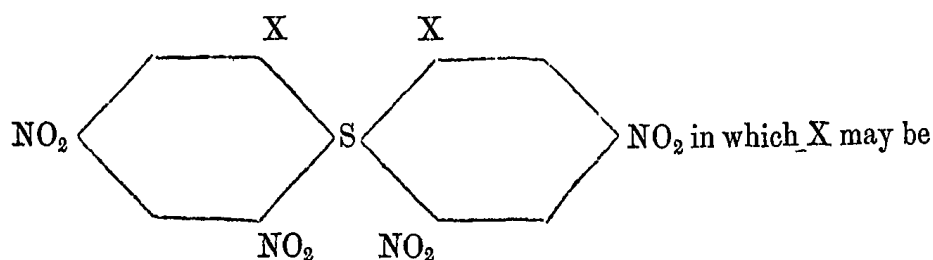


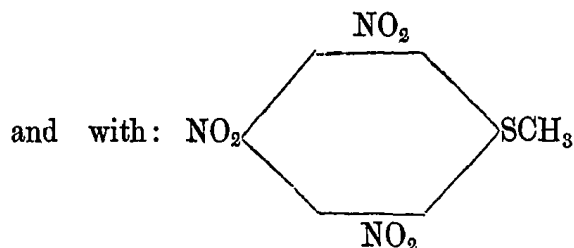
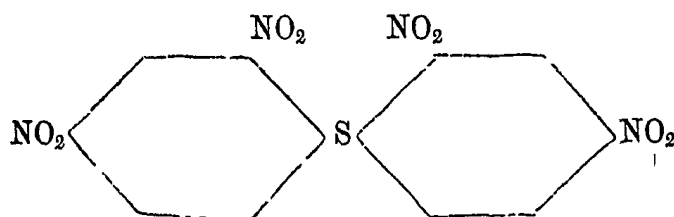
Citation:

G. van Rijnberk, On function and structure of the trunkdermatoma, in:
KNAW, Proceedings, 4, 1901-1902, Amsterdam, 1902, pp. 266-274

Formation of sulphone does therefore not occur with:



NO_2 , CN or CH_3 ; it takes place however, with:



The influence of other atoms and atomic groups such as Cl , Br , COOH and also of three ortho-placed groups will be further investigated.

Amsterdam, Nov. 1901.

Org. Chem. Lab. Univ.

Physiology. — *“On function and structure of the trunkdermatoma.”*

By Prof. C. WINKLER from researches made in connection with Dr. G. VAN RIJNBEEK.

The basis on which is founded the actual physiological knowledge of the innervation of the skin by the posterior roots, through which we are taught in what manner the area's of those roots are ranged on trunk and extremities, is to be sought in most ingeniously conceived and eminently well-executed vivisections, made by LUDWIG

TÜRCK ¹⁾ in 1856 on dogs, and by SHERRINGTON ²⁾ from 1893—1900 on monkeys.

Careful dissections of the nerves of man and monkey, have led BOLK ³⁾ to represent a schema of the arrangement of the area's of the posterior roots — the dermatomata — which, arrived at by anatomical proceedings, offers great analogies with the results of the above-mentioned physiological researches.

Clinical experience too, registering methodically the sensory troubles, found in individuals with organical lesions of the posterior roots, set up a topography of the dermatomata, (by the researches of ROSS ⁴⁾, ALLEN STARR ⁵⁾, THORBURN ⁶⁾, KOCHER ⁷⁾, HEAD ⁸⁾, WICHMANN ⁹⁾), agreeing well enough with the representations of TURCK, SHERRINGTON and BOLK.

All these researches consider the dermatomata as unities and agree to a certain degree with one another as to the way in which they are ranged on trunk and extremities, but they hardly teach us anything about the constitution of that unity itself or about the manner of its functioning.

And yet the supposition that the posterior root represents in itself a unity, is by no means proved beforehand, because it is composed of different bundles (in the animals we experimented upon, from

¹⁾ C. WEDL. Ueber die Haut-Sensibilitäts Bezirke der einzelnen Rückenmarkspaare von weilen Prof. Dr. L. TÜRCK. Aus dessen litterarischer Nachlassen zusammengestellt. Denkschriften der Wiener Akademie 1869. Vol. 29. S. 299.

²⁾ CHARLES S. SHERRINGTON Experiments in examination of the peripheral distribution of the fibres of posterior roots of some spinal nerves. Phil. Trans. R. S. 1893. B. Vol. 184.

CHARLES S. SHERRINGTON. Experiments in examination of the peripheral distribution of the fibres of the posterior roots of some spinal nerves. Part. II. Phil. Trans. R. S. 1898. B. Vol. 190. p. 45.

³⁾ LOUIS BOLK. Een en ander uit de segmentaal-anatomie van het menschelyk lichaam Ned. Tydschr. voor geneesk. 1897. 12 Juni en 4 Sept. I. pag. 982. II. p. 365, voortis LOUIS BOLK in Morph. Jahrb. XXII, XXIII, XXV, XXVI, XXVII, XXVIII.

⁴⁾ JAMES ROSS Distribution of anaesthesia in cases of disease of the branches and of the roots of the brachial plexus Brain. Vol. 7. 1885. p. 66.

⁵⁾ ALLEN STARR. The surgery of the spinal Cord. 1889.
ALLEN STARR. Local anaesthesia as a guide in the diagnosis of lesions of the upper portion of the spinal cord. Brain Vol. 17. 1894. p. 483.

⁶⁾ WILLIAM THORBURN. On injuries of the cauda equina Brain Vol. 10. 1888. p. 381.

⁷⁾ KOCHER. Grenzgebiete der Medicin.

⁸⁾ HENRY HEAD. On disturbances of sensation with especial reference to the pain of visceral disease. Brain. 1893. Pt. I and II. p. 1 etc.

⁹⁾ R. WICHMANN. Die Rückenmarks-Neiven und ihre Segmentbezüge. Wiesbaden.

4—7) and the question arises whether the root-bundles, whose common area of innervation is the dermatoma, do not possess as just a claim to be called unities. At any rate we desire to know how each root-bundle separately behaves itself in reference to the whole of the dermatoma, the more so now one of us¹⁾ has demonstrated that clinical experience demands a still further analysis of the dermatomata. The question whether a separate area of innervation within the dermatoma ought to be attributed to each root-bundle, and if so, whether these areas of root-bundles ought to be ranged therein cranio-caudally or dorso-ventrally, has to be solved experimentally.

For this reason there have been made in the laboratory for neurology at Amsterdam, a great number of experiments on dogs, in view of solving this question for the trunk-dermatomata of that species.

First of all we must observe that the form of the trunk-dermatoma, as it has been deduced from the experiments of TÜRK and SHERRINGTON, and from the dissections of BOLK ought to remind one of a trapezium stretched longitudinally. Because the dorsal part of the trunk from the 1st to the 12th vertebra of the chest, is much shorter than that part of the trunk situated ventrally between manubrium sterni and symphysis pubis, the base of the trapezium lying adjacent to the mid-ventral-line must be stretched and thus made longer than the side lying adjacent to the mid-dorsal-line.

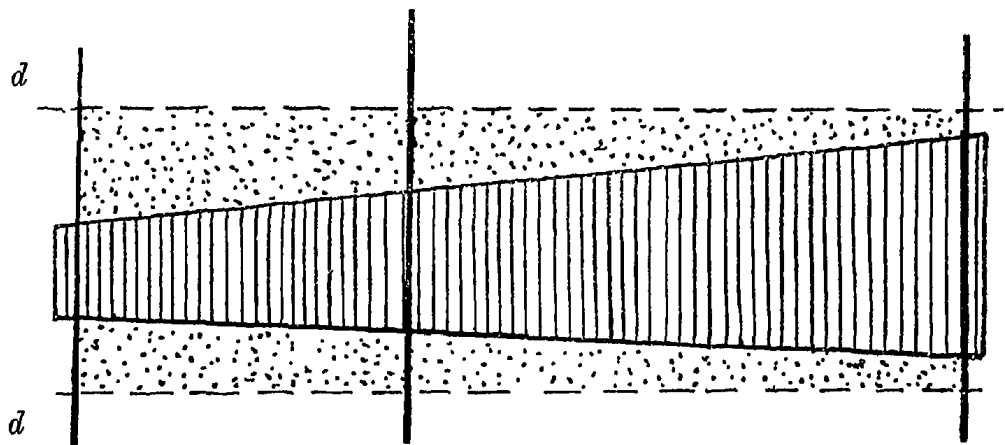


fig. 1.

Ideal form of the (arched) dermatoma, between two (dotted) insensible areas²⁾.

¹⁾ C. WINKLER. Feestbundel Dr. SAPE TALMA aangeboden. Klinische bijdragen tot de kennis der wortelinnervatie van de huid.

²⁾ In all these figures arbitrary demarcation-lines have been traced, limiting the sensible area above and below. The exact situation of these demarcations will occupy us further on.

Supposing the animal to be cut open along the mid-ventral-line and the skin from the right half of the body bent to a level, in such a manner that the mid-ventral line is situated to the right, then the form of the ideal dermatoma isolated by SHERRINGTON may be represented in the manner indicated by fig. 1.

What exceeds the mid-dorsal (*d*) and mid ventral (*v*) lines then signifies SHERRINGTON's crossed overlaps. This ideal form however is never to be met with in dogs, when a trunk-dermatoma is isolated in the manner indicated by SHERRINGTON, by cutting through two or more roots above and beneath the root which is left intact.

The results obtained in this way were not always the same. What follows here gives an account of them.

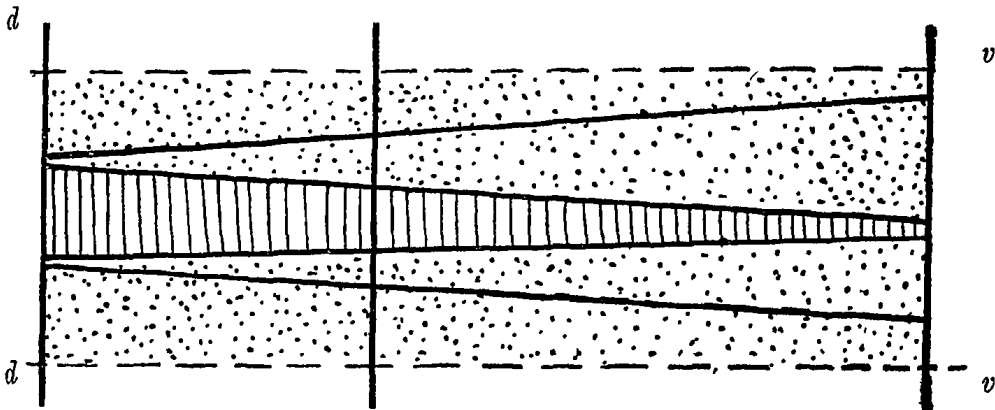


fig. 2.

The isolated sensible (arched) between two insensible (dotted) area's showing an important narrowing of the ideal dermatoma-area.

1. Between two insensible area's, there may continue to exist a sensible area, broadest towards the mid-dorsal-line and narrowest at the mid-ventral-line and therefore much smaller than the ideal dermatoma-area, and different in form. (fig. 2).

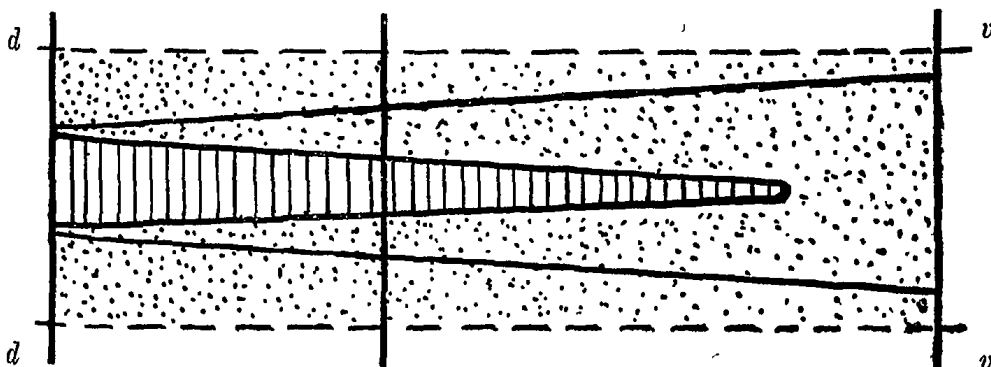


fig. 3.

Further narrowing of the sensible dermatoma-area.

2. Or the sensible area situated between two insensible area's may take the shape of a stretched triangle, whose base is lying adjacent to the mid-dorsal-line and whose top does not reach the mid-ventral-line (fig. 3).

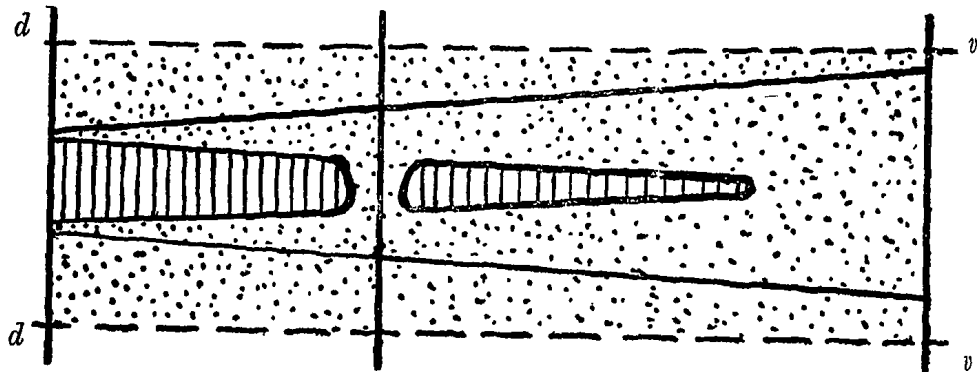


fig. 4

Narrowing of the sensible dermatoma-area with transversal division into a dorsal and a ventral piece of the dermatoma.

3. Or the sensible area situated between two insensible area's not only does not reach the mid-ventral-line, but forms even no longer an uninterrupted area.

It is divided into two parts by a transversal insensible zone. The isolated ventral piece of dermatoma may in this way have become either greater or smaller (fig. 4).

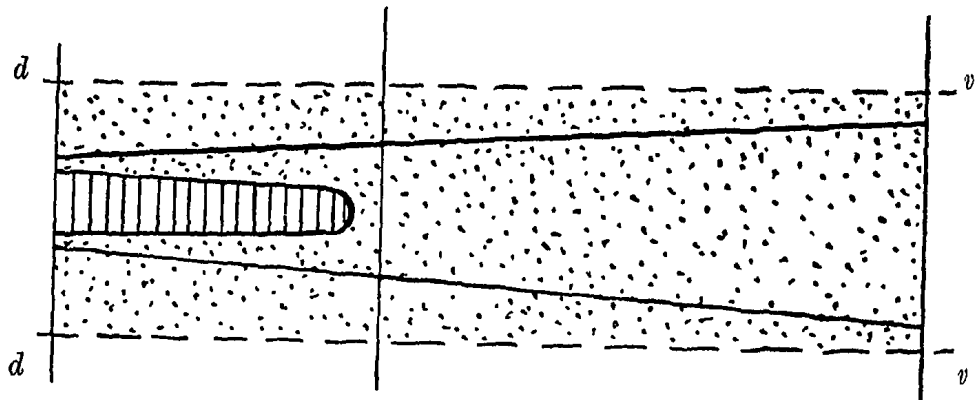


fig. 5.

Dorsal piece of the dermatoma.

4. Or the sensible area situated between two insensible zones, above and beneath it, is found only next to the mid-dorsal-line in the form of a short triangle. Of a ventral piece of dermatoma there is no longer any trace to be found. (fig. 5).

5. Lastly it may sometimes be stated, that only next to the mid-dorsal-line some remnant of sensation is left, localised in single spots as indicated by fig. 6, surrounded by a broad insensible area.

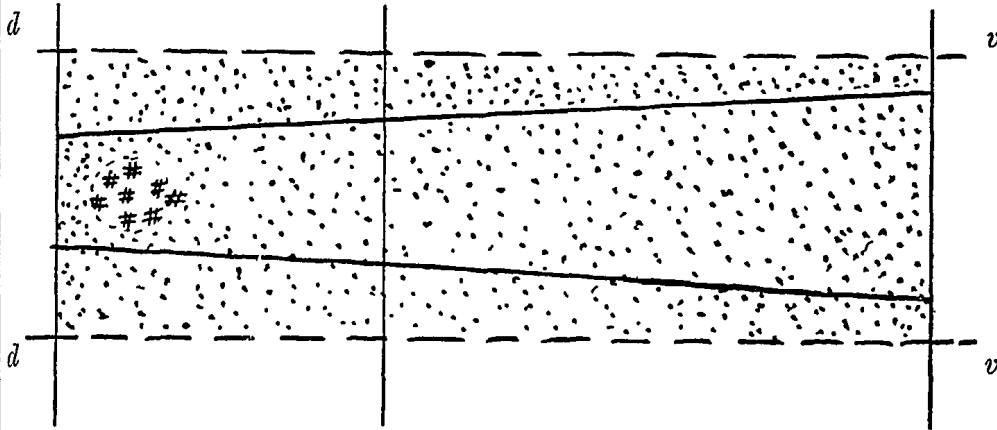


fig. 6.

The part of the dermatoma retaining sensation longest.

As soon as in the posterior root of the dermatoma, isolated in the manner indicated before, one or more bundles are cut through, results are obtained similar to those mentioned above and represented in fig. 2, 3, 4, 5 and 6.

The narrowings of the dermatoma-area's to triangular zones with or without transversal division, are also found, if any bundles of the intact root are sectioned, it making no difference whether caudal or cranial bundles of that root have been cut through. It must however be understood, that in proportion as greater experimental ability is acquired in isolating the trunk-dermatomata, a simple isolation will in most cases offer the sensible dermatoma-area described sub. 1 (fig. 2), whilst the cutting through of bundles in the posterior root of this dermatoma generally will present one of the area's described sub 3—5.

It may thus be rightly supposed that the more or less important narrowings, or even shortenings with transversal division of the dermatomal area's, often to be found after simply isolating the dermatoma must be accounted for by unintentional lesions of the root left intact or of the medulla (profuse hemorrhage, pressure of coagulated blood etc.). There exists only a difference in degree with the results obtained by the intentional lesion, effected by partly cutting through the root-bundles.

One single spot of the dermatoma, lying adjacent to the mid-dorsal-line, preserves sensation longest, in whatever way the operation may be made.

This spot justly deserves to be called the "ultimum moriens" of the dermatoma.

These facts may induce us firstly to distinguish in the dermatoma between a central area, having the form of a knotted triangle the base of which is lying adjacent to the mid-dorsal-line and the narrow side directed towards the mid-ventral-line, and the remainder of the dermatoma, extending on both sides (cranio-caudally) of the first area, and which may be called the marginal area. The latter may be represented by two triangles, whose bases are lying next to the mid-ventral-line, and whose tops next to the mid-dorsal-line, whilst the central area is enclosed between them (fig. 7).

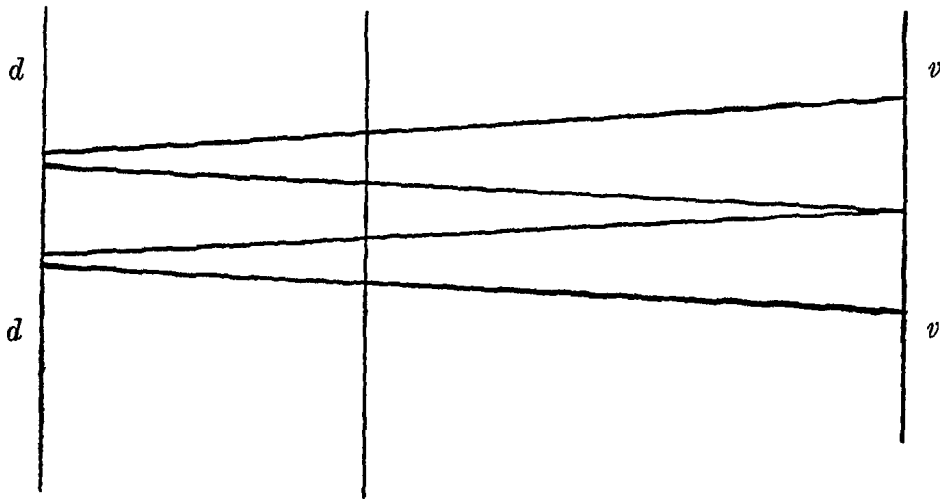


Fig. 7.

This distinction is necessary. The central area, as it is clearly demonstrated in favourable cases by the isolation of the dermatoma, is by itself sufficient for sensation, without assistance from the surrounding dermatomata. The marginal area by itself is insufficient for sensation. It can only be made sensible by means of the central or marginal area's of neighbouring dermatomata, by which it may be overlapped.

Evidently the marginal area is not to be identified with SHERRINGTON's antero-posterior overlaps; for the central area's too overlap one another partly. Still there may be found in SHERRINGTON's researches an indication pointing towards the schema demonstrated here: where he states that the periphery of the dermatomata often possesses only a very imperfect sensation, and sensation diminishes rapidly from the centrum to the periphery.

The marginal area possesses too great a threshold-value to preserve any perceptible sensation when isolated. Because this part does not possess any sensation, as long as it is functioning separately (without assistance from neighbouring central or marginal area's) it cannot be demonstrated by isolation.

Secondly, the transversal division that may be observed and the manner in which the dorsal piece of dermatoma presents itself as "ultimum moriens", compels us to accept for the central area at least two maxima of sensation, one situated next to the mid-dorsal line, the other next to a lateral line of demarcation. If therefore the intensity of sensation is expressed in ordinates, that will rise higher, in proportion as sensation is longer preserved, on abscisses, taken on axes parallel to the mid dorsal and the mid-ventral lines, then those thus formed curves situated to the left (*a*, figure 8) represent the sensation in the central- and marginal area's. If taking the axisline of the central area for absciss, the intensity of sensation is put thereon as ordinate, then the two-topped curve *b*, will represent the sensation in this axisline. Both groups of lines then represent a schema of the distribution of sensation in the dermatoma.

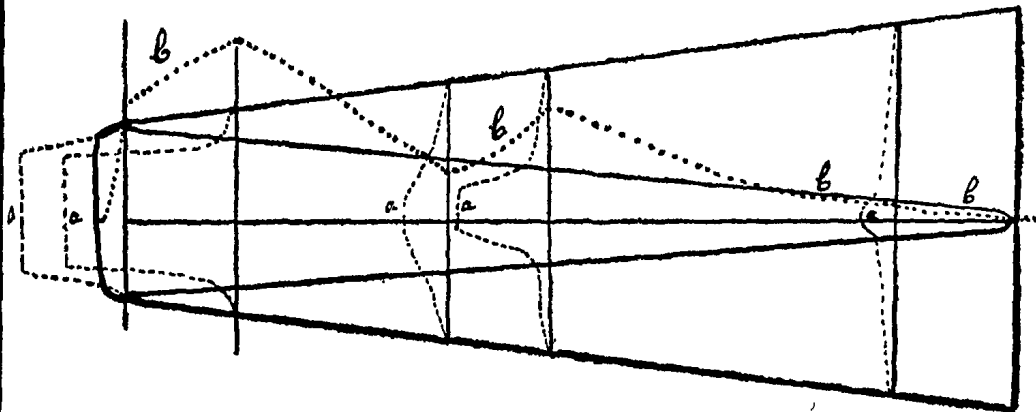


Fig. 8.

This unequal distribution of sensation in the dermatoma is the more remarkable, because already VOIGT believed to have demonstrated by means of anatomical proceedings a lateral minimum of innervation.

Finally we are bound to conclude that every bundle of roots exerts an influence on the whole central area, as this area can preserve sensation over its whole extension, it making no difference whether root-bundles situated cranially or caudally have been sectioned. That in reality every bundle of roots exerts its influence on *the*

whole of the dermatoma, will be made clear by the two following experiments.

Experiment of September 22th on a brown male dog. The medulla is laid bare, and the dura mater opened. The originating bundles of the 19th, 20th, 21th and 22th posterior roots then were distinctly visible. On both sides a few caudally situated bundles of each of these roots are cut through, whilst the bundles situated cranially are left intact.

The next day there is found on abdomen and back a not very strictly defined hyperalgetic area, corresponding to the extension-area's of the four partly injured roots. Nowhere however, analgesia can be found.

As counterpart to this experiment, another is made Oct. 22th on a white female dog. The cranial bundles of four posterior roots (the 17th, 18th, 19th and 20th) are cut through, whilst the caudal ones remain intact.

The result on the next day is again a hyperalgetic area, now perfectly well defined, roundabout the trunk, with strong hyper-reflectory reaction, nowhere however in that area analgesia can be pointed out.

A few bundles only, may they be caudal or cranial (provided the normal conditions of overlapping of the dermatomata do exist), are sufficient for the innervation of the whole dermatoma, and make sensation possible everywhere. If they are cut through in an isolated dermatoma, then sometimes the whole central area may appear, but in most cases those narrowings, resp. transversally divided shortenings of that central area, represented in fig. 3, 4, 5 and 6. It must be understood withal that as long as one bundle remains intact, at least in that part of the dermatoma lying adjacent to the back, sensation is preserved.

Astronomy. — *“Contributions to the determination of geographical positions on the West-coast of Africa.”* By C. SANDERS.
(Communicated by Dr. E. F. VAN DE SANDE BAKHUYZEN).

I. *The instruments used. Determinations of the corrections and the rates of the chronometer.*

The hope expressed in my paper, read at the meeting of the Academy of January 1900, of soon having at my disposal a small universal instrument, by means of which a much higher degree of accuracy