if he wanted any breakfast, and he said, "No," but when told he had better eat something, he went in to breakfast, sat down, drank a glass of water, and in a few minutes left the table hurriedly, and when about to leave the dining-room, said, "Good-bye, people." He went to his room, undressed, and went to bed, pulling the cover up over his head, and at 7 a. m., when asked how he was, he seemed to come to himself and asked about the time. He said he felt so very weak and tired that he did not know what to do. He asked for a drink of water and if he could have a cup of coffee. On being questioned as to his actions during the few hours previous, he said that he did not know a thing that had happened. Within the several weeks spent in the hospital under my observation, he had several attacks characterized chiefly by amnesia, desire to wander, sullenness and irritable disposition. Later he left the hospital apparently in a very much improved condition, and soon afterward enlisted in the army.

Later History.—Several months passed and nothing was heard of him until finally he wrote to me from Fort Leavenworth, telling of trouble he had got into there while on guard duty. He had been arrested for drunkenness and misconduct while on duty. It developed that he had been in one of his peculiar hysterical attacks; he later was discharged from the army. I did not hear anything more about the man for several months, when word came to me again that he was in trouble in some town down in New Mexico. I wrote to the authorities, giving them a history of his case, but have never heard from him since.

CASE 3.—History.—A man, aged 55, physician, weighing 227, with no hereditary taint, who drank considerable liquor, but had no luetic history, one evening was returning home in his carriage; his horse became unmanageable and he was thrown from the vehicle, rendered unconscious and remained so for forty-eight hours. He sustained a scalp wound along the right parieto-occipital junction. The fracture could not be determined. On return of consciousness he presented the following mental symptoms: Disorientation as to time and place; retrograde amnesia (periodical), disturbed perception, diminished sensibility, emotional weakness, memory fabrication, incoherent and rambling conversation; feeling of well-being. On the admission of this patient to the hospital, he did not realize the nature of the institution at all. When questioned concerning the condition of his health, he would declare he was perfectly well and objected to any treatment other than the physiologic remedies. Concerning the runaway accident he displayed fabrication of memory, describing the accident, why it occurred, and how trifling it was, he not having been injured in the least, telling how he got up from the ground and went about his usual business. With but little provocation he at times would exhibit considerable emotional irritability, while at others he would seem quite indifferent to any external stimuli; even such as are ordinarily regarded irritating. Often would he sit for an hour at a time seriously telling experiences (elaborated) to a demented catatonic who, of course, was not giving him any attention or reply. To his physician his tales of professional experiences were very fanciful and improbable. This patient, after a few weeks in the hospital, began to recover his mental powers and faculties, and recovered after a few months' illness.

ABSTRACT OF DISCUSSION

DR. A. C. BRUSH, Brooklyn: I object to the term "traumatic neurosis" as it implies a form of nervous disease due to injury, and does not tell the real story. The use of such a term in medicine is proper, but when we come, as Dr. Gaver has said, to deal with the legal side of the question, it impresses both court and jury with the idea that there is a distinct disease due to trauma, and this leaves the claimants and their counsel at liberty to play on the fancy and increase the severity of the case in the eyes of the jury. In dealing with such cases in court, I absolutely exclude that term and characterize the condition at once as hysteria or neurasthenia. The jury all know what hysteria is, and they all know what nervous prostration is; but they do not know what traumatic neurosis is; and the result is that that term has done more to rob corporations, city railroads and others, than anything

else in the world. Again, many writers have too vague a way of stating the prognosis. The prognosis is that of neurasthenia.

DR. G. T. HARDING, JR., Columbus, O.: I can not agree with the statement that the term traumatic neurosis has done more to rob corporations than any other term used in medicine. Surely this group of medical men should not feel that a disabling neurosis, having its inception in the shock or injury of an accident, partakes of the nature of a fraud because it may be possible to demonstrate that certain mental processes have subsequently contributed to the patient's condition, or help to keep up his symptoms. No other class of medical men, and especially those who deal chiefly with organic disease, seem able properly to appreciate the seriousness of that mental instability that can arise from shock and injury, and that puts its victims in pitiful slavery to suggestions and mental representations. I seriously doubt whether this lack of insight on the part of the profession has resulted in more robbery of corporations than in injustice to a certain class of invalids; and for this reason I feel that neurologists should make an effort to educate their fellow physicians in regard to the true nature of traumatic neuroses.

DR. E. E. GAVER, Columbus: I did not mean to convey the impression that I believe that there is really such a distinct disease as traumatic neurosis. I think these cases are all hysteria, neurasthenia and a mixture of both, or psychoses.

EXPERIMENTAL PRESSURE ATROPHY OF THE THYROID

WITH BRIEF SUMMARY OF THE PRESENT KNOWLEDGE OF THE GLAND*

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INTRODUCTION

Up to a little over a hundred years ago, very scant attention was paid to pathologic conditions of the thyroid. In fact, endemic struma, at least in goitrous territories, were considered quite natural and even beneficial. The sporadic cases were, as a rule, confounded with tuberculous adenitis. Not until 1800, when Fodéré first described the difference between struma and cretinism, did the thyroid begin to attract any special attention.

During the last century such men as Eulenberg, St. Lager, Bircher, Wollfer, Kocher and others devoted much time and labor to study of the gland. Fresh stimulus was infused into the work by the occurrence of the condition now known as "cachexia strumipriva" following complete extirpation of the thyroid; by the discovery of iodine in the gland of Bauman, and by experimental work on the organ by Cyon.

In recent years the medical world has been swept by an epidemic of experimental work on the gland.

Abroad the Kochers, Bauman, Cyon, Oswald, Ewald, and a host of others, and in this country Halsted, Hunt, McCallum, Marine, Mayo and others, have done an enormous amount of excellent work.

I intend briefly to review the literature and to report the results of a year's research on the gland.

ANATOMY (COMPARATIVE)

Owing to the vast amount of work that has been done and is being done on the dog, I deem it to be of some interest to give briefly the anatomy of the gland of that animal. For the human anatomy I refer to text-books.

* From the Hull Physiological Laboratory, University of Chicago; read before the Chicago Medical Society, April 14, 1909.

* On account of lack of space, this article is here abbreviated. The complete article is presented in the author's reprints, a copy of which will be sent by the author or by THE JOURNAL on receipt of a stamped self-addressed envelope, if the request is received within four months.

The dog has, as a rule, two glands situated in the lower and anterior aspect of the neck on each side of the trachea. In only one of fifty dogs did I find an intervening isthmus. Each gland is egg-shaped, brownish-red in color, and of variable size. The consistency is that of a human kidney. It is covered externally by a thin capsule. Posteriorly the gland is attached to the deeper structures by a kind of a mesentery through which runs the vessels, nerves and lymphatics.

The vascular supply is very abundant and probably relatively greater than in any other organ. Generally the gland is supplied by one artery which enters the gland at the superior pole. Sometimes, however, as in the human being, there are two, the superior and the inferior thyroid originating as in man. The veins form large trunks emptying into the internal jugular.

There is especially one prominent tributary which extends halfway around the gland on its external surface. This vessel may be appropriately termed the vena semi-circularis and would be the one most easily used for the blood work on the gland.

The lymphatics are numerous, and of great size. The nerves are derived from the sympathetic and the pneumogastric. The important anatomic relations are similar to those in the human being.

CHEMISTRY

An enormous amount of work has been done on the chemical analysis of the gland, but with very opposing results. The following is the composition which is generally believed to exist in the average normal gland:

COMPOSITION

Inorganic—82 per cent. to 84 per cent.

Water.

Iodin.

Phosphorus.

Iron, etc.

Organic—17 per cent. to 19 per cent.

Nucleoprotein.

Thyreoglobulin.

Albumin.

Colloid.

Fatty acids.

Lactic acid.

Xanthin.

Hypoxanthin.

Inosit.

Leucin.

PHYSIOLOGY

FUNCTION OF THYROID (HISTORICAL)

The older authors attributed various functions to the thyroid, such as protection from cold (Wharton); protection for the large vessels and nerves (Luscha); some regulating connection with the vocal organs (Santorini Winslow); blood-forming function (Crédé, Zesas); moderating the blood supply to the head (Maignien, Guyon); protection of the brain from hyperemia (Simon Waldeyer); taking up blood at night, producing anemia of brain and thus sleep (Fomeris); a means of draining blood from the lung, protecting it from congestion (Kocher); rudimentary lung (Grutzner); some relative function with the genital organs (Guilot, Lawson-Tait, Bennet, etc.).

The first attempts at experimental excision of thyroid were made in the forties by Astley Cooper, Bardeleben and Maignien, with doubtful results.

In 1856 Schiff, after numerous experiments, reported that all the animals died. His paper did not at the time receive any special attention.

When later on in 1882, however, Reverdin, Kocher, Billroth and Weis reported the enormous disturbance in

man caused by thyroidectomy, Schiff, having withheld his final report, related his experiences with sixty thyroidectomized dogs, and then received the credit he deserved.

By these experiences with the human and animals, the peculiar condition later termed cachexia strumipriva was produced, and its close resemblance to myxedema noted.

The symptomatic results following thyroidectomy are those of myxedema in man.

To these formerly were added tetany, but that symptom is now definitely attributed to removal of the parathyroids.

ADMINISTRATION OF THE THYROID GLAND AND ITS EXTRACTS

In 1884 Calzi and later Fano and Zanda succeeded in alleviating the symptoms in thyroidectomized dogs by transfusion of blood from normal dogs. A few years later Vassale used an aqueous extract of thyroid intravenously with good results. This was followed by the subcutaneous use of similar extracts by Gley, Murray, Bertowsky and others. All these experiments were performed on animals.

It was at first, in man, in cases of cachexia strumipriva that the use of the gland per mouth demonstrated such splendid results, showing a gradual disappearance of all the symptoms as long as treatment was continued.

The same results were later obtained in animals by Eisenberg, Lanz and others.

Since Bauman's discovery of iodine in the gland the important relation of iodine to the physiologic activity of the gland has been strongly emphasized by Oswald, Cyon, Magnus Levy and others, and it has been decided by these investigators that the substance known as iodothyron is the active principle of the gland. Therefore, most experiments on the physiologic action of thyroid have been done with this substance, or the gland itself.

Cyon and Oswald found that on injection of iodothyron or its mother substance, iodothyreoglobulin, there was a marked augmentation and increased strength of heart action with diminished blood pressure, and, as this occurred after section of both vagi or atropinizing of animal, they concluded that the result was obtained from direct action on the heart.

Kobert, Van Kraus, Friedenthal and Furth and Schwartz found no action of iodothyron on the heart.

Cyon, from his experiments, finds that the excitability of the vagi is greatly increased by injection of iodothyron. The stimulation of the central end of the cut nerve before injection caused very slight change, but after injection the same strength of stimulation caused, at times, complete stoppage of heart. Even after atropinizing the animal, there was momentary change in heart action. Furth and Schwartz report negative results from similar experiments.

METABOLISM (A) IN NORMAL MAN OR ANIMALS FOLLOWING ADMINISTRATION OF THYROID OR ITS PRODUCTS

The great metabolic phenomena caused by certain pathologic conditions of the gland or by its removal clearly demonstrate its vast influence on the nutritional changes in the organism.

In order to determine the particular changes taking place, numerous experiments have been made by the administration of thyroid or its products and by the removal of the organ, and the noting the effect on the various metabolic activities.

1. *Effect on Nitrogen Elimination.*—All investigators agree on impossibility of an animal being able to main-

tain nitrogen equilibrium, more nitrogen being eliminated than introduced (Vermehren, Richter, Scholtz, Zinn, Magnus Levy, etc.).

2. *On Gaseous Exchange*.—Voit found that in animals brought near nitrogen equilibrium carbon dioxide rose about 20 per cent. on being fed by gland itself. In starved animals the carbon dioxide output averaged about 16 per cent.; carbon dioxide exhalation rose 6 per cent. in animals fed iodothyron; the oxygen intake rose to 13 per cent., consequently the respiratory quotient was lowered.

METABOLISM (B) IN HYPOTHYROIDISM

Proteid Metabolism.—In these conditions there is a general lessening of all metabolic activities. In thyroidectomized animals, there is a decreased nitrogen elimination (Dulta and La Monaco).

There is, however, a marked elimination of ammonia in the urine following thyroidectomy, causing it to become alkaline in reaction (Cowendo, Luzzato).

Administration of Thyroid or Its Products.—This is soon followed by increased metabolic activities, increased nitrogen elimination, increased gaseous exchange, etc.

METABOLISM (C) IN HYPERTHYROIDISM

In this condition all the metabolic activities are greatly increased.

Proteid Metabolism.—Lustig was the first to call attention to greatly increased nitrogen elimination with great reduction in weight. This was confirmed later.

Influence of Feeding of Thyroid.—Scholtz and Hirschhoff found no change taking place. David observed an increase of 90 per cent. of nitrogen output in one of his cases. Matthes also observed quite a rise in his cases. The authors just cited and several others also found great increase of acid phosphates in the urine.

TRANSPLANTATION

The occurrence of operative myxedema naturally brought up the subject of transplantation.

The first attempt was made by Schiff, who was closely followed by Eiselberg and Kocher, and later by Hoarsly and Bircher.

The gland was transplanted at first into the neck; later mostly into the abdominal cavity with temporary improvement of the patients, the transplanted glands, as a rule, undergoing gradually atrophy or absorption.

Payr, whose careful experiments were commented on by Kocher, selected the spleen as the site of transplantation, and obtained the most excellent and lasting result by transplanting part of a mother's gland into the spleen of her child born with cachexia thyreopriva.

Through the direction of Kocher, Miss Serman has recently done a series of experiments of transplanting gland into the junction of epiphysis and diaphysis of bones, this area being selected from its great vascularity and still resistant structure, which makes it possible to form a pocket for the imported gland.

As a rule, the tibia was selected; a cavity was scooped out, and in it was placed a silver bullet. Three or four days later the wound was reopened and the bullet removed. By this time, healthy granulation tissue had formed on the walls of the artificial pocket. A piece was then resected from the animal's thyroid and placed in the cavity and skin closed.

Later complete thyroidectomy was performed without any disturbance to the animal. When still later a part of bone containing transplanted gland was resected, the animal presented all the symptoms of cachexia strumipriva, and shortly died.

So far as I have been able to ascertain from the literature, the excellent and lasting results of Payr's case has not as yet been duplicated.

INTERNAL SECRETION

Haller, in his remarkable medical work (1730), mentions that Ruysch advanced the supposition that the "blood vessel" glands manufactured some substance that was thrown into the blood current.

It was, however, Bernard's work a hundred years later on the glycogenic function of the liver that led to the adoption of the term "internal secretion."

At first in 1880, when Brown-Séquard, who was aging rapidly, began to experiment on himself with testicular extract, hoping thereby to regain vigor and youthfulness, was any special effort made to solve the problem. Since that time, volumes (the result of exhaustive experimental work) have been written on this subject by such men as Howell, Cyon, Oliver, Schafer, Bredt, Renier, Svebla and others.

Karlson has for several years been doing careful and conscientious work trying to isolate the internal secretion of the thyroid. He has strong reasons to believe that it will be found in the lymph discharged from the gland.

I have seen him inject lymph derived from the thyroid of goiter dogs into normal dogs; he invariably produces tachycardia and intense general tremor in the injected animal.

Blood coming from strumous thyroid injected into a normal animal causes no such manifestations.

In spite of the great amount of work done, no material advance has been made in regard to the nature or even presence of an internal secretion of thyroid.

EXPERIMENTAL HYPERTHYROIDISM

Working on the theory of hyperthyroidism in Basedow's disease, a number of investigators have more or less successfully produced Basedow-like symptoms in man and animals by flooding the system with thyroid products. Thus Emiguez, Canter and Lang worked on dogs and rabbits, Angiollella and Ludke on guinea-pigs, and Edmond on rats.

The most constant symptom recorded by these and other observers was tachycardia, and, next to that, emaciation. Other manifestations mentioned are dyspnea, diarrhea, nervousness, enlargement of the thyroid, widening of the palpebral fissure, exophthalmos,¹ etc.

In man, palpitation of the heart, nervous and metabolic phenomena have been observed.

By experiments, Furth and Schwartz find that outside of a transient tachycardia and very slight loss of weight, overdosing with thyroid causes no other disturbance.

DETOXICATION

Blum, who advanced this theory, believes that in the course of metabolism there is manufactured in the body a toxic globulin, and that this later is detoxicated in the thyroid by the chemical action of iodine.

Hunt supports this theory in reporting a series of highly interesting experiments, showing that mice fed with thyroid preparations withstood much larger doses of acetone nitrate than control animals.

This has been confirmed by Karlson and others.

1. Observers are not unanimous as to the occurrence of exophthalmos in the lower animals.

Bevan tells me that in one of the trout-tanks in an eastern fishery most of the fishes became affected with cancer of the thyroid, and that this was accompanied by great protuberance of the eyes. This was undoubtedly exophthalmos, although it was thought to be due to rickettsias behind the eye.

It is interesting to note in this connection that fishes in other tanks were unaffected.

RELATION OF THE THYROID TO OTHER DUCTLESS GLANDS

For years it was thought that certain ductless glands worked vicariously with each other. This has been supposed to be especially the case between the thyroid and the hypophysis. In cases of atrophy of the thyroid, it was often found that pituitary body had become greatly hypertrophied in a supposed effort to take up its fellow's action.

Oliver and Schafer, through their work, confirmed by many others, have thrown great doubt on this supposed vicarious function. They found that extracts of the two organs produce entirely contrary physiologic effects.

The relation of the parathyroids to the thyroid is not at all settled, but recent researches seem to indicate that probably these organs have no functional relationship.

HEMATOLOGY

By far most of the work on the blood done in connection with the thyroid has been worked out in Basedow's disease, and according to Kocher the hematologic picture is pathognomonic in this condition.

Through Kocher's instigation, Drs. Wageli, Kurt, Steigen and Kollman have carefully examined and tabulated 106 cases.

These men find that the erythrocytes in a great number of cases, especially in young females, are slightly higher in number than normal; somewhat over 5,000,000 per cu. mm. As a rule, throughout the cases, there was no anemia.

It is, however, in the leucocytes that characteristic deviations from the normal are found.

In a great majority of the cases, there was a distinct leukanemia; the leucocytes averaged about 5,000 per cu. mm., but in one case numbered as low as 3,700.

As a rule, this low count affected the polymorphonuclear leucocytes exclusively, these often falling as low as 35 per cent. The lymphocytes, on the contrary, showed an absolute, though more often relative increase in numbers, and it is this condition, according to Kocher, that constitutes the main characteristic of the blood picture of exophthalmic goiter. This lymphocytosis may reach 57 per cent. instead of the ordinary 25 per cent.

This leukanemia with leucopenia of the polymorphonuclear leucocytes and absolute or relative lymphocytosis is, according to Kocher, characteristic of exophthalmic goiter. The condition is most marked at the height of the disease.

Sometimes after excision of the gland there is a marked change toward the normal. This also takes place after ligation of vessels, but in a less degree.

Sometimes the eosinophiles were greatly increased (15 per cent.), but as this does not occur with any constancy this condition is not specially emphasized.

Marine, who has done more histologic work on the thyroid of animals than any other man, finds, in examination of 202 Cleveland dogs, that 90 per cent. have goiters.

He divides the thyroids into three main groups—normal, hyperplastic and colloid.

The hyperplastic corresponds closely to the typical pathologic picture of primary exophthalmic goiter in man. Marine considers hyperplasia a physiologic reaction to a deficiency, probably of iodine. This hyperplasia takes place in remaining portion of resected normal gland (Halsted).

The colloid goiter, he reasons, is in all probability usually preceded by the hyperplasia, and is really a quiescent stage of the same, or an attempt of reversion toward the normal. He bases this conclusion on the fact

that hyperplastic dogs fed with iodine invariably undergo this change toward the normal. The pathologic changes, I found in my Chicago dogs, correspond exactly to the splendid description given by Marine.

I wish in addition to emphasize specially the tremendous size of the lymph vessels in these glands. Very often did I find the upper pole of the thyroid, sometimes the entire gland, and in two instances the surrounding muscles, enveloped in a frothy substance which we found to be lymph. I should like to know whether this has been observed in the human being. The above-described condition seems to indicate that the lymph in this region plays an important rôle and should receive careful investigation. Even in other parts of the body may there be excess of lymph.

A colleague recently operated on a patient with unrecognized Graves' disease and found the entire abdomen filled with lymph. Sponging only seemed to increase the excessive flow. A few hours after the operation all the symptoms of Graves' disease appeared in its most aggravated form.

Kocher, in a recent article, very interestingly discusses the similarity of the anatomic picture, and some of the symptoms of lymphatic leukemia, status lymphaticus, Hodgkins' disease and Graves' disease.

In lymphatic leukemia we have lymphocytosis, enlargement of the spleen, the lymph glands and the thymus, loss in weight and strength and excessive water elimination; so also in Graves' disease; in status lymphaticus, the sudden deaths, danger of anesthesia as in Graves' disease, etc.

This certainly gives food for thought, and will surely open up new channels for investigation.

RELATIVE FREQUENCY OF GOITER IN DOGS

In palpating two hundred dogs, I found eighty-six (43 per cent.) with goiter. At the University of Chicago, where all the goiter dogs are segregated by inspection, one-fourth of all dogs are thus found to be goitrous. Of course, should the thyroids of the dogs I palpated be examined histologically, there would be a much higher percentage.

Marine found 90 per cent. of the Cleveland dogs having goiter, but it seems to me that the standard of normal is then probably put a little too high.

MODERN OPERATIVE METHODS

To Kocher, whose name seems indissolubly associated with the term "goiter," we are indebted for most of the modern surgical technic on the thyroid.

The advance under his leadership has been very rapid, and, though certain that his individual operative work will be equalled by only a few, the great mass of operators have certainly gained enormously by his teachings.

He enumerates the modern methods as follows:

1. Excision (Kocher).
2. Enucleation (Porta Socin).
3. Resection (Mikulicz).
4. Combined methods.
5. Exenteration (Kocher).
6. Ligation of arteries (Wolfer).

In order to avoid the parathyroids C. Mayo by his excellent method leaves the posterior capsule of the gland. This procedure is now followed by most surgeons.

Ferguson, in his recently introduced ingenious method, does the entire work intracapsular. The vessels are tied in the gland substance in such a manner that after resection four buttons of thyroid tissue corresponding to the poles are left *in situ*, thus insuring against cachexia strumipriva.

EXPERIMENTAL PRESSURE ATROPHY

Basing my work on the theory of hyperthyroidism in Graves' disease, it seemed plausible that, if by some means one could produce atrophy of the gland and thus a diminished number of secreting cells, there would be a resulting diminution of secretion and consequent alleviation or cure of the hyperthyreosis. By resection of gland, this is at once accomplished; the operation, however, except in the hands of the very expert, is quite dangerous. Therefore, if by some less radical method, one could obtain the same results, this would, of course, materially lessen the operative danger.

Thus I reasoned that by application of a purse-string around the periphery of the gland, as in Figure 1, with subsequent tightening of the same (Fig. 2), or by introduction of multiple ligatures through gland substance, that this would cause atrophy of gland, not only by the resulting diminished blood supply, but also by direct intraglandular pressure.

One of the chief dangers following operations in Graves' disease is the supposed direct absorption of thyroid secretion from lacerated gland tissue.

Fig. 1.—Introduction of purse-string suture and tying of inferior thyroid artery through gland substance.

Now, this compression of the organ following tightening of the purse-string would apparently bring about an immediate increased absorption of gland products, but, as one of the main factors of absorption is increased circulation, and in this case the circulation is greatly diminished, I think this danger is almost surely obviated. Working on the above principle, associated with James J. Moorhead, I performed a series of experiments on thirty-five dogs at the physiologic laboratory of the University of Chicago. We operated in groups of three to twenty. The different operations were done as follows:

In the first group (of twenty dogs), tying of the thyroid vessels through gland substance and purse-string compression was done; in the second group, purse-string only; in the third group, purse-string and tying of the superior thyroid; in the fourth group, purse-string and tying of superior vein, and in the fifth group, purse-string and tying of both artery and vein.

OPERATIVE TECHNIC

In dogs I found it preferable to make a vertical median incision. Through this opening, both of the glands may be easily delivered, one at a time. In the one

human case, I made the transverse incision and the gland was not moved out of its bed at all. The operation proper consists of the introduction of one or more purse-strings along the periphery of the gland with subsequent tightening of these ligatures. I have used No. 3 chromicized catgut threaded on a curved non-cutting needle.

The preliminary tying of vessels was done, in the majority of cases, through the gland substance, as in Figure 1, taking a suture right through the pole. In the others, the vessels were tied just outside the gland.

In desperate cases, in which only vessels are to be tied, I would suggest that it be done in the manner described above, as the tying of vessels outside of the gland requires quite a handling of the gland, and is said by many experienced operators to be almost as dangerous as a resection.

The purse-string ligature is applied by sewing through the capsule and deep into the parenchyma, carefully avoiding the superficial vessels. Should a vessel be punctured, however, the hemorrhage is very readily checked when the purse-string is tightened.

Fig. 2.—Tightened purse-string suture.

The results in all the operations were uniform; the glands sometimes becoming greatly reduced in size and remaining small at least until six months after the operation, that being the longest time we kept dogs for observation. This difference in size of the two glands, those operated on and those not operated on, is shown in Figures 3 and 4; in the latter the glands are shown *in situ*.

In no case did I have gangrene, although I specially tried to produce that condition by excessive tightening of the ligature.

In some of the dogs, there was a more or less marked postoperative lymphatic edema, which gradually disappeared in a few days.

In two dogs, this edema was very excessive, the entire head and neck becoming greatly swollen.

In each case only one gland was operated on; as a rule the larger was selected; the other left for comparison.

The gland on which no operation was done—and this is especially interesting—instead of enlarging, as one would naturally suppose, atrophied in almost all the cases, and in some quite markedly.

In my human case, this reduction in size of the unoperated gland has been most marked and so rapid that

two weeks after the operation³ it can not be definitely palpated, although before the operation it was distinctly seen quite a distance outside of the sternocleidomastoid.

In autopsies on dogs, specimens were taken from both glands and compared.

In most of the cases, there was quite a change; in a few, however, there was no appreciable difference microscopically. In some of the cases the columnar epithelium of the vesicles changed to the cuboidal type and the papillary vesicular ingrowths seemed somewhat decreased in size.

REPORT OF CASE

Patient.—This woman had manifested the ordinary symptoms of Graves' diseases since last September. Before entrance to the hospital her pulse ranged from 120 to 140. The patient had occasional attacks of delirium cordis and her tremor was so intense that she could not at times perform her ordinary housework. After having rested in the hospital for a week the pulse averaged about 100, but came down as low as 90.

Operation.—At the time of the operation the pulse rose to 160, but it was not the rapidity as much as the alarming irregularity that almost made me take the patient off the table without operating. I cut in, however, intending to do a Ferguson operation, but she did so poorly under anesthesia that I changed my mind and rapidly tied the vessels of the right lobe through both poles and followed this by two purse-strings. The gland was not moved out of its bed at all. The time of

FIG. 3.—Thyroid glands removed from dogs some months after operation, showing difference between glands operated on and those not operated on. The small glands to the right are the ones operated on.

operation was less than twenty minutes. During operation the patient was stimulated by salt solution administered hypodermically and per rectum and by other measures.

Postoperative History.—The immediate result has been above all expectations. Next day the pulse came down to 90; the

3. The patient was exhibited two weeks after the operation before the Chicago Medical Society.

maximum rate was 120. On the following day it averaged 110; on the fifth day the pulse at one time came down to 70. From that day the patient was out of bed. Since the fourth there has been no irregularity of the pulse. Two weeks after the operation it ran between 80 and 90, and the patient said she felt generally better than she had done at any time for the last year.

Blood Examination.—In this case the blood findings are very interesting, as, except for a leucocytosis, they correspond closely to Kocher's findings in these cases.

FIG. 4.—Specimen taken six months after operation, showing differences between glands operated on and not operated on.

BEFORE OPERATION

Polymorphonuclear leucocytes	40%
Large mononuclear	10%
Small lymphocytes	45%
Eosinophiles	4%
Myelocytes	1%
	100%

Erythrocytes	4,000,000
Leucocytes	14,000
Hemoglobin	95%
Color index	1 1/6

Some poikilocytes; some macrocytes.
Note the pronounced lymphocytosis (55 per cent.) and the low polymorphonuclear count (40 per cent.).

There is also a slight eosinophilia.

AFTER OPERATION

Blood was examined every other day and it was interesting to see a gradual step-like change towards the normal.

Seventh Day—

Polymorphonuclear	63%
Large mononuclear	5%
Small lymphocytes	27%
Eosinophiles	1%
Neutrophiles	1%
Myelocytes	3%

100%

Erythrocytes	4,200,000
Leucocytes	14,000
Hb.....	95%
Some malformed erythrocytes.	
Fourteenth Day—	
Polymorphonuclear	70%
Large mononuclear	5%
Small lymphocytes	20%
Eosinophiles	2%
Neutrophiles	3%
Myelocytes	0%
100%	
Erythrocytes	4,500,000
Leucocytes	9,000
Hb.....	95%

CONCLUSIONS

A. DRAWN FROM LOOKING OVER THE LITERATURE

1. In spite of the enormous amount of work done on the gland, we are still only in the outer trenches of the thyroid citadel.
2. The whole subject, as it is now presented to us, is a mysterious labyrinth of opposing factors.
3. Thyroid is essential to the well-being of the organism, but not to life.
4. The gland contains iodine.
5. The removal of the gland causes marked metabolic disturbances.
6. Tetany is not due to removal of the thyroid.
7. Iodine seems to have some relation to the physiologic activity of the gland.
8. Iodothyron may contain the active principle of the gland.
9. There is possibly an internal secretion.
10. The gland may have some action on the cardiovascular system.
11. Thyroid may have a detoxicating function.
12. It may have some relation to other ductless glands.
13. It is seemingly functionally independent of the parathyroid.
14. Graves' disease is probably due to hypersecretion of thyroid.
15. Basedow-like symptoms have been produced by overdosing the system with thyroid products.
16. Transplantation has so far been unsatisfactory.
17. The blood picture in Graves' disease may be pathognomonic and also prognostic.
18. There is probably a distinct pathologic picture in Graves' disease.
19. A great deal of splendid research work is being done in this country.

B. DRAWN FROM MY OWN WORK

1. The thyroid gland of dogs may be caused to atrophy by the method described above.
2. The gland which is not operated on also becomes reduced in size in the majority of cases (probably in all).
3. Goiter lymph in dogs probably has some special importance.
4. Some of the goiter dogs exhibit the pathologic picture of Graves' disease in man, but the symptomatic phenomena of human myxedema.
5. A high percentage of Chicago stray dogs have goiter (43 per cent., probably more).
6. Goiter dogs are very susceptible to anesthesia.
7. The operation may be done in the human being without disturbing the gland in its bed.

So far I make absolutely no claim as to the utility of the operation in the human being, but I can not help but think that, in desperate cases, this quick tying of the vessel with an additional purse-string will pave the way for a more radical operation later, if that should be necessary.

I also take occasion to thank Drs. Moorhead, Karlson, Matthews and Miss Edyth Danielson for valuable assistance.

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UNDERDEVELOPED LOWER JAW, WITH
LIMITED EXCURSION

REPORT OF TWO CASES WITH OPERATION

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My reasons for reporting the two following cases are, first, that one of them is, as far as I know, unique in its pathology, and the other presented a degree of deformity that is extremely rare; and, second, that the procedures resorted to for their relief have, as far as I know, never before been employed or suggested except by myself.

CASE 1.—Patient.—A young woman, referred to me by Dr. C. Dewitt Lukens, who gave the following history: When five years of age she was crushed under a falling bale of hay, was generally injured, remained unconscious for forty-eight hours, but made a good immediate recovery. Between the ages of 11 and 12 years it was noticed that she could not open her mouth freely, and on examination it was found that the excursion of the lower jaw was limited. From that time on it was noticed that the chin became relatively more receding and the downward excursion of the lower jaw lessened.

When she consulted me the patient was 21 years old, delicate and very thin. The mandible was undeveloped and the downward excursion was limited to the extent that the greatest possible vertical opening between the upper and the lower incisor teeth was one-eighth of an inch. Owing to the receding jaw, the lower incisors were one-fourth inch behind the upper, which with the one-eighth opening gave a possible feeding space. I thought that probably the lack of development was related to the early injury, but this did not explain the limited movement, which presented the following peculiarities: The movement was free until the opening between the incisor teeth was one-eighth of an inch and then stopped suddenly. During this movement the right condyle traveled forward as much as it would do in normal full opening of the mouth. The left remained apparently stationary and the chin moved to the left more than it did downward. A poor x-ray taken at the time failed to throw light on this point, but I figured out that some obstruction impinging on the dorsal part of the right ramus of the jaw near the angle could cause just that movement by transferring the center of motion on that side from the center of the ramus to the angle. The indications here were to give a free opening of the mouth, to establish a normal occlusion of the teeth and to improve the profile by carrying the chin forward and holding it there. Granting that my idea of the obstruction was correct, all of these things would be accomplished by the operation for receding jaw which I have described elsewhere.

Operation.—At St. Luke's Hospital, on Nov. 8, 1905, under ether an incision of five-eighths of an inch was made in front of the lobe of each ear, the parotid gland turned back, a curved needle passed under the ramus and out through the cheek and a Gigli saw introduced, the soft structures protected and the ramus cut through on both sides. Owing to an abnormality of the ramus on the left side the mucous membrane of the mouth