Dr. WILKINS. Dr. Sprague, friends, since 1950, a number of new drugs have come into use for the treatment of high blood pressure and, considered together, they represent one of the great advances of medical science during the period of our report. These drugs have changed not only our treatment of hypertension, but also our concepts of the nature of this disease. Except in a few rarer forms, the cause of high blood pressure is unknown. None of the new drugs used in treatment, therefore, was designed to get at the cause. Rather, they were designed primarily to relieve the result; namely, the elevation of blood pressure, whatever its cause might be. However, the action of these drugs in lowering blood pressure has provided new information on the nature of hypertension and has brought us closer to a true concept of the cause or causes of this condition.

There are five main categories of drugs now in use for high blood pressure. These are (1) rauwolfia, or Indian snake root, and its derivatives; for example, reserpine; (2) hydralazine or apresoline; (3) veratrum viride and its derivatives; (4) the nerve-blocking agents, such as hexamethonium; (5) (and probably most important) chlorothiazide and similar diuretics that stimulate the kidney to excrete salt.

Each of these agents acts to lower blood pressure, but each acts in a different way. Rauwolfa has a tranquilizing action on the brain and lessens nervous tension. Hydralazine dilates the blood vessels directly, especially those in the kidneys. Veratrum also dilates blood vessels but reflexly through the autonomic nervous system. The nerve-blocking drugs, on the other hand, prevent reflex constriction of blood vessels by blocking excessive nervous reactions. Chlorothiazide and the other diuretic drugs seem to change the body's content or its distribution of sodium chloride and other salts, lessening the blood vessels' constrictive reactivity and the resultant elevation of blood pressure.

Thus, the doctor today has in his bag new chemical tools for lowering blood pressure, and he has a variety of them. One of the most interesting findings has been that these chemical tools are more effective when used together than when given singly, even in increasingly large doses. This is an old trick in treatment, familiar to everyone in the use of different drugs together for pain; for example, aspirin, phenacetin, caffeine, and codeine for severe headaches. The trick is that when the drugs, each in a small dose, are used together against a single undesirable effect, they "gang up," as it were, on that effect, whereas their own bad side effects are so dispersed that they produce no unpleasant symptoms. Thus, the doctor has learned that when rauwolfia, the mildest agent, is not effective alone in a hypersensitive patient, he must add apresoline or chlorothiazide, or both. He may then achieve a very satisfactory result which he could not obtain with any one of the drugs used alone.

The results of treatment of high blood pressure with drugs are most dramatic when the disease itself is so severe or malignant that without such treatment it would be quickly fatal. In less severe cases of hypertension, drug treatment may be as dramatic in lowering the blood pressure; but since many of these patients have not as yet been incapacitated by the disease, their symptomatic improvement is not as striking as in the malignant cases. Nevertheless, all observers are in agreement that treatment of all such cases is most worth while. The area of disagreement is now restricted to the question of whether the very mildest or earliest of cases should be treated with drugs in a preventive way, before strains develop in the heart and blood vessels and especially in the kidneys.

It would appear that in patients with a strong family history of serious high blood pressure this may also be worth while, since it is now clear that high blood pressure is definitely a familial disease that tends to progress with age. Finally, the newer diuretic drugs, by shedding light on the handling of salt by the body, have tended to re-emphasize the important role of the kidney in hypertension, and of salt excretion, which normally is under the control of the adrenal glands. Thus, one can say that drug treatment is not only helping people who already have high blood pressure, but is also teaching us more about the nature of the disease, and how to prevent it, or at least how to prevent its more serious effects.

Thank you. [Applause.]

Dr. SPRAGUE. Thank you, Dr. Wilkins.

Our summation of advances in treatment—this time with special consideration of heart and blood vessel surgery—continues with a report by an outstandingly eminent authority in this area. Winner of the 1954 Matas award for work in vascular surgery, cochairman of the committee on medicine and surgery of the National Research Council, member of the National Advisory Heart Council of the National Institutes of Health, and chairman of the Department of Surgery at Baylor University's College of Medicine, he is Dr. Michael E. DeBakey of Houston, Dr. DeBakey. [Applause.]

Dr. DEBAKEY. Dr. Sprague, ladies, and gentlemen, few areas in medicine have exhibited the phenomenal progress that has taken place in the field of cardiovascular surgery during the past decade. Indeed, the advancement made during this period far surpass all previous efforts in this field of surgery. Among the most striking features of these advancements, and undoubtedly important factors underlying their attainment, have been the increasing intensity of research endeavors and the bold ingenuity and aggressive approach characterizing the surgical attack on these grave diseases. As a consequence, many conditions which only a few years ago were considered hopeless are now amenable to effective therapy. No less important has been the fact that these surgical investigations have contributed significantly to greater knowledge and better understanding of the underlying fundamental factors involved in the pathologic, physiologic, and biochemical disturbances of cardiovascular diseases.

This is well illustrated by the progress which has been made in recent years in the surgical treatment of acquired diseases of the aorta—the main artery of the heart—and major peripheral arteries, particularly aneurysms and occlusive lesions. An aneurysm is a ballooning out and thinning of the wall of an artery.

Aneurysms of the aorta, for example, have challenged physicians for centuries; and although various methods of treatment were devised and attempted, none were effective. Within the past decade, however, curative therapy has been accomplished by the development of the surgical principle of extirpation of the lesion with restoration of normal function. The successful application of this method of treatment and development of these principles is dependent upon a number of factors, among the most important of which are the principles of blood vessel suture and arterial graft replacement.

The development and refinement of these principles were brought to full clinical fruition in the research laboratory. More recently, and as a result of these investigations, the problem of replacement of diseased arteries has been effectively solved through the development of substitute arteries made of such plastic materials as nylon, Dacron, and teflon; and these are now as readily available in the operating room as suture material.

Surgery to replace diseased arteries has become a complete reality. Deadly lesions which were formerly considered hopeless are now amenable to curative treatment.

Equally striking has been the progress made in the treatment of arteriosclerotic occlusive disease, the gravity of which has long been recognized. In arteriosclerotic occlusive disease, the thickening of the wall of the artery gradually narrows and ultimately blocks the opening in the artery.

Owing to its predilection to involving and blocking of such vital arteries as the aorta and those which supply blood to the brain and heart, it is by far the most common cause of death and disability among vascular lesions. As a consequence of intensive research and clinical investigations during the past decade, an important concept of the disease has been evolved which has led to the application of highly effective methods of surgical treatment. This concept is based upon the demonstration that in many forms of this disease the atherosclerotic occlusive lesion is well localized and segmental in nature with relatively normal arteries proximal and distal to the diseased segment of the vessel. From this fundamental knowledge, methods of surgical treatment were developed to restore normal circulation by removal of the occlusive lesion or by its replacement with a substitute artery. Within the past few years, sufficient experience has accumulated with these methods of treatment to establish their efficacy; and it can be stated that a high proportion of patients who formerly would have died or been seriously disabled from gangrene of the lower extremities, strokes, and high blood pressure due to arteriosclerosis, may now be completely relieved.

Equally significant are the brilliant advances made in surgery of the heart. Although pioneering efforts in cardiac surgery were made at the turn of the century, most of the important developments have occurred during the past decade. During this short period, intracardiac surgery was introduced. Although at first the scope of operative procedures on the valves and septum was limited by the fact that maintenance of cardiac function was vital during intracardiac manipulations, the efforts and contributions of the era of closed heart surgery were truly impressive.

Recently a major obstacle in heart surgery was overcome with the introduction of methods for open heart surgery. This problem was solved by the development of mechanical devices to substitute temporarily for the function of the heart and lungs, such as the pump oxygenator—or mechanical heart lung, as it is generally known—which is now in widespread use. Whereas less than 10 years ago only a selected few cases of congenital cardiac disease were amenable to surgical correction, today the majority of cardiac anomalies are completely correctible.

As outlined in this brief account, the tremendous strides that have been made during the past decade clearly reflect the vigor and intense activity characterizing the current status of cardiovascular surgery and portend other advances of even greater importance. With continuing generous support of these research endeavors, only the limits of imagination should restrict their progress.

One thing is certain: The future of cardiovascular surgery is brighter than ever. [Applause.]

Dr. SPRAGUE. Thank you, Dr. DeBakey.

Up to now, our discussions have largely concerned the clinical aspects of cardiovascular research. Our final panelist opens a new and vital area of exploration. He is to discuss the role of basic research in making possible the achievements already described and those we fervently hope will be forthcoming. One of the world's foremost authorities on renal function and electrolyte metabolism, he came to the National Heart Institute in 1950 and has been its associate director in charge of research since 1954. It is my privilege to present Dr.

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