4. The bodies do not contain the chromogen which is always present in suprarenal medulla.

5. The lymphoid "head-kidney" presents none of the features, anatomical or histological, which would lead one to conclude it had anything to do with the suprarenal gland: moreover, extracts prepared from it have no physiological action, and contain no chromogen.

6. Other portions of the kidney give the same negative results.

7. No other gland or tissue which might be suprarenal medulla is revealed by the most careful dissection.

From these observations we are forced to the conclusion that the medullary portion of the suprarenal capsules is non-existent in Teleostean fishes.*

"The Effects of Extirpation of the Suprarenal Bodies of the Eel (*Anguilla anguilla*)." By SWALE VINCENT, M.B. (Lond.), British Medical Association Research Scholar. Communicated by Professor E. A. SCHÄFER, F.R.S. Received February 3,—Read February 10, 1898.

(From the Physiological Laboratory, University College, London.)

Since an extract obtained from the suprarenal bodies of Teleostean fishes produces no rise of blood-pressure when injected into the blood-vessels of a living mammal,† and since the extract produces no physiological effects when injected subcutaneously,‡ and, moreover, contains no chromogen, it§ seems clear that these bodies contain nothing corresponding to the medulla of the suprarenal capsules of the higher vertebrata.§ These results entirely corroborated the opinion previously entertained from morphological and histological considerations, that the suprarenal gland of Teleostean fishes consists entirely of cortex.‖

Now all we know about the functions of the suprarenal capsules is confined to the medulla,¶ and although the cortex bears every appear-

* There may of course be some gland or tissue somewhere in the body which pours into the blood-stream a substance having the same physiological action as that which can be extracted from mammalian medulla, but unless this were a definite gland, and possessed a recognisable histological structure, we could not reasonably call it suprarenal medulla.

† Swale Vincent, 'Roy. Soc. Proc.,' vol. 61, p. 68.

‡ Swale Vincent, 'Roy. Soc. Proc.,' vol. 62, p. 177.

§ B. Moore and Swale Vincent, 'Roy. Soc. Proc.,' vol. 62, p. 280.

‖ Swale Vincent, 'Anat. Anz.,' vol. 14, No. 5, 1897, p. 152; see also ‡.

¶ Oliver and Schäfer, 'Journ. of Physiol.,' vol. 18, No. 3, 1895, p. 269; Swale Vincent, 'Journ of Physiol.,' vol. 22 (Nos. 1 and 2), Sept. 1, 1897, p. 119.

ance of being an actively secreting gland, one can at present offer no satisfactory suggestion as to the nature of its activity. It is even a matter of surmise whether it has any functional relationship to the medulla, considering its distinct origin and location in Elasmobranch fishes.*

It is almost universally acknowledged that removal of the suprarenal gland in mammals (Brown-Séquard,† Tizzoni,‡ and Oliver and Schäfer §), and in frogs (Abelous and Langlois ‖), is invariably followed, sooner or later, by death, and that the symptoms during life are those of extreme muscular prostration. Of course in all these cases both cortex and medulla have been removed together, and it would be impossible to state how far the fatal effects were due to loss of the medullary substance, and how far to the loss of the cortical. But Teleostean fishes, having only cortex, seemed to offer an admirable opportunity of testing how far the cortical suprarenal glands were essential to the life of the animal.

Among Teleosts the eel is practically the only fish available for this purpose; since in most species the suprarenal bodies lie on the dorsal surface of the kidney, and would be practically inaccessible during life. Again, the length of time an eel will live out of water, and its power of resistance to the shock of operation, render it peculiarly suitable for extirpation experiments.

The eels were anæsthetised by being placed for a short time in chloroform water. The operations were performed as aseptically as possible, but without the use of chemical antiseptics. An incision an inch or so in length was made to one side of the anus, reaching the middle line in front of this aperture. The abdominal cavity being opened, the edges of the wound were held apart by means of retractors. The gut was pushed over to one side, and the ventral surface of the kidney laid bare. The suprarenal bodies were then picked out with a pair of fine curved forceps. After any bleeding had been checked, the wound was sewn up and dressed with a layer of flexible collodion.

In three cases in which the animals survived the operation, they have appeared quite lively soon after being put back in the tank. One survived twenty-eight days, another sixty-four days, and a third was killed on the 119th day. These experiments show that an eel will survive the operation of extirpation for a very much longer

* Swale Vincent, 'Zool. Soc. Lond. Trans.,' vol. 14, Part III, April, 1897, pp. 52—56; also 'Birm. Nat. Hist. and Phil. Soc. Proc.,' 1896, vol. 10, Part I, p. 1.

† 'Journ. de la Physiol.,' vol. 1, 1858.

‡ 'Ziegler's Berträge,' vol. 6, 1889, and 'Arch. ital. de Biol.,' vol 10.

§ *Loc. cit.*

‖ 'Compt. Rend. de la Soc. de Biol.,' 1891; also *ibid.*, 1892, and 'Archives de Physiol.,' 1892.

time than mammals or frogs, and the difference is so striking that one must attribute it to the absence of medulla in Teleosts, and must assume that *the cortical gland is not absolutely essential to the life of the animal.* The longest time that a frog will survive removal of its capsules is, according to Abelous and Langlois,* twelve or thirteen days, and this period is shortened in the summer to forty-eight hours. Mammals usually die in a day or two.

The validity of these experiments depends obviously upon the fact that all suprarenal material has been actually removed at the operation. This has been verified in two ways. In the first place, previous study of the anatomy of the organs in many individuals has shown that the suprarenals are never more than two in number. Secondly, all three animals have been carefully dissected *post mortem*, and no trace of suprarenal bodies has been found to be left behind.†

Pettit‡ has described a true physiological compensatory hypertrophy of one suprarenal in the eel after the other one has been removed. This indicates a secreting function for this cortical gland. Pettit looks upon this organ in the eel as the fundamental type of the suprarenal capsule; but this view is quite untenable in the face of the facts that it has none of the characters of the double suprarenal of mammals, and its removal does not cause death.

"The Kelvin Quadrant Electrometer as a Wattmeter and Voltmeter." By Ernest Wilson. Communicated by Dr. J. Hopkinson, F.R.S. Received January 11,—Read January 27, 1898.

During the past seven years the author has had continued experience with the Kelvin quadrant electrometer, both in connection with scientific research and the training of electrical engineering students in the Siemens Laboratory, King's College, London. This paper embodies a good deal of the experience which he has gained with the instrument, and he has been fortunate in that two of these instruments were available. The numbers of the instruments are 71 and 184. The writer was therefore able to test the one as a Wattmeter, using the other for the purpose of investigating the instantaneous rate at which work was being done by alternate currents. The instrument used as a Wattmeter (No. 184) is of comparatively

* *Loc. cit.*

† For the animal which lived 119 days this statement has been verified by Professor Schäfer.

‡ 'Recherches sur les Capsules Surrénales,' Thèse. Paris (Félix Alcan), 1896.