The present serious shortage of adequately trained chemists in essential industries will rapidly grow worse. They can not be replaced by women, for there are too few trained in the subject, nor can substitutes be trained in two or three years.

Does America really appreciate brain power or does it secretly distrust trained intelligence, as the British voters for so long distrusted the brilliance of Winston Churchill? In Germany, Professor and General Karl Haushofer, with a staff of a thousand experts in many fields, has exerted powerful influence on the grand plan of total world war. What is wrong with copying the best features of such an organization? Could we listen attentively in war and in peace to the advice of one hundred of our ablest scientists, economists, sociologists, manufacturers, labor leaders, military men and others chosen, not politically, but by their peers in their own professions or callings? We have the brains in this country to solve most of present and future difficulties if we will only give them a chance to function effectively.

In conclusion, let me deny that science is to blame from all the horrors of war. Destruction of life and property was relatively as great in the days of Genghis Khan as now. Perhaps the essential difference is that in Caesar's time the average cost of killing a soldier was twenty-four cents, while to-day it has reached several thousand dollars.

Science is the friend of the poor, for research has always lowered costs and raised the standard of living. A little more than a century ago, in England, a laborer worked 15 hours a day for a week to earn two bushels of wheat. To-day he earns two bushels (at nearly the same price) in less than half a day.

The liberating influence of the much-criticized Machine Age is convincingly shown by consideration of the cotton gin. "Without this mechanical device 37,000,000 American citizens, working 300 days per year, would be kept busy removing seed from cotton if the present rate of cotton fabric production is to be maintained" (Hugh Davis). Think of it! One fourth of our population toiling to prepare raw cotton! With three more such demanding industries the books would be closed.

At the entrance to the Rochester Public Library is carved in stone a great and richly deserved tribute.

Science
The Master of
Light and Energy
Of Time, Space and Sound
Foe of the Forces
That Assail Life

Science, I may add, has vision, which the public and many of its leaders lack. Without vision the people perish.

WHO ESTABLISHED THE ELGIN BOTANIC GARDEN?

By Dr. C. STUART GAGER
BROOKLYN BOTANIC GARDEN

THERE has been published this year a biography of "Doctor Bard of Hyde Park," by John Brett Langstaff. This is a valuable and too long-delayed contribution to the history of American science.

In a review of this book in SCIENCE for September 15, 1942, it is stated (p. 299) that Samuel Bard (1742–1821) "with his pupil David Hosack (1769–1835) established the Elgin Botanical Gardens, where Rockefeller Center now stands."

In another review of the book in the *Journal* of the New York Botanical Garden it is stated that: "Mr. Langstaff gives in detail the history of Bard's gallant though unsuccessful fight to perpetuate this institution."

In a pamphlet of 56 pages, published in the spring of 1811, entitled "A statement of facts relative to the establishment and progress of the Elgin Botanic Garden and the subsequent disposal of the same to the State of New York," Dr. David Hosack gives the facts leading to the establishment of this garden by him. Considering the known integrity of the author of the pamphlet we must consider the record authoritative, and that if Hosack had merely collaborated with another person that fact would have been clearly stated by Dr. Hosack. However, in the pamphlet, he mentions Dr. Samuel Bard but once, and then only to quote two paragraphs from an address delivered on November 14, 1909, by Dr. Bard before the Medical Society of Dutchess County. In these paragraphs Dr. Bard expresses his regret at the failure the preceding year to induce the Legislature of the State of New York to purchase "Dr. Hosack's botanic garden."

". . . it has become indispensable," says Bard, "and if we suffer this garden of Dr. Hosack's to sink, as sink it must, if left in the hands of an individual, we give a decided advantage to every medical school in the United States. . . . I hope, therefore, that the institution, as well as both our medical schools, may continue to receive a decided patronage from our government. . . ." So far as the printed records show, this would appear to be Dr. Bard's sole contribution to the endeavor to have the state acquire the garden. He was an influential citizen, and of course, may have used his influence orally in this connection. Notice Bard's own statement, *"this garden of Dr. Hosack's."*

In May, 1795, Dr. Hosack succeeded Dr. Samuel L. Mitchell as professor of botany in "the medical school of Columbia College," and the following year he "was elected to the joint professorship of botany and materia medica." On page 7 of the pamphlet above