

**On the structure of the sudoriparous glands / by G. Rainey ; with  
delineations of these organs from microscopic preparations, by T.S. Ralph.**

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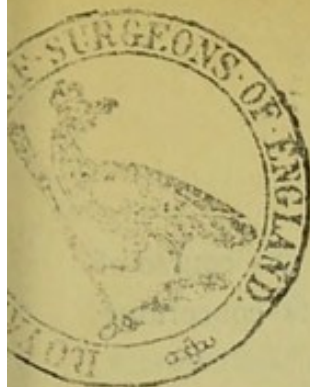
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PRESENTED-BY

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ON THE  
STRUCTURE  
OF THE  
SUDORIPAROUS GLANDS,

By G. RAINEY,

DEMONSTRATOR OF ANATOMY, ST. THOMAS'S HOSPITAL:

WITH DELINEATIONS OF THESE ORGANS FROM

MICROSCOPIC PREPARATIONS,

By T. S. RALPH, M.R.C.S.E. &c.

*c*

THE Sudoriparous Glands are among the more recent discoveries of minute Anatomy; they were first noticed by Breschet, and have since been described by Gurlt, Mandl, Wagner, and others, who have given drawings of these parts. Fig. 1, is a view of a Sweat Gland, copied from Wagner, which has been frequently represented in systematic works on Anatomy in this country.

Having myself examined these organs with considerable care, but without being able to verify the facts as portrayed in the drawings and descriptions of these Authors, I have been induced to publish the result of my own observations, accompanied with drawings, as well as with microscopic preparations of the parts; so that those who are desirous of examining the facts, may be enabled to judge for themselves.



Before describing the Sudoriparous Glands, and the course of their ducts, it will be necessary to notice a few facts concerning the structure of the skin.

The skin consists of two perfectly distinct structures—the Cutis, or Dermis; and the Cuticle, or Epidermis. The surface of the former, especially in the palmar and plantar regions, presents numerous rows of conical papillæ, separated by corresponding grooves. Each papilla is composed of a vascular loop of greater or less complexity, contained in a conical process of thin, but strong basement membrane. The latter, or Epidermis, comprises all that portion of the integument which is superficial to the basement membrane of the papillæ: it may be divided into two layers, a deep, and a superficial one: the former answering to the *rete mucosum*, and the latter to the *cuticle* of former Authors. The deep layer rests upon the basement membrane, and fills up, in a great measure the grooves between the papillæ; superiorly it extends a little beyond the level of the apices of the papillæ, where it is often distinguished from the superficial layer by the appearance of a dark undulating border. This deep layer of the Epidermis is made up entirely of nucleated cells in different stages of development: those lying in contact with the basement membrane are very small and crowded together, being probably only cell nuclei; whilst those more remote from it are approaching the condition of epidermic scales.

The superficial layer of the Epidermis extends from the undulating border above mentioned, to the surface, where it is in a state of desquamation, and is made up entirely of scales, or degenerated epidermic cells, which have lost their nuclei and become flattened. These scales are placed with their broadest sides parallel with the surface of the body.

The fact of the nucleated cells being confined to one part of the cuticle, and the scales to another, is contrary to the opinion generally entertained by physiologists; namely, that the epidermic cells are gradually and progressively changed into scales, in proportion as they recede from the basement membrane, and approach the surface of the body.



A Sudoriparous Gland consists of a minute tube coiled up in a globular form, situated in the subcutaneous areolar tissue, and surrounded by a mass of fat; as represented in fig. 2, *g.g.* One extremity of this tube is closed, whilst the other which is accounted as its duct, after leaving the gland, passes in a course more or less flexuous to the surface of the true skin, where it terminates in a papillary groove, *d.* This portion of the apparatus will, for distinction and brevity sake, be always called the *dermic* part of the duct, fig. 2 *p.* \*

The membrane composing this duct is thin and transparent, and of considerable strength; and becomes gradually dilated at its upper part, and terminates by becoming continuous with the basement membrane covering the adjacent papillæ, fig. 2, and is not continued through the cuticle to the surface, as represented in fig. 1.

The duct is lined with epithelium, which appears to have no regular form below, being merely finely granular, but which becomes more distinct at its upper part, where it is continuous with the deep layer of the Epidermis; namely, that lying upon the basement membrane.

These lowest cells possess a greater degree of coherence than those which are situated above them; so that when the Epidermis is separated from the Cutis after maceration, they come away with the cuticle in a tubular form, being in fact the lining of the duct, leaving the basement membrane of the papillæ and the membranous part of the duct in the areolar tissue.

That part of the duct which traverses the Epidermis, and which may be called for distinction, the *epidermic* portion, is altogether of a different structure to the one just described, not having like it,

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\* It might not have been objectionable to distinguish the portion of the duct which is situated within and below the dermis, by the name of *Sudoriparous*, as it probably has the same office as the gland, namely, that of secretion; and that portion of the apparatus situated in the Epidermis as the *Sudoriferous* part, being in fact the true excretory portion.



membranous parietes, but being merely a spiral passage between epidermic cells and scales.

In the scaly or superficial layer of the Cuticle, the passage is made up entirely of epidermic scales, placed with their flat sides parallel with the axis of the tube which they compose: while in the corpuscular or deep layer of the Epidermis, the passage is situated between scales above, and cells below, which cells being less and less perfect as they are situated nearer the basement membrane, render the parietes of the duct at its origin between the papillæ very indistinct; this part of the duct being merely a passage through a confused stratum of cell-nuclei and blastema, and gradually contracting in diameter as it approaches the dermic portion, insensibly disappears, hence its inferior extremity cannot be clearly defined by the microscope.

The delineations of the Sudoriferous ducts are in this respect altogether incorrect, see fig. 1; their parietes being always represented as passing continuously from the Dermis into the Epidermis, and the tube in this part as having an equal diameter; whilst it is impossible that any such continuity of these parietes can exist here, in consequence of the lowest part of the *epidermic* and the upper portion of the *dermic* part of the duct, being both conical, and the one cone being situated above the other, fig. 2, *d*.

It has also been stated that the Sudoriferous ducts take a straight course between the cutaneous papillæ. This is both an anatomical and a physiological error; since it can be easily seen by examining the preparations from which the accompanying drawings were taken, that in this situation they are very much curved or twisted, and that it is in this part of their course, and this alone, they acquire their spiral form, as will be hereafter noticed. This error I can easily imagine to have originated by mistaking the capillary vessels emptied of their blood in the papillæ nearest to the indistinct part of the duct, for the duct itself: a mistake at all times likely to occur, but more especially if there existed in the mind of the observer the idea of continuity of the parietes of these ducts, represented in the plates of Breschet, Gurlt, &c.



As the cause of the spiral course of the Sudoriferous ducts cannot be referred to any changes taking place in the dermic portions, which differ so materially in form and structure, it must therefore be attributed to the changes which are constantly going on in the *cells* composing the Epidermis: and, that of the two layers, which compose the Epidermis, it can only be produced in the deep or corpuscular one; as it is in this layer only, the cells undergo any material alteration, either in form or structure. The lowest part of the *epidermic* portion of the passage being situated in a confused mass of cell-nuclei and blastema; the part above this, lying between cells just being developed from their nuclei and afterwards advancing to a state of maturity; and the part of the passage still higher, being between cells which have been protruded to a great distance from the basement membrane, and which have become flattened and converted into scales, it follows that the passage in these several parts must acquire a different form and dimension. Now, as the flattening of the cells takes place in a direction parallel with the axis of the passage, its diameter between the scales must consequently be greater than that between the cells; and hence its conical form between the papillæ. Besides the form of the inter-papillary space, and the more crowded state of the cells at its lower, than at its upper part, may also contribute something towards the infundibular form of the passage in this situation. These changes, namely, the progressive developement of cells from their nuclei, and their subsequent conversion into scales, cannot fail to render this part of the Epidermis of variable thickness, and thus throw this portion of the passage into a zig-zag or spiral course. After the *epidermic* portion of the duct has reached the commencement of the scaly layer of the Epidermis, it undergoes no further change; the scales bounding it never altering, either in their structure, form, or relative position, during their passage from the deep layer of the Epidermis to the surface of the skin.

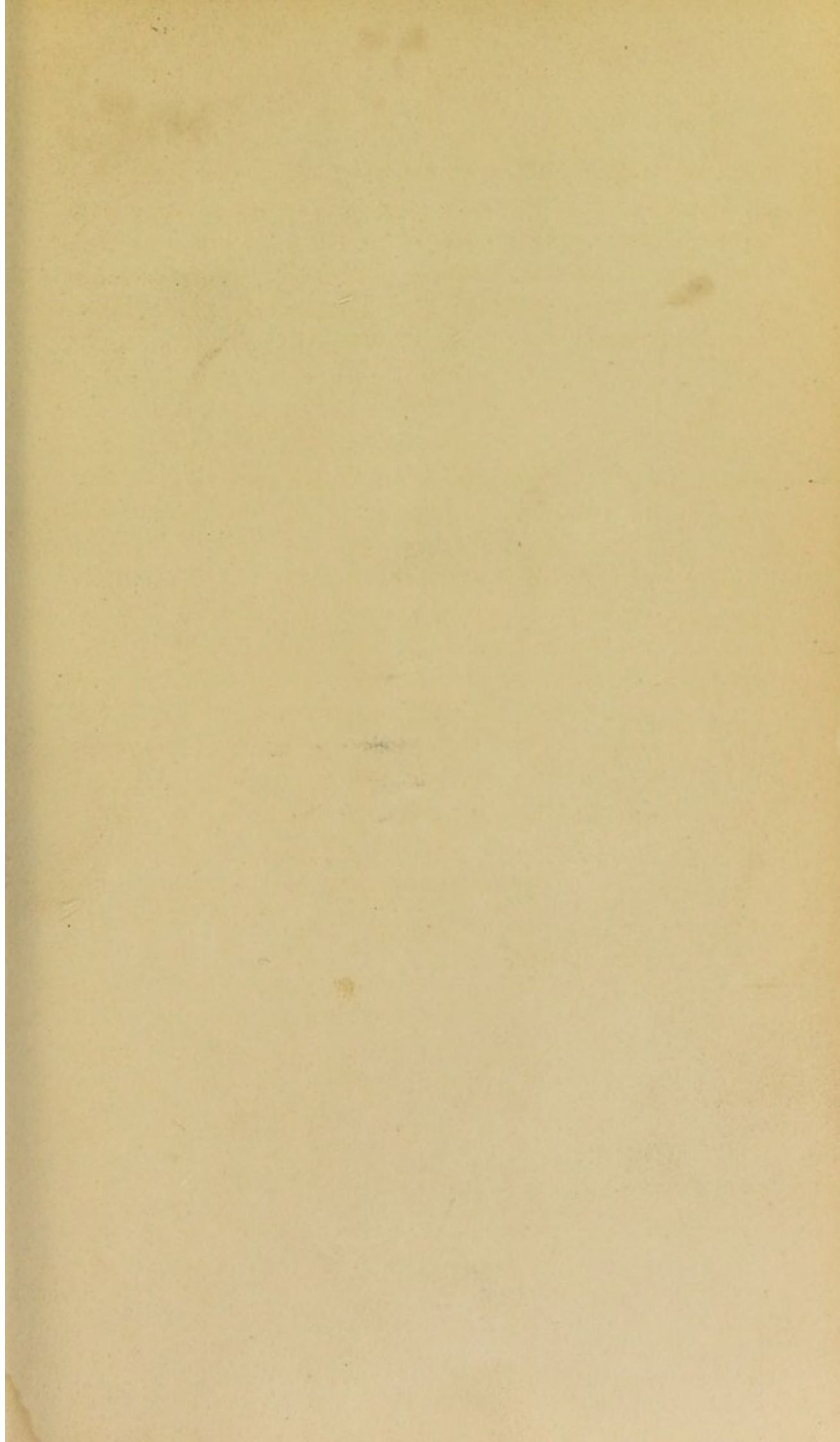
This explanation will doubtless appear to the pure physiologist too mechanical, and independent of those changes which are termed vital. I am not so anxious to explain this, or any other phenomenon



upon mere mechanical principles, as not to admit that vitality has an important part to play in it; but as all organized bodies are a species of philosophical machinery, and in some respect or other always in part physical, it follows that mechanical considerations must not be altogether discarded as a necessary element in physiological reasonings.

G. R.

*October 1849.*





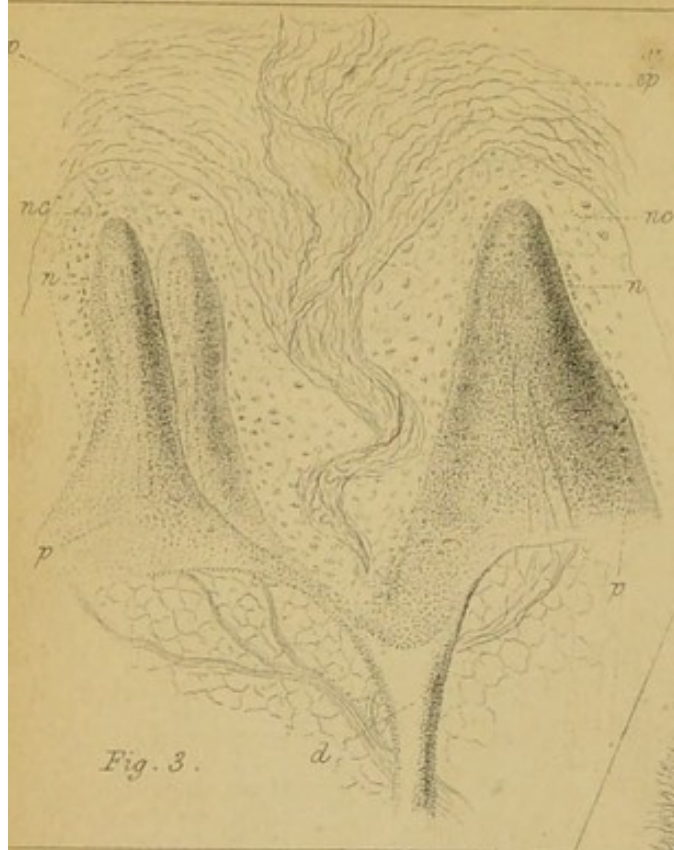
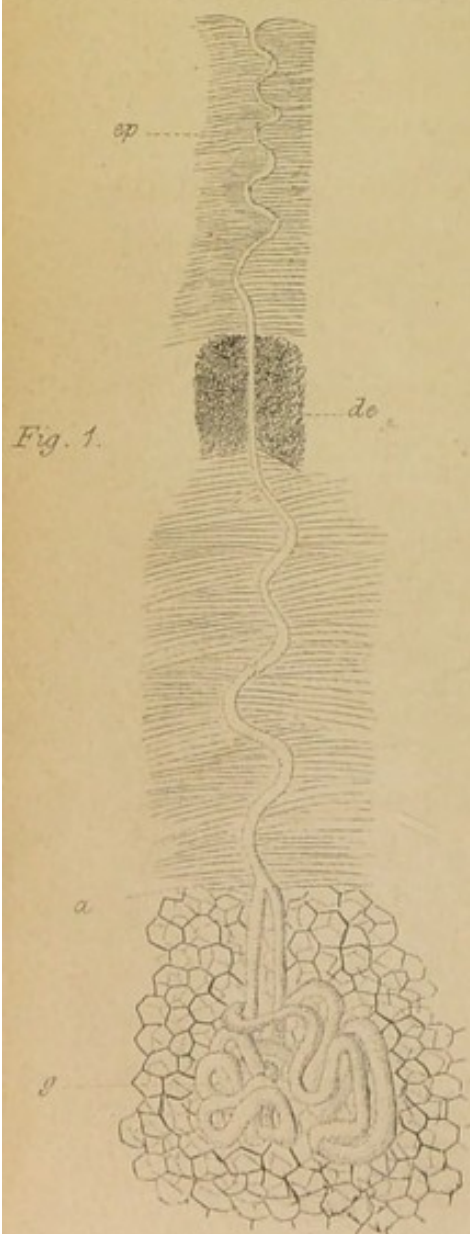
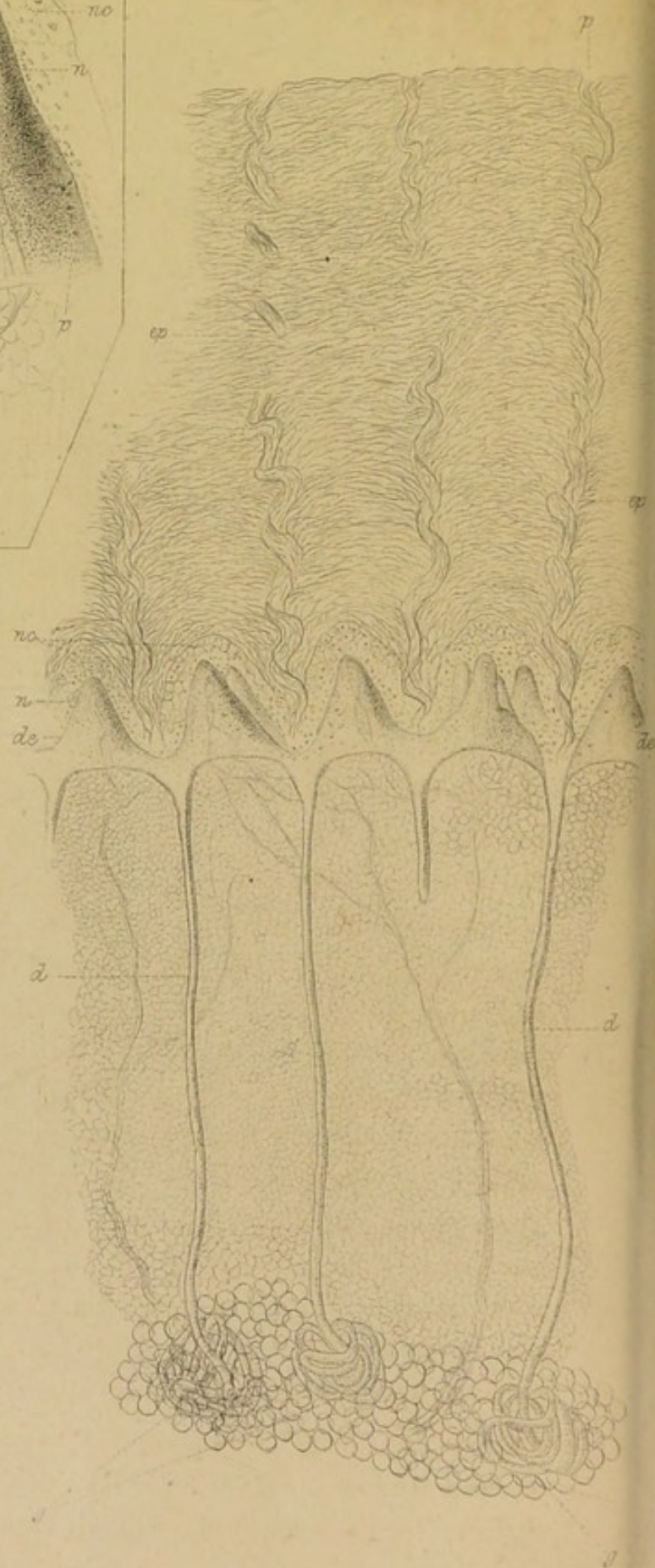


Fig. 2.





## DESCRIPTION OF THE PLATE.

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Fig. 1. a Sudoriparous Gland taken from Wagner's *Icones Physiologicæ*: *g.* the gland composed of contorted tubes surrounded by fat vescicles, the tubes uniting at *a.* and forming a duct which pierces the Dermis at *de.* and then taking a spiral course through the Epidermis, *ep.* opens on its surface. This figure gives the idea of continuity of the parietes of a Sudoriferous duct from the gland to its termination on the surface of the cuticle.

Fig. 2. represents a magnified view of a vertical section of the skin under a power of seventy or eighty diameters: *g.g.* Sudoriparous Glands embedded in fat vesicles; *d.* the ducts of the same passing in a flexuous course through the areolar tissue to *de.* the dermic portion of the skin; two of these ducts are represented cut across. On the right, a duct is represented cut open at its upper part, and its parietes are seen to be continuous with the basement membrane of the papillæ which bound it on each side, assuming as it approaches them an infundibular form. Between the same two papillæ may be seen the lowest portion of the *epidermic* part of a duct, at first very indistinctly, and without any defined continuity of structure with the duct below—gradually assuming a spiral form, and having the scales of which its walls are composed, arranged parallel with the axis of the passage. The other ducts are seen dipping down between and behind the papillæ; at *n.* may be seen the nuclei on the basement membrane of the papillæ, which at *nc.* are developed into a layer of nucleated cells forming the lower stratum of the Epidermis, *ep.* through which one complete Sudoriferous passage *p.* may be seen passing to the surface, together with portions of others. The spaces between



these passages have been cut away in the preparation, by which the direction of the scales of the Epidermis not in the vicinity of a passage are seen to be horizontal, but variously inclined where situated in its vicinity.

Fig. 3. is a magnified view (two hundred and twenty diameters) of the dermic part: *d.* the *dermic* portion of a duct cut open at its upper part, also with the basement membrane of the papillæ on each side continuous with it; *p.* the *epidermic* portion of the duct between the papillæ, exhibiting a scaly structure almost at its commencement; *n.* nuclei on the basement membrane, at *nc.* developed into nucleated cells, and forming together the lower part of the Epidermis; above which at *ep.* may be seen the commencement of the scaly layer of the Epidermis; *p.* three papillæ with a vascular loop in each.

T. S. R.

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\* \* *Microscopic preparations illustrative of the Sudoriparous Glands may be had of Mr. HETT, M. R. C. S. E. of 24, Bridge Street, Southwark.*