"On the Regeneration of Nerves." By ROBERT KENNEDY, M.A., B.Sc., M.D., Glasgow. Communicated by Professor MCKENDRICK, F.R.S. Received January 7,—Read February 11, 1897.

(Abstract.)

The author treats the subject under the following heads:—

I. A short historical and critical review of the books and papers which have appeared on the subject from the time of Cruikshank (1776).

II. Clinical reports of four cases of secondary suture of nerves as follows:—

1. Suture of the median and ulnar nerves six and a half months after division in the middle of the forearm. There was total loss of sensation and motion in the distribution in the hand, and marked atrophic changes. Three days after the operation, sensation commenced to return; by the nineteenth day, touch was correctly localised on all parts of the fingers; and by the end of the first month, sensation was almost perfect. Improvement in motion was slow and imperfect.

2. Suture of the median three months after complete division above the wrist. Sensation was lost in the median distribution, and opposition of the thumb was impossible. There was marked atrophy of the thenar eminence. Two days after the operation, sensation commenced to return. Both sensation and motion speedily improved, and by the end of a year recovery was almost perfect.

3. A case in which the median, musculo-spiral, and ulnar were involved in cicatricial tissue at the seat of fracture at the elbow joint; excision of portions from median and musculo-spiral, and suture, two months after accident. There was total anæsthesia in the distribution of the affected nerves, and paralysis of the muscles. Sensation, after the operation, commenced to return on the fourth morning, but made slow progress. The case was under observation for six weeks only, at which time no improvement had occurred in motion, but sensation was present in the fingers.

4. Suture of the ulnar nerve eighteen months after division. Sense of pain was totally lost in the ulnar distribution. Five days after the operation, sense of pain returned in the little finger, and by six weeks, sensation was almost perfect, although motion had not improved.

III. Deductions from the results of operation.

From the above results the author concludes that the early return

of sensation must be regarded as indicating a restored conductivity of the divided nerve. He holds that the theories which have hitherto been advanced to account for early return of sensation apart from reunion of the nerve, are inapplicable to cases where *early* return of sensation occurs from suture, performed after the lapse of *several months* from the time of section. The imperfect return of motion he takes to be fully explained by the fact that the muscles have undergone great trophic change, or indeed total destruction, and that, therefore, their restitution must be slow, or may even be impossible.

IV. Microscopical examination of the portions removed previous to suture.

Both the central and peripheral ends of nerves which had not reunited in any way, contained young nerve fibres grouped in bundles, each bundle containing, as a rule, many fibres. The fibres contained an axis-cylinder lying in the centre of a clear, well-defined zone, which, again, contained a granular, myeline deposit, while spindle-shaped nuclei were attached to the sides of the fibres at frequent intervals. Where the ends of the nerve were united by a cicatricial segment without conductivity being restored, the examination of the segment showed a dense network of connective tissue containing in its meshes bundles of young fibres.

The portions excised from the nerves involved at the seat of fracture showed at their central ends a normal structure, but elsewhere no trace of old myeline fibres, nor of degenerated fibres; but the section was made up of young fibres in bundles, which bundles were of only slightly greater diameter than the old myeline fibres, and often surrounded by a delicate sheath. At the point of transition from old to young fibres, many of the old myeline fibres contained an enlarged nucleus, with one or two distinct young fibres lodged between the sheath of Schwann and the myeline sheath. In other cases the number of young fibres lying in a similar position was greater. All stages up to complete replacement of the old myeline sheath and axis-cylinder by young fibres were found.

V. Deductions from the microscopical examination.

1. Degeneration :—

(*a*) That there is no evidence of ascending degeneration of the kind described by Krause after interruption of a nerve.

(*b*) That the old axis-cylinder and myeline sheath are destroyed in the peripheral segment, and in the ultimate portion of the central segment.

2. Regeneration :—

(*a*) That young nerve fibres are developed in the peripheral segment, as well as in the end of the central segment, and that even while there is no connexion between the two ends.

(*b*) That these young nerve fibres originate within the old sheath of Schwann from the protoplasm and nucleus of the interannular segment. The spindle-cells formed from the protoplasm and nuclei of the interannular segments elongate and unite to form protoplasmic threads, with the elongated nuclei attached to their sides. The central portion of the protoplasmic thread develops into the axis cylinder, while myeline is deposited in drops in the protoplasm surrounding the newly formed axis-cylinder. The protoplasm in which the myeline is deposited remains with the nucleus as the neuroblast of the new interannular segment.

(*c*) That so long as conductivity of the nerve is not re-established, the development of the fibres proceeds only to a certain stage, and as the new fibres three months and eighteen months subsequent to division present identical characters, this stage may be regarded as a resting stage, depending for its further development on re-establishment of function.

(*d*) That cicatricial intercalary segments reuniting the ends of a divided nerve may be permeated by young fibres from end to end without re-establishment of function, if the amount of cicatricial connective tissue present in the mass is sufficient by its pressure to prevent the passage of impulses.

February 18, 1897.

The LORD LISTER, F.R.C.S., D.C.L., President, in the Chair.

A List of the Presents received was laid on the table, and thanks ordered for them.

The following Papers were read :—

I. "On the Iron Lines present in the Hottest Stars. Preliminary Note." By J. NORMAN LOCKYER, C.B., F.R.S.

II. "On the Significance of Bravais' Formulæ for Regression, &c., in the case of Skew Correlation." By G. UDNY YULE. Communicated by Professor KARL PEARSON, F.R.S.

III. "Mathematical Contributions to the Theory of Evolution. On a Form of Spurious Correlation which may arise when Indices are used in the Measurement of Organs." By KARL PEARSON, F.R.S., University College, London.

IV. "Note to the Memoir by Professor Karl Pearson, F.R.S., on Spurious Correlation." By FRANCIS GALTON, F.R.S.