Adrenal Glands Save Our Lives

Physiology

By Jane Stafford

THE mysterious bearded lady of the old circus side-shows; Sappho, the great poetess of ancient Greece, whose strange love-life has been severely criticized; the thousands of men and women living today whose peculiar problem has been the theme of recent novels and a much-discussed play; all these have probably owed their abnormality to overfunction of two small glands that cap the kidneys and are known as the suprarenal or adrenal glands.

About the size of a man's thumb, shaped somewhat like the famous Liberty caps of the French Revolution, only of a yellow color instead of the revolutionary red, these small organs are among the most vital in the entire body. Life does not long continue in a body from which they have been removed.

When these glands become overactive in adult life, some of the characteristics of the opposite sex appear; a woman's voice acquires the deep tones of a man's; hair grows on her face; the smooth curves of neck and face and limbs are replaced by more masculine contours. Such a type is the bearded lady of the circus. The condition is known as virilism. Similar charges occur in the male sex; the voice becomes high and squeaky; there is an abundance of fat and a lack of muscular development; the hair on the face and body is scanty.

The earlier in life that these glands become overactive, the more pronounced are the changes in the outward sex characteristics. When the glands are overactive in infancy or childhood, the children mature at an exceedingly early age, sometimes as young as 6 or 7 years. These are veritable child men and women, not, however, to be confused with dwarfs, whose condition is due to abnormality of another gland.

When the gland becomes overactive during the developmental stage before birth, it causes an even more marked change. The characters in certain modern novels, and the living people from whom they are drawn, are of this type. The disharmonies and strangely faulty composition of the body from which these people suffer were known for centuries before Christ, but the unfortunate sufferers have been under a dire social tabu. Only recently have their complex problems become topics of conversation, just as only recently medical science has learned that the causes of these strange anomalies are to be found in abnormal functioning of the glands.

Feats of daring and athletic prowess are made possible by the action of the adrenal glands.

Of all the organs of the body, the suprarenal glands are among the very most important. Life itself cannot continue without them. They play a large part in regulating the growth and development and temperature of the body. Much depends on their normal functioning. In time of stress they help us to think and act quickly, and often save our lives. The fighter, the soldier, the football player, all depend for their success on good functioning of their suprarenal glands. In modern life, we all of us meet situations every day when our suprarenal glands stand us in good stead. When a man jumps out of the path of an approaching automobile, or swerves his car sharply and jams on the brakes to avoid an accident, the tiny caps above his kidneys have helped him to act quickly enough to avoid catastrophe.

Just how the glands act to help in this way is part of the new knowledge of the body's functions. But the knowledge that the glands were important organs seems to have existed for many centuries.

Primitive peoples knew, perhaps instinctively, that the glands were important to life. They attributed strange powers to them and were careful to eat them along with the flesh of animals. Some races endowed the glands with specific powers, such as courage or wisdom, and fed the appropriate ones to their fighters before battle. Thus they anticipated in a haphazard fashion modern scientific glandular therapy.

Exact knowledge of the glands began with the work of a great French physiologist, Claud Bernard. It was he who gave the name "internal secretion" to the process by which the glands affect our bodies. To him we owe the initial work, begun in 1848, which has placed this subject as a whole on a scientific footing. The adrenal glands themselves were discovered and described in 1563 by the Italian anatomist, Eustachius.

But it was an Englishman, Thomas Addison of London, who gave us the first knowledge of the function of these adrenal glands. He first described in 1849 the strange disease which bears his name and showed that it was due to disease of the suprarenal glands.

Each adrenal gland has two parts, called the cortex and the medulla. These two parts have a different structure, are made up of different kinds of cells, and apparently have different functions. The medulla secretes a powerful substance known variously as adrenalin, adrenin and epinephrin. A small amount of this substance is always present in the blood, acting as one of the regulators of the body processes. Under stress of certain emotions, notably anger and fear, the glands pour much larger amounts of this substance into the blood. When the medulla is diseased, it secretes less than the usual amount of its hormone.

The cortex is considered by some scientists to be the more important part of the adrenal gland. Animals have been known to live when the medulla of the gland is missing, but no animal has ever survived more than a few hours after removal or loss of the entire gland. From this circumstance, it appears that it is the cortex that is essential to life tiself. One investigator removed the cortex, leaving the medulla intact. Invariably the animals died. But, in cats and dogs,

The adrenal gland, shaped like a queer cap and just this size, rests above the kidney.

seven-eighths of the adrenal glands could be removed with safety, providing that the remaining portion of gland consisted of cortex. Post mortem examination of the glands following a rapid death from disease of the adrenal glands has shown that the medulla is hardly affected, but the cortex gives evidence of acute disease.

There is a theory that the cortex secretes a hormone of its own, but this has not yet been proved. So far no hormone has been isolated from the gland. Some experiments have been made with cortical extract. These have given results indicative of glandular activity, but the possibility exists that a trace of medullary substance is mixed with the cortical extract.

Addison's disease is a destructive disease of the adrenal glands. Generally the gland is attacked by tuberculosis, and often the tuberculosis spreads to the rest of the body. This disease is always fatal, although persons suffering from it may live as long as six to ten years. The most characteristic and unusual feature of this disease is the peculiar change in the color of the skin. The exposed surfaces at first, and later the entire surface of the body, become a deep bronze hue. In the very early stages of the illness, this change in coloring appears as only a few brown spots on face, hands or arms. Gradually the entire skin undergoes a change.

Patients suffering from Addison's disease become very weak and lose weight. In the last stages they appear entirely emaciated. The tone of all the muscles is considerably lowered and the patients are not capable of much physical effort. They tire very quickly. The pulse is slow and the heart action becomes feeble. The blood pressure and the metabolism are very low. Loss of appetite generally occurs, and the patients often suffer from digestive upsets with severe abdominal pain. Occasionally anemia is present.

Treatment with epinephrin has not been very successful. Extracts of whole gland have been more effective. The disease is fortunately not a very common one; in a series of 2417 cases studied at the Mayo Clinic, only 13 were Addison's disease. Sir William Osler, who was professor of medicine at the Johns Hopkins University and later at Oxford, saw only 17 cases in the course of 21 years of extensive practice and teaching.

Addison's disease is a wasting process in which the gland is partially destroyed and functions less actively than normal. In the opposite condition, the gland is overactive with the disturbance of the sex characteristics already described. The overactivity may be due to a tumor on the gland and underlying kidney.

The theory that the adrenal glands give the body extra strength in emergencies is held by Dr. Walter B. Cannon, professor of physiology at Harvard University. In his newly published book Dr. Cannon describes experiments by which he and his associates proved the effect of emotions on the adrenals.

In anger or fear these glands pour their secretion, epinephrin into the blood in larger amounts than usual. This speeds the heart beat and raises the blood pressure. The blood is shifted from the digestive organs to the brain, heart and lungs. At the same time the epinephrin has reached the liver, where the body's extra supply of sugar is stored in the form of glycogen. When the epinephrin reaches the liver in large amounts, the glycogen is released into the blood stream. Sugar is the body's fuel. When more work is to be done, more fuel is needed. Thus in an emergency, this extra supply of sugar, liberated at the signal from the adrenal glands, supplies the greater energy to the muscles needed for offense or defense, and fatigue is warded off. The entire action takes place instantaneously, so that the body is immediately equipped to meet the emergency, whatever it may be.

According to this theory, the successful prize-fighter owes his victory to the functioning of his adrenal glands. All of us have felt the quickening of the pulse and the extra surge of energy in times of stress, anger or fear, which indicates that our adrenal glands are functioning. This action is not confined to human beings. Cannon made his observations on dogs and cats, and another scientist, Dr. A. C. Redfield, found that in lizards epinephrin also acts as part of the protective mechanism. The pigment cells of certain of these creatures act to vary their color in accordance with the shade of the surroundings. This action of these cells is stimulated by epinephrin, while nervous excitement in these animals has a similar effect.

Like the thyroid gland, the adrenal gland is closely connected with the temperature regulation of the body. Cool, bracing climates stimulate the gland to function normally, to secrete and to make a (*Turn to page* 142)

Sappho, the famous poetess of ancient Greece, exhibited strange abnormalities which were probably the result of disturbance of her adrenal glands.

How Your Adrenals Determine Your Character—*Continued*

normal amount of its hormone epinephrin. Lack of stimulus of the adrenal gland by warm tropical climates is one reason why the European is unable to adapt himself readily to life in the tropics. Another reason for this is given by the British scientist, W. Cramer, in a recently published book.

"There is a close chemical relationship between adrenalin and pigment. It has been shown that pigment can be formed from adrenalin and substances allied to adrenalin by a special ferment. . . . When owing to disease of the adrenal medulla or Addison's disease the formation of adrenalin is impaired, pigment is deposited in the skin. The pigmentation of the races living in tropical climates may perhaps be the method by which the organism disposes of the material which would otherwise have been used for the formation of adrenalin. In the white races this method of excretion of the excess of adrenalin of its precursor is not so well developed and this may be one of the reasons why white races are less fitted for a tropical climate," said Dr. Cramer.

The powerful hormone of the adrenal glands has been extracted in pure form, in fact this was the first hormone to be obtained in pure state. The work was done at the close of the last century and the beginning of this one. Professor John J. Abel of the Johns Hopkins University and Jokichi Takamine, a Japanese investigator, are the scientists chiefly responsible for the extraction and crystallization of this hormone. It has also been prepared synthetically in the laboratory.

Adrenalin has a wide use in modern medicine, though a drug, ephedrin, has been found to have similar properties and has replaced adrenalin to some extent in the treatment of asthma. Adrenalin acts to contract the arteries and so checks the flow of blood. Other uses are for relief of shock, as an aid in heart failure and in conditions of circulatory weakness.

Adrenalin has long been used to raise the blood pressure, particularly in cases of shock following severe injuries or operations, and because of its relaxing effect on the bronchial muscles it has been used effectively in treating bronchial asthma. However, to produce the desired effect, the adrenalin had to be injected directly into a vein, and for each fresh attack a fresh injection of adrenalin had to be made.

A new method of using adrenalin has been put forth quite recently by Dr. A. B. Luckhardt of the University of Chicago and Dr. Theodore Koppanyi of Cornell Medical College. These men have shown in dogs that adrenalin is capable of elevating the blood pressure even if injected beneath the skin, but they have also discovered the conditions under which the blood pressure elevating effect of the adrenalin injected under the skin may be elicited. They found that about fifteen minutes after the injection of adrenalin under the skin, when the injected area was gently massaged, there was at once a very considerable and protracted rise in blood pressure. It was even possible to produce blood pressure rises from such areas that had been injected twenty-four hours before the massage.

Dr. Koppanyi has lately shown that adrenalin injected underneath the skin with massage of the injected areas is just as effective in man as in dogs. In both cases the adrenalin forms a reservoir underneath the skin, the massage of which results in a blood pressure rise for over twenty-four hours. A New York surgeon, Dr. Howard Lilienthal, has shown that by using the method of Drs. Luckhardt and Koppanyi he could restore a patient suffering from traumatic shock.

Besides bronchial asthma, hives and hay fever respond very readily to adrenalin. It has heretofore been necessary for each attack of these diseases to be checked by a new injection of adrenalin. The method of massaging the injected areas does away with that very often inconvenient procedure, and during the course of a day or two only one adrenalin injection is necessary. The patient himself may be instructed to massage the injected area with a piece of cotton. Thus he will get the benefit of the full therapeutic effect of adrenalin. Clinical reports have already substantiated the effect of the massage of the adrenalin-injected areas in these diseases.

Invisible Flying—*Continued*

for Promotion of Aeronautics in fog flying. Although they showed conclusively that it is possible to land by instruments alone the procedure is still in a highly experimental stage and needs to be brought to a point where it is commercially applicable, Lieutenant Doolittle explained.

"When this is brought about," he said, "the airplane will become the safest known means of transport as it will be the only one than can operate unhampered by fog."

In flying "blind" in the tests, the take-off was made in the path of a radio beam with all instruments corectly calibrated and set at zero, the aviator said. Piloting by means of gyroscopic instruments, he followed the beam about four miles while the plane climbed 1000 feet. Then the plane was turned around and headed back into the beam.

"As the beacon, the source of the beam, was approached, the beam became narrower," he said, "and, while it was more difficult to follow, the course became much more exact. At the exact moment of passing over the beacon house, the reeds affected by the beam stopped vibrating momentarily and then began to vibrate in the opposite direction."

The beam was followed about four miles again in the new direction, a turn made and the field approached at an altitude of about 400 feet. As Lieutenant Doolittle was preparing to land, he took care to follow with the aid of the directional gyroscope, the exact center of the beam. An air speed of 60 miles an hour and a descent less than 600 feet per minute were assumed, both accurately indicated on the instrument board, because he had previously found that his plane would absorb the shock of hitting the ground at this speed and angle. The aviator read his altitude within 10 feet of the exact figure from an instrument for which varying air pressure was checked by radio from the ground. The actual landing was made at about 55 miles per hour and 400 feet glide per minute.

Lieutenant Doolittle's interest in flying began when he entered the air corps in the World War at the age of 21. He was the first to fly across the continent in a day, making the trip from Jacksonville, Fla., to San Diego, Calif., within 24 hours during 1922. In the fall of 1925, he won the Schneider trophy race in Baltimore. The difficult outside loop, performed by only a few daring pilots, has been flown by Lieutenant Doolittle, and he has been awarded the Distinguished Fying Cross.