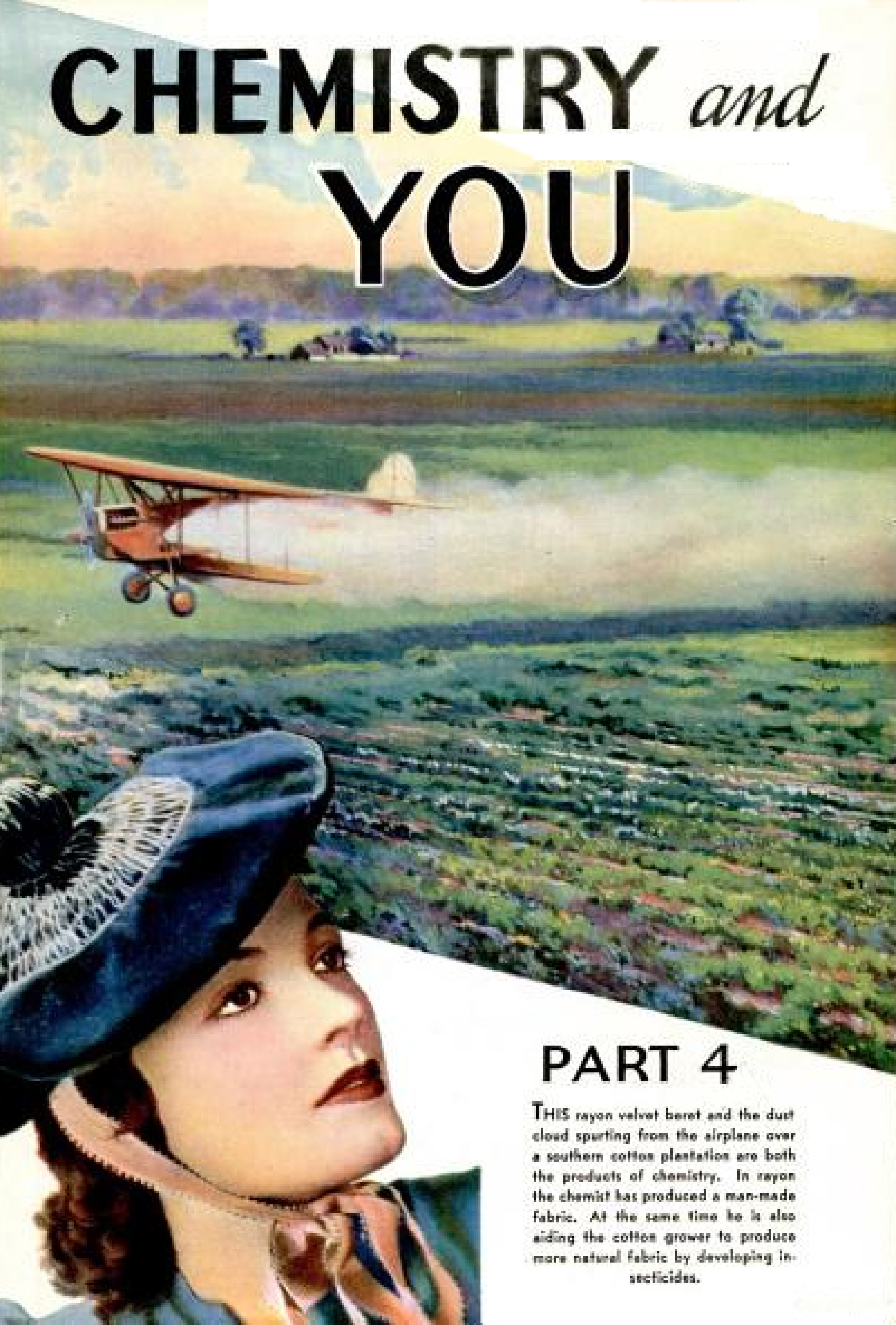
CHEMISTRY *and* YOU



PART 4

THIS rayon velvet beret and the dust cloud spurting from the airplane over a southern cotton plantation are both the products of chemistry. In rayon the chemist has produced a man-made fabric. At the same time he is also aiding the cotton grower to produce more natural fabric by developing insecticides.

CHEMISTRY on parade at the New York Museum of Science and Industry. Left, a miniature electroplating apparatus. Right, refrigerant used to preserve flowers.

By DR. C. M. A. STINE

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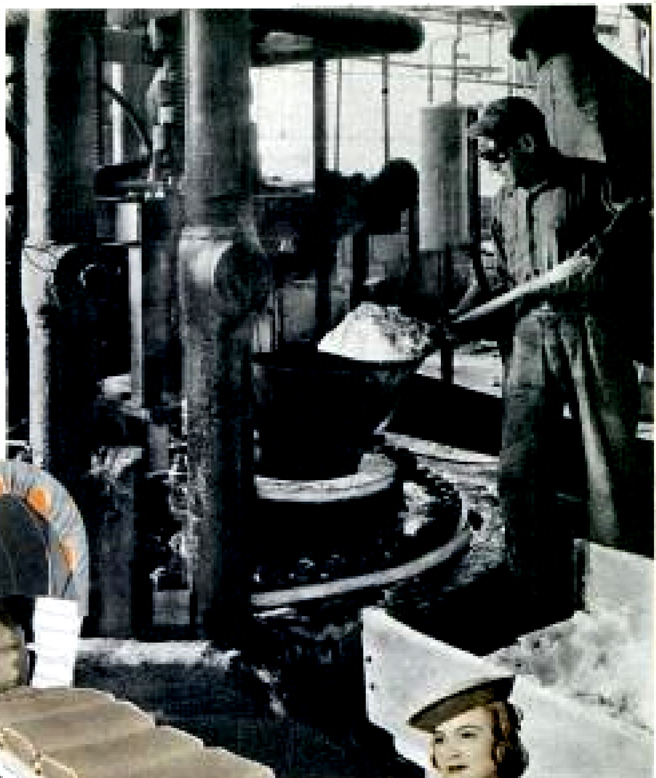
MODERN medicine is largely applied chemistry. The physician, chemist and biologist working together have swept aside almost the last of the superstitions which characterized the so-called "healing art" for centuries, with the result that tremendous advances in medicine now seem to be just ahead, dependent only upon a continued and even closer alliance of these sciences.

The importance of chemistry to medicine may be readily appreciated when the human body is accepted for what it fundamentally is, a complex and highly integrated chemical machine. It takes food, water and air and converts them by chemical and biological processes into flesh, blood, bone and energy, in the production of which it employs various chemicals of its own creation. The secret of being able to control normal health and development is knowledge of these materials and processes, to the end that we may supplement them when deficient and supply them when missing.

We know, for example, that chemical secretions of the body known as hormones control the characteristics by which men and women differ in bodily structure, muscular development, voice, amount and nature of the hair, and even in reactions, temperament and personality. Irregularity in any of the characteristics is often a serious handicap that disrupts the life of an otherwise normal individual to the detriment of



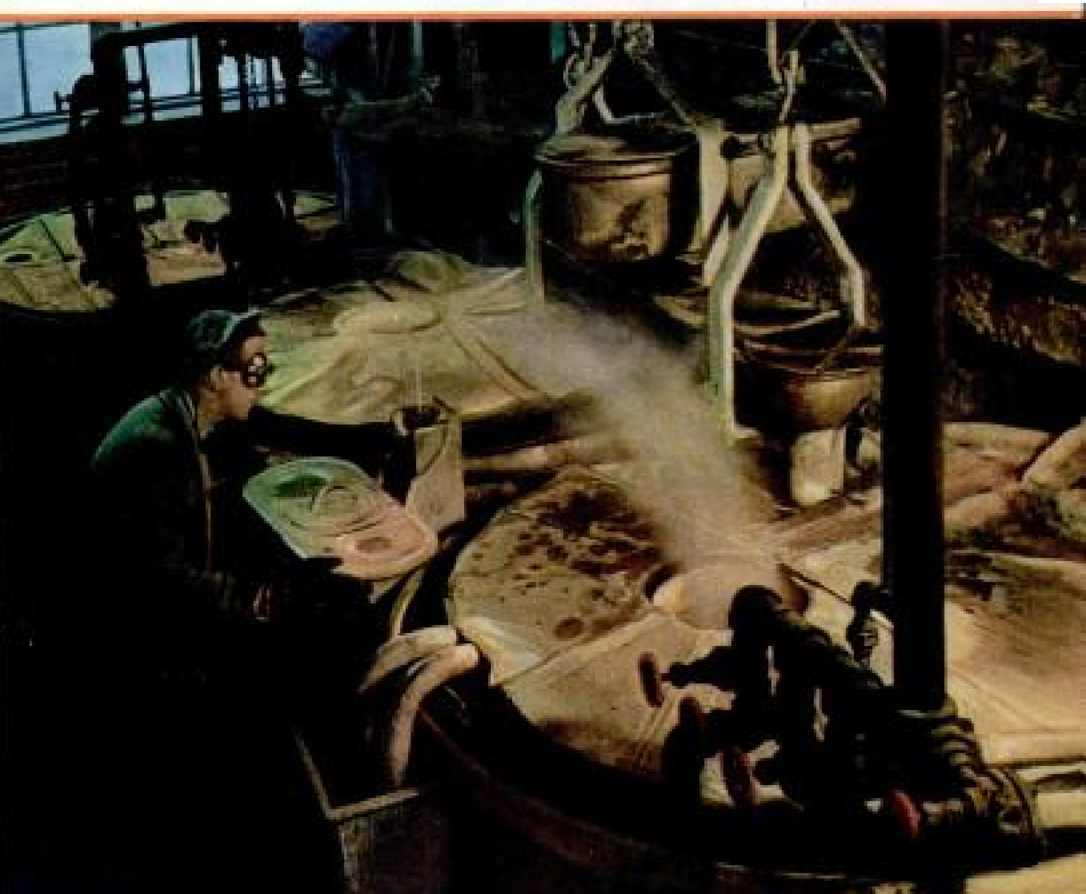
MAKING formic acid, right, to be used in camphor. Below, this outdoor furniture is equipped with a fabric made water-repellent by the magic hand of the chemist. Lower right, satin cape treated with a water repellent which does not alter feel or texture of the fabric in any way.

himself and society. In the world are literally millions of misfits, through no fault of their own but because the body is chemically out of balance. A way is now pointed to correct abnormalities of this kind, or, better, to insure a normal development in children during growth. Within two years three of the several known hormones have been synthesized in the laboratory. So new is this development and so promising are its implications that as yet we can only guess to where it will lead.

One by one the vitamins are being synthesized or produced by artificial methods, and their role in the chemical functions of the body analyzed and catalogued. Enzymes, the highly complex proteins that make digestion, body oxidations and other physiological processes possible, can be formed out of inactive proteins by suitable chemical changes. Apparently the first step has been taken toward the eventual synthesis of the blood itself, through the synthesis of porphyrin, related to both hemoglobin, essential substance of the blood, and of chlorophyll, the green coloring matter of plants. Equally important is the development of exact knowledge of medical phenomena only hazily understood and the synthesis of new medicinals for directly combating disease. One very recent discovery points the nature of this work and its broad possibilities.

As long ago as the sixteenth century an observer noted that blowfly larvae or maggots in wounds seemed to have a beneficial effect in healing. The same effect was observed during the Napoleonic wars and again during the World War. In fact, following the World War a way was devised to use live maggots in treating extreme cases of a chronic bone disease where conventional methods had failed. But nobody knew why the maggots could heal where science failed.

Biological chemistry has finally solved this mystery of centuries, and with astonishing results. The secret of the maggot's healing lies in a colorless, odorless excretion containing allantoin, which is a painless, harmless, but rather expensive organic chemical compound. Allantoin was then synthesized in the laboratory and the synthetic product was found to have the same healing properties as



CHEMIST testing sulphuric acid in coolers of an acid plant. This acid enters into many of the modern miracles performed by the chemist.

THIS dress is of rayon jersey and the hat is a lacquered fabric. Even the slide fastener on the waist is a plastic, a product of the chemist. Below, transparent chair made of cellulose acetate plastic. Tests show it will support the combined weight of two large men.

the secretion of the maggot. Since allantoin on decomposition yields urea, the trail was followed to urea itself, which in pure form proved in this instance to have the same healing action as allantoin, and, in addition, is very much cheaper. Weak solutions of urea directly applied were of value in such ailments as diabetic and varicose ulcers, carbuncles, infected burns, osteomyelitis, and certain skin infections.

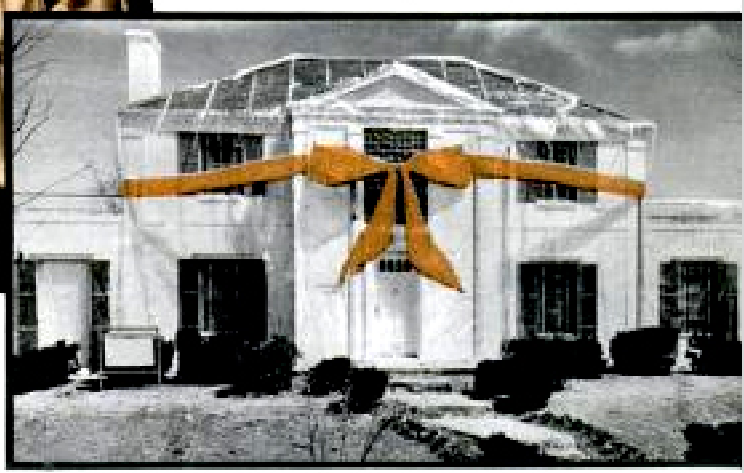
Urea was the bodily waste synthesized by Wohler in 1828 in the first convincing proof that organic matter can be created by man from inorganic matter. He got his synthetic urea by heating ammonium cyanate, but more than a century passed before synthetic urea was made available in quantity at low cost by industrial chemistry. It is now produced by car-

loads, literally from air and water, and has more than a hundred patented uses. It is used in compounding some of the newest and most beautiful of the plastics, in the preparation of sponge rubber, in the brewing, wine and liquor industries, and as a source of nitrogen in agricultural fertilizers.

Urea is an inoffensive crystalline substance in its pure state, and the fact that it is present in urine is only a detail. It also occurs in many plants used for food, notably in spinach, and in the tissues and blood of animals and human beings. There is little doubt that urea is destined to fill an important role in medicine. It stands as a perfect example of the common bridge between chemistry, biology and pathology over which are being achieved advances that otherwise might be delayed for decades.

Early in 1935 German chemists startled the medical world by announcing the discovery of a new complex compound that enabled mice to survive after being inoculated with deadly blood-cell destroying streptococcus. Apparently the chemical attacked the streptococci directly and killed them. Later this chemical was administered to human sufferers with infected blood, and a variety of diseases—all of them in effect blood poisonings—responded favorably to its treatment. These included septic sore throat, arthritis, erysipelas, peritonitis, and childbirth fever.

Throughout the civilized world physicians are now studying this chemical discovery of infinite promise and as yet it has developed no unfavorable features, except the



SATIN dress which has been treated with chemical preparation making it water-repellent and resistant to spotting. Right, this modern home is wrapped in 6,000 square feet of Cellophane.

limitation that infections must be treated promptly for success. In one form, a bright red solution, it is known as prontosil and administered by hypodermic injection; in its second form, prontylin, it is a white tablet to be swallowed. The significant fact is that it was a common chemical of industry, a sulphamide dye, that served as a clue to the discovery of this long-sought remedy.

Through chemistry, progress is being made in the world-wide combat against cancer, sufficient to

TRANSPARENT containers for blankets, above, made of plastic material, and dinnerware decorated with American ceramic colors. Right, jacket with fringed rayon.

WROUGHT iron outdoor furniture with synthetic finish that stands weather exposure, and water-repellent upholstery. Below, a "chemical" costume from shoe heels to crown of hat.

lead us to believe that eventual success against this scourge is only a matter of time. For one thing, the past few years have added substantially to our knowledge of cancer-producing substances to the end that cancer in many instances may be prevented. In brief, medicine may be said to be in a stage of transition from a closed field wherein its possibilities are distinctly limited to an open field where the only limits are those of the horizon of expanding scientific knowledge.

Today from one side we hear charges that chemistry is ruining the farm by synthesizing materials once produced exclusively from the soil, and that indeed the time is not distant when we will live

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Chemistry and You

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not on natural but on synthetic foods. And from the other side we hear that agriculture's future lies in the chemical conversion of huge farm crops to industrial uses, in the transformation of wheat, corn and potatoes into factory raw materials for motor cars, fuels, buildings, roads and other as yet unheard-of things.

The truth of chemistry in agriculture lies somewhere between these extremes but it inclines more toward the second view. Food compounded in pills is a technical possibility now but a most remote practical probability. Man is too fond of meat, vegetables, fruit, milk and bread to desert them for centuries to come.

The chemical conversion of farm crops into factory materials is not new. It dates back at least to 1845 when Schoenbein made guncotton or nitrocellulose. Followed "Celluloid," rayon, smokeless powder, pyroxylin plastics and finishes, and the literally thousands of things made today from the cellulose of cotton. It is estimated that cotton now goes to the retail market in no less than 10,000 forms and that the industrial consumption of cotton linters now approximates 500,000,000 pounds. The coated textile industry consumes more than 110,000,000 yards of cotton cloth yearly.

There is half a ton of seed produced to each bale of cotton, and fifty years ago thousands of tons of cotton seeds for which no use could be found were dumped into southern streams. Chemists devised ways to use the oil of cotton seeds in soaps, in cooking and salad oils, and later in butter and lard substitutes. The cottonseed crop is now worth $200,000,000 in a normal year to southern farmers, and indeed all oil-bearing seeds have become valuable.

Parallel developments have converted a tenth of the corn crop to industrial uses, have made oat hulls a source of furfural for plastics, wheat straw a raw material for corrugated paper boxes, and sugarcane bagasse and other fibrous stalks the chemical basis for wallboards used commonly in modern building insulation. The chemist's ability to convert crops to uses other than food is the smaller and less difficult part of the problem. The real difficulty is the farmer's, to grow and sell crops at prices low enough to make their conversion justifiable and economically practicable. Competition is keen in industry. Why make alcohol from corn when that from molasses is as good and cheaper? Why make paper from cornstalks, which our grandfathers could do, when wood pulp costs much less and is more readily available? Why use wheat when sawdust will do as well? The big problem of wholesale use of crops by industry is one of economics, not chemistry.

It is not easy to lower prices in an industry where they are already close to or even below costs of production. Nevertheless this can be done in agriculture. Losses suffered by farmers mount to almost unbelievable figures. More than 6,000 known species of insects cost growers each year something like $2,000,000,000. Thirty-four insect species alone cause a known damage of $924,000,000. Losses traceable to weeds are estimated at $3,000,000,000. Add to these figures another $1,500,000,000 chargeable to plant diseases, and the total of $6,500,000,000 is staggering.

Almost may it be said that for every dollar the farmer now earns he has another dollar taken from him by enemies against which he must wage ceaseless war. Chemistry is doing its utmost to help him save some portion of that dollar. New large-scale laboratories for an intensified study of better scientific means to control pests, weeds and plant diseases are even now being built.

A new science in fertilization of the soil is being developed, as well as a wide range of improved chemical fertilizers, based on discoveries in soil chemistry that promise much in improving both the quantity and quality of yields. It has been found that the presence or absence of minute quantities of certain elements in the soil may determine the success or failure of a crop, or the health or disease of animals feeding on the land, or even of human beings who use the animals' meat as food. A science of plant genetics is being developed that will enable farmers to grow crops to order, ways of speeding up growth are being studied to permit shorter growing seasons and reduce losses from late and early frosts and better ways for preserving fruits and storing crops are being devised.

Like medicine and most of our manu-

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facturing industries, agriculture too is in a state of transition from old methods to new, with chemistry furnishing the bridge for its progress.

We have entered the Chemical or Scientific Age. The Machine Age could not go beyond the limitations of natural materials, so that in the main it was limited to improving things known for centuries. The Scientific Age is taking us beyond into a realm of new materials not to be found in nature, and from them we are creating things that did not exist before.

This new ability of man to create, and the new vision it has given us, in turn is creating a new economy—an economy that is putting wealth, in the true sense of greater enjoyment of life, within the reach of millions who never before knew it, that is creating new opportunities for work, new leisure, new health. Above all it is creating new knowledge in the light of which almost nothing stands as impossible.