Thyroid Sets the Pace

Endocrinology

By Jane Stafford

Dr. Oscar Riddle, of the Carnegie Institution of Washington, who has made a recent contribution to our knowledge of how the thyroid gland functions.

YOUR thyroid gland governs the speed at which you live. Whether you are fast or slow, tall or short, fat or thin, or comfortably in between, is determined by the small U-shaped gland located in the front of the neck. This gland sets the pace for all the other organs in the body, including the nerves and the brains. The gland does this through a very powerful substance which it secretes, called a hormone.

That the thyroid regulates the tempo of the body processes has only now been definitely established, though the problem of the thyroid has puzzled scientists for many years. This gland exerts its influence on all parts of the body, and slows or speeds their development and functions.

"Research has slowly enlarged the circle which circumscribes those physiological processes recognized to be under the regulation of the thyroid gland and today it can be clearly stated that the gland determines the pace which is to be maintained by all of the other organs and systems of organs of the body," stated Dr. Edward C. Kendall of the Mayo Foundation in his recently published book on thyroxin, the active principle of the thyroid gland, which he was the first to isolate.

Back in 1874 Sir William Gull took the first step in solving the problem of how the thyroid functions. Another step has just been taken by Dr. Oscar Riddle of the Carnegie Institution. In a paper read before the Association for the Study of Internal Secretions, Dr. Riddle presented evidence of the relation of the thyroid to the process of reproduction. Working with pigeons, he and his associate, Dr. J. Krizenecky, found that the structure of the thyroid undergoes characteristic changes with each ovulation cycle. The formation of the egg is only a part of the entire process of reproduction, and the thyroid undoubtedly bears a close relation to the rest of the process, in pigeons and other animals, including man. So far the studies have been limited to ovulation. But it is known that during the spring and summer, the periods of active reproduction, the thyroid is at its lowest ebb as to weight and function. In winter, when the thyroid is largest and most functional, reproduction is entirely suppressed in the pigeons.

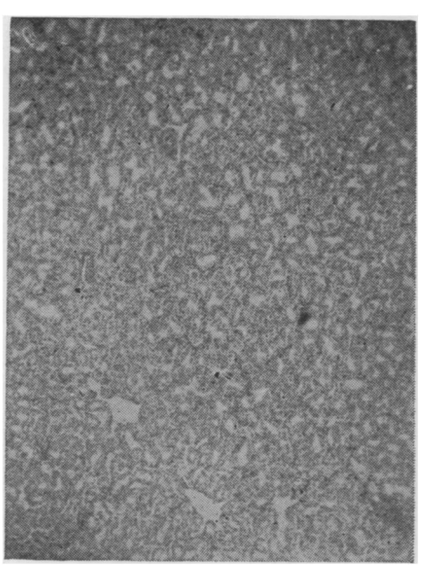
"When thyroid weight is low, or rather while it is undergoing a definite decline in weight and function, the period of riotous reproduction occurs in these animals," declared Dr. Riddle, referring to the doves and pigeons which he and his associates observed.

In between Gull's original observations and Dr. Riddle's most recent investigations lies a period in which important facts concerning the thyroid and its activity and diseases were learned. Thyroxin, the active principle of the substance which the gland secretes, has been isolated, its exact nature determined and it has been produced synthetically in the chemist's laboratory. This has made it possible to treat successfully persons suffering from a certain form of thyroid disease.

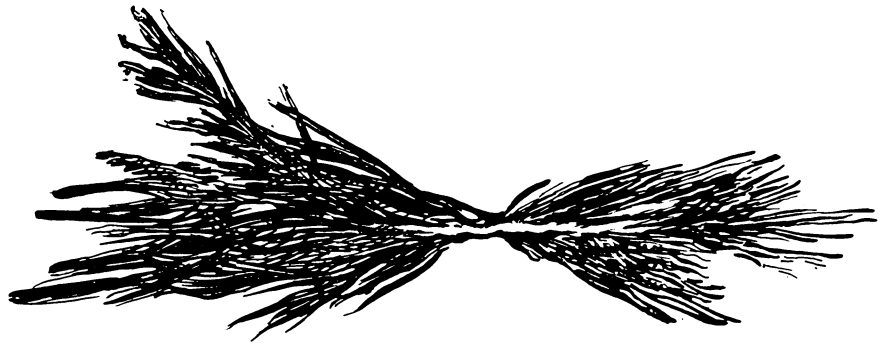
Normally the gland regulates the various organs so that they function at the most efficient rate for carrying on the body's activities. In disease, the thyroid may speed up the organs so that the body becomes worn out from the rapid pace. The heart beats faster, the nerves are highly agitated, food is swiftly converted into energy and burned up, and the reserve fat of the body is all used up in supplying additional energy. The whole picture is that of an engine that has been raced until every part is worn out.

In another kind of thyroid disease, the gland secretes so little of its hormone that the pace is much too slow for efficient or comfortable living. The body moves slowly and fat accumulates rapidly. The nerves and circulation are sluggish. The mental development is greatly retarded. The long bones do not grow as they should. The fat lady of the circus is an example of this type of thyroid disease.

Stored in the thyroid is the body's supply of iodine. This is elaborated into a hormone, of which the active principle is the powerful thyroxin, as it is now known. Through the blood stream the thyroxin reaches every part of the body with its



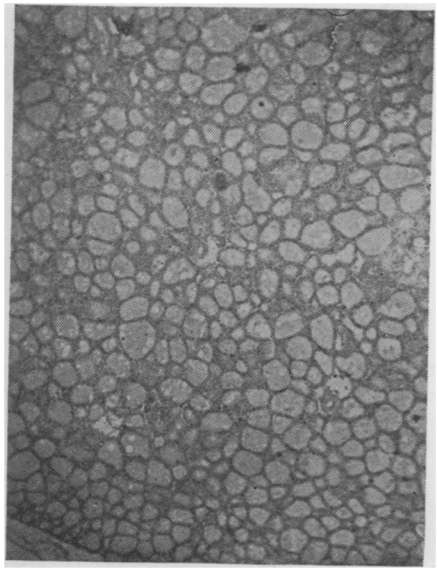
Structure of thyroid in the pigeon at the time of ovulation. A characteristic structural change takes place at each ovulation cycle.



These needle-like crystals are the powerful thyroxin, the active principle of the thyroid hormone which controls the speed of body processes (Kendall).

charge of iodine, so necessary to the well-being of animals. The mechanism by which this chemical affects the body organs is not clearly understood even yet. Only the results of its action or failure to act are known definitely. Dr. W. Cramer, formerly of Edinburgh University, thinks it acts on the sympathetic nervous system and thus affects the entire body.

When the gland, either through removal, disease or failure to develop properly, does not secrete enough hormone, the body processes slow up. The result is known as myxedema. Persons thus affected are short, very fat, slow of action and of comprehension. The tongue is thickened and speech is slow and hard to understand. If persons so affected are treated with extract of thyroid gland or with thyroxin, they may be restored to a normal condition. Children who are born with too little thyroid or with underactive glands are known as cretins. Mentally they never develop and they have all the other symptoms of advanced myxedema. If they are treated with thyroid extract or its hormone, they also recover, particularly if treatment is started before they reach the age of ten. In both cretinism and myxedema, the treatment must be continued always, as it is supplementary but not curative. That is, thyroxin or thyroid extract supplements the very small amount of hormone being secreted by the patient's own gland, but it does not restore the gland to a normal condition.



Thyroid of pigeon during "resting" period, more than 108 hours removed from ovulation.

When the thyroid gland becomes overactive, it secretes an excess of its powerful hormone. This brings about too rapid a rate of function on the part of the other organs. Sometimes the gland itself is enlarged, producing the familiar goiter. In one type of hyperthyroidism, as this excessive activity is called, the eyes of the sick person also bulge. The skin sweats profusely, the heart works faster, movements are quick and there is a complete lack of repose, even to the extent of sleeplessness. People suffering from excessive thyroid activity lose weight rapidly, and although they may eat much more than usual, still the food is used up supplying the extra energy needed by the body in keeping the terrific pace set by the overactive thyroid. Removal of part of the gland brings back a normal condition. The small part of the gland that is left cannot secrete enough thyroxin even at the previous rate of the accelerated activity, to disturb the normal tempo of the body.

With this control of the body's speed, the thyroid also plays an important part in controlling the temperature of the body. Under-activity of the thyroid lowers the temperature of the body and those suffering from myxedema, in spite of their heavy layers of fat, are not able to keep warm at the temperatures normal people find comfortable. On the other hand, hyperthyroidism, or overactivity, may bring about a feverish state. The actual elevation of temperature may not be great in degrees, but sweating is free, and the patients suffering from this condition present a picture of feverish activity and warmth. Studies recently made by Dr. Cramer have indicated that the temperature-regulating power of the thyroid is affected by climate.

What we know as a "bracing climate," one in which temperature changes are frequent but high temperatures are rare, stimulates the thyroid gland to increased activity, but usually not to a dangerous degree. A cold breeze in midsummer or the fresh, crisp days of autumn make us feel full of energy and well-being. That is because the temperature change has stimulated the thyroid and more thyroxin makes its way to nerves and organs, accelerating their pace. Similarly high temperatures, such as fever, stimulate the thyroid. But in warm, even climates, thyroid activity does not vary. The greatest initiative, energy and creative ability of people living in temperate regions over those living in the tropics is due to frequent stimulation of the thyroid by the frequent weather changes, Dr. Cramer thinks. It is generally conceded that man would never have progressed to his present state if he had not left the tropical land of his origin.

The thyroid may even have been responsible for the evolution from amphibians of many and all vertebrate animals living on land. This possibility, advanced by Dr. E. Uhlenhuth of the University of Maryland Medical School, is seen from the fact that thyroid activity can cause an entirely new set of organs and tissues to develop in certain amphibians or water animals, such as salamanders. May not, Dr. Uhlenhuth asks, this power have once been exerted in such a way as to develop the organs and tissues which men and other animals have but which are lacking in fish, another class of vetebrates? It is the thyroid which causes the metamorphosis in salamanders. Increased thyroid activity increases the speed of this process but salamanders suffering from too little thyroid activity fail to metamorphose completely. When the thyroid gland is (*Turn to page* 123)

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removed, they do not metamorphose at all.

At one time it was thought the changes occurring in the body of a patient who had hyperthyroidism were due to a poison elaborated by the gland. Other theories credited bacterial infection of some sort with the production of these diseases. But the latest work has shown that the disease is the result, not of an invading germ nor of a subtle poison, but of too much of the substance normally secreted by the gland and needed in normal amounts to maintain the body functions.

This normal secretion of the thyroid gland has found a place among the therapeutic agents of modern physicians. It has also, unfortunately, found its way into the hands of the quack. Some reducing agents, sold to fat people who wanted to lose weight easily, were found to contain either thyroxin or dried thyroid gland. A small amount of this substance will cause loss of weight, but the loss is only a side-issue of the hyperthyroidism brought about by taking it when there is no previous thyroid deficiency. Misguided women and girls who took such "reducing" medicine found themselves very ill with dangerously overactive thyroid glands.

The thyroid gland needs iodine to elaborate its hormone. In fact the active principle of the gland, thyroxin, contains 65 per cent of iodine. This iodine is obtained from food and water. In some parts of the world the water contains very little iodine and the food grown in such regions also lacks this important substance. Then the gland cannot get enough for its needs and either too little hormone is secreted or else the hormone contains too little iodine to function properly. People living in such regions sometimes have large goiter and the other symptoms of underactive thyroid or thyroid insufficiency. Places where iodine is lacking are apt to be mountainous and far from the ocean. Seashore regions are especially rich in iodine, which is abundant in seawater.

In some places where there is a deficiency of iodine it may be given as a medicine, to supplement the amount the gland gets from the water and food, and thus prevent the development of goiter, myxedema and cretinism. For example, the Swiss government puts iodine in all the salt sold in the country. In some cities in other regions of endemic goiter iodine is fed to the school children.

Iodine is also given to persons suffering from the quite different goiter of hyperthyroidism, just before operation for removal of part of the overactive gland. One dose of iodine is all that may be given to these patients. More would be fatal. Just why this one dose is helpful is one of the still unsolved mysteries surrounding the thyroid.

Not only has thyroxin been isolated from the thyroid gland, it has also been prepared artificially by synthesis from coal tar products. This was first done by Dr. E. C. Kendall of the Mayo Foundation in this country, then by Dr. C. R. Harington of England.

Science News-Letter, February 22, 1930

The "Barrel" of Corona

When high voltage surges on electric transmission lines jump an ordinary string of insulators, arcs form from one insulator to the other and destroy them.

But when both ends of the string are protected by metal grading shields, the arc jumps through the air from shield to shield and saves the insulators, F. W. Peek, General Electric engineer, has found in his high voltage laboratory at Pittsfield, Mass.

With the shields a greater voltage is required to produce arcing. This is probably because the additional voltage must supply energy to the "barrel" of corona which forms between the edges of the rings of the shields before the final breakdown, Mr. Peek explains.

The striking appearance of this "barrel" of corona is pictured on the front cover.

Electricity
Science News-Letter, February 22, 1930

California ranks first in the number of farms using electricity, with 65,000 being wired.

The lake front of a Seattle park is being planted with 3,500 Japanese cherry trees.

A survey indicates that more than half the salesclerks in ten cent stores are less than 20 years old.

Factors which make for strength in brick walls have been studied by the U. S. Bureau of Standards.