The Human Thyroid Gland, its early literature, its anatomy, histology, with some considerations with regard to its functions.

A. Thesis

for

The Degree of Doctor of Medicine

submitted by,

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Preface

Very early in my student life, I found myself directed with
more than ordinary interest to the consideration of certain organs.
Among these, the Thyroid Gland held the most prominent place
in my regard; immediately after graduation in 1859 I resolved
to study the function of that body. I made that the subject of
my thesis for the degree of M.D. Almost three years have
elapsed since I formed that resolution; though much has
been done, I cannot say that I have fulfilled it. I naturally
began with the literature of the subject; and I had access to
many old medical works. I went pretty fully into its
earlier history. Coming down to the present century
it became necessary for me to divide my paper
under the different headings of Anatomy, Histology &
Embryology. I then felt that it would be quite impossible
to have a proper conception of the Thyroid if I did not
enter into its Pathology. Thus I was compelled to take up
the consideration of Goitre with its enormous mass of
literature; to look to other diseases which were
commonly associated with the Thyroid Gland such as
Myxodema, Cretinism, Acromegaly, Eculpthalmic
Igoitre, and finally to note the relationship of the Thyroid
to the various systems; to ascertain something about
the gland in animals. In this manner I began to
compile a large treatise on the Thyroid Gland which
was arranged in the following manner:

**Part I**  Normal Thyroid Gland

*Chapter I*  Its earlier literature

1. The literature of this century
2. Anatomy
3. Histology
4. Development
5. Results of excision in animals
6. Results of excision in animals
7. Results of Thyroid injections and transplantations.

**Part II**  Abnormal Gland

*Chapter I*  Goitre (a) literature (b) causes (c) treatment

1. Malignant disease
2. Cretinism
3. Exophthalmic Goitre
4. Myxedema
5. Acromegaly
6. Results of Removal in Man
7. Chemistry
8. Relation of the Thyroid Gland

(a) to blood and vascular system (b) to reproductive system (c) to nervous system (d) to other systems

**Part IV**  The Gland in Animals

**Part V**  The Physiology of the Gland

Such an elaborate work would evidently
require years of completion even were it a mere compilation. As it was however I was desirous of having some personal experience so, this end I had examined several features. I had dissected the gland in more than 50 cadavers. I made chemical examinations in a few of these and nearly 30 were hardened & examined microscopically. I even wished to make some novel observations with regard to the excitation of the thyroid on its influence on the bodily metabolism. One day was experimented on, but the venture was not particularly successful. I saw that more than six months were occupied by it. Thus it came about that I saw that what I had in contemplation could not be finished for many years & if I waited till then for my M.D. thesis, I might have to wait a very long time indeed. I have selected therefore the three chapters which seemed to me to be nearest completion very the earlier literature, the anatomy & the histology of the gland. At the same time I have added a few considerations which my present (confessedly imperfect) knowledge of the gland would authorize me to make in regard to its functions. The work presented in this thesis is only a small part of that to which I have been striving (for I might have flung the whole work with its unfinished parts to the exhausted examiner) if for no other, I hope it may not be considered unworthy of the degree of M.D. for which I have submitted.
The Earlier Literature of the Thyroid Gland.

In Antiquity Anatomy and Physiology were almost unknown sciences. There are only a few books explicit which treat upon these subjects, but these the most important are some works by Aristotle & Galen. On this account we are quite prepared to learn that the thyroid gland was almost unknown to the ancients. It is true that Hippocrates says (De glandulis caerullis) glandularies etiam sunt ad utramque aurem, et in jugulares venae, & others have spoken in similar words but the reference is too vague for us to place much dependence on. So far as I know, Antiquity possesses but one passage which undoubtedly points to the thyroid. This passage occurs in a book of voice which is attributed to Galen but only exists in a Latin translation. I give the English rendering (Tractatus III): For voice & speech are provided the tongue & the epiglottis & the trachea, & to each of these is given a certain glandular organ, to the end that each may be kept suitably moist. In the tongue there are two glands, which have two ducts through which the saliva flows to the tongue & to the whole mouth. The neck however has two glands in which moisture is generated; I in the epiglottis, a thick & warm humors is secreted for the moistening of that organ. But from the two glands which are in the neck & from the substance of the epiglottis are no ducts through which the humor may flow, as in the case in the two glands in the tongue. But those which are in the neck are of a spongy nature. From them the humor comes out & trickles
Some, then being no necessity for deaths (which the others need) whereby the fluid may be carried."

After Galen there is a long silence. The genius of medicine transferred itself, at least to the Saracens, I have well received by them, but it is doubtful whether the Arabs ever made any great advance in the science. They were skilled certainly, but their knowledge was almost entirely derived from old Greek works. The Arabian medical writers rarely did more than make translations & compilations from various authors. In this account anatomy was not any better than it was before. The religious regard with which the bodies of the dead were held forbade anything in the way of dissection. However, Christian Europe at last woke up, & universities began to appear, and a new epoch in the history of medical science dawned with the establishment of the Salernian School of Medicine. Other medical schools were soon formed, & these tried to equalize the brightness of Salern. Thus was promoted a healthy rivalry & competition, which undoubtedly gave a great stimulus to the study of medicine. During all this time, however, anatomy had, for various reasons, made but little progress; and at length [Name] of [City], professor of anatomy in Bologna, laid the foundation stone of modern anatomy by publicly dissecting before his pupils the bodies of women. Their most memorable scene took place in 1315; & a few years later probably about 1320 or 1321 [Name] published a book on anatomy. This
work is nothing more than a mere pamphlet, but it is interesting as being the first contribution to anatomy in modern times. It contains no reference to the larynx.

Other works on anatomy gradually appeared, but they were hindered much by the difficulties of transcription and reproduction. In the discovery of printing, however, toward the close of the fifteenth century, a great impetus was given to the advance of knowledge, and books on anatomy became much more frequent. The most important works were Abellinius, Jacobius Berengarius de Carpi, Alexander Benedictus, Johannes Reyndilus, and Basanus Landulphus. Their works, all more or less good, were decidedly advances on that of Mundini, but they were all outstripped and eclipsed by the Anatomy of Andreas Vesalius, which appeared in 1543. This truly magnificent work is a folio volume of 800 or 900 pages, embellished with drawings from nature. That is more wonderful than the completeness and thoroughness of the work is the fact that most of what is stated is the result of his own observation.

1. Mundini, Anathomia. 4to. Parisiis 1507
2. Alexander Abellinius, Anathomia. 8vo. Bononae 1520
3. I. Berengarius de Carpi, Anatomia. 4to. Basii 1523
5. Johanni Reyndilus, Anatomica. 4to. Marburgi 1537
7. And. Vesalii, De Humani Corporis Fabrica. fol. Basiliæ 1543
It may well be doubted if any man ever did more for a science than Vesalius did for Anatomy. In us in the present instance these folios is of especial interest, for in it we find the first mention of the Heyroid gland. The modern authors, but general references I select the following (lib 71 cap 18). "The interior also shows two glands, one on each side of the root of the larynx, there are large somewhat fleshy, almost of the colour of flesh, but rather darker, with many prominent veins." Further on in the same chapter he suggests a use for the Heyroid, "This also the gland, which lie at the root of the larynx perform for the trachea, since they moisten its surface with a humor not indeed fluid, but rather more thick, for the glands themselves are thicker & denser than the rest of the glands which secrete a humor. In lib 71 cap 21, Vesalius remarks: The Heyroid in four of his dia-
grams of the larynx. It appears as two rounded bodies—one on each side of the base of the larynx.

Vesalius may be said to have furnished the general outline of Anatomy & details could be filled in only as time went on. With regard to the Heyroid, this work was quite content with his description of it for a hundred years. During that period most of the anatomical writers omitted any reference to the gland, or spoke of it just in the terms of its description by Vesalius, i.e. Glanulæ ad laryngis radicem adiunctæ. Among those who paid such scant
attention to our subject I may mention the following
Anatomists: — Willichius, Stefanius, Vassaxius, Protogal-arians, Eustachius, Felix Platonius, Fallopius, Bozziomius, Bedikius, Kyploch, Laurentius, Galenicus, Galeni, Banchius, Bartolomius, Syphicus, Sophonis, Tom Horstius, Ind, de Bels, Hoffmannus, Reymonardus, and

1. Ind. Willichius, Commentarius Anatomicus, Basle, 1544.
2. Ind. Stefanius, De Dolorum Partita, Basle, 1545.
10. David Kyplochius, De homini procreatione, Basle, 1576.
11. And. Laurentius, Anatomia Corp. Humani, Basle, 1600.
16. Felix Platonius, Opera Medica, Basle, 1630.
17. J. D. Kyplochius, Anatomia Corp. Humani, Basle, 1639.
18. Ind. de Bels, Specimen Anatomicum, Basle, 1641.
20. Reymonardus, Corp. Hum, Specimen Anatomicum, Basle, 1651.
Rhagellis.

Reales Columbus in 1562 pointed out for the first time that the thyroid gland was relatively larger in women than in men. Johannes Bokelius advanced a use for the thyroid on the same lines as Vesalius, as a constant inspiration for the great difficulty of speaking or shouting should dry up too much the pharyngeal slungs, Nature has provided these glands to continually prepare moisture for them (lib. 2 cap. 12).

Julius Camerarius was the first to describe the thyroid as a single organ. In his first description of a man, there is a drawing in which the gland figures as an elongated body stretching across the top of the trachea, and is called, Corpus glandulosum ad tracheam diaem acutum. Strangely enough, he speaks in the text as if there were two glands. He made some investigations as to the presence of an excretory duct, but came to the conclusion that there was none. He regarded the thyroid as having an important aesthetic use in filling out the sides of the neck. He goes on to moralize thus: "And though it is only becoming that the soul which is the noblest part of man should have a splendid dwelling place, and Nature has especially beautified the gentle female sex, especially many..."
rose of ornaments, and not least among them is this one, that the empty spaces which exist around the larynx being filled up, they show to our eyes to the great joy of our sight a regular & rounded neck.

Scolino Bordiungus 1 received the opinion, but most copied the word of Bokelius. Valverdi 2 was as much impressed as Casserius with the importance of the gland in relation to female beauty. This is a point which seemed to have a special attraction for many succeeding writers as well.

The first anatomical work written in English is that of Niss Vicary 3, published at the end of the sixteenth century. It makes no mention of the Thyroid gland; and Helkiah Crooke in his Microcosmographia 4 written in 1615 sees little more than allude to it. In Bk. x, ch. 43, he says, 'There are also two (i.e., glands) at the root of the larynx a thrushlike, hard under the gullet, which sometimes do so swell that they interclude the way both of meat & drink; and if drink especially for the solid meat make itself a way by compression, whereas that which is liquid both rather fill the fungus substance of the glandule.

1 Scolino Bordiungus. Vepnologia 8vo Rostockii 1605
2 Iannus Valverdi. Anatomia Corporis Hum. fol Venetii 1607
3 T. Vicary. The Englishman's Treasure 4to Ed. 8vo London 1615.
4 Helkiah Crooke. Microcosmographia, fol London 1615.
The swelling referred to above may be construed to mean Goitre, but Fabricius de Agraquendunde seems to have been the first to definitely localize the Thyroid gland as the anatomical seat of Goitre. In his work, de Gula, he states that he is somewhat confused but in his surgery he is quite distinct. He differentiates between bronchocele or goygo (ic Jochet), says that the former arises from the trachea while the latter always springs from glands especially from those placed immediately below the larynx at the sides of the Trachea.

In 1654 however, Domenici de Marchettus gave to them the appellation of Bronchial Glands: "Besides the tonsils, other glands are to be seen between the tongue and the hyoid bone. Beneath the neck at a lower level are two large ones adhering to the sides of the trachea in front of the gullet, these are called bronchial glands. These enlarge so much as sometimes to form a tumor in the neck, and their is called by us goygo, but in Latin bronchocele." Marchettus evidently had no doubt as to the identity of goygo with bronchocele or as to the origin

1 H. F. de Agraquendunde, de Gula, Ventricul of Latinus. Ad. 4 to Patura 1618
2 ... " Chirurgia. 1619
3 Domenici de Marchettus, Anatomum. 1654
from the Thyroid Gland.

The term branchial glands has been occasionally applied to this organ even up to the beginning of the present century; but the name by which it has become generally known as Descriptive Anatomy is that proposed by Wharton in 1654-5, namely, the Thyroid.

This author devotes a whole chapter (chap. XVIII.) of that most interesting book, the Adenographia, to the consideration of these "thyroid glands"; and in it forms the first systematic description of them. I am tempted to translate the whole chapter.

"And first come into sight the thyroid glands, which are situated around the lower part of the larynx, lying immediately against the sides of the Thyroid Enoid. A few of the upper tracheal cartilages; and are they so placed as to be easily separated from these structures except when they are more closely around their head, at the points where the vocal cords join in front. In shape each is like an oblong fig or pear, on that side that looks toward the larynx they are somewhat hollowed. On the external aspect they are rounded, being thicker above, approach the form of an oval, once between their lateral borders. They bulge out a little towards the outside. As regards the substance of these glands, authors are not very consistent in describing it. They say that they are large, or, as it were, fungous glands, that they are also

"Thom. Wharton, Adenographia 800 Lond 16546"
dense think of fleshly. 

And if they are dense, think of flesh, how can they, at the same time be fungous, since fungous must be considered as equivalent to forms of fungi? 

Coming to the 

size of the organ, we found in a man of 28 that each weighed 7½ drachms. In a foetal calf already covered with hair, but in the last month of gestation, each weighed one drachm. — — — in the 

ox each does not exceed half an ounce. — — — As regards the 

fleshy part of their structure, it is much more closely than 

that of other glands; it is also more viscid, and of a true 

flesh. Nor, however, is of interest, that it is not fibrous, but 

rather glutinous, for which reason its parts firmly adhere 

together, it also resists considerably cutting with a knife. 

that all the more, because its branches of arteries 

are distributed throughout its substance, that because of 

the membranous connections between the parts. The first 

principal use of these glands seems to be to receive the 

excess of moisture from the recurrent scene & to conduct it again 

to the venous system by means of their minute vessels. Secondly, 

they warm the castelopes, which would otherwise be rather cold; 

for they are copiously supplied with arteries, & abound in 

blood, so that they easily impart heat to the parts around 

them. Thirdly, they contribute to the lubrication of breathing 

in the larynx, so as render the voice more light & sweet 

clear. Fourthly, they contribute much to the roundness 

& beauty of the neck by filling up the vacant spaces around
The muscles, they surrounding off the protruberances into a level
I even surface; especially in men the case in females, in whom
The glands are larger on this account, whose backs are so beauti-
fully rounded"

To ends The first detailed account of the Thyroid
Gland in it we may notice that the imagination has greater
scope than anatomists nowadays would admit allow. how-
ever, Karston must have investigated the subject in a practical
manner, as his description clearly shows: He made a great
step in advance by bestowing the name Thyroid upon the glands.
Its name could be more suitable, because it was suggested not
from any fanciful idea as to its shape or its use, but from its
anatomical situation beside the Thyroid cartilage. Although
however, one organ had risen to the dignity of a name, im-
partial investigation photographs detection were not bestowed
upon it for a long time. A few quotations will show how little was
done by Karston's fellow-countrymen; for the Continent the
case was little better.

Thomas Giber, says, - At the sides of the carotid (Thyroid)
the following one are the glands placed called Thyroidea,
which Dr. Karston says are of the shape of a pear or fig, being
somewhat bottoned on that side next the aorta artesia, and
somewhat copped on their outer side. Their substance is more
...pared than that of other glands, like to muscosous flesh, though it be not fibrous. They contribute to the roundness of the neck by filling up the empty spaces about the larynx, the humour separated in them seems to serve for the lubrication of the larynx, where by the voice is made more smooth and clear." (Bii cap. 18)

James Keil speaks thus: "On the lower part of the larynx, upon the sides of the annular cartilage of the first ring of the trachea, there are two lymphatic glands called thyreoides of the figure of a pear; their colour is red; they have less nerves or arteries as the larynx" (chap iv. section 7).

Drake in the Anthropologia Nova (vol ii. cap 6), says: "Near the larynx are situated four pretty large glands, two of which, called the amygdales, shall be accounted for among the glands of the mouth; the other two lie at the sides of the lower cartilage of the larynx, and are called glands of the thyreoides, which have no seceretary duct (as yet discovered) belonging to them, but are looked on to be of the same kind with the thyreoides, and discharge their lymph with the thoracic duct."

William Cheselden3 has evidently paid some attention to the subject of the Thyroid, as his remarks will show. — In the neck...

2. James Drake, Anthropologia Nova, 8vo. Lond. 1707
are situated a great number of these (lymph glands) by the sides of the carotid arteries. Intimal irregular nerves, I find, are a sort of doubling, upon the larynx immediately below the hyoid cartilage. From which situation they derive their name of thyroidea: for within the thorax is situated another, called the thymus. In very young children the thymus is as large, or larger, than the thyroid glands: but in man these glands are very large & the thymus very small, the former having increased in about a double proportion of any other gland of this kind, the latter having rather diminished than increased. But in brutes, such as have fallen under my observation, it is just contrary. From which observations I am inclined to conclude that they both belong to the same sympathies — that either of them increasing as much as both ought to do of both increased, answers the same end as if both did: that the reason why the thymus increases, rather than the thyroid glands in brutes is because the shape of their thorax afforded convenient room for it to lodge in: while in man the thyroid glands increased so much because there is no room in that part of the thorax where the thymus is seated for a large gland to be lodged."

On the continent, as I have already stated, the investigation of the thyroid gland was making as little progress as in England. Most authors contended themselves with repeating almost verbatim what had already been said by Wharton.
The only interest manifested was in the question whether the thyroid was a single or double organ. Most anatomists declared that there were two glands, one on each side. Van Home, in 1660, following Castorreus, said that the organ was single. Philip Verheyen was of a similar opinion; but curiously enough, though he has a pretty accurate diagram of the gland, he makes its lobes point downward from the isthmus instead of upward. Eustachius also described the organ as single. The name of the structure joining the lateral lobes the name of isthmus. Morgagni made several important additions to the known anatomy of the thyroid. It is often stated that to him is due the name of isthmus applied to this central gland of the thyroid. He himself states that the name had been given by a previous writer. There can be no doubt that Eustachius was the author in question. Morgagni, however, was the first to point out the existence of a slender vertical column of gland tissue, which, he said, might arise from either lateral, especially the left or from the isthmus. This structure he called the appendices. J.B. Morgagni also gives the credit of putting

1. Johannes Van Home, Microsomes, 1768, Ley. Bat. 1660
2. P. Verheyen, Humane Corporis Anatoniæ, 2nd Ed., M. Bat. 1710
3. Bartholomeus Eustachius, Tabulas Anatomicas, 1st Rome, 1714
4. J.B. Morgagni, Adversaria Anatomica Omn., 8th Ley. Bat. 1723
an end to the controversy as to the identity or singleness of the organ. He fixed the weight of his name to influence on the side which described a single organ. He admitted that sometimes there were two separate lobes in the human subject, but he pointed out that their condition seems normal to many animals. What it probably results from the dissection of such animals that the idea arose that man had two thyroids.

Looking back from this distance, we find it difficult to believe that the supposed of the single or dual organ could have entered such a trivial controversy with so much heat & enthusiasm; yet such was the case. Doubtless we are not acquainted with the spectacle of men vigorously writing up their own ideas, strongly doubting the honesty, propriety, common sense, age sanity, of those who cannot agree with them; but we may well congratulate ourselves that the time has passed away when the concentrated essence of all that is caustic in and venomous in words was found out (perhaps fortunately, prominent politicians only knew how) by celebrated anatomists & doctors, in the delightfully free personal form of an open letter to one lone celebrated opponent. A singular fact about these words is this, that the abuse of the commentators was in inverse ratio to the importance of the subject. So much was this the case that it passed into a proverb, that whenever a fierce discussion arose over any matter,
outsiders would say that "the difference was evidently about a gland, not about a man's head."

But although Morgagni settled one controversy with regard to the hyoid, there was another which was discussed with great animation long after his time and even up to the beginning of the century. Morgagni inquired the question as to the existence of a duct, a duct. Morgagni himself was of opinion that there were small ducts, leading from the gland into the tongue, but there were so minute, and uncertain were their passes, that it was impossible to discover them. Altmann as late as 1791, thought he had demonstrated the presence of such small ducts. Altmann, however, long before that, however, ducts had been described and described. Vater, Santorini, and Escobedo found a duct opening near the mouth of the buccal sinus. Escobedo traced a duct to the foramen cecum of the tongue; Neehuyt was equally fortunate. De Verney, without going so far, was quite satisfied that there was a duct and that this was

4. Santorini, Observations Anatomicae. 4 to Venetius 1724
5. G. Demes, Lettres à M. Guerin, 4 to Rome 1706
nothing more than the Pyramid. De Borden described the ducts as passing through the cartilages of the trachea. As time went on, however, the opinion gained ground that there was no duct, and the appearances which suggested ducts were mere imaginations on the part of those who pretended to see them.

Apparently, the first monograph on the thymus gland was that of P. Brodie in 1708. But it contains very little in the way of information, and it does not give a good account of the organ as it was even then known. He concludes his unsatisfactory memoir with the suggestion that the reader wants to know something about the subject he had better investigate for himself as there was a free field before him in that direction.

The next monograph appears to be that of J. Z. Laboulette, published in the Histoire des Sciences, Paris, 1750. This is a very carefully prepared, full and fairly accurate account of the thymus, the author speaks with the knowledge gained from frequent dissections of men and animals. He concluded that the venous supply was derived from the first cervical nerve and from nervous filaments springing from the ganglions which the eighth pair forms with the intercostal. The appendix was called by him the Pyramid.

1) De Borden, Physiographia Historica de Patte Paris 1752
2) P. Brodie, De Plului des Vagabundus, 46, Lug. Bat. 1708
He believed that the Thyroid was a secretory gland. He was lead to this conclusion by the fact of its copious blood supply. He thought that the secretion passed away by the lymphatics, was poured into the larynx which it seemed to lubricate, at the same time giving suppleness to the glottis rendering the voice softer. Kegphius, in 1722 had expressed the opinion that the secretion was carried away by the Thyroidal veins; but Laérouet could not agree with such an idea, for he formed that on injecting the Thyroidal vessels, the injection never appeared to reach the acini of the gland.

Winslow also seems to have carefully dissected the region of the Thyroid. He says, "The Thyroid gland is a large, whitish mass which covers the anterior convex surface of the larynx. It seems at first sight to be made up of two elongated glandular portions, united by their inferior extremities below the Cricoid cartilage in such a manner as to have some resemblance to a crescent; with the carina turned upward. Its of moderate thickness & bent laterally, like the Cricoid cartilage from which it seems to take its name. The two lateral portions lie on the Muscles, Hyo-hyoidei, the middle or inferior portion on the Arce Thyroidei. The Hyo-pharyngei inferioris send fibres...

Roscii, de fabrica glandulorum in capite Hominis. Ex Leidae 1722

Winslow's Anatomy, from French by Douglas & Bartland 1763
over the gland, they communicate on each side by some
such fibres with the sterno-thyroidi or hypo-thyroidi. This
pland seems to be of the same kind with the other
salival glands. And it is, more oral. Some anatomists
thought they had discovered the axillary duct, but they
mistook a bloodvessel for it. We sometimes meet with
a kind of glandular nodule which runs before the cartilage
thyroidi 9 disappears before the base of the 9 hyoidea. This
plandular nodule, goes out from the common basis of the lateral
processes of the thyroid gland, just, back between the muscular
sterno-hyoidea behind the basis of the 9 hyoidea, or between
the basis of the epiglottis. I have likewise observed in my
private courses, on the side of the anterior ligament of the
epiglottis, a large which it is connected with the base
of the tongue, certain small openings. One of these appears
like a small papilla. This is the further or that I have
ever been able to trace the glandular nodule.

It is a curious reflection on the statements of Draneus,
Cooper, and Whitaker, which were so long regarded as the out-
come of low-spirited imaginations, to find that during develop-
ment the appendix is really the duct of the thyroid 9
opens into the former cavities of the Tongue. I have been
able in a few cases, to trace the duct almost to the base of the Tongue,
9, according to benches Anatomy (Tenth Edition) the remains
of the duct may be evident even in adult life. It appears,
speaking with regard to Winslow and others, said "Clarum ex arce ad eum expectationis aggregat minimum eventus instans non respondet," but time has since further opportunity for investigation. I have now to confess to the accuracy of
carefulness of their directions.

Haller in 1765 published his well-known and admirable
work on Physiologia. In this work we may say that the first
and only of the thyroid gland was completed. I can hardly
recommend his description of the organ (vol. III, p. 374875)
to all who
may wish a full account of it. I am excellent summary of
its literature. In his Disquisitions he devotes two or
three short treatises to the consideration of the thyroid gland;
and in vol. II of this work he describes for the first time the vessel
which is now known as the artery, thyroid or aorta, which in
his case arose directly from the aortic arch.

Though we may say that by Haller's time we had
acquired pretty well all the knowledge we could gain
with regard to the microscopic anatomy of the thyroid;
the Physiologia had not made much a rapid advance. Its
function was by no means clearly defined. This however,
did not arise from absence of interest in this regard for
there is probably not another organ in the body whose

1. Albert von Haller, Physiologia, Sects. 4 et 5, Lausanne 1767
2. Albert von Haller, De justitiam anatomica, Vol. IV to sitting 1746
were raised so many curious & diverse opinions.

The quotations already made several curious uses are ascribed to the Hydropid. Very many considered that this organ was specially connected with voice production & that such a thing was advanced as lately as 1857 by Martyn.

2. P. H. Boéler, De Hydropide, Hypos Be. B. Med. 1853
3. F. Ausslini, De Differentia utraque utraque, 1713
4. F. Bellenger, Acta Acad. de Petri Puteoli, 1717
5. J. A. Vercellonii, De fundus oeosphagi Be. Bro. Actue 1711
seemed to be of use during digestion, though in abnormal conditions they might develop into worms. Not so extraordinary was the view of Remnerbeck, that he considered the thyroid to be of importance in digestion; he was looked upon it as a special salivary gland. Browne's (quoted by Madge) wrote that the spleen, the thymus, and the thyroid glands had independent movement; the foetus seemed to propel the blood along the vessels. Autenrieth believed that the thyroid had a special function in preparing the blood for the changes it undergoes in the lungs. Ruytschius was probably the first to suggest that some particular fluid was elaborated or separated from the blood in this organ, the secretion passing into the general circulation through the lymphatic vessels. This view became more and more accepted as time went on, though the exact meaning of the secretion and its subsequent use, were the subject of much discussion. Madge thought that the secretion was nothing more than a separation of purefying matter from the blood, this matter being subjected to a purifying process within the gland and then returned harmless to the blood.

1 Remnerbeck, Anatómes Cauf. Hum. 4 to Lübing. 1672
3 Ruytschius. De Patæca glandulis in caps. Hum. 4 to Lübing. 1722
4 H. Madge. Diseases of Foetuses in utero. 1854
Another opinion which received very wide support was
that which made the Thyroid a sort of blood-flow regulator.
N. Schrèger, P. O. Haininger and Ackerman believed that it
formed an obstacle to the unmoderate rush of blood to the
brain, so prevented injury to that organ, Diebrowskie and
Grüger held similar views. The latter based his opinion on the
examination of many prominent women, who claimed that this
function came into play chiefly during labour pains. He found
that during the pains the Thyroid was forced back upon the
cartilage so materially diminished as to almost suppress
the blood stream to the head & brain. But for this, he concludes,
rupture of the over-distended venus in the interior of the
skull would be very common during labour. Magnien 6
considered that this function (i.e. regulation of blood flow)
had much to do with the nutrition & development of the
brain. In the foetus the Thyroid is relatively larger than in
the adult. He argued that its pressure on the carotids
would also be greater & thus the most of the blood for the

1. N. Schrèger. Fragmenta Anatom Thyroidei. 8vo Leipzig 1791
2. P. O. Haininger. Von Bau der mensch Körper. 45. Frankfurm M 1791
3. F. Ackerman, Dezert de Staudichs. 45. Dresden 1813
5. Guyau. Arch. De Chirurgie vol 1 1868 p 6
brain would have to pass by the vertebral arteries. These vessels supplied mainly the pons, medulla, cerebellum, whence parts therefore developed in the parts much more quickly than the higher parts which were supplied by the carotids. This theory was taken up transferred by Michel. This investigator argued that the vertebral arteries supplied the parts of the brain which had to do with the lower more vegetative functions of the body, while the carotids supplied the intellectual portion of the cerebrum. Thus in those people who had enlarged thyroids the mind was apt to be weak. The gland is usually considered more developed in females than in males. Thus, he declared, caused the women to have a more active generative than a less developed intellectual capacity than men. Fair readers, observe, listen! If perchance you do not find the intellectual destruction after which you aspire, hearken to Michel, he will console you.

The fault is, not indeed in your stars but in your thyroid. We are not prophets, nor perhaps would we care to be, but those who pretend to read the future had better ascertain the full value of Michel's theory. If it be true that a great change must arise in society, every soul who proposes to graduate must first submit to an operation quite as necessary as matriculation. One half at least of the thyroid must be

removed (later science is against removing the whole organ) so that one could be free to neglect the intellectual portion of the brain. This fits the girl for her arduous studies. Naturally, there will now be two classes of women — the intellectual and the loving, those with a reduced Thyroid and those with the organ intact. Antagonism between the two parties cannot fail to arise; but for the other possibilities I must refer the whole subject to her reader Huggard or some of his companions who will find it a suitable basis for a thrilling romance.

Less for reaching in its results would be the Theory of John Simon. According to him, the Thyroid gland was homologous with the lung; he declared that it always contains an intimate relation with the vascular supply of the brain. It is always so considered as to be capable of a peculiar or less immediate, according to the activity or repose of the nervous centre. Gallon was inclined to consider that the principal function of this organ was the preparation of 'haematome.' This opinion also is one that has become pretty general as it places the Thyroid in somewhat the same category as the spleen.

A Theory has been proposed with regard to the Thyroid

2. E.S. Gallon, Recherches sur le cap. Thyroide Thiere de Paris 1851
body by Victor Horsley. Though it dates only from 1886, 5
think I may be pardoned for mentioning it, if only from some justice to Michelin, Vercellino's father, Horsley has declared his belief that the symptoms of old age are mere phenomena caused by a decaying Thyroid. Had Wharton made such a mistake we would be inclined to smile at it, but science is saying such wonderful things nowadays that we are afraid to smile lest we should appear unscientific. We used to be amused at the stories of the great for the elixir vitae. Brown-Séquard has taken up the task scientifically, and we are ashamed of our past ignorant waste. Some people, however, may have a prejudice against his elixir, but no one can object to the brand "obtained from the Thyroid." He may then expect to hear that injections of Thyroid juice, transplantation of the gland into the bodies of old people has been tried with marked success. If Horsley be correct, then the Drs. Fantus and the future will have no need of Mesmerists unless he has a Thyroid at hand.

Various other theories have been proposed to explain the function of the Thyroid, but I think I have included the more 10 important of the older ones. This paper however would not be complete of some reference were not made to the monographs on this subject published during the eighteen century.

W. Horsley, Relation of Thyroid to General Nutrition. Lancet 1886 m 6, 13.
I have already referred to those of Breteigue [falsely for La place], but very interesting matter will be found in the treatises of Hager, Lauth, Boccal, Mayer, Loder, Schmidtmüller, and Weden. 7

Later works on the Heywood will be found included in the Bibliography at page 92. (This unfortunately had to be omitted from want of space.)

1. Nicolaus Hager, De flamula Heywoodica. 8vo Vitæba 1721.
2. Lauth, Dei iaurg. de flam. Heywoodica. 8vo August 1742.
3. P.H. Boccal, De Heywoodica Heywoodi. 8vo August 1753.
4. C.A. Mayer, Heywoodica. 8vo de flam. Heywood. 4to August 1785.
5. Loder, Heywoodica. 8vo de flam. Heywood. 8vo Leipzig 1797.
7. Weden, Anabaptic de flamula Heywoodica. 8vo Leipzig 1822.
Anatomy of the Human Thyroid Gland

Shape.
The Thyroid Gland consists of three parts, two lobes joined together by an intermediate or more slender part. The whole has been said to have a semilunar shape, the concavity being directed upwards. This description cannot be said to be a very good one, inasmuch as the bridge between the lobes is very much less than them in size. Moreover, this bridge is sometimes, as it is called, may be inserted nearer the middle of the lobes than toward their inferior extremities, so the gland will approximate more to the form of the letter H.

Position
The gland is situated in the neck and so placed that the isthmus crosses the front of the larynx. The lobes are on each side of this structure, stretching upwards, however alongside the Cricoid and Thyroid cartilages. Indeed it is from the close relation to the latter cartilage that the organ was called the Thyroid Gland.

Consistence
The gland has a very fine texture, so that a sharp knife cuts readily. It has been long noticed however, that if a
L'unit knife be used there is very considerable resistance experienced in the cutting: this is probably due to the large amount of fibrous tissue entering into its composition.

Colours

The colour of the Thyroid has been very variously given, some say it is usually yellow (Poincaré), others brown, some say red, others again that it is red or yellowish brown. I have found it most frequently to be of a fleshly red colour. In living animals, the difficulty of distinguishing the gland from a piece of muscle, is by no means a slight one.

Size & Weight

The normal size & weight of this organ is of some importance because from that alone can we judge whether the particular example is larger or smaller than usual. Nevertheless we have not yet gained what may be regarded as a standard in that respect. This probably arises from the fact that, as Cruveilhier says, 'Il est peu d'organes dont les différences individuelles de volume soient plus multipliées. The weight too is very variable. Through the kindness of Dr. Bruce Runel & Barret I have been able to examine a series of

2
1 Cruveilhier, Traité d'Anatomiie Generale 4th Ed. Paris 1852.
more than 50 Thyroids in the Post Mortem room of the Royal Infirmary, Edinburgh. A few examples will show the extreme variability of the organ in weight. In two women of about equal height, thickness aged 47 & 48, the glands were respectively 55 & 8 grammes. Again in a man aged 71, it weighed 17 grammes; in another aged 65, it was only 7 grammes while in a boy of 14 it was 14 grammes. The mean weight of the Thyroid is according Wharton one ounce & in this he was followed by Mecel 2 & by Breuerhier (32 grammes). Legendre puts it as high as 50 grammes but this is certainly too high. Poincaré 5 is lower than Wharton as his mean in a series of over 100 cadavers was 28 grammes.

Talley 6 is still lower with 22 to 24 grammes. My own experience coincides exactly with that of Stephen McKenzi 7 who found the average weight to be about 18 grammes [311 p.38]. It is a general opinion that the Thyroid increases with age in a relatively greater proportion than the rest of the body.

Boiron 8 & Poincaré 5 have recently stated their belief in this

1. Wharton, Adenographia, 1847.

2. Mecel, Descriptive Pathological Anatomy, 1st edn from French 1839 & 2nd 1858.


5. Poincaré, op. cit.


doctrine which was perhaps first enunciated by Chezelden. Of late years it has been more customary to regard the Thyroid as being larger proportionally during fetal life and gradually to decline in its proportional size as age advances. In this fact the proportion is said to be \(1:243:400\), while in the adult the proportion is given as \(1:180:0\). A later opinion however stalwartly puts down the proportion in the adult as \(1:367:101\). It does not see any very great change in this proportion with advancing years. My own experience is so small that I can offer no opinion on the subject. The extreme variation, within the limits of health, which the Thyroid at any particular age shows, makes it necessary to consult a very large number of cases before coming to a conclusion.

Since the time of Realis’s Colombe’s the gland in the female sex has been described as larger than that of the male.

Poirier, however, found the average excess of weight to lean rather to the side of the male. W. Keenee found the case to be similar in his investigations. My own examination would rather support the more general opinion, for with

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5. Of. cit.
The average weight in the female was 19 grammes, while in the male it was only 17.5 grammes.

In several cases of death occurring during Rheumatic fever I have found the gland larger than usual. The gland in one case weighing over 55 grammes which made it the heaviest in my series. Clinical observation has already pointed out the fact that Rheumatic fever is sometimes associated with acute enlargement of the Thyroid. My cases would tend to show that such association is not a mere coincidence.

Poincaré was not able to detect any connection between enlargement of the Thyroid and venous engorgement of the right side of the heart, but I have been lead to conclude that in most cases of mitral disease, chronic Bronchitis and other diseases which tend to dam back the blood in the Superior Venae Cavae, the Thyroid gland is larger than usual. This increase in size is sometimes very considerable.

From what has been said above, it is evident that the rôle which has been ascribed to the Thyroid in women, of filling up the spaces at the side of the larynx, has no foundation. In fact, since the gland is not usually of such large size as compared with the male organ, as to warrant such an idea. Saffrey, however, as recently as 1873, considers that the roundness of the neck in women

1 Among them, Barlow & Berry, Lancet, Dec 17th 1857 p. 1209.
2 Poincaré, Contribution à l'Antoine du Corps Thyroidien.
3 Of Cat. Tom. II.
is due to their larger Thyroid through he confesses that the difference in size is not very marked.

The Relations of the Thyroid Gland.

From its position in the front of the neck, the Thyroid Gland has close relations with many important structures. It is covered in front by the skin & superficial fascia & below them it is almost entirely concealed by the Sternothyroid & Sternothyroid muscles of both sides of the neck, only a small part of the isthmus of the gland being uncovered in the middle line in the slight space existing between the sternothyroid muscles of each side. The deep fascia of the neck which gives a sheath to the aforementioned muscles becomes condensed around the gland forms its capsule.

The more intimate relations of the lobes & the isthmus will be described immediately under these headings.

The Isthmus

The narrow bridge of tissue connecting the lobes together was called the Isthmus by Eustachius. The reason is that by which it is now known. It is composed of the same tissues as the rest of the gland & it is usually flat somewhat ribbon like in appearance. It lies in front of the trachea, generally

'Barran, Eustachius. Tabulæ Anatomicae. 4th Rome 1714.'
covering the 2nd, 3rd and 4th rings, to which it is very firmly attached by connective tissue. It sometimes rests higher in the neck, but if it varies in position it is usually by passing across the trachea at a lower level. Allan Burns (quoted by Robertson) relates a case where the isthmus instead of stretching across the front of the trachea, passed immediately behind it, being between that structure and the oesophagus. Such a condition, if it be a fact, is unique.

The isthmus more frequently varies in its size than in its position. It often is increased in size so that it justifies the name sometimes given of, "the middle lobe? Sometimes again it is smaller than usual or altogether replaced by a band of fibrous tissue. I have met with two cases where it could not be detected at all. Though a blood vessel ran across the trachea between the lobes. Metzger and Gruber do not consider its absence so rare, for he finds such a condition once in every 19 cases. He also states that there may or may not be an artery running in its position or connecting the lobes. If such a communication is present it is usually an anastomotic branch between the two inferior thyroid arteries, more rarely between the inferior thyroid of one side & the superior thyroid of the other, still more rarely between the two superior

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Hyoid Cartilages.

The Lobes

There are two lobes usually described, one on each side of the Larynx & Trachea. A third, however, or median lobe is sometimes mentioned, but this has just been fully described under the title of the Stomach. The two lateral lobes yet remain for examination. Each has been likened to a fig or pear, being broad & rounded below while it gradually tapers off superiorly. The lobe is usually said to have two surfaces, the internal & the external. The latter is rounded & looks forwards & outwards. The internal surface is hollow & looks backwards & inwards, lying against a few of the transverse rings of the Trachea, & where these being in intimate contact with the side of the Cricoid Cartilage, & while its apex is in relation to the triangular surface at the side of the Hyoid Cartilage, a surface behind & below the oblique line to which the Hyo-Hyoid & Hyo-Hyoid Membranes are attached. At a posterior plane the upper surface of the lobe lies against the side of the oesophagus, & sometimes there is to be seen a vertical ridge indicating the line of separation between the Trachea & the gullet. This ridge frequently becomes hypertrophied as if it were a line of least resistance & the gland tissue could easily spread in that direction. The natural result of such a growth on both sides would be to surround the Trachea.
with a Ring of Thyroid tissue which might cause very serious symptoms of hypothyroidism; that without any apparent enlargement of the gland as seen or felt in the neck.

Each lobe has likewise two borders, one anterior & internal, the other posterior & external, & these are continuous with one another over the apex to the base of the lobe. The posterior border is in intimate relation to the Carotid Sheath & lies upon the Carotid Artery. Frequently that part of the lobe is thicker than usual & could be better described as a posterior surface mass which acts as a flat area resting on the Carotid Artery & Jugular Vein & the prevertebral muscles. The lobe does not come into close relation to the Ganglionic Cord in the neck masswhich as their lies upon behind the Carotid Sheath. The Vagus nerve from its position within the sheath of the vessels is easily affected by enlargement of the lobe. The recurrent laryngeal branch of the Vagus is also in close relation to the internal surface of the lobe at the spot where it disappears under the lower edge of the Superior Constrictor of the Pharynx.

The lobes are rarely of the same size, & the right one is usually the larger. In only two cases did I find the left lobe larger, while in 24 cases the right was distinctly larger than the left.
The Capsule of the Gland

I have already indicated that the Deep Cervical Fascia gives a special covering to the Thyroid gland, forming a capsule to it. In certain places this general covering is particularly strong. I have uniformly found that the apex of each lobe is fixed in position by means of a firm band which might well be described as a ligament. Wentzgl. Gruber in 1863 described a special ligament running down from the Cricoid Cartilage to the Sartorius, he also noted two lateral ligaments. Huetter thought that this median ligament was the great obstacle to the art of rhinology in children as it prevented the Sartorius from being pushed downwards. In this connection, however, one must give due consideration to the fact that the Sartorius is itself very firmly attached to the Trachea.

In the capsule of the gland are to be found arteries in great numbers, sometimes very large. These ramify in it before entering the substance of the gland. The treatment of the capsule in cases of excision of the Thyroid is a vexed question, some recommend the opening of this capsule, others think it better to cut away the organ & capsule together.

1 Wentzgl. Gruber.
2 Huetter.

Wien Zeit. 1863.
Arch. f. Klii Chir. 1864.
The Muscles of the Thyroid Gland

Not only are certain parts of the capsule of the Thyroid so thickened as to serve as ligaments, but distinct muscular bundles have been described as being inserted into the gland or into its capsule. Laloulette in 1750 pointed out that the middle Constrictor of the Pharynx sends fibres to each lobe.

The Sternothyroid and Thyrohyoid Muscles also, give an occasional sheet to the gland. There is one muscular band, however, which is occasionally so frequently seen that it has received a special name, I mean the Levator Glandulae Thyroidea. This muscle was first described by Bremner, but lately been very minutely studied by Streeckisen. It arises from the lower border of the hyoid bone & passes down towards the larynx. Sometimes it contains a prolongation of gland tissue called the appendix, sometimes this latter structure is short. The muscle is inserted into the apex, or the appendix may be wanting. The muscle is then attached to the larynx or to one of the lobes of the gland. Streeckisen has also described a short transverse muscle arising from one or other side of the Thyroid cartilage & inserted on the Appendix. He has found, too, that slips are sometimes sent to the gland.

2 J.T. Bremnering, Von Dinge des Mundes Kopf. 4 Ge. Frankfur. 1791.
from the Hyo. Thyroid & Parasympathetic nerves as well as from the
Superior Constrictor of the Pharynx. Guérin has found a band
passing to the back of the Thyroid from the Oesophagus & to this
he has given the title of M. Hyo-oesophageus.

Blood Vessels

The blood supply of the Thyroid body is relatively
large. Leibermeister has calculated that the amount of
blood passing to it does not fall much short of that
which is supplied to the brain. As to the vessels themselves
it is to be noticed that they have a great tendency to become
tortuous & twisted around the outside of the organ. This
is particularly the case with the veins & the lobes often
seem completely enclosed in a network of dilated vessels.

Arteries

The Arteries of the Gland are five in number, two for
each lobe, & one median vessel passing to the Oesophagus. Each
lobe has a Superior & an Inferior Hyo-oesophageal Artery.
The Superior Hyo-oesophageal is usually the first branch of the Internal
Carotid Artery; it passes at first forward & inward under area of
The M. Platysma Myoides, then turns downwards & runs under

W. Guérin. Ueber d. M. Hyo-oesophageus. Virch Arch. 1876 (Anno 1877) p.396
the Sub-hyoid Muscles to the Apex of the Cleft. It anastomoses with the Inferior Hyoid Artery of the same side & sends across a communicating branch to its fellow on the opposite side, through the Softness. This Artery sometimes springs from the Common Carotid or it may arise in conjunction with the Lingual or some other branch of the External Carotid. It is occasionally absent & such are these two on the same side.

The Inferior Hyoid Artery is generally a branch of the Vertebral Artery. Its course is at first vertically upwards, then it curves downward behind the great vessels of the neck & the sympathetic nerve, finally it bends upwards to reach the Inferior Extremity of the Cleft of the same side. At the point where it turns down it is usually beneath the Middle Cervical Spinalis which appears to side of the concavity of the vessel. Cruveilhier was of opinion that this Artery was very liable to vary as regards its origin. He noticed it on different occasions coming from the Common Carotid, the Arch of the Aorta, the Arteria Bronchialis, or from the Vertebral, or Subclavian & sometimes there are two on one side. 

In 4 cases out of 56 Stuckeirn has found it absent, all four cases occurring on the left side.

The fifth Artery is called the Arteria Thyroidea ima.

1. Cruveilhier, Of Citat.
is only occasionally present. It seems to have been first described by Waller in 1767 but for what reason it is not known is sometimes called the Artery of Vagnerus. Probably from a misprint several anatomists have styled it the Artery of Vagnerus. This is a small vessel usually springing from the Aorta *praemunens*, near its junction with the Aorta, and sometimes as in Waller's case, it comes from the Arch of the Aorta directly. Thielestein found it 12 times in 120 bodies which he examined, 6 times it arose from the *praemunens*, twice from the Right Common Carotid, twice from the Right Thyroid Artery, once from the Right Subclavian, twice from the Right Superior Hyoid. In some cases it seems to have sprung from the Internal Mammary Artery (Aurain). I have said that the Thyroidica *fina* is usually small but it varies considerably (as do most the other arteries supplying the Hyoid) according to the other vessels are larger or smaller than usual.

Dr. Simon has pointed out that the four principal arteries to the Hyoid arise just below the junction of origin of these arteries to the brain by the Internal Carotid and Vertical Arteries. From this he would argue that there is some relation between

1. *R. Waller*. *Disputations Anatomicae* - Stuttgart 1746
2. Thielestein, loc. cit.
Veins

The venous blood coming from the Thyroid Gland finds its way out by a large number of vessels which form a plexus, more or less dense, on the surface of the organ. From this plexus arise six vessels, three on each side, the Superior, Middle, and Inferior Thyroid Veins. The Superior Thyroid joins the Internal Jugular Vein; the common trunks formed by the Dorsal and Facial Veins. The Middle Thyroid runs downwards and crossing the Common Carotid Artery to join the Internal Jugular Vein. The Inferior Thyroid Vein runs directly downwards but usually forms a plexus in front of the trachea, with its fellow of the opposite side. Out of this network emerge two vessels which join the Vein of the same name at the same point. The Right Inferior Thyroid Vein may, however, end at the junction of the two Sphenoidal Veins or move at the lower end of the Right Sphenoidal Vein. Sometimes there is a small median vein which passes down from the Sinus I carotici to the Arteria Thyroidea Inca.

Though the above may be taken to indicate the general arrangement of the Thyroideal Veins, it must be borne in mind that they are very irregular both as regards number and distribution and destination.

The Thyroid Veins are destitute of valves.
The Lymphatics of the Gland

The lymph vessels emerging from the substance of the Thyroid, ramify upon its surface. The network thus formed can be beautifully demonstrated by the intrathelial injection of Mercury. The Lymphatics of the Thyroid end in the deep Cervical Lymph Glands.

The Nerves of the Gland

The nerves supply of the organ has not been sufficiently worked out. I have already pointed out the close relation between the Middle Cervical Ganglion & the Inferior Thyroid artery. Many branches from the jugular pass to the Thyroid in the sheath of that vessel. It is usually stated, also, that the gland receives filaments from the Recurrent Laryngeal & External Laryngeal branches of the Vagus Nerve.

According to some, the Sympathetic Nerve sends some things to the Thyroid. Poinsard, in a special investigation upon the nerves of the Thyroid, came to the conclusion that it had a very liberal supply, far above its mere Vaso-motor needs & that therefore, the many of the nerves must be secretory or reflex pointing to some important function on the part of the gland.

The fifth nerve has been described as sending branches to the

Poinsard, Duées sur l'Observation de la Thyréide, Annales d'Endocrinologie 1876
Fluid of the Gland

In incising the Thyroid a peculiar juice or fluid, is said to pour out. Morgagni spoke about this fluid, and others have mentioned it. Truly if there are small cysts present, there flow on section, I may be a considerable amount of liquid, but I have not been able to satisfy myself that the Thyroid contains any juice apart from the blood stained serum which can usually be squeezed from glands.

Bone in the Gland

Frequently calcareaous masses may be found in the gland. Real Bone too, has been described by Parsons 
2 others.

These conditions however are certainly abnormal.

Division of the Gland

Sometimes the fibrous tissue forming the true capsule of the gland slips bodily inwards splitting up a lobe into two or more parts. Such a condition can only be noticed on section, and is of no importance. (3) Others, have recently de

2 Parsons. Medical Times Jr. 1862 vol II p 685.
sclerosis such conditions but they have been noticed at a very early period in the history of the Thyroid Gland.

Cysts:

Cysts of various sizes and with different contents, are often seen in the substance of the Gland, but there is no reason for believing that they belong to its normal structure.

The Pyramid or Appendix

In addition to its lobes, thus lobes, the Thyroid Body may possess an additional part. This is a strip of gland tissue, vertical in position usually turning upwards. It was first described by Morgagni as the Appendix. It was afterwards called the Pyramid by Laënnec. It is composed of thyroid tissue and must not be confounded with the Muscles Laterali glandis Thyroidae. As has been already stated, this muscle may envelop the Appendix or be inserted on to it but they are quite distinct structures.

The frequency of the presence of this strip of tissue, is very variously given. Meckel says it is more frequently present than absent. The first Morgagni who found it absent only six times in a large number of dissections. All seem to be agreed that it is more

common in children than in adults. In several instances I have found it uniformly present. Gruber (cited by Kanz) stated that it occurred in 40 pc of cases examined, while Leuca

makes it 33 pc. Tucker-Kaudt found it in 74 pc. Streeck is not far off with 68 pc. In 50 cases I found it distinctly present nine times.

The position of the appendix varies. In 3 of my cases it opening from the centre of the stomach; in 4 cases it came from the left side of that structure or from the adjoining lobe; in 2 cases it arose from the right side of stomach or from the right lobe. Gruber found it 10 times on the right side 82 times on the left. Streeck in on the other hand would place it as often on the one side or on the other. Of his 106 cases 49 arose from the right side, 47 from the left side, 13 only 7 from the middle of the stomach, while in one occasion there was a Pyramid on each side, joining up wardly forwards to meet at the pyriform bone.

The direction of the Pyramid is usually upward & in some have lead Walter & Arnold to believe that it was definitely proved that it forms the endogenic duct of the gland which aces as an imagination from the primitive sacropharynx. So far as we can

concerned it does not matter whether the Thymic arises as Three lumps or as a single lump. On the former hypothesis we could easily explain the appearance of a spot on each side, that these being the remains of the two lateral ducts while the medial one had disappeared. But others seek to explain the appearance of the Appendix as being due to a growth upward of the Thymic Tissues. They seek to justify their supposition by pointing out the fact that similar strips of tissue extend out from the lobe in a lateral direction or may grow downward from the bottom. It is indeed evident that such further have not the same origin as the Pyramids is supposed to have, but there is no necessity to suppose that the two sets of structures arise in a similar manner. These outgrowths frequently get out of from the parent gland too few arise to at least some of the glands known as Supernumerary Thymic

The Pyramid is often connected with a small accessory gland at its tip. It stretches up towards the hyoid bone, either going reaching at a being connected with it by means of a band of connective tissue or muscle fibre. In some rare instances it may be traced behind the Hyoid bone or even as far as the Foreamen Lacern of the Thyroid (Windsor, Contraction Anatomy, Anatomy of Development of the Thyroid). The Appendix is usually flat & obl��rshles & tapering to a point above, but it may be larger & rounded, or alternately contracted depending having a very appearance.
Accessory Thyroid Glands

In addition to the gland described within the limits of the Thyroid Gland, there may occasionally be found in the surrounding tissue, little glands which have a similar structure and are hence called Accessory Thyroid. Inasmuch as these are very small it was quite natural that they should be overlooked. It was only when they became enlarged in Goutte that they were noticed.

Vernueil seems to have been the first to find out the cystic tumours in the front of the neck often arising from such glands. The frequency with which they present themselves has not yet been clearly ascertained. I have myself often noticed little pieces of glandular tissue round about the Thyroid gland in the absence of a microscopical examination. I could not say whether they were Accessory Thyroids.

Gurdon found them present in 7.6% of cases examined, but Streekeisen gives the higher figure of 16.3%. The latter observes that they increase in frequency with age. Of those under 40 only 9.8% had them, while in those above that age the proportion was 19.7%. These Accessory Glands are usually

classified as Superior, Lateral, Posterior & Inferior.

The Superior Gland are those found between the
Soft Palate & the Hyoid Bone. Gubler found these present once
in every 9 women, three in every 12 men. Rarely are the
Glands found above the Hyoid Bone but such cases do occur,
for instance in 1887 Dr. Wolff of Hamburg removed an enlarged
Hyoid from the tongue of a patient. The Lateral Glands are
Those situated near the borders of the gland that they may occur
anywhere in the triangle cut off by the lower jaw, auricular bone
of Temporals & the Scapula. The Posterior ones are of importance
because of their serious result, they being about when enlarged.

Beckel, Sti, & probably that the retro-pharyngeal tumors described
by Stark & Beekel were merely enlarged posterior Hyoids.

The inferior accessory Hyoid include all those found near
The middle line below the Softness & bases of the Larynx.

Madelung has made another division of these glands, viz
The anterior ones but it seems the case reported by Pollard is
The only one which could be referred to such a group. The
same author finds that accessory glands are much more...

1 Wolff.
4 Madelung, Analee Parti, Uber die Larynx Hyoid Acces. Arch. klinische. 13. 14, 1879
common on the right side.

These glands vary in shape, being round, ovate or cylindrical. In size they range between that of a pea and that of a bean.

Absence of the Thyroid Gland

If one judges from recorded cases there is one certain conclusion: that the thyroid is rarely absent. Lobstein found not a trace of it in anencephalus foetuses of eight months.

Curting, Beach, and John Thomson have noted its absence in fetuses. Jaurès is responsible for the statement that the gland is frequently congenitally absent in domestic animals.

On the other hand, a part of the gland is not unfrequently absent. I have already spoken of absence of the thyroid, but one lobe may be absent, or even both, so that the isthmus is the only part left to represent the gland. Jochamoff has noticed a case in an infant where the left lobe of the thyroid were both wanting. A similar occurrence is in a

women between 60 & 70 has been noted by G. In this case the right lobe was only of normal size. Handfield Jones stated a similar specimen was in the Museum of Guy's Hospital, among other examples of variation in the form of the Thyroid Gland.

The Histology of the Human Thyroid Gland

The Minute Anatomy of the Human Thyroid does not go back many years. Morgagni, in 1723, described it as being made up of a large number of small round bodies. "Morgagni dixit glandula, in quiescentique corporis inspexita, saepe numerosae evanescentes, sivae annis inventae." Lallemand says, "En examinant avec le microscope la substance interne, j'ai aperçu un nombre infini de petits grains arrondis placés près les uns des autres."

To be brief, we may say that Berres was the first to give a proper idea of the minute structure of the gland. Since his time the knowledge of it histology has not progressed at all. Relatively speaking, it is probably there is no organ in the whole body whose normal appearance is so much disputed at the present moment.

The microscope shows that the Thyroid Gland is covered by a layer of fibrous tissue which sends it broad bands cutting the gland into irregular spaces. These spaces are further subdivided by fine bands into very small areas which contain the true gland vesicles. The Thyroid is also seen to be largely supplied with blood vessels, and many nerves can be

Tissues in it. With these few lines, which probably contain all that can be said without contradiction in regard to the organ, I will now go on to describe the various parts more in detail.

The fibrous tissue as I have stated forms the covering to the gland. In thicker or finer strands separate the vessels from one another. In some cases, however, it is quite impossible to demonstrate the presence of any tissue between some of the vessels. This tissue consists mainly of white fibrous tissue and connective tissue; corporacles and corpora lucentes but yellow fibres are also present though not very numerous. It serves to carry the blood vessels, nerves, and the nerves of the gland. It seems to be much more abundant in the human thyroid than in that of lower animals, and also seems to increase in quantity with age. This tissue has been very carefully studied by Serreschke, who states that yellow fibres cannot be found in the fine tissue separating the smaller vessels.

The Vesicles of the Gland

Benecke was the first to describe the vesicles of the gland as we now know them. They form the true glandular portion of the thyroid but unfortunately the almost uncertain

2. Benecke, loc cit.
prevails as to their real structure.

We have them usually described as closed sacs; this, indeed, being their description as originally given by Bosses. There have not been wanting, however, others who contested this opinion. Babée thought that most of the vessels were branched. But Cruveilhier, Verchot, Bouéchat, Conant & Ranvier believe that the vessels are intercommunicating; this is my own opinion. It is objected that if they communicate, they ought to be capable of injection but we must remember that the vessels are filled with various kinds of material & that these would require to be removed before such injection could be accomplished. Absolute certainty on this point might be achieved by means of serial sections of the gland. Unfortunately, from some chemical peculiarity, or from some other reason, the Thyroid does not readily cut by the Paraffin Method. For some time I attributed this to mere want of skill on my part but that could not be the reason for the Paraffin method in my hands yielded excellent results in the case of other organs. The dozen or so times, that I attempted this method on the

3. Verchot. Pathologie des Tumeurs
4. Bouéchat. La structure normale du corps Thyroïde. Thèse de Paris 1873
Physiologic were often puzzling so that I had to be content with

gross sections. From a careful study of these however I feel quite

convinced that the vessels communicate with one another.

The vessels vary much in appearance, sometimes round,
sometimes polygonal, sometimes oblong. They differ also much
in size also, some being very small, others very large through
the latter are in all probability the seat of some pathological

changes.

What is the outer covering of the vessels? Is there a membrane

proper such as is described in other animals? Kollescher 1, Kohl-

rausch 2, Lods & Bowman 3, Vercin 4, Austin Flint 5, & Baker 6

thought so. On the other hand the presence of such a structure

has been denied by Vecht 7, Frey 8, Hessling 9, Parnes 10 &

Boechat. 11 I have not been able to convince myself of the presence.

1 Kollescher. Histologie Humaine—tiré fr. Paris 1836 p 523


3 Lods & Bowman. Physiological Anatomy of Man—2 vols. Lond 1859 vol. 2 p 519


5 Austin Flint. Textbook of Human Physiology. Lond 1876 p 433.


8 H. Frey. Das Mikroskop. 2nd ed. 8 vo Leipzig 1886

9 Von Hessling. Grundzüge der allg. u. spez. Gewebslehre. 8 vo Leipzig 1866

of this membrane

Is the vesicle covered by a special layer of cells? Richer (loc. cit.) believes not, as he sees the lining of the vesicle membrane.

Kohlrausch (loc. cit.) who describes a basement membrane, is equally unable to detect a particular layer of cells forming the periphery of the vesicle. Flecher & Eulenburg have also been unable to find such a condition. Others, however, have described such special lining cells. Peremeshko thinks there is a single layer of cylindrical epithelial cells. These cells, he states, fall to pieces immediately after death, so that unless the fluid is examined at once they will not be seen. Veron (loc. cit.) & Rader (loc. cit.) are also of opinion that there is a single layer of columnar cells.

Tregler & Brücke describe a single layer of cubical epithelium. Brücke (loc. cit.) found the vesicles to be lined with polygonal pavement cells. This has been my own experience. Todd & Bowman seem to have been of a similar opinion. It is needless perhaps to state that the above descriptions are only meant to apply to the normal condition of the fluid as in abnormal states especially when the vesicle is filled with colloid matter, it is absolutely impossible to detect any appearance of epithelium.

2. Eulenburg. Arch fü Wissenschaft. Heilkunde Bd. IV.
When we come to investigate the normal contents of the vesicles we find even greater diversity of opinion. Perhaps the opinion most generally accepted is that the vesicle is filled with a clear fluid in which perhaps a few cells may be detected. Others believe that the normal substance occupying the follicle is colloid matter; these authors declare that the particular function of the Thyroid is the preparation of this material. Some (eg. Hegar of Dét) declare that the vesicles are filled with cubical cells. Virchow's opinion I will give in his own words, as I believe it is the one most consistent with fact. He says (loc. cit. p. 201) the vesicle contains a good number or less number of rounded cells, peripherally which are nucleated. Frequently this nucleus may be seen outside the cells from which they have escaped. Formerly it was believed that these cells formed an epithelial lining to the follicles, but on examining a normal follicle it is found to be entirely or almost entirely filled with cells. If not a mere epithelial investment, it is a mass of cells which by their size, shape, structure as well as by the size of the cells, it recalls possibly the conformation of the lymph glands. Poincaré's results seem to point to a similar conclusion. In 17 of his cases the acini were filled with a peculiar or a colloid matter, in 30 of them the vesicles for the most part contained a clear liquid, in which were a varying number of cells, while in 40 cases he found that there
majority of the acini were filled with nuclei. The presence of bodies of various kinds within the vessels has been frequently noted. Among these may be mentioned the 'lymphocytes' (of Anreker & others), the 'albuminous bodies' of Robin & the 'amyloid Bodies of Romanae' & others. Such appearances are due to degenerations & need not be further noticed here.

I have already drawn attention to the fact that in the vessels large cells are frequently to be seen. These have been variously termed 'plasma cells' (Waldeyer) & 'parenchyme cells' (Baker). They have also been described as the 'mother cells' of leucocytes & haemocytes. These cells are often formed singly or in groups outside the follicles. Baker describes how they gradually approach these structures & pass into their interior. Such a description is to my mind extremely fanciful. I feel certain that these cells are always within the acini & that they are produced by proliferation of the lining endo-thelium of the acini & finally they have nothing to do with blood formation. No doubt in sections one may frequently see one or more of these cells apparently outside the vessel, but it must be remembered that the section cuts the acini at different

levels. It is quite easy to suppose that where an aneurysm is bent, the apex alone may be cut off. Thus we may see its contents, only one cell, or two.

As my purpose is to describe the normal constitution of the vessels, it is out of place to describe the peculiarities which microscopes have occasionally noticed. Therefore it is that I have omitted to make any reference to the longitudinal direction of the cells as pointed out by Baker. The various peculiar alterations in the form of attachments of the cells which have been described.

**Blood Vessels**

The microscope shows that the Thyroid is an extremely vascular organ. The arteries run along the septa & give off branches which end in a fine arterial network which closely embraces the vessels. This close relation of the blood-vessels to the tissue is a fact upon which all are agreed. It has been stated that the arteries end by breaking up into a plexus of branches. This observation, which would show an analogy between the Thyroid & the Ovaries, I have not been able to corroborate. The blood vessels of the Thyroid seem often to be somewhat separated from the fibrous tissue of the septa, being apparently surrounded by lymph-cyphuses.

E.C. Baker, Frcs
Lymphatics

The Lymphatic System is very well developed in the Thyroid Gland. The large vessels run in the septa & end in perivascular or perifollicular sinuses. Boéchat thinks that the follicles simply dip into large lymph sinuses. Certainly, some sections would warrant such an idea but I do not think such a condition is the general rule. In all that large spaces, apparently lymph sinuses, can be detected between the septa & the acini, & between the walls of neighboring acini. There is no reason to believe that the lymphatics directly communicate with the interior of the vessels. It has been stated that the Collaid Matter passes away by the lymph vessels & that this matter has been detected in them on section. I have often seen collaid matter in what might easily be mistaken for lymphatics in my early vessels, but I cannot say that I have ever found it elsewhere than in the vessels. It is probable that the great differences among the vessels, both as to size & shape, have not been sufficiently recognized & have thus originated descriptions both of collaid matter & of large cells external to the acini. The Collaid Material, as I believe due to degeneration & once formed does not tend to pass away either by vessels or lymphatics, in fact it usually tends to increase & by its increase in size it distends the vessels & destroys any normal structure which might still be within them.

Boéchat, La structure normale du corps Thyrôïde. Thése de Paris 1873
The lymph vessels of the thyroid are said to form valves.

Nerves

The nerve fibres within the gland are said to be very numerous. They do not merely run along with the vessels but pass in various directions quite independent of these structures. They form anastomoses with each other and ganglion cells are to be seen at the points of junction as well as in the course of the fibres. How these nerve fibres end is not known. They have been seen in very close proximity to the acini of the gland, and it has been suggested that they terminate in a coating

Redimentary Parts

Baker and others have described parts of the gland which differ from what they considered to be the normal part of the gland. Such parts have been called Redimentary or Subcapsic or undeveloped. From what I have read about these I have come to the conclusion that they are nothing more than the normal acini of the gland which had come to be considered abnormal merely because they were unlike the greater part of the gland, hence were not degenerated and filled with colloid.

1

2 Poissonneaux, loc. cit.
3 Baber, loc. cit.
Under a high power we see such an appearance as I have endeavoured to reproduce. 'A' is a large vesicle lined with pavement epithelium, the nuclei of which may be seen at the periphery; part of the mass filling the acinus has fallen away and shows us partly the close network of capillaries which invests the follicles, only in some parts can cells be made out in the connective tissue filling of the vesicle, for the most part it consists of nuclei in a homogeneous matrix. 'B', 'C', 'D', and 'E' are other follicles of different shapes. In 'D' there is commencing colloid degeneration in the centre of the acinus. The close relation of the vessels to the follicles may be seen at 'V', while various lymph spaces are depicted as 'T'. In this...
Drawing there is no appearance which properly shows the epithelial lining of the vesicles, and in suitable sections where the contained mass has dropped out of the vesicle, the large polymorphous pavement cells can be easily seen.

Conclusion

One cannot pursue the different works which treat of the Histology of the Thyroid bone without concluding with Pernice that the Thyroid is rarely normal in the strict sense of the word. This is, which explains the extremely conflicting ideas which have been held with regard to its structure. The Thyroid is very prone to undergo degeneration. Fatty degeneration in the stroma and parenchyma is very common. Hyaline degeneration of the vesicles is frequently seen. The changes occurring in the vesicles are legion in number, but Colloid degeneration is the most common, so common indeed, that it has been considered normal. From all this it would seem that the Thyroid should be classed with the Thyroid gland which it closely resembles in structure, though it does not like that gland altogether disappear. Considering the different appearances (let us even admit that they are not degenerations) seen in different Thyroids, it is difficult to believe that this organ has any very important function. Whatever function it may have should be, arguing from similarity of structure, on the same lines as that of the
Spleen or Thyroid Glands.
Some Considerations with regard to the
Function of the Human Thyroid Gland:

From what I have stated in my introduction it will
be seen that the Function of the Thyroid Gland in man
has been the aim & subject of my studies. In order to gain that
end I felt that it would be necessary to gather in all that
was known about the Thyroid in every possible direction. This
proved to be an undertaking of much greater amplitude than
I had ever dreamed & I saw that some more years would
be needed before it could be accomplished. In speaking about
the Physiology of the Thyroid Gland, I am, in my own con-
fession entering on a subject on which I am not completely
qualified to speak. But, on the other hand, one cannot devote
the almost continual consideration of more than three to the
consideration & investigation of any subject without having
some opinion however hasty or coming to some conclusion
however imperfect.

At the present moment the generally received opinion
is that the Thyroid is an important organ in the economy of
man. The reasons for holding this view are the following:
I. The dangers incurred in removing the Thyroid
II. The serious consequences following disease or destruction of it.

In this two lines are summed up the various facts which
have gradually led to the conclusion that the presence of the
Thyroid in Man is a necessity.
I. Excision of the Thyroid Gland.

This operation is almost always fatal in dogs and wolves. Severe, not so fatal in monkeys, hardly seems to affect rabbits, guinea pigs, sheep, pigs, oxen &c. From such facts one can hardly argue that the operation would be fatal in man & yet such a deduction has been drawn. Why should man suffer with the dog, rather than escape with the rabbit or pig? It is quite obvious that the question can only be solved by performing a similar operation in Man. Undoubtedly the latter result of the extirpation in dogs would tend to prove that the Thyroid gland was an essential part of Man's body. But here we stop, we cannot say that such a necessity is absolutely demonstrated. To improve the position other facts are needed.

If, from the mistake of a Schiller, 1 has stated that the introduction of the excised Thyroid of one dog into the peritoneal cavity of a second prevents the extirpation of the second dog's Thyroid from being followed by any ill effects. Unfortunately such has not been the experience of other observers, so that we cannot count much, if at all, on this.

The fatality of the operation in dogs has been attributed by Meckel 2 to either to the severity of the operation or the injury sustained to important nerves both by the operation of the wound, secretion afterwards. In other words which one gives

1 Schiller, De l'Ablation des Corps Thyroid. Rev. de la Suisse Romande vol. 1983.
by tubes, showing the relative position of the thyroid in dogs, to various important nerves, would convince one of the very serious nature of the operation. The gland is situated so very deeply in the neck of the dog that its removal, as I have found, requires a long tedious dissection and consequent exposure of important structures. This explanation receives some support from the experiments of Munk who by injecting cotton oil in the region of the thyroid brought on a fatal result in dogs within symptoms similar to those following removal of the gland.

Munk has also found that tying all the vessels going to the thyroid does not bring about any dangerous result. This would go to show that the mere presence of the thyroid is not essential to the life of the dog.

Again, is the thyroid gland necessary why does death not invariably follow its removal? The reply to this is that its place is taken up by accessory thyroid bodies. Munk on the other hand finds that such glands are almost always present in dogs, so it is difficult to understand how they can prevent a fatal issue in some cases but not in others.

The increased toxicity of the urine after the operation of thyroideotomy in dogs has led Landauer and F. Fahr, the editors of the Archiv fur Pathologische Physiologie, to investigate the problem further. Landauer, in his paper "Le rôle des corps thyroidiens" presented at the Société de Biologie, Paris, March 15, 1891.
& Gley, to believe that they have found a new argument in favor of the importance of the Thyroid. Such fact, however, cannot be properly estimated till we know more about the variations in the toxicity of the urine. Besides, as has been pointed out, the presence of curariformes in the dogs may alone be the cause of increased toxicity after operation. Again, Roggendorf has found that there is no alteration in the blood. We added a drop of blood with that removed from a hypophysectomized animal, without any evil result.

From all this we may conclude:

I. That the Thyroid is not necessary in all animals;

II. That removal of it is usually fatal in dogs;

III. That this fatality may be due to the severity of the operation or to the absence of the gland; the former alternative very probable.

IV. That experiment alone can determine whether removal of the Thyroid will or will not be dangerous in Man.

I think that the results of experiments with dogs have been too much in evidence in regard to the question of the function of the Thyroid in Man. Even supposing that it were absolutely proven, which is by no means the case, that the Thyroid was absolutely necessary to the dog, it does not follow that it must have a similar importance in man.


2. Rogendorf. Observation sur Corps Thyroïdien. Arch. de Physiol. 1885
Extraction of the Thyroid in Man

The removal of the Thyroid Gland has been frequently performed in Man. Bee1 was able to collect 203 cases which occurred between 1850 and 1883. Of these, 172 were cured and 31 died, thus showing a mortality over the whole period of about 15%. Statistics compiled since the general adoption of the anaesthetising system show a considerable reduction on that percentage. The operation of Thyroidectomy was thus becoming a recognised surgical procedure when in 1882 and 1883, Reverdin2, Kocher3 and others sounded a note of alarm. The former had noticed some curious nervous symptoms following the operation. Kocher described under the term ‘Chorea Strumigos’ a peculiar condition which he believed to be brought about by the removal of the Thyroid. The experiments that had been performed on dogs seemed to support the opinion that it came to pass that the Human Body was believed to be essential for the proper nutrition of the Human Body. I may, here, just incidentally refer to the discovery of Myxoeclonia in England about the same time, which to a considerable extent helped on the idea of the importance of the Thyroid.

1 E. Bee. Extraction du corps thyroide. Arch. de Med. 1883 vol II p176
2 Reverdin, quoted by Bee; see above.
3 J. Kocher. Congress of London Surgeons 1883
At the outset it is well to point out the extreme dissimilarity between the symptoms following excision of the gland as seen in the dog and man respectively. Dogs die rapidly, their usual duration of life being about 10 days. They are affected with convulsions, tremors and nervous symptoms. The results as described in man are very different: slow insidious onset, often not appearing for years after the operation. The disease itself is chronic and characterized rather by perversion of nutrition than nervous symptoms.

Again, it must be borne in mind that the excision in the two cases is done for quite distinct reasons.

A presumably healthy gland is removed from a dog for more experimental purposes. On the other hand it is disease which suggests the removal in man. Now Goitri is frequently associated with a disease known as Cretinism and it is known that persons going to reside in a district where these diseases are endemic, become pituitary just as their children share that disease as well as a tendency to Cretinism. This latter disease comes on in childhood but it has a very close resemblance to the 'Cachexia Tumurativa.' So close is the resemblance that Bardeleben pointed it out at once to Kocher, I suggested that the Condition was coming upon

Bardeleben. Corps of German Surgeons 1883
the patient when the gland was removed, that in fact it was a case of post hae and non propter hoc.

It may be at once conceded that a condition known as Cachexia Strenuusiva does follow Thyroidectomy, but it does not follow that the Cachexia is due to the absence of the Thyroid. If mere loss of that body is its cause, why does it appear more frequently? Liiders has collected all the cases he could find up till 1890. The number is 56. Many of these cases are included on very slight grounds indeed. The probability is that the real number of cases is considerably below 56.

The reason, we are told, is two-fold: (1) the incomplete saturation of the gland, and (2) the presence of Accessory Thyroid Bodies.

It is difficult to believe that the removal of a considerable part of an important organ would not be followed by some symptoms, yet such would seem to be the case with the Thyroid. A similar argument might be brought against the supposed preventative effects of Accessory glands. I admit that it is difficult to have absolute conviction on the point. If a particular patient survives Thyroidectomy it will be said that the survival is due to a piece of tissue left behind or to a supplementary gland. If the patient then dies from some ordinary complaint.

B shows on P.M. examination, not a trace of Hypothesis, we cannot conclude that the extirpation has had no effect. It will be pointed out that the Cachexia may not come on for 5, 10, or (as in Bruno's case) even 18 years after the operation!

But there is another explanation of the absence of the Cachexia after Thyroidectomy. It is pointed out that the gland is removed for disease; now it is argued that the disease has slowly destroyed the Thyroid so that when it was removed it was practically useless, & its removal of no consequence. This theory, however, brings in another proposition that there is an organ or series of organs within the body which can take up the function of the Thyroid & which is able to do so satisfactorily provided that the burden be slowly imposed on it. Schiff's experiments tended to support this view for he found that on removing the gland from the dog in two some time before the other was taken away, the dog was not affected with the fatal symptoms. Rogowitz & others have, however, failed to get any protective influence from this double operation. This theory of a supplementary organ has therefore no foundation on fact.

1 Bruno quoted by Lichten
2 Schiff Revue de la Suisse Romande
It has also been suggested that the Thyroid is of more importance in the young than in them its removal is constantly followed by the Cachexia. Thus we are to understand that the older a person gets the less chance they have of falling victims to the disease. Admitting for the moment the truth of this, we might explain it by suggesting that Cachexia is essentially a disease of youth, that therefore it is more likely to occur in such hypodectomised people as are young. But we cannot admit the truth of the constant fatality in young people. One of Dr. Wason's first cases was a girl & she escaped; I many such cases might be cited. Moreover, there are some who consider the Thyroid to be of very great use in old people. Victor Horsley, for example, believes that degeneration of the Thyroid causes many of the symptoms commonly ascribed to old age. We cannot, therefore, assume that the difference in importance of the Thyroid at different ages is a sufficient explanation of the fact that comparatively few cases suffer by its removal.

On the other hand, those who do not believe that atrophie of the Thyroid has any bad effect, have got considerable evidence on their side. First there is the

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1. After, I was informed by a personal letter from Dr. Watson.

undoubtedly fact that a certain proportion of those whose thyroid had been removed, do not seem at all inconvenience by the loss. This answer has been already dealt with.

Secondly, they attribute the 'cachexia Stammifera' which sometimes occurs, not to the loss of the thyroid but to the continuance of the condition which brought on the goitre, or to some other causes. Whose operations have been most frequently followed by the 'cachexia'? Precisely those surgeons whose patients were drawn from Gustous & Continuous operations. Kocher and others in Switzerland lead the list of percentages. In England & Scotland such cases are rare. Dr. Herschel Williams informs me that only on one occasion did the 'cachexia' follow this operation. In that case, he is inclined to believe that the disease was there before he operated.

He concludes his letter with these significant words: "I have always, for my own part, been suspicious of the alleged connection between the removal of the thyroid & suppuration" (i.e. cachexia Stammifera). Rossander states that suppuration & cachexia are unknown in Sweden & that the thyroid had been extirpated there, 32 times without a single case of 'cachexia'. Statistics might be compiled on the subject, but this is hardly necessary, the frequency of the 'cachexia' in pustulous countries being well known. Thus it would

'Rossander. Lancet Jan 24th 1891 p 218.'
see that the occurrence of cachexy is a question of locality
I not of the operation which is everywhere the same.

With regard to hypophysectomy in man we may conclude
I that a large number are unaffected by the operation
II that this immunity is due in a considerable degree to locality
III that some get 'Cachexia Depressiva'
IV that incidence of the cachexia is primarily dependent on locality.

We may accordingly sum up that the extirpation of the
thyroid in man is an operation which is in itself free from
remote consequences. The evil effects which have been
ascribed to it are readily explained, being nothing more
than the superposition of a cretinoid state. Cretinism
has been ascribed to disease of the thyroid but further on
I will show how little reason there is for this idea. The
cretinism & the goitre seem to be both produced by the
same cause or series of causes. The first evidence of the disease
is the goitre & it is only when the cause or causes have been
acting for some time that the further stage of cretinism is
reached. One manifestation only of the disease is removed
with the extirpation of the thyroid. The causes still go on
acting & at a person经纪or epoch in the further stage
of disease is jammed.
II. Maladies induced by disease of the Thyroid

Now come to the second reason on which those rely who believe that the Thyroid has an important function to fulfil. They say that disease of the Thyroid tissue, or abnormal functioning of the part of the Thyroid, induces serious symptoms. To the Thyroid is referred the origin of Acromegaly, of Retinism, of Myoedema, of the Exophthalmic Goitre.

Acromegaly

Why this rare & recently discovered disease should be laid at the door of the Thyroid I do not know. It is supposed to be a disease of the metabolic processes of the body & perhaps its simplest explanation was to ascribe it to an organ which was supposed to be specially concerned in the nutrition of the body. It was also thought that it was an analogous disease to Retinism & as the latter was thought to be due to the Thyroid, Acromegaly was believed to have a similar origin. All these suppositions, however, do not make up one fact. What we do know is that there is no instance recorded where actual examination revealed a diseased Thyroid.

Exophthalmic Goitre

I hardly think that we are so prone nowadays to accept the Thyroid as the cause of Basehow's Disease. It is, I
I imagine, rightly, considered to be due to disease of the Central Nervous System. I need not go to great pains to prove the innocence of the Thyroid. The Goitre does not need to be the first in the train of symptoms, in fact it usually is not. Goitre may not be present at all. Post mortem examination usually shows no important change in the gland, which of enlarged is merely hypertrophied.

**Criticism**

Criticism as defined by Morel is "a degeneration of the Human Race, characterized by the presence of idiocy in a greater or less degree, I associated with a falsely confirmation of the body." This disease is peculiar inasmuch as it occurs only in certain places over the world, these being localities where goitre is endemic. Goitre may prevail in districts where there is no criticism and I do not know of a single place where the latter disease is present and goitre absent. Moreover, as I have already indicated, it would seem that Criticism was the continuation of the Goitrous Disease. People coming to reside in an affected locality may get Goitre, but their children are almost certain to have enlarged Thyroids with a tendency to Criticism which becomes more marked with each generation till the race was extinguished for the advanced Criticism has no

Morel. Étude sur le Criticisme Arch. de Médec 1863
procreative powers. It would be out of place here to enter into detail as to the supposed causes of Cretinism, suffice it for the present to ascertain the relationship which this condition holds towards the Thyroid Gland. From the statement made a few lines back it would seem as if there were a direct and very intimate connection between the two. Jodere, 1 thought that the Cretinism was the result of the Goitre. In this he has been followed by Morel, 2 Gueron, 3 Archbishop Billiet, 4 Fabre 5 and Meige 6. On the other hand the American Commission of 1845 does not believe that the Goitre has anything to do with it. Terres, 7 Kocherle 8 and Baillarger are of a similar opinion.

The case is not quite so clear as it might seem at first sight. In many cases Goitre is present but in quite one third there is no appreciable enlargement of the Thyroid

1 Jodere. Enre sui la Cretinisme
2 Morel. Loc cit.
4 Billiet. Obs sur la portee et la Cretinisme - Paris 1847
5 Fabre. Traite du goitre et du Cretinisme
6 B. Meige - " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " 

7 Terres. Arch. Gen. de Med. tom. 85, anno 1851
8 Kocherle
9 Baillarger
The beliefs in the thyroidal origin of cretinism explain the matter in this way. In some of the cases the thyroids is enlarged and degenerate, in the remaining third it is atrophied. In both cases it is functionless. This is the condition of cretinism. There is simplicity about this explanation which is captivating. It does not need to consider what particular organs were the function of the gland and how its want of action brings on this disease. Unfortunately it is only a supposition. There is an exceedingly copious literature on this subject of cretinism. I have carefully worked through a great part of it, but I am compelled to gain my information directly from the dictation of Burry's "We do not know of any accurate record as to the condition of the thyroids gland in cretinism." And yet it has become almost of gospel faith to believe that the thyroids gland causes the condition.

Sporadic Cretinism

I have said that I do not know if any place where cretinism prevails apart from goitre. Now I again, however, cases which resemble cretinism so very closely as to make them with that condition indistinguishable, almost certain, such cases are described and have been known for many years as examples of Sporadic cretinism.
Enlargement; this name was suggested by...

...many years before... described his cases in which the Thyroid gland was found at post-mortem examination, to be completely absent. Beach has described a similar case. On the other hand zigzag has found the gland present seven slightly enlarged. This case is a particularly instructive one because he had previously, from clinical examination, come to the conclusion that the Thyroid was altogether absent. Such a fact ought to be remembered by those who estimate the Thyroid by clinical methods. I consider that under normal circumstances it is almost impossible to estimate the size of the gland. In cases where it seemed about the same as usual, it has been found larger or smaller than usual. The condition of the Thyroid in sporadic enlargement is thus summarised by Bury.

"It is usually absent, sometimes it is quite normal, sometimes it is slightly swollen, but a portion is rarely present." The Thyroid has been found absent, in reality, only in a few cases; it has been often described as absent; so that the "usually" in Bury's sentence must be understood as the

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considerable limitations. However, it is acknowledged that sometimes the gland is quite normal & this should of itself prevent the thyroid from being considered the mainspring of the condition.

Myxedema

A peculiar condition in middle aged women has been noted by Dr. W. Gull & termed 'cretinoid' from its symptoms. Several cases were collected by Dr. Ham & he applied to them a new name, Myxedema. Dr. Jenner pointed out its resemblance to 'Cachexia Thurneriva,' as the latter condition was currently ascribed to the removal of the thyroid & Myxedema came to be put down as due to disease of that organ. The Clinical Society of London made a special investigation of the malady & confirmed the general notion which had prevailed as to its cause. Let us shortly examine the reasons which lead the Committee of the Clinical Society to this conclusion. First of all, they set forth the result of extirpation of the gland in animals; the value of these experiments I have already discussed. Next they pointed to the similarity between the disease & Kocher's Cachexia which they endeavoured to show was due to the extirpation of the thyroid, though I have already shown such a conclusion

Ref: Myxedema - Clinical Society of London 1888
is hardly warrantable. Finally they submitted their own investigations. They got particular of 109 cases of Myxoedema. Clinically speaking, the Thyroid was normal in 4, in 22 it was atrophied, in 44 hypertrophied & in one hand. In 23 cases the examination of the Thyroid did not give any definite information. In the other cases the condition of the organ was not investigated from William Fagg's reference & my own I should not be inclined to put much faith in these statistics as actually indicating the state of the Thyroid. However the Committee had something more tangible to fall back upon, viz 13 post-mortem examinations. It is said that the Thyroids in these 13 cases were similarly affected. There was a small confluent infiltration of the wall of the vessels followed by an epithelial proliferation within the vessels themselves. Considering the very many changes which the Thyroid experiences in people who apparently do not suffer from thyroid displacement, it is certainly curious that such a slight change should be followed by such terrible results. I have frequently seen infiltration of the vessel walls with leucocytes & very often noticed proliferation of the epithelial cells. Yet these people did not show any signs of Myxoedema. New & Pfullmen on the other hand examined the Thyroids in his cases of Myxoedema & they say not a word about cell

'New & Pfullmen, ' Myxoedema. American Medical Journal.'
infiltration or proliferation. What struck them was the
the degeneration of the glands, as evidenced by the increase
in quantity of the connective tissue & the diminished amount
of gland tissue. Such a condition however is not confined
to the glands in Myxoeoea, but may be seen in many
apparently healthy old people.

But experimental evidence is adduced to show the
causal relation of the Thyroid Gland to this disease.
The gland from an ox has been incorporated in the
affected person's tissues. This is merely the repetition in
man of the experiment of Schiff on the dog; but the
similarity is not absolute. Schiff placed the Thyroid
of one dog inside another dog, but it is the gland of an
ox that is selected for man. The removal of the Thyroid
does not seem to affect the ox much & how the useless organ
of that animal will benefit man it is not easy to see. One
might understand the method if a Human Thyroid were used!

However the method has been tried & like all new remedies
it has found favour with some who have loudly vowed its
merits. On the other hand it must not be forgotten that
Myxoeoea often improves spontaneously. Most of the
cases of Cachexia Strumiparae tabulated by Liddes are
said to have terminated by improvement. Again there
have been those who have tried the implantation &
found it to be absolutely without effect.
Another experimental proof of the Thyroid origin of Mypaesthesia, is that furnished by the injection of Thyroid juice into the tissue. Ewald found that such injections in some healthy dogs brought on a fatal crisis with symptoms not unlike those which follow extirpation of the organ.

In other dogs the injections had no effect. In the case of Mypaesthesia the juice has failed to make any improvement in some cases while in others it has worked wonders. These wonders may be explained in quite a similar manner to those consequent on the engrafting of the gland. Besides the effect of 'testicular juice' has not yet been tried in Mypaesthesia & it remains to be seen whether it will not yield even more astonishing results.

Mypaesthesia was ascribed to disease of the Thyroid (1) from analogy with other diseases (2) from the observation of some facts (3) the consideration of certain experiments, but none of these accounts can true as the designation as correct. The evidence in favor of the accepted view, is very small indeed, when scrutinized closely. Not only is it small in amount but it is not conclusive.

Thus we are forced to conclude that there is not sufficient evidence to support the idea that the degeneration of the thyroid is the cause of Mypaesthesia.
On page 68 it was pointed out that the Thyroid was an important organ, for two reasons:

1. Because it is dangerous to remove it.
2. Because serious maladies follow disease of it.

In the last 20 pages we have discussed these reasons and we must conclude that neither have any basis of fact. Extirpation is fatal in certain animals but there is every reason to believe that the mortality is due merely to the operation itself to the loss of the gland. Extirpation has no particular after effects in man though Eberlein Thymiflux has been erroneously attributed to it. There is no reason to believe that a lesion of the Thyroid causes, Accouchement, Eclampsia, Scurvy Disease, Asthenia or Hypothyreosis.

Such are the results of our investigations. The popular view of the subject has arisen by drawing generalizations from isolated facts, instances, by accepting hypotheses as truths and by overlooking undeniable facts.

The Thyroid therefore would appear to be of no special use in the animal economy.

Of course I am now speaking of the Adult; in all probability the gland discharges in the foetus, functions similar to those of the Thyroid.

Why does the Thyroid not disappear in a similar manner to the Thyroidus? This I believe is due to
its peculiar relation to the vascular system. It has been pointed out that its arteries arise just beyond those going to the brain. That is to say they arise almost from the fountain head. Owing to its fine capillary network the Thyroid can hold a large quantity of blood. Its tissue is strong & the injection of its lymphatics makes the organ swell up considerably. Thus the Thyroid comes to be almost an erectile organ. Any increase in the blood pressure, causes it to fill up with blood. The presence of the blood naturally prevents to some extent the degeneration of the gland. The frequent presence of excess of blood will tend to cause proliferation of the tissues & by persistently. This is probably the reason of the foetid in Graves disease, where there would seem to be a vasomotor paralysis of the vessels of the Thyroid. But apart from such paralysis, the long-continued presence of excess of blood in the cases of increased blood pressure, will bring about a similar result. We know that at puberty there is a rise in the blood pressure, this in the case of Chlorosis is very rare being probably due as Vachows has pointed to a congenital deficiency in the vessels which do not grow in proportion to the blood or to the needs of the tissues. This may easily explain the frequency of foetid at puberty & in Chlorosis. The high blood pressure in Pregnancy & Parturition will also serve to explain the enlargement of the Thyroid which is often associated with
The presence of goitre in deep valleys, where climbing with heavy burdens on their backs is a necessity, to the inhabitants, may well be initiated or augmented by the increased blood pressure their daily duties entail. The occurrence of goitre suddenly in large numbers of soldiers, who were armed, taxed by forced marches & whose necks were lightly encircled by a leather band, could be easily explained on such grounds. I may mention also the instance of Goethe among the lace makers of Hanover who had to hold their heads in a peculiar constrained position at their work. The cases quoted by Virchow in his School Hygiene where scholars who were working hard got enlarged thyroids as also did some officers who were engaged for many days continuously making drawings. The swelling of the thyroid left the officers after a short rest, & the school boys came back from their vacation without normal thyroids, owing to trade competition. Lace making was given over at Hanover & the goitre which had up till then been prevalent disappeared.

Such are a few instances where the relation of the Thyroid & the Vascular System was very apparent. I do not go the length of saying that this is the cause of Endemic Goitre. I am not sufficiently well informed to decide on that point but that goitre is often initiated or augmented in this way, I consider, is quite proved & that in certain cases this
The sole cause of the Enlarged Thyroid, is no less certain.

All this however is by the way. It is merely an explanation of the circumstance that the Thyroid does not atrophy like the Thymus, for I am firmly convinced that the Thyroid Gland of Man has absolutely no functions to perform, & beyond the mechanical office of diluting with blood it has no duty to perform.

In conclusion I would refer to the Histology of the Thyroid as very strongly supporting my opinion.

End. 

A. Y.