satisfaction, and stating he never had expected to feel his eye so strong and free from all irritation.

CASE II.—My second patient was a young woman who had been previously under the care of a distinguished surgeon in one of the principal hospitals in this city. According to her statement she suffered for a considerable time from trichiasis affecting the lids of both eyes, which produced chronic conjunctival inflammation and superficial corneal opacities. About eighteen months before her admission to the Mater Misericordiæ Hospital she consulted the surgeon already alluded to, who most skilfully performed Arlts's operation; but although the patient consequently derived great ease and benefit, yet a few cilia, forming a limited districhiasis, continued to cause considerable annoyance to the right eye. As the other patient was at the time in hospital, and afforded most satisfactory evidence in favour of the injection treatment, I adopted a similar method in this case, and with like permanent relief.

The chief points demanding attention for the safe injection of tincture of the perchloride of iron are:—Firstly, That the eyelid should be firmly compressed between the blades of a suitable entropion forceps. Secondly, That the fine tubular needle of the hypodermic syringe should be passed, and applied, as closely as possible, to the deep ends of the hair follicles. And lastly, That only a very small quantity of the tincture should be introduced.

If those rules be adhered to the operation affords a simple, comparatively painless, and effective means for producing the required extent of madarosis.

ART. VI.—*The Bearing of Anomalous Anatomy on the Evolution Theory of the Origin of Man.* By ALEXANDER MACALISTER, M.B., Professor of Zoology, T.C.D.

THREE arguments deduced from anatomy are advanced in support of the evolution hypothesis of the origin of man; these may be called—1st, the argument from embryology; 2nd, the argument from rudimental organs; and 3rd, the argument from anomaly; of these the second and third merge into each other; and I desire in the present paper to examine the last of these arguments with a view to ascertain its true force.

This argument may be stated thus:—It is the experience

of anatomists that in man's body, organs are variable in position, relative degrees of development or arrangement; and as these varieties in man are supposed often to simulate the ordinary disposition of parts in the lower animals, it is inferred that this indicates the existence of a genetic affinity between man and the other mammals. This argument is used by Mr. Darwin in his book on the Descent of Man.

Of all parts of the human body the muscular system is that which the most frequently exhibits varieties; thus I have collected notes of over two thousand forms of anomaly which have been hitherto described in human myology; and as the normal muscular arrangements in lower animals are usually of easy recognition and are pretty well known, the first point is to determine, do these abnormalities point towards characters distinctive of lower animals?

The proper method for the ordering of our facts in attempting the determination of this point is to classify in relation to it muscular anomalies, to see whether they are all explicable on the hypothesis of a law of Reversion, and if not, to ascertain what are the other factors by whose agency the existence of anomalies is brought about. The first class of varieties considered in this respect consists of such muscles as are not normal elements of the average human body, such as the occipito-scapular, sternalis brutorum, levator claviculæ, epitrochleo-anconeus, peroneus quinti, abductor ossis metatarsii minimi digiti, dorsi-epitrochlear, &c. Now, of these the first exists in the majority of the primates, except man and the chimpanzee; the second is not so universal, but does occur; the third exists in all but man; the fourth, though present in a few of the lower primates, yet is not, as a rule, present in man or in the nearest of his allies, the catarrhinæ; the fifth peroneus is present in all but man as a rule, and its rudiment is of very frequent occurrence as an anomaly in the human foot; the last of the series is constant in all but man: in him, cases of its occurrence have been noticed by Bergmann, Henle, Theile, Halbertsma, Wood, and myself. Thus, of the seven examples of this class of anomalies, taken by way of illustration, three occur normally in all the primates but man, one occurs in all but man and the chimpanzee, and the remaining three occur only in some of the primates, and most frequently in the lowest or least anthropoid species. All these varieties, then, would be explicable on the hypothesis of development, by the law of reversion.

Are there any muscles of this class not admitting of such an

explanation? Certainly there are; take, for example, the large group of laryngeal occasional muscles. Of the entire group of sixteen—[thyrohyoideus minor or azygos (Sömmerring, Morgagni, Weber-Hildebrandt, Haller, Gruber); kerato-cricoid, crico-hyoid (Zagorsky); kerato-hyoideus (Gruber); thyreo-syndesmicus (Sömmerring); thyreo-triticeus (M.), hyo-trachealis (Gruber: Reichert's *Archiv.*, 1868, p. 644); thyro-trachealis (*ibid.*, *Bulletin de l'Acad. Imp. de Petersb.*, tom. 3, p. 153, 1861); crico-trachealis (M.); thyroideus transversus anomalus (Gruber: *Neue Anom. Kehlkopfmuskel. Oesterreich Med. Jahrbuch*, Bd., 52, 1845, p. 148); kerato-arytenoideus (*ibid.*, Reichert's *Archiv.*, 1868, p. 640); hyo-epiglotticus, thyreo-epiglotticus major and minor (*Tarin Myographie*, p. 62); crico-epiglotticus (*Verheyen*, p. 188); glosso-epiglotticus (Eustachius)]—only five have been found in animals: the thyroideus transversus anomalus, in *Hylobates albifrons* by Eschricht (Müller's *Archiv.*, 1834, p. 218); the kerato-arytenoideus I found in a chimpanzee, the hyo-epiglotticus, thyreo-epiglotticus, and glosso-epiglotticus also occur in lower animals. Of course it is possible that homologues of these may be found in some animals; but, as far as I know, none have as yet been met with, so that a reversionary theory would fail to account for their presence.

2. The second class of varieties as considered in the light of evolution consists of failures of the specific human-muscle-forms. Cases have been described of absence of the peculiarly anthropoid muscle arrangements, which are—1. The coronoid head of the pronator teres; 2. The radial head of the flexor digitorum sublimis; 3. The tibial origin of the solæus; 4. The peroneus tertius; 5. The presence of a perfectly separate flexor pollicis longus; 6. And of an extensor primi internodii pollicis. Of these the first and third have been found in the chimpanzee by Professor Humphry, as anomalies in the myology of that animal, for Vrolik, Wilder, Moore, and I, find no trace of such heads in the specimens dissected by us, and Professor Humphry also failed to find them in another specimen. Such instances of germ suppression or failure of peculiarly human characters are of course, like all other arrests of development, easily explained on an evolution hypothesis.

3. The third group of varieties is that which includes all the examples of structures normally human, arranged according to plans observed in lower animals, such as—1. The varieties of the digastric muscle, the anterior bellies joined by a transverse tendon or decussating in the middle line, which forms are normal among

the primates. Another form of this muscle, as a monogastric depressor of the mandible, is found in still lower forms of the mammalia; as a human anomaly, it was described by Platner.

2. The varieties of the lesser pectoral; these have also their representatives among the primates as normal arrangements; thus, De Souza's variety, or that in which it is inserted into the greater humeral tuberosity, is the common mode of its arrangement in the catarrhine monkeys. In one chimpanzee Professor Humphry found it inserted into the humerus, crossing the coracoid process; in Professor Wilder's animal it was attached to the humerus on the right and into the coracoid on the left. In one chimpanzee I found the muscle attached to the coracoid process on both sides; and in a second I found it attached to the coraco-acromial ligament on the right and to the coracoid on the left.

3rd. The insertion of the extensor minimi digiti into the fourth and fifth fingers in man is not uncommon, and this is the commonest mode of insertion in the quadrumana. In the chimpanzee, however, as in man, it is restricted alone to the little finger.

4. The existence of a middle finger slip of the indicator. This is also a common anomaly, and is a universal character among the higher primates; it was only known to fail once in the chimpanzee by Wilder.

5. Some varieties in position of the flexor tendons of the hand coincide with the arrangements among the catarrhinæ; thus the form in which the radial deep flexor is indicio-pollicéal in its insertion, resembles the arrangement found by Wilder in his chimpanzee. Examples of this class of varieties might be multiplied, but I confine myself to these as illustrations.

Are there any anomalies of this class which cannot be accounted for on the theory of reversion? Perhaps a few may be in this category, such as the not uncommon and very well known pterygoideus proprius, a case of which was recorded by Mr. Wagstaffe in the May number of the *Journal of Anatomy and Physiology*, 1871.

In analysing these and many other forms of anomaly, in order to determine to what factors the occurrence of muscle-anomalies is due, there are, to my mind, only two hypotheses which offer any intelligible explanation of their mode of production; the first of these is based on considerations of function, the second is purely morphological.

With regard to the first of these, if it were the sole explanation of the occurrence of anomalies, then we would find such muscles as

present the greatest complexity of function to be not only the most variable but the only muscles exhibiting a great range of variation. It is true that such muscles are very variable, as exemplified in the case of the flexor sublimis digitorum, digastric, omohyoid, lumbricales, &c. But no such consideration could account for the enormous variability of the biceps or of the palmaris longus; the former of these has certainly not more than four simple functions—supination, flexion of the forearm, extension of the shoulder, and tension of the antibrachial aponeurosis; yet its varieties enormously exceed those of the triceps, which has a double function, in the proportion of thirty to five in number of forms of variation, and thirteen to one in absolute frequency of variation; while the brachialis anticus, with its single function, is twice as variable as the triceps.

That functional variety is a factor and an important one in the production of anomalies is probable, however, from three considerations:—

1st. Structures like the laryngeal muscles, which are enormously varied in their degrees and combinations of actions, are exceedingly variable, as the list of anomalous laryngeal muscles (*supra*) will show.

2nd. Such rudimental parts as have their functions obsolete are exceedingly variable. A case in point to illustrate this is the example of the forearm muscles in the whale *Balænoptera rostrata*. Two specimens of this animal have been dissected with care; in the first I drew and described carefully the forearm muscles; in the second Mr. Perrin, with equal care, examined and described them, and in many respects the two were different. I have been informed by Professor Struthers of Aberdeen that he found a still different arrangement in *Bal. musculus*, and by Dr. Murie that he examined the corresponding part in *Physalis antiquorum* and found none at all, as I had also found in *Globiocephalus Svineval* and in *Delphinus*.

3rd. Muscles with definite single functions, though not invariable, yet are the most stable in form, and present the fewest anomalies, *e.g.*, the rectus femoris, vasti, cruræus.

But this functional consideration (that anomalies are due to the hereditary transmission of forms produced by varieties of action or use), we can only regard as one factor in the production of anomaly, as it is utterly inadequate to account for the formation of many varieties, which, instead of being advantageous for the generality of

actions, are positively injurious; thus the indicio-polliceal deep flexor, muscle absences, a cubito-radial insertion of the biceps, the *achselbogen*, the insertion of the digastric into the angle of the jaw, are undoubtedly prejudicial to many of the functions of their respective parts, and scarcely, if at all, beneficial to any, while they are all well-known lower animal forms. If the second factor be not a tendency to reversion, what is it?

Two explanations are sometimes given of such anomalies. One of these is, "that they are accounted for on the hypothesis of a fundamental unity of plan in animals." But if we analyse this as an explanation, we will find that though the expression enunciates an undoubted fact, that such a unity of plan exists, yet it contains no information or interpretation as to the cause of the unity, which, after all, is the point of which we are in search; for if muscle anomalies be (as they are) the accidental production in one animal of the normal structures of another, it is the cause of this, whatever it may be, final or secondary, which must determine the production of anomalies.

A second explanation is that such anomalies are accidental arrests of development, retentions of fundamental structures, but that this is wholly inadequate can be easily understood if we consider that the largest proportion of anomalies are never normal embryonic conditions in man—certainly none of the supernumerary muscles are so.

We are thus placed in this position: we must account for anomalies on one or other of the following grounds:—

1. Variety depending on variation of function.
2. Depending on evolution or on the plasticity of form and liability of the frame to return, in some of its details, to more primitive arrangements. In this sense alone are anomalies explicable as arrests of development.

Or else we must confess ourselves thoroughly incapable of explaining their occurrence.

A high authority, Dr. Carpenter, has warned us of the danger of hasty theorizing, but I think we should not condemn all theory. Under proper regulation a hypothesis is a most valuable aid in our studying and grouping of facts; besides, our consciousness is so conditioned that we cannot conceive of anything produced, that is, an effect, without its necessary and logical condition of a cause; these anomalies are remarkable phenomena, and the more closely they are studied the more it will be perceived that they are capable

of definite classification, and that their production is apparently under definite laws, and a detailed study of individual abnormalities will, I believe, be found to bear out strongly the general principles herein enunciated.

ART. VII.—*Five Hundred Cases of Re-Vaccination.* By RICHARD J. HALTON, L.K. & Q.C.P.I., L.R.C.P.E., L.R.C.S.I., Physician to the Dispensary, and Medical Officer of Health to Kells.

WHEN the alarm, caused in Ireland last spring by the fearful mortality of the small-pox epidemic in England, was at its height, and it was feared by many amongst us with what has unfortunately proved a well-grounded fear, that we would not escape a visit from the disease, the majority of the cases with which this paper deals presented themselves at the dispensary for re-vaccination.

At that time re-vaccination was held to be a tolerably efficient protection against the small-pox.

Having heard that this opinion has now been abandoned in several quarters where the highest professional eminence has given great authority to that abandonment, I deem it the duty of every one who has had any experience of the question to give the results of that experience.

This I will endeavour to do for my part, as shortly and succinctly as possible, premising that my experience has not been confined to the number of cases heading this paper, but I take them as they were for the most part observed with scrupulous care, and the results, where possible, accurately noted.

As each case presented itself, the state of the arm was noted in reference to vaccination marks, and the result was that 179 had scars that were mostly circular, and did not seem to go deeper than the true skin. 106 had scars so slight that they had often to be carefully looked for, amounting in many cases to a mere puckering, and 66 had deep scars that were mostly irregular in shape, and seemed to penetrate through the skin into the cellular tissue beneath.

In 24 of the cases no scar was to be found, though they stated themselves to have been vaccinated in infancy.

Out of the whole number 50 stated that they had never been vaccinated, and of these 8 were born since 1864.^a

I have excluded 75 cases from the above enumeration, as the state of the arm was not recorded with sufficient accuracy.

The cases were all vaccinated in the usual way, from healthy infants with well-formed vaccine vesicles, and they were requested to present

^a When the Registration first made compulsory vaccination possible.