

The double-flap and circular amputations contrasted : being an abstract of a first prize essay at the University of Edinburgh / by F.N. MacHardy.

Contributors

MacHardy, F.N.
Royal College of Surgeons of England

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THE

DOUBLE-FLAP AND CIRCULAR

AMPUTATIONS CONTRASTED,

BEING AN ABSTRACT OF A FIRST PRIZE ESSAY AT THE
UNIVERSITY OF EDINBURGH

By F. N. MACHARDY, A.M. & M.D.,

SURGEON.

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TO

THE REVEREND MATTHEW BOWIE, D.D.,

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THE FOLLOWING PAGES ARE AFFECTIONATELY DEDICATED

BY THE AUTHOR.

THE REV. MATTHEW DOUGLAS

MINISTRE

OF THE PARISH OF ST. ANDREW AND ST. MARTIN

BY THE ACTING

PREFACE.

IN the twenty-first volume of the Edinburgh Medical and Surgical Journal, Messrs Syme and Liston respectively recommend to the professional world the general adoption of the double-flap operation. However, although these operators do at present employ it, as well as others in the Infirmaries of Edinburgh and Glasgow, still, it has by no means elsewhere received that countenance which its merits seem to deserve.

The following is an abstract of an Essay,* for which the first Prize was awarded at the termination of the Session 1839, by Sir George Ballingall, Professor of Military Surgery in the University of Edinburgh.

The elaborate statistical account detailed in that production is necessarily much abridged in this, while 460 recorded cases of both operations, with remarks on the constitution, elucidative of primary and secondary amputation, together with a *general* comparison of the different modes of operating, are here altogether excluded.

The following outlines of the investigation are sent to the press, in the hope that such may prove of some avail in regulating the performance of one of the most frequent and most important operations in the field of surgical experience.

* " On the comparative advantages and disadvantages of amputation by the circular incision and by the double-flap operation, with reference to the particular parts of the limbs at which amputations are generally performed, investigating the views of M. Sanson on secondary union, and illustrating the whole as far as possible by reference to the results."

REPORT

ON THE

The following tables of the investigation are given in the report and each page is numbered in the order of the pages of the report. The results of the investigation are given in detail in the report. The following tables are given in the report:

1. The number of cases of the disease in each of the several districts of the city.
2. The number of cases of the disease in each of the several districts of the city, according to the age of the patients.
3. The number of cases of the disease in each of the several districts of the city, according to the sex of the patients.
4. The number of cases of the disease in each of the several districts of the city, according to the season of the year.
5. The number of cases of the disease in each of the several districts of the city, according to the occupation of the patients.
6. The number of cases of the disease in each of the several districts of the city, according to the mode of exposure to the disease.
7. The number of cases of the disease in each of the several districts of the city, according to the mode of transmission of the disease.
8. The number of cases of the disease in each of the several districts of the city, according to the mode of treatment of the patients.
9. The number of cases of the disease in each of the several districts of the city, according to the mode of recovery of the patients.
10. The number of cases of the disease in each of the several districts of the city, according to the mode of death of the patients.

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Page 9, line 25, for *below*, read *above*.
 — 14, — 26, for 60, read 48.

THE
DOUBLE-FLAP AND CIRCULAR
AMPUTATIONS, &c.

IN the reign of Tiberius, Celsus (1) described the manner of amputating gangrenous limbs by one direct incision to the bone, but no allusion is made to this operation either by Hippocrates or Galen. (2.)

During the middle ages, there was little improvement in this department of surgery. (3) However, in the year 1679, James or Jacob Yonge (4) of Plymouth, in a pamphlet, entitled, "Cursus Triumphalis e Terebintho," exposed the defects of former methods, and introduced his "new plan," or single flap operation. This, like all other great innovations, scarcely outlived its inventor, although revived at different periods with varied success by Garengot, (5) Sabourin, (6) M. Verduin, (7) Vermale, and La Faye. Verduin wrote a Latin Dissertation on the subject, which appeared in the *Bibliothèque Chirurgicale* of M. Marget, and Sabourin (8) proposed it to the Royal Academy of Paris, and adopted it in practice.

In 1739, Ravaton of Landau, and afterwards M. Vermale struck with the imperfect results of the circular amputation of the thigh, conceived that the flap operation, so sound in principle and so successful below the knee, (9) if modified, might be equally advantageous elsewhere, and accordingly, with this

(1) *De Re Medicâ*, lib. 7. (2) *Lib. ad Glauc.* (3) *Cyclopæd. Pract. Surg.* pt. 2, p. 119. (4.) *Mem. de l'Acad. Roy. de Chir.* t. 2, p. 224. (5) *Ibid.* t. 2, p. 244. (6) *Disert. Epist. de Novâ Artuum*, &c. 8vo. Ams. 1696. (7) *Historie de l'Amputat à Lambeau Suivant la methode de Verduin*, par La Faye. (8) *Le Dran*, Ed. 3, 1757, p. 430. (9) *Alanson on Amput.* p. 146.

view, proposed to the French Academy, a method by "double flap," different from that of Verduin and Sabourin.

What is a good stump? is the natural question, before commencing a series of inquiries; and how is such a stump to be fashioned with the least expense to the animal economy, and to prove most serviceable hereafter, by its adaptation to an artificial member?

A good stump is *allowed* (1) to be, that which has abundance of skin and muscle entering into its formation.

A good stump is *found* (2) to be, that which is sound, firm, and painless.

On *dissection*, (3) such a stump presents the ends of the muscles, fasciæ, nerves, and vessels, all blended in one common cicatrix, in which the bone is sunk deep and embedded.

A stump of this description is to be procured, 1st, *by rapid incisions*. (4) "Sat cito, si sat bene," (5) though an admirable maxim in surgery, yet, by good authority (6) "celertique sane" appears to be equally applicable. But, it has been remarked, that directly as the rapidity in operating, so is the shock to the system, as if cannon balls could be averted in their course, as if military experience had responded to the assertion. (7) In fine, is it a matter of no consequence, that Mr Key (8) of London requires one hour and forty minutes to remove a tumour weighing fifty-six pounds from the scrotum of Hoo Loo, (9) and death immediately to ensue, while M. Clot, the Egyptian Bey, amputates a turnour, similarly situated, of one hundred and ten pounds weight in twenty-two minutes, with perfect recovery to the patient; that Sir Astley Cooper (10) occupies twenty minutes in amputating at the hip joint, when Mr Mayo (11) in one fortieth of the time executes a like operation.

(1) Edin. Med. and Surg. Jour. v. 21, p. 30; Bell's Operat. Surg. 1807, v. 1, p. 387. (2) Lond. Med. Chir. Trans. v. 16, p. 128, c. 13.; Lond. Med. Gaz. 1827-28, v. 1. p. 67. (3) Cyclopæd. Pract. Surg. pt. 2, p. 136; Edin. Med. and Surg. Jour. 1830, v. 33, p. 248. (4) Ibid. v. 24, p. 263. (5) Pott's Lect. (6) Edin. Med. and Surg. Jour. v. 21. p. 29, Syme. (7) Lond. Med. and Phy. Jour. v. 44, p. 413. (8) Ibid. 1831, v. 10, N.S., p. 453. (9) Lancet, 1830-31, v. 2, p. 824. (10) Ibid. 1823-24, v. 1 and 2, p. 425. (11) Druitt's Surg. 1839, p. 401.

When Bromfield, (1) Cooper, (2) Guthrie, (3) Liston, (4) Dupuytren, (5) and others, (6) declare that the double circular incision is a tedious operation; again, Dr Robertson, (7) Benjamin Bell, (8) Ballingall, (9) Liston, (10) Sir Charles Bell, (11) Valpeau, (12) and various operators, (13) extol the comparative facility afforded in amputating with the double flap.

If, however, the *single* circular division can be performed with equal quickness as the flap, it was Dupuytren (14) alone who did it.

2dly, *By the least possible pain.* (15) Moore (16) and Cooper (17) have made laudable attempts to diminish pain in surgical operations, the former by application, the latter by position; but as this desideratum still remains undiscovered, (18) then, agreeably to the axiom, that the duration of pain is in the direct ratio of the time, as the flap operation has just appeared to be more quickly performed than the circular incision, it hence follows, that the former is less painful than the latter, and such is corroborated by the experience of Drs Anderson, (19) Couper, (20) Creaser, (21) Young, (22) and Robertson (23); Messrs Dewar, (24) Druiitt, (25) King and Costello, (26) Wardrop, (27) Syme, (28)

(1) Surg. v. 1, p. 260. (2) Surg. Dict. 7 Edit. (3) Lond. Med. and Phy. Jour. v. 6, N.S., p. 520. (4) Operat. Surg. 1838, p. 317. (5) Leçons oral. de chir, &c. t. 4, p. 297. (6) Hargrave's Operat. Surg. 1831, p. 227; Lancet, 1831-32, v. 1, p. 809; 1832-33, v. 2, p. 539; Lond. Med. Gaz. 1829, v. 3, p. 506. (7) Edin. Med. and Surg. Jour. v. 22, p. 437. (8) Surg. v. 7, p. 296. (9) Mil. Surg. Ed. 2, p. 71. (10) Lancet, 1836-37, v. 1, p. 748. (11) Lond. Med. Gaz. v. 2, p. 183. (12) Nouveraux élém. de med. opert. (13) Lancet, 1827-28, v. 2, p. 204; Ibid. v. 1, p. 413; Glas. Med. Jour. 1829, v. 2, p. 170; Ibid. 1828, v. 1, p. p. 330—406. (14) Cyclopæd. Pract. Surg. pt. 2, p. 142. (15) Lancet, 1836-37, v. 1, p. 476, Wardrop. (16) English Rev. 1784-85, v. 4, p. 218. (17) Surg. Dict. 7 Ed. Art Thigh. (18) Wardrop's Lectures in Lancet. (19) Glasgow Med. Jour. 1828. v. 1, p. 330. (20) Ibid. p. 406. (21) Lond. Med. and Phy. Jour. v. 53, p. 31. (22) Glas. Med. Jour. v. 1, p. 96. (23) Edin. Med. and Surg. Jour. v. 22, p. 437. (24) Ibid. v. 24, p. 265. (25) Surg. 1839, p. 407. (26) Cyclopæd. Pract. Surg. pt. 2, p. 142. (27) Lancet, 1836-37, v. 1, p. 748. (28) Edin. Med. and Surg. Jour. v. 21, p. 39.

Liston, (1) Sir Charles Bell, (2) and Dupuytren, (3). &c.

Formerly, Sir Charles Bell, (4) and Mr Cooper (5) deemed the flap operation equally painful, if not more so than the circular incision, but *now* in their works (6) no such mention is to be found.

3dly, *By smooth cut surfaces.* (7) Union by the first intention dawned with the flap operation, (8) and the advantages it in general possesses over former methods of cure, have been clearly pointed out, in particular by Hunter, (9) Mynor, (10) Alanson, (11) Latta, (12) Syme, (13) Brodie, (14) Roux, (15) Dubois, (16) Percy and Lucas (17).

Among the conditions favourable for such a union, so well described by M. Sanson, the smooth cut surface has been insisted on as absolutely essential, from Hunter (18) to Dupuytren (19).

Alanson (20) held it to be an infallible maxim, that inversely as the extent of cut surface, so is the cure. But, when Professor Delpech (21) amputated at the hip joint in the Hôtel Dieu, Saint Elois, and exposed the largest surface in any operation, on the eighth day union throughout the whole extent had taken place, excepting a single point; and similar success has attended La Mott (22). However, as none question the preference given to a diminished surface, it would appear that the extent of flap exceeds that of the circular incision.

(1) Lancet, 1836-37, v. 1, p. 748. (2) Institutes of Surg. 1838, v. 1, p. 330. (3) Leçons oral. &c. t. 4, p. 297; Lond. Med. and Surg. 1834, v. 4, p. 349; Glas. Med. Jour. 1829, v. 2, p. 100. (4) Lond. Med. Gaz. 1833-34, v. 2, p. 182. (5) Surg. Dict. 3 Edit. (6) Inst. of Surg. 1838; Surg. Dict. 7 Ed. (7) Monro's Works, sect. 20, p. 178; Magendie's Physiol. Ed. 4, p. 160. (8) Currus Triumphalis à Terebintho. (9) On the Blood, Fol. Ed. p. 203. (10) Edin. Med. Com. 1792, v. 16, p. 365. (11) Pract. Surg. 1779. (12) Surg. v. 3, p. 591. (13) Edin. Med. and Surg. Jour. v. 24, p. 52. (14) Lancet. 1832-33, v. 1, p. 160. (15) Mem. et obs. sur la reun. imméd. 1814. (16) Nougraph. Chirurg. &c. Ed. 4, p. 475. (17) Trait. Theor. et Pract. des bles. par Arm. de guerre, &c. Dupuytren. (18) On the Blood. (19) London. Med. Gaz. 1830-31, v. 7, p. 134. (20) Pract. Thoughts on Amput. 1782, Ed. 2, p. 175. (21) Revue Medicale, September, 1824. (22) Lond. Med. and Phy. Jour. 1827, v. 3, N.S., p. 229.

Sir George Ballingall (1) has entered minutely into this subject, and, with the united assistance of Sir John Robsin and Mr Russell, has come to the conclusion, that the exposed surface of the former will be rather double that of the latter, and this result, nevertheless, is based on the supposition that the length of each flap shall equal the breadth of its base. But to be regulated by such an inference, when operating at the lower third of the thigh, flaps of these dimensions would extend *below* the knee! as will be at once apparent by consulting Vermale's plates, delineated in *Memoires de l'Académie Royale de Chirurgie*, Paris, 1753, t. 2, p. 215, fig. 14.

By the circular incision, according to Hammick, (2) or Lawrence, (3) in a limb 12 inches in circumference, the extremity of the bone shall have a covering half an inch thick, which, together with $1\frac{1}{2}$ inches, the allowance for muscular retraction equals 2 inches, the rading of the circle; and in a *flap*, the length of which is the breadth of its base, under the *same conditions*, the cushion will be $2\frac{1}{2}$ in.; but $1\frac{1}{2}$ in. will be the covering given by an average flap of ordinary magnitude, the difference between the transverse and conjugate axes of the ellipse represented by the circle's diameter.

If 10 be the area of the circle, then, according to Sir George, 20 will be about that of the larger, and of course 15 that of the average or smaller flap, which last mentioned superficies will be even considerably *below* that allowed by Drs Tolefree (4) and Busche (5), whose observations on this subject have, on the whole, been rather hypercritical. Then, since the ratio of the *single* division is to that of the double-flap as 10 to 15, much more will the *former* proportion be increased by the *double* circular incision, the truth of which has been well illustrated by Mr Liston in the second edition of his *Elements of Surgery*.

But, the very nature of the flap incisions precludes the dire circular concomitants, — the lacerated surfaces, and angular pouches, and just as more ready union is to be expected after the extirpation of tumours, &c. by elliptical than by circular

(1) *Mil. Surg.* 2 Ed. p. 368. (2) *On Amputation*. (3) *Lectures in Lancet* for 1829-30, v. 2, p. 945. (4) *American Jour.* Feb. 1824. (5) *Lancet*, 1827-28, v. 2, p. 204.

incisions, so is a like result to be anticipated rather from this than from the other amputation.

Mr Lawrence (1) of St Bartholomew's Hospital amputated a fore-arm by the double-flap, and on the *second* day the wound had united by adhesion in its whole extent.

Mr Mayo, (2) from an instituted comparison of both methods, found this preferable, and Rees (3) has declared that in a few weeks the cicatrix can hardly be perceived.

In general, union by adhesion, according to Alanson, (4) Sharp, (5) Bromfield, (6) John, (7) and Benjamin, (8) Bell, King, and Costello, (9) Liston, (10) Lizars, (11) and Le Dran, (12) has been more frequent than after the circular incision, which in this respect is so often abortive, as testified by Monro, (13) Messrs Creaser (14) and Dewar, (15) Syme, (16) Samuel Cooper, (17) Guthrie (18) and Sanson (19).

And, 4thly, *By abundance of skin and muscle* (20). The valuable aphorism of Petit, (21) to cut as little of the muscle off, and as much of the bone as possible, was familiar to Celsus, (22) and has since been inculcated by Heister, (23) Wiseman, (24) Alanson, (25) Bromfield, (26) and the profession in general. However, Sir Astley Cooper, (27) recommends skin alone to be preserved, as muscular fibres cause retraction, while another operator (28) has denounced against a muscular cushion, because,

(1) Lancet, 1827-28, v. 2, p. 472. (2) Lond. Med. Quart. Rev. 1834, v. 2, p. 415. (3) In his Cyclopædia, v. 2, art. Amput. (4) On Amput. 2 Ed. 1782, p. 146. (5) Ibid. p. 68. (6) Surg. v. 1, p. 240. (7) Surg. 1801, v. 1, p. 42. (8) Surg. v. 7, p. 259. (9) Cyclopæd. Pract. Surg. pt. 2, p. 142. (10) Elem of Surg. 1832, p. 364. (11) Pract. Surg. 1838, pt. 1, p. 206-219. (12) Edit. 3, p. 438. (13) Edin. Med. Essays and Obs. 1747, Ed. 3, v. 4, p. 253-274. (14) Edin. Med. and Surg. Jour. v. 22, p. 51. (15) Ibid. v. 24, p. 265. (16) Surg. 2 Ed. p. 129. (17) First lines, p. 150. (18) Gun Shot Wounds, 3 Ed. p. 291. (19) Lond. Med. and Phy. Jour. 1829, v. 6, p. 80. (20) Heister's Chir. Works, Book 1, pt. 2, sect. 1, p. 358. (21) J. L. Petit, Traité des Maladies Chirurgicales, t. 3, p. 150. (22) Lib. 7. (23) Works, Book 1, pt. 2, sect. 1, p. 358. (24) Surg. 1734. v. 2, Ed. 6, p. 226. (25) Surg. Ed. 2, preface. (26) Surg. 1773, v. 1, p. 143. (27) Lectures in Lancet for 1823-24, v. 1 and 2, p. 105. (28) Cooper, in his Surg. Dict. Ed. 7, p. 57.

consonant with the law of the animal economy, it must soon shrink into a comparatively small mass, just as if Bécclard (1) had not shown that the tissue surrounding the muscular fibre, although diminished by rest, yet is not altogether destroyed; just as if Professor Syme (2) had not verified by dissection, that the muscles of a stump can at least for two years preserve all their natural characters.

From a comparative view of the plates accompanying Mr Syme's paper on amputation, in the 21st volume of the Edinburgh Medical and Surgical Journal, it will be evident, that the redundant tissues disposed at the *sides* of the bone by the circular incision, are so economized by the flap, as to be placed on its extremity, at once answering the double purpose of a conveniency for the present,—a reservatory for the future.

From what has already been said under adhesion, it is reasonably inferred, that a more perfect stump can be formed by the flap than by the circle, and though the latter may produce such plumpness as to resemble a "chubby cheeked boy," (3) yet this is all *apparency*; it is the rotundity peculiar to a hemisphere.

That an inadequate protection to the bone is no uncommon result after this amputation, is recorded by Wiseman, (4) O'Halloran (5) Alanson, (6) Hay, (7) Sharp, (8) Monro, (9) John (10) and Benjamin (11) Bell, Latta, (12) Mr Creaser, (13) Syme (14) Liston, (15) Cooper, (16) Lizars (17) and Ritche (18); but, that an admirable stump is the common occurrence after the flap, is sufficiently confirmed by Rees, (19) Drs Robertson, (20) and Young, (21) Mr Dewar, (22) Sir Charles Bell, (23) and

(1) General Anat. p. 304. (2) Edin. Med. and Surg. Jour. 1830, v. 33, p. 248. (3) Sir C. Bell's Inst. of Surg. v. 1, p. 338. (4) Surg. Works, 1734, v. 2, p. 226. (5) On Gangrene, 1765, preface. (6) On Amput. Ed. 2, p. 63. (7) Cooper's Surg. Dict. Ed. 7. (8) Surg. Ed. 8, p. 220. (9) Edin. Med. Essays and Obs. 1747, v. 4, p. 256. (10) Surg. 1801, v. 1, p. 43, foot note. (11) Surg. v. 7, p. 256. (12) Surg. v. 3, p. 598. (13) Edin. Med. and Surg. Jour. v. 22, p. 51. (14) Ibid. v. 21, p. 30. (15) Elem. Surg. 1832, p. 372. (16) First lines, 1836. (17) Pract. Surg. 1838, pt. 1, p. 206. (18) Edin. Med. and Surg. Jour. v. 21, p. 32. (19) Cyclopæd. 1819, v. 2. (20) Edin. Med. and Surg. Jour. v. 22, p. 437. (21) Glasgow Med. Jour. 1828, v. 1, p. 331. (22) Edin. Med. and Surg. Jour. v. 24, p. 226. (23) Lond. Med. Gaz. v. 2, p. 181.

Le Dran. (1)

Dupuytren, Sanson, and Breschet, (2) supposed, that by one direct incision to the bone, they produced remarkably fine stumps, and left the extremity of the bone more than sufficiently covered, but, had this been a decided improvement, there would have been imitators, at least, they would have avoided the sarcasm, that such stumps resembled those in a "ham shop." (3)

By a want of conformity to the foregoing particulars, a *bad stump* may unintentionally be formed; but as such a result may be either partial or complete, it is requisite that the various modifications and particulars of causes, tending either directly or indirectly to this effect be investigated, and the *first* of which to be noticed is that of

Secondary hæmorrhage (4). The ligature of Ambrose Paré, (5) and the tourniquet of Louis Petit, have conferred advantages on surgery incomparable with the rude cauteries in use at, and subsequent to the age of Celsus. (6)

At various times, and with various success, have pressure, styptics, and torsion been introduced. The one was advocated by Dr Rach, (7) senior surgeon to the Hospital of Munich; the "aqua Binelli," the "lycoperdon," the "liquide hæmostatique," and the "aqua cornuti," by Dr Fidele Binelle (8) of Turin, Monsr. La Fosse, (9) M. M. Talrich and Halmagrand, (10) and by Dr Müller (11); the third by Amussat, (12) Thiers, (13) Dr Fourcade, (14) Stilling, (15) Ficke, (16) and Clot Bey. (17)

Although the occasional use (18) of these means is not to be deprecated, now unanimity of sentiment pervades the profession as to the still greater security afforded by the ligature, the silken

(1) Ed. 3, 1757, p. 435. (2) Lond. Med. and Phy. Jour. v. 6, (N.S.) p. 80. (3) Sir C. Bell's Inst. of Surg. v. 1, p. 336. (4) Rees's Cyclopæd. v. 2, Art. Amput. (5) Trait. Theor. et pract. de la ligat. des art. par J. L. Manec. (6) Liv. 7. (7) Græfe and Walther's Jour, t. 9, pt. 4. (8) Lond. Med. and Phy. Jour. v. 12, (N.S.) p. 171. (9) Lond. Philos. Trans. 1755, v. 49, pt. 1, p. 39. (10) Lond. Med. Gaz. 1831, v. 1, p. 346. (11) Klein repert. 1836. (12) Lond. Med. and Phy. Jour. v. 7 (N.S.) p. 463. (13) Trait. Theor. et pract. des bles. par arm. de guerre, &c. par Dupuytren, t. 2. (14) Lancet, 1830-31, v. 2, p. 587. (15) Ibid. 1834-1835, v. 2, p. 446. (16) Ibid. 1832-33, v. 1, p. 342. (17) Lond. Med. Chir. Rev. 1834, v. 20, p. 491. (18) Lancette Française.

as recommended by Lawrence, (1) in preference to the worm gut of Mr Fielding, (2) the animal of Dr Physic, or the leaden of M. Levert, (3) and from researches and experiments on the arterial coats by Jones,* (4) Bell, Hodson, Abernethy, Breschet, Roux, and Larrey, (5) the command over hemorrhage by such a method is now rendered comparatively safe.

Secondary hemorrhage may arise either from a diseased state of the vessels, (6) or from an imperfect application of the ligature, but the former being common to both operations, the latter only shall be here alluded to.

It has with some measure of justice been observed, (7) that the number of divided arteries in the flap exceeds those in the circular incision, directly as the surface of the one is greater than the other, and that when the arterial branches may be cut across in the former, the trunk whence these proceed may have only been divided in the latter; but, on the whole, these objections are too speculative, as sixteen ligatures (8) have been applied after the circular incision, whereas one (9) has been found quite sufficient after the double-flap; yet these instances are undoubtedly rare; and, secondly, in the London Medical Gazette, (10) cases are recorded (!) where the several vessels were incised after the round incision, almost at their point of divergence.

Hennen, (11) Ballingall, (12) and Klein, (13) insist that the oblique division of the vessels in the flap oppose their ready and perfect securement, but *aware* that the extremities may not only be directly, but inversely pen shaped, or even notched, ordinary

* It has been asserted that Petit and Moraund demonstrated Dr Jones's experiments 100 years ago. (Lond. Med. Chir. Rev. v. 2, p. 268.)

(1) Lond. Med. Chir. Trans. 1815, v. 6. p. 163. (2) Edin. Med. Chir. Trans. 1826, v. 2, p. 347. (3) Lond. Med. and Phy. Jour. v. 7, (N S.) p. 465. (4) Ibid. 1806, v. 15, p. 463. (5) Ibid. 1833, v. 3, p. 162. (6) Carswell's illust. and forms of disease. (7) Ballingall's Mil. Surg. 2 Ed. p. 369. (8) Lond. Med. Gaz. v. 1, p. 158. (9) Edin. Med. and Surg. Jour. 1824, v. 22, p. 51. (10) 1829, v. 3, pp. 171—506. (11) Mil. Surg. Ed. 3, p. 268. (12) Mil. Surg. Ed. 2, p. 376. (13) Pract. Ansic. der bedent. ten. chir. oper. 1826, 4to, pp. 35—38.

caution, as Alanson, (1) Bell, (2) Hargrave, (3) and Syme, (4) remark, will prevent discomfiture.

Again, in France (5) it has been asserted, that, when secondary hemorrhage did occur, the flaps had to be disunited in order to secure the bleeding vessels. But Brodie, (6) Liston, (7) and Syme, (8) recommend, in preference, the tying of the main arterial trunk; and even this measure, according to the experience of the last-named surgeon, can often effectually be substituted by pressure. Nor does the passing of the ligature round such a vessel produce inconvenience to the part; on the contrary, it may favour it, for the existence of new vessels can scarcely be controverted at present, as the fine injections of Ruysch, Haller, Prochaska, Sæmmering, and other profound anatomists, completely sets the matter at rest, and prove, that the calibre of the arteries of the stump is greater than that of the same name on the opposite side. (9)

Although Liston (10) and Alcock (11) have noticed secondary hemorrhage from the flap, yet it is to be presumed from the reference the former (12) makes to securing the femoral artery, that such an event is almost exclusively confined to the *single* flap below the knee, (13) an amputation hereafter to be considered.

Hey, (14) Sharp, (15) Latta, (16) Brodie, (17) and Pelletan, (18) have observed that secondary hemorrhage is not unfrequent after the circular incision; and by comparing its results with those of the double-flap, as represented at page 60, it will be remarked how nearly these operations are balanced in this respect.

(1) Rees's Cyclopæd. v. 2, Art. Amput. (2) Operat. Surg. p. 400. (3) Operat. Surg. 1831, p. 220. (4) Edin. Med. and Surg. Jour. v. 24, p. 49. (5) Rees's Cyclopæd. v. 2. (6) Lond. Med. and Phy. Jour. 1833, v. 13, p. 135. (7) Operat. Surg. (8) Edin. Med. and Surg. Jour. v. 24, p. 49. (9) Larrey, Annales des Sciences Naturelles, April 1827. (10) Operative Surg. p. 352. (11) Ballingall's Mil. Surg. 2d Ed. (12) Elem. of Surg. 1822, p. 371. (13) Lancet, p. 1836-7, v. 2, p. 627. (14) Obs. in Surg. 2d Ed. p. 530. (15) Surg. 8th Ed. p. 222. (16) Surg. 3d Ed. p. 574. (17) Lond. Med. and Phy. Jour. v. 13, (N.S) p. 135. (18) Chir. Clinique, t. 3, p. 219; Græfe's an. rep. hosp. Berlin.

2d, *Union by the second intention*. Dr Simpson, De Haen, and Dr Morgan, having pointed out the true nature of the suppurative process, the well known microscopical researches of Katenbruner and Gendrin have been powerful auxiliaries in establishing the doctrine of granulation. (1)

Hunter, (2) Sir Astley Cooper, (3) and Dupuytren, (4) contend that granulations are a new production, while members of the Royal Academy of Paris, and Professor Syme, (5) assert the contrary. Mr Syme conceives, that since amputated parts are not produced, neither are granulations; and adds, that there is always a depression subsequent on an ulcer, as on the head or over the tibia. This may be the case where little or no muscular substance exists; but, certainly, such a result can scarcely be expected if a circular portion of the glutei muscles were detached down to the os ilium. Bone is reproduced, tendon is reproduced, and these are well recognized from the original, being formed, not from choice, but from necessity,—not with freedom, but with an effort. So with the cicatrix; it is a substitute for the lost skin, bearing the same ratio to it as the new tendon to the old, and the contraction which accompanies the closing of a wound, commonly ascribed to the loss of substance, perhaps depends, partly on mechanical auxiliaries, and partly on the economy of nature shortening the curative process, denominated by Hunter the stimulus of necessity, by Darwin the aptitude for accommodation, and by Dupuytren the natural contractile tendency from the circumference towards the centre.

Monro (6) and Hunter (7) observed, that the cicatrix ought to be an object of much solicitude, owing to its keen sensibility to injury, and probably this, among other reasons, has induced Cooper, (8) Simmons, (9) Hawkins, (10) Dubois, Richerand, Mamoir, Langenbeck, and Græefe, (11) to recommend the exclu-

(1) Carswell's illustrations of the forms of disease. (2) On the blood, p. 471, folio. (3) Surg. by Lee, 1837, v. 1, p. 91. (4) Trait. Theor. et pract. des bles. par arm. de guerre, &c. 1834, t. 1. (5) Verbal Clinical Lectures. (6) Works, 1781, No. 54, p. 711, de cuticula humana. (7) On the blood, folio, p. 471. (8) Surg. dict. 7th Ed. (9) Lond. Med. and Phy. Jour. 1805, v. 13, p. 97. (10) Lond. Med. Gazet. 1832-3, v. 2, p. 577. (11) Dupuytren Trait. theor. et pract. &c. par. arm. de guerre.

sive use of primary union. But this practice is too restricted, and unfortunately, in this country, (1) has too often been perversely insisted on; for it has appeared from facts, hereafter to be detailed, that at least in the following instances consecutive union ought to be adopted, and the "mixed method" of Sanson, not unknown to Heister, (2) as the most consistent treatment to be employed. (3)*

1st, After amputation for spreading gangrene, erysipelas, or the like, when the divided textures indicate their participation in the disease. †

2dly, After amputation for chronic disorders, which have been accompanied with profuse discharges. †

3dly After primary amputation, when the parts above the lines of incision have been implicated in the recent injury. §

By thus practising in particular what Boyer, Roux, Dupuytren, and Larrey, have advocated in general, a rational discrimination is at once evinced, as will be obvious by consulting the statistics in the well-merited Thesis of M. Avery, or in a paper by Benjamin Philips, F.R.S. (4)

The greater extent of surface exposed by the flap has been adduced as an objection, (5) by facilitating the more profuse

(1) Roux, Mem. et obs. sur. la reun. immed. &c. 8vo, Paris, 1814. (2) Chirurgical Works, 1768, general introduction. (3) Sanson's Thesis, and Larrey's paper on his treatment of consecutive amputation, occasioned by the last days of July; read before the Academy of Sciences. (4) Read before the Royal Med. Chir. Society of Lond. (5) Ballingall's Military Surg. 2d Ed. p. 371.

* Mr Brodie has in a few instances adopted this practice at St George's Hospital.—Lancet, 1831-2, v. 1, p. 693; Lond. Med. Gaz. 1829, v. 1, p. 171.

† Dr Buchanan of Glasgow remarks, that in *no* case does adhesion by the first intention take place after gangrene, nor, indeed, should it be looked for.—Glasgow Med. Jour. 1830, v. 3, p. 325.

‡ Youge in his *Currus Triumphalis é Terebintho*, and M. Sanson in his Thesis, conceive that when the suppuration is of such a kind as to improve the general health, it should not be suddenly suppressed.

§ Dupuytren observes, that in amputations for gun shot wounds, primary union can never be completely effected.—Trait. Theor. et pract. &c.

suppuration, which being admitted, can but prove inconsiderable owing to its comparative prompt consolidant properties. (1)

On the whole, in the event of secondary union, the balance is in favour of this operation, as possessing fewer inconveniences, agreeably to the experience of Alanson, (2) Allan, (3) Benjamin Bell, (4) Mr Dewar, (5) Dr Busche, (6) Liston, (7) and Paroisse. (8)

3rd, *Tetanus*.—The aphorism of Hippocrates (9) still remains unquestioned, as the pathology of tetanus is yet involved in great obscurity, (10) there being no description of wounds on which it will not supervene, (11) learned by reference to Duchatelet, Martinet, Duer, Galen, Willis, Hoffman, Earl, Larrey, Cooper, (12) and Craigie, (13) while its treatment appears to be varied as its cause.

Drs Finckh Stuttgard (14) and Hamock, (15) have observed this malady ensue the tying of the umbilical cord; Dr Sym, (16) suppurative wounds; Drs Dickson (17) and Adamson (18) sloughy sores; Dr Murray, (19) pricks; Dr Latham, (20) lacerations; Mr Travers, (21) wounds; and Larrey, (22) cicatrices.

As remedials of more or less efficacy, Drs Bladwin, (23) Anderson, (24) and Beirne, (25) have employed tobacco and cata-

(1) Page 7 of this abstract. (2) On Amput. 2d Ed. pref. (3) Path. and op. Surg. 1819, p. 66, foot note. (4) Surg. v. 7. p. 256. (5) Edin. Med. and Surg. Jour. v. 24, p. 266. (6) Lancet, 1827-8, v. 2, p. 204. (7) Elem. of Surg. 1832, p. 371. (8) Opus. de Chir. 1806, pp. 185—203. (9) Sect. 5, Aph. 6. (10) Abercrombie on the Brain, 1st Edition, p. 396. (11) Sir James M'Grigor's Med. Hist. of the Army, in London Med. Chir. Trans. 1815, v. 6, p. 453. (12) Surgical Essays, pt. 2, p. 190. (13) Patholog. Anat. 1828. (14) Lancet, 1836-7, v. 2. p. 2. (15) Edin. Med. and Surg. Jour. 1831. (16) Glas. Med. Jour. 1830, v. 3, p. 23. (17) Lond. Med. Chir. Trans. 1816, v. 27, pt. 1. p. 449. (18) Glas. Med. Jour. 1829, v. 2, p. 134. (19) Calcutta Trans. (20) Lond. Med. and Phy. Jour. 1814, v. 31, p. 456. (21) In referenee to Edin. Med. and Surg. Jour. 1821, v. 17. (22) Lancet, 1830-1, v. 2, pp. 510—518. (23) Lond. Med. and Surg. Jour. 1834, v. 4, p. 243. (24) Edin. Med. Chir. Trans. 1824, v. 1, p. 184. (25) Lond. Med. Chir. Rev. 1824, v. 4, p. 335.

plasms ; Dr Adamson, (1) purgatives and blisters ; Dr Latham (2) cataplasms and ipecacuan ; Dr Murray, (3) enervation ; and Dr Cavallini, (4) M. M. Stutz and Humbolt, (5) and Michele Medici, (6) the internal use of opium and the carbonate of potass.

Mr Travers (7) refers the indirect or secondary cause of traumatic tetanus to a highly irritated state of the nervous papillæ ; Dr Perry, (8) to a local inflammation of the nerves ; Mr Sym (9) to undue muscular excitement ; but, perhaps, the most probable cause is that assigned by Lepelletra, (10) who regards this affection to arise from an inflamed state of the neurilema, which hypothesis is in accordance both in the views of Béclard, (11) on the structure of the nerves, and the dissections of L. Martinet (12) and others. (13)

Mr Thomas Blizard Curling, (14) after alluding to the practice of White, Wayte, Howslip, Larrey, Huc, Sir James M'Grigor, Hernnen, Gutherie, and Sir Astley Cooper, allows, that on the whole, as a remedy, the balance is against amputation. But, it is possible, that the general failure may be attributed to prolonged tetanic symptoms, ere the amputating knife was deemed essential, the inflamed neurilema having not only extended to the lines of incision, but even to the spinal marrow on the brain, (15) as indicated by trismus giving just the measure of the intensity of nervous excitement. Therefore *early* and *high* amputation seems alone capable of affording a prospect of recovery.

From the intricacy of this subject, it is still undetermined by analogy or experience, whether tetanic symptoms are more liable to ensue the punctured nerves of the flap, or the lacerated of the

(1) Glas. Med. Jour. 1829, v. 2, p. 134. (2) Lond. Med. and Phys. Jour. v. 31, p. 456. (3) Lond. Med. and Phys. Jour. v. 13, (N.S.) p. 240. (4) Ibid. 1820, v. 44, p. 289. (5) Ibid. 1807, v. 18, p. 95. (6) Ibid. 1820, v. 44, p. 372. (7) On constitut. irrit. 1835, v. 2, p. 294. (8) Glas Med. Jour. 1831, v. 4, p. 94. (9) Ibid. p. 203. (10) Lond. Med. Chir. Rev. 1833, p. 19, p. 528. (11) Gen. Anat. 1830, p. 332. (12) Lond. Med. Chir. Rev. 1825, v. 2, p. 165. (13) Lond. Med. and Phys. Jour. v. 11, (N.S) p. 312. (14) Jacksonian Essay. (15) Lancet, 1827-8, v. 1, p. 325.

circular incision. Two particulars, however, which have already appeared to favour the former, in preference to the latter, are here interesting. First, Sir Charles Bell (1) finds that a kindly suppurating wound is least allied to the result just treated of; secondly, Mr Travers (2) never knew or heard of its development after a *clean* incised wound, without concussion, whatever structures were divided; and from 280 cases detailed in Mr Curling's Jacksonian Prize Essay, three were from incised wounds, and these three were cured.

4th, *Phlebitis*.—M. M. Beuchieve (3) and Loffre (4) of the Hospitals St. Antoine and Hôtel Dieu, Montpellier, with other operators, (5) have observed the comparatively rare occurrence of death ensuing the admission of air into the veins; but as neither this nor the circumstances attending mechanical injury * done to these vessels bear directly on comparative amputation,

(1) Institutes of Surg. 1838, v. 1. p. 84. (2) On constitut. irrit. 1835, v. 2, pp. 291—294. (3) Foreign and Brit. Quart. Rev. 1836, v. 1. p. 162. (4) Lond. Med. and Surg. Jour. 1834, v. 5, p. 445. (5) American Cyclopæd. of Med. and Surg.—Lond. Med. Quart. Rev. v. 3, p. 206.

* Either by the application of a ligature, or by an inordinate pressure of pus on the veins, the former being common to both operations, as also the latter, when primary union is universally persisted in. Dr Davidson has applied torsion (Edin. Med. and Surg. Jour. 1838, v. 49, p. 54); and Messrs Hammick and Lawrence ligatures to these vessels (Lancet, 1829-30, v. 2, p. 194) with satisfactory results; but both at St Thomas's and St Bartholomew's, fatal cases are on record from such treatment. (Lond. Med. Gaz. 1829, v. 3, p. 171; and Lancet, 1826-7, v. 2, p. 493.) Bell, (Inst. of Surg. v. 2, p. 106) Dumbreck, (Edin. Med. Chir. Trans. v. 1, p. 492) Hodson, (On the Arteries) Wickham (Provincial Med. Gaz.) Cooper, Travers, (Surg. Essay, 3d Ed. v. 1, p. 286) Breschet, (Lond. Med. and Phys. Jour. v. 42, p. 161) and Dupuytren (Leçons oral, &c.) justly deprecate this practice, so common in Italy, as remarked by Gordon in his observations on those schools, yet so frequently followed by purulent depositions (Dr Lee on Foreign Institutions.) Accordingly, the practice of placing a piece of lint over the venous mouths, as employed by M. Vincent of St Bartholomews, appears to be less objectionable. (Lond. Med. Gaz. 1827-8, v. 1, p. 138.)

the phenomena concomitant or a suppurating * stump alone require examination.

Hunter (1) seems to have been the first who drew the attention of medical men to the nature of Phlebitis, and has been followed by Hodson, (2) Travers, (3) Bell, (4) Rose, (5) Guthrie, (6) Abernethy, Carmichael, (7) and the French pathologists, Bouillard, Ribes, and Breschet, (8) able investigators in this fertile field of research.

The statements regarding this affection have frequently been contradictory, and the deductions from similar data often varied and so inconclusive as still to veil this doctrine in partial obscurity. (9)

Mr Arnott, (10) M. M. Dance, Blandin, and Cruveilhier (11) conceive this event to arise from pus entering into the circulation as the principal but not the sole cause; Drs Wright (12) and Cheston, (13) from metastatic principles; Sir A. Cooper (14) from a diseased state of the stump; Drs Carswell (15) and Buchanan, (16) from an admixture of pus with the blood; Donné (17) from a diffuent and dissolved state of the coagulum induced by the combination of the fluids just mentioned; Marechal, Rochoux, and Valpean, (18) on the separation of pus from the blood, and consequent accumulations in the capillaries, or in

(1) Beclard's Gen. Anat. 1830. (2) On diseased state of the arteries and veins, 1815, p. 511. (3) Cooper and Traver's Surg. Essays, 3d Ed. v. 1, p. 286. (4) Middlesex Hosp. Reports, pt. 3. (5) Lond. Med. Chir. Trans. v. 14. (6) Gun shot wounds, 3d Ed. (7) Lond. Med. Gaz. 1829, v. 3, p. 821. (8) Lond. Med. Chir. Rev. 1825, v. 2. p. 161. (9) Glas. Med. Jour. 1831, v. 4, p. 435. (10) Lond. Med. Chir. Trans. v. 15, p. 131. (11) Brit. and For. Quart. Rev. 1836, v. 1, p. 147. (12) Lond. Med. and Phys. Jour. 1831, v. 4, p. 435. (13) Patholog. Obs. 1766. (14) Surgery by Tyrell, v. 3, p. 205. (15) Fas. 8. Illus. and Forms of Diseases. (16) Edin. Med. and Surg. Jour. 1838, v. 49, pp. 51—53. (17) Archives générales août, 1836. (18) Rev. Medic. Juin. Juil. et Decém, 1836, Mar. 1827.

* Hunter supposed that death was caused by inflammation running along the course of a vein to the heart, but Dr Rooks observes that this is of rare occurrence.

the cellular texture ; while Dupuytren (1) objects alike to both hypotheses of pus derived from suppuration, or from the surface of the veins, and regards the traumatic fever to be "fièvre pyogénique."

Professor Syme (2) is of opinion, that, when inflammation attacks a vein, the resulting adhesion opposes the ingress of secreted fluids into the circulation. But surely by an excess of this inflammatory process, suppuration ensues, and the venous mouths again become dilated.

According to the views of Arnott, (3) and the dissections of Dance, (4) the injection of animal poisons into the system, appears to produce similar effects to Phlebitis, as well as the fluids absorbed from foul ulcers, or from soiled applications to abraded surfaces, as observed by Mr Harrold (5) of Cheshunt, from which it may be presumed that a vicarious fluid is absorbed from the stump by the venous centripetal conduits, producing a vital change in the composition of the blood, indicated by the purulent accumulations being generally found in the lungs and liver, * the elaborating reservoirs of this fluid, alluded to by Valpeau, (6) Blandin, (7) and Dupuytren. (8) It appears, then, that Phlebitis may arise from the united agencies of *absorbed* and *secreted* abnormal fluids, the latter being essential in the case of a tied vein, but rather an accessory than a necessary cause, more an effect in the instance of a suppurating stump ; the morbid matters, however, either alone or combined, being equally virulent, may produce like results.

As to colliquative suppuration, it is perceived from the reports of St Thomas's Hospital, (9) that, in the course of long

(1) Trait. theor. et pract. des bles. par arm. de guerre, &c. par Paillard et Marx, 1834, t. 2. (2) Oral. Clin. lectures. (3) Lond. Med. and Phys. Jour. v. 7. (N.S.) p. 137. (4) Ibid. v. 9, (N.S.) p. 267. (5) Lond. Med. Chir. Rev. 1837, v. 26, p. 289. (6) Rev. Medicale, 1826. (7) Lond. Med. Chir. Rev. 1833, v. 19, p. 195. (8) Trait. theor. et pract. des bles. par arm. de guerre, &c. t. 2. (9) By South, 1836, v. 1.

* The Vena Portæ to its minutest ramifications has been found filled with pus from disease of the rectum (London Med. Gaz. 1828, v. 2, p. 701.)

experience, in no instance have purulent deposits ensued which were distant from the primarily inflamed vein, without manifest symptoms of inflammation in that part. This, however, may be rather an effect, as it is obvious, that the ordinary secretions, as into the joints, must participate in the contaminated circulation inflaming the textures, * and inducing suppuration, not by pure deposition, but by its acquired irritant properties, so as even to account for ophthalmic diseases, which have accompanied a translation of gonorrhœa, or parturition, alluded to by Marshall Hall, and Higginbottom. (1) Moreover, according to Dupuytren, Valpeau, and Sanson, (2) debilitated and hospital patients are most liable to this disease; and from the above theory, such would be anticipated, as in these individuals the system is most susceptible of impressions. In fact, the idiopathic form of this disease, and the instances where purulent depositions have been found with no trace of Phlebitis, (3) may be caused by deleterious effluvia acting on the respiration, changing the condition of the blood, and inducing the result in question.

Valpeau, Dupuytren, Guthrie, (4) and Buchanan, (5) from this malady, have witnessed the dire catalogue of hospital deaths; and the more is it to be lamented, since it has been recorded by Travers, (6) that, in no single instance, when fully confirmed, has a cure been accomplished, baffling every kind of treatment, both stimulant and depletory. The only alternative—the forlorn hope, is centred in the efforts to prevent this calamity, so calm in operation, (7) yet so terrible in effect, evidently excited by the

* In the instances where pus has been found in the tissues where there was not the slightest proof of inflammatory action, as for instance of the coagula contained within the cavities of the heart, the appearances may be referred to the theory of Donné, admitting only that the change is simultaneous with the patient's disease; the viciated blood, losing its vitality, deposits purulent specks in the coagulating masses.

(1) London Med. Chir. Trans. v. 13. (2) Sanson's Thesis. (3) Glas. Med. Jour. 1829, v. 2, p. 424. (4) Obs. made after the battle of Waterloo, in hospitals through Antwerp, by Armauth and Colchester to London. (5) Glas Med. Jour. 1831, v. 4, p. 435. (6) On Const. Irrit. 1826, v. 1, p. 189. (7) Glas. Med. Jour. 1829, v. 2, p. 422.

powerful agency of overabundant suppuration, (1) confined pus, (2) and undue pressure on the stump. (3)

If secondary union be judiciously employed, the first excitant will often be allayed. If the surfaces are in general, instead of mere tegumentary apposition, the favourite recommendation of Sir Astley Cooper, (4) not less the favourable reservoir of stagnated pus, explained by Sanson, the second will become a rarity. If the rollers, such as those of Bell (5) and Cooper, were less employed, Carswell and Phillips (6) would have been saved the allusion to such fatal cases as those of the Hôpital La Charité, and many victims might yet have lived.

Already it has appeared, and will be sufficiently confirmed by reference to the second volume of Dr Rees's Cyclopædia, that flaps, whether treated by the first or second intention, are least allied to these generating irritants, * and from reasonable analogy, it may be inferred that Phlebitis seldom supervenes on this amputation. But the reverse is the case; for the circular incision, as appeared from the Appendix of the Essay of which this is but an abstract, is less liable to such a result, only to be accounted for on the ground, that many of the flap amputations were performed *subsequent*, the circular prior to, the investigations on this subject, even when the case was denominated "morbi sine materia." (7)

5th, *Erysipelas*.—Drs Pitcairn, Baillie, Cullen, Williams, (8) and Stenson, (9) William Henry, (10) F.R.S., Mr Weatherhead, (11) and Travers, (12) regard erysipelas as contagious;

(1) Sanson and Buchanan. (2) Sanson. (3) Lond. Med. Gaz. 1833-4, v. 1, p. 193. (4) Lectures, by Tyrell. (5) Inst. of Surg. 1838. (6) Lond. Med. Gaz. 1833-4, v. 1, p. 193. (7) La Clinique, Hôtel Dieu, 1829. (8) St Thomas's Hosp. Reports, by South, v. 1, p. 323. (9) Edin. Med. Chir. Trans. 1836, v. 2. p. 128. (10) On the Laws of Contageon. (11) Lond. Med. and Phys. Jour. 1814, v. 31, p. 451. (12) Const. Irrit. v. 2.

* The extremities of the lines of incision in the flap are at right angles with the end of the bone, but the corresponding parts in the circular incision being considerably anterior, retard the free egress of accumulated fluids, and consequently favour their stagnation.

Messrs Syme, (1) and Dowel, (2) Dr Young, (3) and several Parisian surgeons, (4) to be epidemic; Mr Druitt, (5) epidemic and infectious; and Dr Wells, (6) infectious and contagious. Of these theories, * the latter, based on extensive observation, appears to be the most rational, but, as yet, sufficient proof has not been adduced that this malady is also epidemic.

Mr Travers (7) has attributed tightness and the irritation caused by suppurating surfaces to be a frequent cause of this affection, and although theoretically the flap should be more exempted than the circular incision, still, practically, it appears that a common liability extends to both.

6th, *Gangrene*.—Gangrene, which M. Corbin (8) of Hôpital La Charité, finds frequently complicated with phlegmonous erysipelas, has been ably investigated by John Bell, Rollo, Thomson, Blackadder, (9) Boggie, Sir Gilbert Blane, (10) Trotter, (11) and Carswell. (12)

Gangrene, as the *cause* of amputation, may be spontaneous or traumatic. In either, it is essential to know when and where to

(1) Oral. Clin. Lectures. (2) Dublin Journal of Med. Science. Nov. 17, 1834. (3) Glas. Med. Jour. 1829, v. 2, p. 247. (4) Lancette Française, 1831. (5) Surg. 1839, p. 196. (6) Trans. for improv. of Med. Chir. knowledge, v. 2. (7) Const. irrit. 1835, v. 2, p. 127. (8) Clin. Hôp. La Charité, 1835. (9) Phagedæna Gangrenosa. (10) Diseases of seamen. (11) Medica Nautica. (12) Forms and illus. of disease.

* Dr Williams (on Cut. diseases) remarks, that if a person be inoculated with the fluid contained in the phlytænæ of genuine erysipelas, a swelling characteristic of that from which it was derived is produced; also, in twenty-one cases on board the ship *Jalouse*, the majority took erysipelas from direct personal contact, (Lond. Med. and Phys. Jour. 1814, v. 31, p. 451.) 2dly, Dr Wells observes, that the miasmata of erysipelas may extend from the patient with marked intensity to a greater range than in typhus; and Ralph Cumming has made similar observations. Again, the new buildings of St Thomas's being commenced, before the old, in which this affection prevailed to a great extent, was demolished, the symptoms again appeared, from which it may be inferred, that the erysipelatous poisonous effluvia contaminates the structure, from which the disease may be propagated with more or less intensity, according to the seasons and variations of temperature.

amputate. Between the former and the latter, analogy is incomplete, as the constitution was primarily affected in the one acting as a cause, while in the other, it partook of the secondary affection, and became an effect.

When spontaneous, the line of demarkation is the signal for amputation, for the system is rallying from the effects of its abnormal condition, evinced by the effort to detach the dead textures from the living. On the contrary, when traumatic, as the destroyer on the wing, amputation is requisite before the constitution becomes saturated * with the disease—before a line of separation is indicated, and the practice of Larrey, Lawrence, Hennen, Ballingall, Cooper, and Mayo, (1) seems preferable to that of Pott, Sharp, Thomson, and Guthrie, as is confirmed by many striking instances recorded in the London, (2) Dublin, (3) and Glasgow (4) Journals, and other periodicals.

The “Paurriture des Hospitaux,” as the effect of amputation, has, by Cumming (5) and Moffat, (6) been deemed contagious; by Annesly, (7) as seen at Proome, the contrary. It is possible, however, that its influence may partake of the nature of erysipelas.

Perhaps, in spreading gangrene, when high amputation is implied, and the integuments above the line of unavoidable selection, implicated in the disease, the single circular incision may be preferred to the flap; but under other circumstances, the concluding remarks on erysipelas may here also be equally applicable.

7th, *Cystitis—Abscess—Sinus.*—These effects often prolong

* As an instance, of which the following case may be adduced :— On December 27, 1839, a man sustained a compound fracture of the leg. Next day the limb was amputated at the Edinburgh Royal Infirmary, below the knee. On the 30th, the stump appeared gangrenous, and reamputation was performed above the joint, but the patient died the following day with discoloured patches on different parts of his body.

(1) Lond. Med. and Phys. Jour. 1831, v. 10, (N.S.) p. 320. (2) Lond. Med. Chir. Rev. 1834, v. 10, p. 256. (3) Meath Hosp. Reports. (4) For 1829, v. 2, p. 456. (5) Lond. Med and Phys. Jour. 1804, v. 11, 390. (6) Ibid 1800, v. 4, p. 408. (7) On diseases of India, v. 2, p. 7—Appendix.

the cure, exhaust the patient, and prove the indirect agents of more momentous complaints. (1)

Valpeau (2) has maintained, that the flaps are very subject to inflammation from their mobility; but this is entirely prevented by the use of the interrupted suture so strenuously recommended by Liston (3) and Ballingall. (4)

In general, it would appear, that these results are more liable to supervene on the circular incision than on the flap, being the concurrent testimony of Alanson, (5) Bromfield, (6) Sharp, (7) the Bells, (8) Cooper, (9) Guthrie, (10) Hutchinson, (11) Liston, (12) Lizars, (13) and Pelletan. (14)

8th, *Irritability—Spasms—Neuralgia.*—Baron Larrey (15) presented to the Royal Academy a preparation of a stump exhibiting the expansion of the nervous filaments with their intricate adhesions, from which he inferred that the cicatrix enjoys the same sensibility as the other parts of the body, perhaps even in a more developed degree.

Morgagni, Prochaska, Meckel, Vanhorn, Discot, Portal, Bel-
lengeri, (16) Andral, Monro, Bell, and Swan, (17) have directed in particular their attention to the subject of neuroma, but the various states in which this exists have been elaborately investigated by Mr Langstaff, and detailed by him in the sixteenth volume of the London Medico-Chirurgical Transactions.

Sir George Ballingall (18) has remarked, that the nerves are left too long after the flap operation. But need this attract public attention, since curtailment can be as effectual here, as Bell (19) and Guthrie (20) have found for the bone.

(1) Andral, p. 400. (2) Cooper's Lectures at North London Hosp. (3) Surgical Works. (4) Clin lect. at Edin. Infr. 27th Feb. 1827. (5) On Amput. p. 32. (6) Surg. v. 1, p. 73. (7) Crit. Inq. 3d Edit. p. 282. (8) Benj. v. 7, p. 256; Charles, Operat. Surg. v. 1, p. 100. (9) Surg. Dict. 3d Edit. p. 219. (10) Gun shot wounds, 3d Edit. p. 291. (11) Surg. 1826, 2d Edit. p. 87. (12) Operat. Surg. p. 317; Elem. of Surg. p. 372. (13) Pract Surg. pt. 1, p. 219. (14) Clinique Chirurg. t. 3, p. 219. (15) Annales des Sciences Naturelles—Ap. 1827. (16) Annali Universali. (17) On the Nerves. (18) Mil. Surg. 2d Edit. p. 373. (19) Inst. of Surg. v. 1. p. 331. (20) Gun shot wounds, 3d Edit. p. 108.

The objection, that slight spasms frequently follow this amputation, by the nerves suffering compression, has been adduced by Sir Charles Bell, and borrowed by Mr Druitt. (1) But, although this is admitted to disappear as the edges of the bone become rounded off by absorption, still, such a result is almost confined to the single flap below the knee, presently to be considered.

More cases of nervous affections have been witnessed by Sir Charles Bell (2) during his last year's attendance at the Middlesex Hospital, than at any former period, which he attributes to the flap; while Mr Liston (3) declares that neuromita is less frequent since this operation came into use. But had a comparison been instituted at the Middlesex, the comprehensive conclusion already drawn must have been supported by insufficient and presumable data, as the North London Hospital is the only Metropolitan Institution in which such a method of amputating is held in any degree of repute.

The nerves being parallel in the flap, but converging toward the bone in the circular incision, theory would at once suggest, that nervous ganglions and their effects are more apt to be the consequence of the latter than the former; which really is in accordance with the experience of Bromfield, (4) Alanson, (5) Latta, (6) Cooper, (7) King and Costello, (8) Liston, (9) Messrs Crooks, (10) and Langstaff. (11)

From the slightest twitch of the nerve to the spasm of the muscle,—from the excruciating agony of the stump to its total ramollissement—from the complete disuse of the limb to the death of the patient, is the brief yet striking career of this affection. The pining sufferer, who has again and again submitted to abortive resections, (12) at last finds his way to the fabricator of limbs, who, by addition, may give that relief so often denied by detrac-

(1) Surg. 1839, p. 418. (2) Inst. of Surg. 1838, v. 1, p. 332. (3) Elem. of Surg. 1832, p. 174. (4) Chir. Works, 1773, v. 1, p. 165. (5) On Amput. 2d Edit. pref. (6) Surg. v. 3, p. 574. (7) Surg. Dict. 7th Edit. p. 69—421. (8) Cyclopæd. Pract. Surg. pt. 2, p. 143. (9) Elem. of Surg.. (10) Lancet, 1826-7, v. 2, p. 740. (11) Lond. Med. Chir. Trans. 1830, v. 16, p. 137, &c. (12) Ibid. v. 16, p. 132; Lond. Med. Chir. Rev. 1834, v. 20, (N.S.) p. 555; Sir C. Bell on the Nervous System, 1836, 3d Edit. p. 165; Lancet, 1836-37, v. 1, p. 110.

tion, and although here his comfort is also incomplete, still here a store of facts is preserved, * which attests that neuralgia frequently supervenes on the circular incision, but almost never on the flap.

9th, *Atrophy or Conical Stump*.—According to the observations of Mr Langstaff (1) and others, (2) this result is the effect of the meagre covering of skin and muscle, exposing the nerves to irritation, and occasioning general excitement in the stump. This frequently occurred after the operations of Celsus, (3) Dupuytren, (4) and others circulists; even Cheselden (5) himself fared little better, as testified by O'Halloran, (6) Bromfield, (7) Alanson, (8) Sharp, (9) Latta, (10) Dewar, (11) Rees, (12) Hawkins, (13) Syme, (14) and Liston. (15)

An experienced military surgeon (16) had the mortification to find three tapering stumps, although his amputations were performed according to Sabatier, Desault, Pelletan, and Pott; using the greatest circumspection in their formation and after-treatment.

Hey, Guénand, Monro, and Bromfield, (17) were treating scientific questions regarding the best means for effectually covering the bone, when Louis (18) described his peculiar method to their general satisfaction. But even this mode has been declared by Valentin (19) still to be insufficient. In fact, the general tendency to pyramidal stumps, after *every* variety of the circular

* Messrs Ferguson and Fortune, artificial limb-makers to St Bartholomew's, London, and the Royal Infirmary, Edinburgh, from extensive experience, the former of the circle, the latter of the flap, corroborate the above statements.

(1) Lond. Med. Chir. Trans. v. 16. (2) Andral, p. 228; Bell on the Nerves, 3d Edit. p. 429. (3) History of Amput. (4) Bell's Inst. of Surg. v. 1, p. 336. (5) B. Bell's Surg. v. 7, p. 256. (6) On Gangrene, 1765—pref. (7) Surg. 1773, v. 1, p. 153. (8) On Amput. 2d Edit.—pref. (9) Crit. Inquiry, p. 287. (10) Surg. v. 3, p. 590. (11) Edin. Med. and Surg. Jour. v. 24, p. 265. (12) Cyclopæd. v. 2. (13) Lond. Med. Gaz. 1832-3, v. 2, p. 877. (14) Edin. Med. and Surg. Jour. v. 21, p. 35. (15) Ibid. p. 44. (16) J. B. Paroisse, opus. de chir. 1806, pp. 185—203. (17) Cyclopæd. Pract. Surg. pt. 2, p. 120. (18) Mem. de l'Acad. Chir. t. 5, p. 275. (19) Recherches critiques sur la chirurg. Modena, 1772.

incision, is too evident from the various inventions of Van Sweiten, (1) Monro, (2) White, (3) and Bell, (4) to prevent retraction of muscles or integuments, and also from a passage in the 1st vol. of Sir Charles Bell's Institutes of Surgery, (5) headed "Amputation of the Stump."

From the remarks already made under the last particular necessary for the formation of a good stump, it has appeared that protrusion of bone could scarcely ever supervene on the flap, which is in unison with the views of Cooper (6) and Guthrie, (7) and actually confirmed by Professor Syme. (8)* Neither is the experience of the limb-makers, already alluded to, at variance with the above statement, from which it may be deduced, that the cone, according to Euclid, which has a circle for its base, and a point for its apex, is a definition, though formerly peculiar to the mathematician, is now equally allied to the surgeon, admitting of an easy and happy application to those formidable results, so frequent concomitants on the circular incision.

10th, *Necrosis*.—Professor Von Walther, (9) and Brünninghausen, (10) solicitous of preventing changes in the bone after amputation, have advocated the propriety, the one of retaining the capsular ligaments, the other, a portion of the periosteum; but the justness of such precautions must be resolved in accordance with the conceived theory of osseous formation. Du Hamel, Scarpa, Michele Medici of Bologna, (11) Hunter, (12) Howship, (13) Boyer, (14) and Louis, (15) have recorded much varied and interesting information on the growth and diseases of the bones;

(1) O'Halloran on Gangrene, 1765, pref. (2) Edin. Essays and Obs. 1747, v. 4, p. 256. (3) Bromfield, 1773, v. 1, p. 153. (4) Inst. of Surg. v. 1, p. 336. (5) P. 336. (6) Surg. Dict. 7 Ed. p. 70. (7) Gun-shot wounds, p. 306. (8) Edin. Med. and Surg. Jour. v. 21, p. 38. (9) Journal. (10) Jour. of Foreign Med. v. 2, p. 70. (11) For. and Brit. Quart. Rev. 1836, v. 1, p. 549. (12) Trans. of Soc. for dif. of Med. Chir. Knowledge, 1800, v. 2, p. 277. (13) Lond. Med. Chir. Trans. 1816, v. 7, pt. 1, p. 389. (14) Rev. Medicale, Nov. 1834. (15) Mem. de l'Acad. Roy. Chir. t. 2, 1753, plate 14, fig. 4.

* On 23d Nov. 1838, resected a flap stump for its partial conical form, occasioned by phagedenic ulceration, which is the only case that has come under the Professor's observation, and is yet unpublished.

and at present Bell and Syme, (1) keenly contest the subject, the former contending that bone is produced by bone, the latter by the periosteum; opinions similar to what have been already broached by Louis, Fabre, Pibrac, (2) Cooper, (3) Cruveilhier and Dupuytren. (4)

Béclard, in his work on general anatomy, (5) describes the periosteum to accompany the vessels to the interior of the bone, and sustain them there. The periosteal envelopes may therefore be the communicating media between the blood and the bone, and, as a consequence, the latter dies when the former is intercepted by being stripped of its covering. According to the same anatomist, there has also been attributed to the periosteum the faculty of determining the form of bones; and this appears not improbable from the facts, that deposits of bone were found in the voluntary muscles of Prussian recruits, occasioned, as Dr Ritcher (6) observed, by the pressure of heavy German muskets; and that the tourniquet (7) has been successfully applied in consolidating ununited fractures of long standing.

If bone formed bone, the detachment of the periosteum ought not to cause necrosis. If the periosteum formed bone, *united* fractures within the capsule of the hip joint, (8) and osseous depositions in the auricles of the heart, must have some other producing agent. It is possible, then, that the periosteum, by pressing on the blood which passes through it, presides over and determines its peculiar secretions, and where equivalent abnormal pressure exists, that osseous effusion, or an approximation to it, may be the result. But in whatever way this question may be theoretically explained, the fact is unequivocal, that when a bone is exposed, it gets caries, it becomes necrosed, and this, as a frequent result after the circular incision, has been established by Wiseman, (9) Sharp, (10) Alanson, (11) Monro, (12) Bell, (13)

(1) Oral Lectures in Edinburgh University. (2) Mém. de l'Acad. de chir. t. 4. (3) Surgery by Tyrell, v. 1, p. 160. (4) Dict. des Sciences Medicales, art. ossificat. (5) 1830, p. 235. (6) Lond. Med. Chir. Rev. 1834, v. 2, p. 334. (7) Lond. Med. and Surg. Jour. 1834, v. 4, p. 287. (8) Stanley, Lond. Med. Chir. Trans. 1833, v. 18, p. 256. (9) Works, 1734, 6th Edit. v. 2, p. 225. (10) Surg. 8th Edit. p. 219. (11) Surg. 2d Edit. pref. p. 32. (12) Works, 1781, No. 20, p. 472. (13) Operat. Surg. p. 400.

Cooper, (1) Wardrop, (2) Hawkins, (3) Liston, (4) Syme, (5) and Ravaton; (6) and never * on the flap, by Alanson, (7) Le Dran, (8) and Syme. (9)

Both at St George's Hospital (10) and a Dublin institution, has it been remarked, that the "full cushion" by the circular incision in young stumps *speedily* degenerated, leaving a projecting bone; which sequela is attributed to the ossific process. (11) † Had, however, more attention been paid to the *real* preservation of muscle—had the bone been sufficiently "buried," (12) there might have been fewer resurrections. ‡

In the second volume of the Memoirs of the Royal Academy of Paris, the academicians are there discussing the question, whether the projecting bone should be left to exfoliate, or to be sawn off; but in our country "resection" is but too often the proffered apology for this vaunted incision, though performed by the first men in the kingdom. (13) And, according to Bromfield, (14) Syme, (15) and Liston, (16) such an event is of no rare occurrence, and cases

(1) Surg. Dict. 3d Edit. p. 29. (2) Lancet, 1826-7, v. 12, p. 351. (3) Lond. Med. Gaz. 1832-3, v. 2, p. 877. (4) Elem. of Surg. 1832, p. 372. (5) Edin. Med. and Surg. Jour. v. 21, p. 30. (6) Bell's Operat. Surg. p. 400. (7) Surg. 2d Edit. p. 32. (8) Surg. 3d Edit. p. 435. (9) Edin. Med. and Surg. Jour. v. 21, p. 38. (10) Hawkins, Lond. Med. and Surg. Jour. 1834, v. 4, p. 349. (11) Hargrave's Operat. Surg. 1831, p. 229. (12) Bell. (13) Alanson on Amput. p. 32; Lond. Med. Chir. Trans. v. 16, p. 132. (14) Surg. 1773, v. 1, p. 153. (15) Edin. Med. and Surg. Jour. v. 21, p. 30. (16) Elem. of Surg. 1832, p. 372.

* Mr Liston conceives that if the flaps are made too long, the consequent irritation may cause the bone to become denuded, and subsequently to exfoliate. But the preceding and subsequent remarks refer only to amputations as they are generally performed, and all exceptions are *specially* alluded to.

† A boy, at the age of 10, had his knee joint excised by Mr Syme. When presented again, aged 17, at the Edinburgh Royal Infirmary, the sound limb was large and muscular, but the other appeared emaciated in the extreme, having gained *no addition* in length through the space of seven years.

‡ Mr Ferguson has alone seen five protrusions at St Bartholomew's Hospital after the circle; but Mr Fortune, at the Edinburgh Infirmary, *none* after the flap.

are even on record (1) where secondary amputation by the circular incision, from proving still abortive, had finally to be ransomed by the flap.

Since the foregoing general contrast evidently gives a degree of preference to the flap, it is now requisite to consider the relation this operation bears to the circular incision in *individual* amputations, illustrating the comparison by reference to the results.

Articular amputations have generally been performed by flaps; Dupuytren (2) even acquiescing in the common decision.

Mr Lawrence (3) has suggested high amputation of the thigh, with the disarticulation of the bone, as preferable to the flap operation at the hip joint; and Veitch (4) and Latta (5) have recommended the circular incision at this articulation, which Sir Astley Cooper (6) has actually performed. * The methods, however, in general use, are the flaps of Larrey, Lisfranc, or Guthrie. Here, amputations have been performed by Kerr, Travers, Blandin, and Hen Von Walther; successfully, by Brownrigg, Orton, Macfarlane, Bryce, Syme, Guthrie, Mayo, La Mott, M. Baffos, Valpeau, Larrey, and Delpech. (7)

* Flaps now appear to him more favourable for union. (Lectures by Lee or Tyrell, v. 2.)

(1) *Edin. Med. and Surg. Jour.* 1805; *Lancet*, 1836-7, v. 2, p. 143; *Ibid.* 1834-5, v. 2, p. 548; *Ibid.* 1836-7, v. 1, p. 748. (2) *Leçons oral. de chirurg.* t. 4. (3) *Lancet*, 1829-30, v. 2, p. 945. (4) *Edin. Med. and Surg. Jour.* v. 3, p. 132. (5) *Surg.* v. 3, p. 624. (6) *W. P. Cocks' illustrat.* for 1833; *Lancet*, 1823-4, v. 1 and 2, p. 425. (7) *Reports of Hôpital La Charité, Berlin*, by C. T. Kuhk, 1834; *Reveu Medicale* for Sept. 1824; *Gräefe and Walther's Journal* for 1824; Guthrie on gun shot wounds, 1827, 3d Edit. p. 167; Bryce's *Surgical Cases in Greece*, 1827; Dr Thomson's *Report of the Belgium Hospitals*, 1816, p. 268; Travers on *constitut. irrit.* 1826, v. 1, p. 125; Bell on the *Nervous System*, 1836, 3d Edit. p. 165; Cooper's *Surg. Dict.* 3d Edit. p. 44; *Lond. Med. Chir. Trans.* 1827, v. 13, p. 605; *Lond. Med. Chir. Rev.* 1824, v. 4, pp. 227-947; 1828, v. 9, p. 502; 1833, v. 19, p. 195; *Lond. Med. and Phys. Jour.* 1824, v. 52, p. 66; 1825, v. 53, p. 21; 1827, v. 3, p. 229; 1828, v. 4, p. 80; *Lond. Med. Gaz.* 1831, p. 281; 1832, v. 1, p. 232; *Lancet*, 1824, v. 5, pp. 185-244; 1827-8, v. 11, p. 682; 1834-5, v. 1, p. 307; 1830-31, v. 2, p. 742; 1836-7, v. 1, p. 110; *Edin. Med.*

Alanson, Sanson, Valpeau, and Dupuytren, have inclined to, and even employed the circular incision at the shoulder joint; (1) but the flap amputations, as practised by Le Dran, (2) La Faye, Larrey, Garengot, (3) Desault, (4) Lisfranc, Champesme, Cooper, Hennen, Sharp, Guthrie, and Bell, have been found to possess superior advantages; (5) the ratio of recoveries in Larrey's Egyptian campaign being as 90 to 100; and after the battle of Vittoria, as 17 to 18.

As the professional opinion, however, is more at variance respecting the proper method of amputating the arm, * forearm, thigh, † and leg, ‡ these shall now be more particularly considered.

and Surg. Jour. 1824, v. 22, p. 22; 1828, v. 29; Edin. Med. and Philos. Com. 1769, v. 6, p. 337; Glasgow Med. Jour. v. 24, p. 262.

(1) Turnball's Naval Surgeon, 1806, p. 308; Lond. Med. and Phys. Jour. 1805, v. 14, p. 108; Lancet, 1826, v. 3 and 4, p. 69; Edin. Med. and Surg. Jour. 1836, v. 46, p. 429. (2) Surg. 3d Edit. 1757, p. 435. (3) *Traité des oper. declin.* t. 3, p. 350. (4) *Med. Oper.* t. 3, p. 399. (5) Dupuytren, *Leçon oral. &c.* t. 4, p. 326; Larrey, *Mem. de chir. milit.* t. 4, p. 432, Paris, 1817; Klein, *Practis. &c.* h. 1, 1-10; Report of Cases at Hôpital La Charité, by C. T. Kuhk, Berlin, 1832; Alanson's *Pract. Obs. on Amput.* 2d Edit. 1782, p. 192; Guthrie on gun shot wounds, p. 108; Bryce's *Surgical Cases in Greece*; Cooper's *Surg. Dict.* 7th Edit. p. 89; Lond. Med. Chir. Rev. v. 18, p. 274; Lond. Med. Gaz. 1822-3, v. 1, p. 299; 1829-30, v. 2, p. 496; 1830-1, v. 7, p. 511; 1832, v. 1, p. 806; 1833-4 v. 1, pp. 300, 458; v. 2, pp. 73, 864; Lancet, 1826-7, v. 2, p. 740; 1827-8, v. 2, pp. 65, 198, 815; 1830-1, v. 2, p. 741; 1832-3, v. 1, p. 170; 1833-4, v. 2, pp. 233, 252, 368; Edin. Med. and Surg. Jour. 1805, v. 1, p. 289; v. 24, p. 45; 1835, v. 44, p. 15, 1836, v. 45, p. 16; 1838, v. 49, p. 39; v. 50, p. 369; Glasgow Med. Jour. 1828, v. 1, p. 117; 1830, v. 3, p. 193; 1831, v. 4, p. 259.

* Amputation at the humero-cubital articulation appears to have been first proposed by Ambrose Paré, but it soon fell into disuse. Since, however, Dupuytren and Liston revived and practised it with some success. (*Liston's Operat. Surg.* p. 308.)

† Fab. Hildanus, in the 16th century, and Hoin of Dijon, and J. L. Petit, have amputated at the knee joint. M. Valpeau adopted this practice at Hôpital La Charité, and although some cures were effected, yet, during the winter 1835-6, three cases operated on, proving fatal about the 7th or 9th day, the operation was condemned as being bad and impracticable. (*Lancette Française.*)

‡ The operations of Hey and Chopart on the foot, and Langen-

First, Mr Hargrave (1) observes, that amputation of the humerus by the circular incision is confined to the space between the elbow and the insertion of the pectoralis major; such selection being apparent from the nature of this operation requiring an equalized distribution of muscular tissue surrounding the limb.

Key and Cooper, at Guy's; Guthrie and White, Westminster; Travers, St Thomas's; Hawkins and Keate, St George's; Latta and Hunter, Edinburgh; and Cooper, at Glasgow Infirmaries, have severally amputated the arm by the circular incision, the results of which are now subjoined:

Of xxx amputations,

1 had Un. by Suppurat.; 2, second Hem.; 3, Phlebit.; 1, Erysipelas; 6, Gang.; 1, Abscess; 4, Spasm; 3, Conical Stumps; and 5, Necrosis; 4, Resected Circular Stumps.

Generally, 4 ligatures were applied.

Time of cure, 14 to 60 days.

Majority, chronic cases.

Average age, 20.

Deaths, 9. 3 from immediate amputation, 2 of which were succeeded by phlebitis in debilitated cases, æt. 11 and 18; 1, phlebitis, and another erysipelas, succeeding amputation for gangrene, æt. 18 and 72; 1, scrofulous disease, æt. 11; 1, gangrene, æt. 58; 1, diseased lungs; and 1 from the effects of the operation, æt. 63. (2)

beck on the toes and fingers, require no special mention. M. Gensaul, at Hôtel Dieu, Lyons, amputated at the carpo-metacarpal articulation, preserving the thumb. (Archives Generales, Valpeau, Juin, 1827.) Mr Evans Riadore (Lancet, 1826-7, p. 559,) and Dr Sully (Ibid. p. 784,) have similarly operated; and Mr Syme has amputated the fingers through the metacarpus by the double flap, saving the thumb, which was subsequently used with astonishing freedom. (Edin. Med. and Surg. Jour.)

(1) Operat. Surg. 1831, p. 154. (2) Wiseman's Surgery, 1734, 6th Edit. pp. 42, 229; Latta's Surgery, v. 3, cases, 11, 32, 33, and 38; Guthrie on gun shot wounds, 1827, 3d Edit. p. 507; St Thomas's Hosp. Reports, by South, 1836, v. 1, p. 36; Lond. Med. Chir. Trans. v. 16, p. 140; Lond. Med. and Phys. Jour. 1800, v. 3, p. 4; 1804, v. 11, p. 390; 1819, v. 41, p. 388. Lond. Med. and Surg. Jour. 1834, v. 4, pp. 349, 508; Lond. Med. Gaz. 1827-8, v. 1, p. 736; 1829, v. 3, pp. 752, 791; Lan-

Syme (1) and Lizars (2) conceive, that if this method is applicable anywhere on the body, it is between the elbow and shoulder joint, and within these limits has the former and Dr Busche (3) found it successful in cases of emaciated individuals, where there was flaccidity of muscular fibre.

Key, Morgan, and Bransby Cooper, at Guy's; Liston, and Mr Cooper, at the North London; Wardrop, at the Hospital of Surgery, Panton Square; Ballingall, and Syme, at Edinburgh; and Messrs Weir, and Perry, at Glasgow Infirmaries, have amputated by the double flap, as well as Klein, (4) Græfe, and Langenbeck, who, by such a system, have made admirable stumps, with results as follow:—

Of xxiv amputations,

5 Un. by Suppurat. ; 2, Sec. Hem. ; 1, Phlebit. ; 2, Erysipelas ;
and 4 Gangrene.

Generally, 4 ligatures were applied.

Time of cure, from 18 to 22 days.

Majority, chronic cases.

Average age, 30.

Deaths, 5. 2 from secondary amputation, the one being followed by phlebitis, the other gangrene, æt. 55 ; 1 from the effects of gangrene causing amputation, æt. 20 ; and two from gangrene attacking the stump. (5)

cet, 1823-4, v. 1 and 2, pp. 76, 244 ; 1825-6, v. 10, p. 672 ; 1826, v. 3 and 4, p. 81 ; 1826-7, v. 12, p. 351 ; 1827-8, v. 1, p. 685 ; v. 2, p. 815 ; 1831-2, v. 1, p. 346 ; Edin. Med and Surg. Jour. 1824, v. 21, p. 32 ; Edin. Med. and Philos. Comment. 1790, v. 4 ; Edin. Phys. and Lit. Essays, 1771, v. 3, p. 502 ; Glasgow Med. Jour. 1829, v. 2, p. 423 ; 1831, v. 4, p. 424.

(1) Edin. Med. and Surg. Jour. v. 21, p. 32. (2) Pract. Surg. 1838, pt. 1, p. 206. (3) Lancet, 1827-8, v. 2, p. 204. (4) Pract. Ansic. der chir. opér. 44. (5) Garengéot, Mem. de l'Acad. de chir. t. 5, 12mo. ; Klein, Pract. Ansic. der chir. opér. 44 ; Ballingall's Milit. Surg. 2d Edit. p. 375 ; Sam. Cooper's First Lines of Surgery, p. 717 ; Lond. Med. and Surg. Jour. 1836, v. 8, p. 655 ; Lond. Med. Gaz. 1830-1, v. 7, p. 63 ; Lancet, 1825-6, v. 10, p. 730 ; 1827-8, v. 2, p. 274 ; 1834-5, v. 2, p. 155 ; Edin. Med. and Surg. Jour. 1830, v. 33, p. 248 ; v. 34, pp. 223—225 ; 1832, v. 38, p. 327 ; 1833, v. 39, p. 29 ; 1838, v. 49, p. 54 ; v.

Klein, (1) Liston, (2) and Cooper, (3) have advocated antero-posterior flaps, which, though of general application, still possess the disadvantage of favouring a protrusion of bone, when formed at the insertion of the deltoid muscle; but by there adopting the lateral flaps, as employed by Garengeot, (4) and Mr Morgan (5) at Guy's, this occurrence will be entirely prevented.

Hey (6) deemed the flap unnecessary in the arm, and many operators are of opinion that a sufficient stump can be effected by the circle; but even here there are living monuments of *its* deficiency, (7) such as have never yet been recorded of the flap.

Second, British surgeons seldom hesitate to amputate the forearm at the lower third; but the continental, and especially the French operators, object to this selection, on account of the parts being involved in tendinous and fibrous structures; but were they less seldom to adopt consecutive union, their fears might be dispelled, and their objections removed.

Malgaigne (8) declared that Lisfranc's operation at the wrist was showy, but less advantageous in its results than the circular amputation; but Sir Astley Cooper (9) relates fatal cases from the latter; while Liston, (10), Lawrence, (11) Hey, (12) Wardrop, (13) and Cooper, (14) have had ample satisfaction of stumps from the former.

Lawrence (15) has amputated immediately below the elbow joint; Tyrell, (16) $3\frac{1}{2}$ inches under it; Ballingall, (17) at the middle of the forearm; and Sir Anthony Carlisle, (18) 4 inches above the wrist; the choice depending much on the nature of the injury,

50, p. 373; Glasgow Med. Jour. 1828, v. 1, pp. 117, 331, 406; 1829, v. 2, p. 155; 1830, pp. 222, 233; 1831, v. 4, p. 100.

(1) Pract. Ansic. der. chir. opér. 44. (2) Lond. Med. Gaz. 1829, v. 4, p. 350. (3) Lancet, 1826-7, v. 12, p. 61. (4) Mém. de l'Acad. de chir. t. 5, 12mo. (5) Lancet, 1825-6, v. 10, p. 730. (6) Surg. 1810, p. 526. (7) Lond. Med. Chir. Trans. v. 16, Langstaff; Lancet, 1834-5, v. 2, p. 548. (8) Sam. Cooper's First Lines, p. 717. (9) Lancet, 1826, v. 3 and 4, p. 67. (10) Operat. Surg. p. 305. (11) Lancet, 1827-8, v. 2, p. 472. (12) Ibid. 1824, v. 5, p. 59. (13) Ibid. 1825-6, v. 10, p. 351. (14) Lond. Med. Gaz. 1829, v. 3, p. 791. (15) Lancet, 1831-2, v. 2, p. 223. (16) Ibid. 1826, v. 3 and 4, p. 203. (17) Clin. Lect. Edin. Infirmary, July, 1828. (18) Lond. Med. Gaz. 1829-30, v. 2, p. 319.

and much on the endeavour to preserve the motions of pro and supination.

At Guy's, Key, and Bransby Cooper; St Bartholomew's, Lawrence, and Sir Anthony Carlisle; and at the Edinburgh Infirmary, Latta, have amputated the forearm by the circular operation, the result of whose experience with that of others is now detailed:—

Of xxvi amputations,
2 had Un. by Suppurat.; 1, Sec. Hem.; 1 Phlebit.; 2, Spasms;
and 1 Conical Stump.

Generally, 3 to 5 ligatures were applied.

Time of cure, 9 to 20 days.

Majority, chronic cases.

Average age, 20.

Deaths, 2. 1 from phlebit. following amputation for gangrene, æt. 21; the other from hemorrhagic disease, æt. 39. (1)

By Key, and Bransby Cooper, at Guy's; Lawrence, St Bartholomew's; Wardrop, Hospital of Surgery, Panton Square; Latta, Ballingall, and Syme, Edinburgh; and Messrs Cooper, and Perry, at Glasgow Infirmeries, has the flap been employed with the following results:—

Of xxvii amputations,
2 had Un. by Sup.; 1, Sec. Hem.; 2, Gang.; and 1 Cystitis.

Generally, 2 or 3 ligatures were applied.

Time of cure, 7 to 25 days.

Majority, chronic cases.

Average age, 25.

Deaths, none. (2)

(1) Latta's Surgery, v. 3, cases 26, 28, 29, and 60; Guy's Hosp. Reports, by Barlow and Babington, 1826, v. 1, p. 197; Lond. Med. and Phys. Jour. 1800, v. 4, p. 415; 1833, v. 13, p. 205; Lond. Med. Gaz. 1829-30, v. 2, p. 319; Lancet, 1823-4, v. 1 and 2, p. 321; 1826, v. 3 and 4, pp. 67, 203, 641; 1831-2, v. 2, p. 253. (2) Latta's Surg. v. 3, p. 689, cases 25 to 29; Ballingall's Clin. Lec. at Edin. Infir. July, 1828, and Feb. 1829; Guy's Hospital Reports, by Barlow and Babington, 1836, v. 2, pp. 369, 378; Lond. Med. Chir. Trans. v. 16, p. 128, case 13; Lond. Med. Gaz. 1829, v. 3, p. 791; Lancet, 1824, v. 5, p. 59;

Dr Lubbock (1) observed, that by flaps of the forearm, the tendons were left projecting; which objection, however, will speedily vanish by the use of sharp instruments, and by grasping firmly the wrist. But the more formidable result of neuroma has been attributed by Mr Liston (2) to be occasioned by the circular incision, an event which Mr Cooper (3) has never witnessed, but may be made aware of by consulting the 16th vol. of the London Medico-Chirurgical Transactions, or the 2d of the Lancet for 1831-2. (4) Neither can Mr Cooper, (5) out of numberless instances, hardly recollect a bad result from the flap, which by Wardrop, (6) Hennen, (7) and Ballingall, (8) is extolled for its facility of performance, and its permanent utility.

A lad Flockhart had his forearm amputated, and years subsequent appearing in the Infirmary of Edinburgh, (9) though considered to possess *a good circular stump*, yet the parts could not bear free manipulation, and the bones were on the alert to protrude on the slightest emergency. Unphilosophic, then, is it to compare this game of chance with almost absolute certainty.

Third, M. Gensaul (10) of Hôtel Dieu, Lyons, reprobates the general military practice of saving as much of the limb as possible; but Mr Cooper (11) conceives, that the lower the thigh is amputated, the better is it adapted to an artificial contrivance, which opinion is diametrically opposite to that of Mr Liston. (12)

Langenbeck and Gräefe supposed than the tendinous aperture in the triceps muscle would prove an obstacle to ready union after amputation at that part, a matter, however, apparently too theoretical to require refutation.

1825-6, v. 7, p. 216; v. 10, pp. 5, 36, 351; 1827-8, v. 2, p. 472; Edin. Med. and Surg. Jour. v. 24, p. 168; 1830, v. 33, p. 248; 1831, v. 36, p. 234; 1833, v. 39, p. 29; Glasgow Med. Jour. 1828, v. 1, pp. 118, 406; 1829, v. 2, p. 153, 236; 1831, v. 4, pp. 100, 219.

(1) Ballingall's Milit. Surg. 2d Edit. p. 374. (2) Elem. of Surg. 1832, p. 174. (3) Surg. Dict. 7th Edit. p. 69. (4) P. 253. (5) Surg. Dict. 7th Edit. p. 79. (6) Lancet, 1825-6, v. 10, p. 536. (7) Military Surg. p. 269. (8) Military Surg. 2d Edit. p. 373. (9) 1839. (10) Archives generales, Juin, 1827. (11) Surg. Dict. p. 57. (12) Lond. Med. Gaz. 1833-4, v. 2. p. 559.

The limb has been removed by Monro (1) 4 inches above the knee; by Mayo, (2) Hawkins, (3) and Andrews, (4) immediately above this articulation; Mr Vincent, (5) and Dr Davidson, (6) at lower third; Mr Macfarlane, (7) at middle; Mr Green, (8) upper part of middle; and Travers, (9) lower part of superior third; Guthrie, (10) and Syme, (11) through, and Roux, (12) above the trochanters of the thigh bone. The most eligible site, however, appears to be about the lower part of the middle third; but, as already remarked, the point of selection must entirely depend on the nature of the injury or affection requiring dismemberment.

Dr Hennen, in the first edition of his work on Military Surgery, describes, that by vertical lines of incision after amputation of the thigh, the cure is retarded by the formation of a triangular cavity, occasioned by the pressure of the stump on the support on which it rests; and Valpeau (13) has observed the cicatrix to have been drawn backwards and inwards; while Richter (14) agrees with Professor Musinnæ, (15) that the flexor muscles contracting more than the extensors, leave an unseemly stump. Although these events may be partially obviated by horizontal union, yet even this means may be superseded by lateral flaps, the inner being made larger than the outer, as adopted by Delpech (16) at the hip joint. The lateral sections of Vermale, (17) practised by Carlisle, (18) Mayo, (19) Key, (20) Cooper, (21) Walker, (22) Morgan, (23) Paul, (24) Syme, (25) and Liston, (26)

(1) Works, 1781, No. 19, p. 468. (2) Lond. Med. Quart. Rev. v. 2, p. 415. (3) Lond. Med. and Surg. Jour. 1834, v. 4, p. 93. (4) Lancet, 1831-2, v. 2, p. 253. (5) Ibid. p. 221. (6) Edin. Med. and Surg. Jour. v. 49, p. 69. (7) Ibid. (8) Lond. Med. Gaz. 1827-8, v. 1, p. 357. (9) Lancet, 1833-4, v. 2, p. 220. (10) Gun-shot wounds, 3d Edit. pp. 369, 391. (11) Edin. Med. and Surg. Jour. v. 36, p. 238. (12) Lancette Française, 1830. (13) Nouveaux élém. de méd. operat. p. 506. (14) Rees's Cyclopæd. v. 2. (15) Neu. Med. in Chir. Biol. tungen. 1776-8, p. 515. (16) Lond. Med. Chir. Rev. 1828, v. 9, p. 502. (17) Mem. de l'Acad. roy. de chir. t. 2, p. 215. (18) Lancet, 1827-8, v. 2, p. 464. (19) Lond. Med. Quart. Rev. v. 2, p. 415. (20) Lancet, 1827-8, v. 1, p. 512. (21) Ibid. p. 239. (22) Ibid. 1836-7, v. 1, p. 541. (23) Lond. Med. Gaz. 1827-8, v. 1, p. 67. (24) Lond. Med. and Surg. Jour. 1835, v. 6, p. 214. (25) Edin. Med. and Surg. Jour. v. 32, p. 235. (26) Lond. Med. Gaz. 1833-4, v. 2, p. 559.

on the whole possess fewer advantages than the antero-posterior of Roux, (1) employed by Creaser (2) and Ballingall, (3) now by Syme, (4) Liston, (5) and Mayo, (6) who, in order, to meet unequal muscular retraction, form the posterior flap the larger.

At La Charité, Kuhk; Guy's, Sir Astley Cooper, Key, Keate, and Morgan; St Bartholomew's, Lawrence, Vincent, Llyod, Stanley, Earle, and Keate; Middlesex, Bell and Mayo; Westminster, Guthrie and White; St George's, Brodie, Keate, Jeffreys and Hawkins; St Thomas's, Sir C. Blike and Green; and, at the London Hospital, Sir William Blizard and Mr Andrews, have employed the circular incision on the thigh; with what success the following statistics exhibit:—

Of c amputations,

20 had Un. by Sup.; 9, Sec. Hem.; 3, Phlebit.; 2, Erysip.; 7 Gang.; 4, Cystitis; 7, Spasms; 5, Con. Stump; and 10 Necrosis.

6 Rections of circular stumps.

Generally, 2, 5, 6, 8, 9, 12, and 16 ligatures were applied.

Time of cure, 14, 20, 25, and 60 days.

Majority, chronic cases.

Average age, 30.

Deaths, 28. 6 from secondary amput., 1 followed by gang., respective æts. 2, 26, 44, 45, 57, and 64; 1, immed. amp. drayman, æt. 42; 1, effects of operation for gang. æt. 52; 1, gang. lax fibre, æt. 52; 2, suppuration, 1 in arteries, the other in stump, æts. 4 and 12; 1, sec. hem.; 6, irritable stump, inducing secondary disease, æts. 20, and upwards; 3, phlebit. æts. 30, upwards; 2, hectic fever; 1, gout; 1, general injury previous to operation; 2, scrofulous diathesis; and 1 from the effects of resection. (7)

(1) *Lancette Française*, 1830. (2) *Edin. Med. and Surg. Jour.* v. 22, p. 51. (3) *Chir. lect. at Edin. Infirm.* Feb. 1829. (4) *Edin. Med. and Surg. Jour.* v. 50, p. 373. (5) *Lancet*, 1836-7, v. 2, p. 538. (6) *Lond. Med. Quart. Rev.* v. 2, p. 415. (7) *Portuguese Hosp. Reports*, 1824; *Reports of Hôpital La Charité, Berlin*, by C. T. Kuhk, 1832; *Pract. Obs. on Amput.* by Ed. Alanson, 2d Edit. 1782, p. 37; *Monro's Works*, 1781, No. 19, p. 468; *Latta's Surg.* v. 3, pp. 637 to 669; *Copland Hutchinson*, 2d Edit. 1826, p. 83; *Guthrie on gun-shot wounds*, 3d Edit. 1827, pp. 369, 391; *Travers on Const. irrit.* 1826, v. 1,

Though Dupuytren (1) declared, that the flap operation in the trunk of a member had for long been banished from modern surgery, yet its revival in the thigh seems well established by Roux at La Charité; Key, Morgan, and Bransby Cooper, Guy's; Vincent, St Bartholomew's; Mayo, Middlesex; Sir Anthony Carlisle, Westminster; Brodie, St George's; Walker and Green, St Thomas's; Luke, London; Liston, North London; Ballingall, Syme, and Lizars, Edinburgh; Drs Buchanan, and Macfarlane, Messrs Davidson, and Perry, Glasgow Infirmaries, with the subscribed results:—

Of cii amputations,

13 Un. by Sup.; 9, Sec. Hem.; 8, Phlebit.; 1, Ery.; 9, Gang.; 4, Cyst.; 3, Partial Con. Stumps, oc. by disad. in cure; and 2 Nec.; 4, Flap Resections of Circular Stumps; and of 1 Flap Stump, occasioned by phagedenic ulceration.

Generally, 2, 3, 4, 5, and 15 ligatures were applied.

Time of cure, 10 to 27 days.

Majority, chronic cases.

Average age, 25.

p. 196; v. 2, 1835, p. 181; St Thomas's Hosp. Reports, by South, 1836, v. 1, p. 129; Lond. Philos. Trans. 1708, v. 26, p. 42; 1775, v. 65, pt. 1, p. 273; Lond. Med. Chir. Trans. 1815, v. 6, p. 175; 1827-8, v. 2, p. 703; 1830, v. 7, p. 316; v. 16, pp. 132, 138, 140; 1836-7, v. 1, pp. 110, 339, 747; v. 2, p. 143; Lond. Med. Chir. Rev. v. 18, pp. 279, 280, 218; 1834, v. 20, pp. 250, 555; Lond. Med. Rev. 1834, v. 2, pp. 412, 413; Lond. Med. and Phys. Jour. 1803, v. 9, p. 499; 1829, v. 6, pp. 29, 80, 291; v. 7, p. 520; 1832, v. 12, p. 211; Lond. Med. and Surg. Jour. 1833, v. 2, p. 472; 1834, v. 4, pp. 93, 150, 159, 189, 220, 378, 445; 1835, v. 6, pp. 184, 538; Lond. Med. Gaz. 1827-8, v. 1, pp. 96, 138, 158; 1829, v. 2, p. 168; v. 3, pp. 171, 363, 506, 592, 751; 1832-3, p. 511; Lancet, 1823-4, v. 1 and 2, pp. 113, 244; 1825, v. 10, p. 157; 1826, v. 3 and 4, p. 385; 1827-8, v. 1, pp. 326, 772; v. 2, pp. 125, 158, 382; 1830-1, v. 2, p. 351; 1831-2, v. 1, pp. 693, 809; v. 2, pp. 221, 312, 253; 1832-3, v. 1, pp. 160, 416; v. 2, p. 539; 1833-4, v. 2, p. 220; 1834-5, v. 1, pp. 35, 38, 108, 269; Edin. Med. and Surg. 1824, v. 21, p. 33; Edin. Med. Essays and Obs. 3d Edit. v. 4, p. 523; Edin. Med. Comment. 1772, v. 16, p. 298; Glasgow Med. Jour. 1828, v. 1, p. 117.

(1) Leçon oral. de chirurg. t. 4, p. 305.

Deaths, 28. 5 from second. amput., gang. supervening on 2, and phlebit. on one, æts, 50, 56, 58; 1, immed. amput. and general bruises; 3, loss of blood depending on operation, one in which no arteries were tied, æts. 10, 20; 8, phlebit. æts. 11 to 32; 2, gang. appearing previous to the operation in one, and subsequent in the other, æts. 18 and 40; 1, effects of necrosis previous to amputat., æt. 10; 1, excessive suppurat.; 1, erysip.; 2, operation for compound fracture, æts. 40 and 58; 1, abscess; 1, exhaustion, æt. 31; and 2 from fever, æts. 34 and 36. (1)

Sir Astley Cooper (2) has seldom succeeded with circular stumps above the knee, without the use of bandages to prevent muscular retraction and excessive suppuration; but Sharp (3) and Richter (4) have declared that all such contrivances, even as those of La Charité, have been unavailing. In fact, from what has already appeared, there are many disadvantages from this

(1) M. Garengot, in Mem. de l'Acad. de chir. t. 2; Lancette Française, 1830-1; Klein, Pract. Ansic, &c. chir. oper 1816, pp. 35, 38; Pract. Obs. on Amput. by Ed. Alanson, 1782, 2d Edit. pp. 205, 231; Benj. Bell's Surg. 1801, v. p. 260; Guthrie on gun-shot wounds, 1827, 3d Edit. p. 275; Lizars' Anat. plates, 1824, pt. 6, p. 151; Chir. Lect. at Royal Infirm. of Edin. Feb. 1829, by Dr Ballingall; Lond. Med. Chir. Rev. 1834, v. 20, p. 191; Lond. Med. Quart. Rev. 1834, v. 2, p. 415; Lond. Med. and Surg. Jour. 1833, v. 2, pp. 350, 376, 472; 1835, v. 6, p. 214; Lond. Med. Gaz. 1827-8, v. 1, pp. 67, 706, 357; 1829, v. 3, p. 751, v. 4, pp. 192, 443; 1830-1, v. 7, pp. 88, 255; Lancet, 1826-7, v. 2, pp. 64, 464, 740; v. 3 and 4, p. 728; 1827-8, v. 1, pp. 299, 413, 512; 1827-8, v. 2, p. 272; 1832-3, v. 1, p. 606; 1833-4, v. 1, p. 493; 1834-5, v. 2, pp. 495, 548; 1836-7, v. 1, p. 541; v. 2, pp. 143, 558, 559; Edin Med. Chir. Trans. 1826, v. 2, p. 347; Edin. Med. and Surg. Jour. 1805, v. 1 or 3, p. 289; 1824, v. 22, p. 437; v. 24, pp. 269, 270; 1829, v. 32, pp. 235, 241; 1830, v. 33, p. 248; 1831, v. 35, p. 257; v. 36, pp. 238, 240, 247; 1832, v. 37, pp. 245, 325, 226; v. 38, p. 58; 1833, v. 39, p. 29; v. 40, p. 335; 1834, v. 42, p. 99; 1836, v. 45, p. 16; 1837, v. 47, pp. 11, 46; 1838, v. 49, pp. 49, 69; v. 50, p. 373; Glasgow Med. Jour. 1828, v. 1, pp. 117, 332, 406; 1830, v. 3, pp. 3, 101, 424, 426; 1831, v. 4, pp. 100, 181, 187, 216, 219, 324, 329, 334, 424, 432. (2) Lancet, 1823-4, v. 1 and 2, p. 107. (3) Surg. 8th Edit. p. 220. (4) Edin. Med. and Surg. Jour. v. 21, p. 32.

method of amputating the thigh, although, in particular, such cases as are related in the London Philosophical Transactions, (1) and the Edinburgh Medical and Surgical Journal, (2) where the limbs were miserably flabby, or in a state of high spreading gangrene, (3) the single circular incision might be admissible. But Sir George Ballingall (4) is by no means prepared to admit of the exclusive use of flaps in the arm, and still less so in the thigh, just as if better stumps could be formed by the circular incision, which, though evidently entitled to the appellation of "plump," still, generally bear no small resemblance to a ship amputation, where the Captain operated as another read; so by the alternate use of theory and practice, the limb was dismembered in the course of a day, leaving for years, in every sense, rotundity of parts, but an almost denuded bone. *

Klein, (5) Guthrie, (6) and Mr Hargrave, (7) question not the excellence of flaps at the upper third of the thigh; and, in military surgery, Mr Cooper (8) has recorded the frequent advantages possessed by the operation in this division of the lower extremity.

The thigh has been amputated by flaps in less than a minute, (9) and cures have been completed in ten days, (10) less than the general term of a "few days," (11) required by the circular stumps of Heister's formation, which, in special language, as declared in another passage of his work, to be really "two months." (12)

Without alluding to the operations of Wiseman, Cheselden, Monro, and other ancient surgeons, the more modern circular division will be found to be practically compared with the flap by Dewar (13) and Mayo, (14) and the military surgeons, Lardner (15) and Busche. (16) From the observations of the former,

(1) Benj. Gooch, 1775, v. 65, pt. 1, fol. p. 273. (2) V. 36, p. 247. (3) Ibid. v. 50, p. 373. (4) Milit. Surg. 2d Edit. p. 372. (5) Op. 39, 43. (6) Gun-shot wounds, p. 200. (7) Oper. Surg. 1831, p. 227. (8) Surg. Dict. p. 71. (9) Lond. Med. Gaz. 1827-8, v. 1, p. 67. (10) Klein, Pract. Ansic verden. chir. 1836. p. 35. (11) Surg. v. 1, fol. p. 357, note. (12) Ibid. v. 1, pt. 1, p. 362. (13) Edin. Med. and Surg. Jour. v. 24, p. 269. (14) Lond. Med. Quart. Rev. 1834, v. 2, p. 415. (15) Lancet, 1836-7, v. 2, p. 627. (16) Ibid. 1827-8, v. 2, p. 204.

* The cast of this stump is in Professor Syme's museum, Edinburgh University.

and of Richter, (1) the other operation appears to possess many disadvantages in formation, cure, and ultimate recovery, scarcely applicable to the flap, which so often successfully baffles with debilitated patients and ill-conditioned limbs.

Analogous to those cases of extensive burns on the neck, where the cure was deemed complete, yet the chin left bridled to the breast, are the instances of circular amputations of the thigh, condemned to the Cripplegate Workhouse, for twenty years under the superintendence of Mr Lanffstaff, (2) in whose museum relics yet remain, emblems of unphilosophic surgery—of unphilosophic men !

Fourth, Experienced surgeons have not always agreed as to the proper part to be selected in amputating the leg, which has been removed by Guthrie (3) at the calf; Bransby Cooper, (4) Key, (5) and Travers, (6) 4 inches below the patella; and by Syme (7) close to the tuberosity of the tibia. Abernethy (8) and Richerand (9) have recommended the leg to be removed 4 inches below the knee, as it gives convenience, and preserves the motion of the stump, which has been denominated by Cooper “the point of election.” Those who can afford an elegant artificial limb, may safely have a longer stump; but in the lower ranks of society, the patients are solicitous of a shorter; (10) and prudence is here requisite, in case the tibial arteries are divided as they branch from the popliteal,* above the superior fibres of the soleus muscle; and in case the capsule of the knee joint be entered, as frequently in old people it communicates with the tibio-fibular articulation, (11) from which it would appear, that the excision of the caput tibialis, as practised by Larrey, (12) and

(1) Edin. Med. and Surg. Jour. 1824, v. 21, p. 33. (2) Lond. Med. Chir. Trans. v. 16. (3) Gun-shot wounds, 3d Edit. p. 305. (4) Lancet, 1825, v. 7, p. 169. (5) Ibid. v. 6, p. 219. (6) Ibid. p. 158. (7) Edin. Med. and Surg. Jour. v. 22, p. 51. (8) Lancet, 1826, v. 2, p. 276. (9) Nosograph. Chir. t. 4, 510. (10) Surg. Dict. 7th Edit. p. 71. (11) Lancet, 1826, v. 3 and 4, p. 47. (12) Monro on Bursæ mucosæ, 1788, p. 25.

* A case came under the observation of the writer, where double secondary hemorrhage was occasioned by the non-coagulation of the blood from this cause; the high division of the limb being only made at the solicitous entreaty of the patient.

occasionally by Travers, (1) possesses the disadvantages mentioned by Latta (2) and Liston. (3)

Mr Hargrave (4) enjoins the first application of the saw to the fibula; Malgaigne (5) and Professor Béclard (6) recommend the removal of the spina tibialis, which Guthrie (7) employs in lean persons, precautions but too seldom attended to in practice.

By M. Cloquet, at Hôpital de l'Eisle; Morgan, Key, and Bransby Cooper, Guy's; Sir Charles Blike, Lawrence, and Earle, St Bartholomew's; Guthrie, Westminster; Travers and Hawkins, St George's: and Messrs Macfarlane and Weir, Glasgow Infirmary, the circular division of the leg has been performed; and although Bromfield, (8) Syme, (9) and Mr Langstaff (10) have instanced woeful results from this operation, yet Latta (11) and Sir Astley Cooper (12) have found it very successful. However, the following numerical results may aid the illustration:—

Of xliii Amputations,

9 had Un. by Sup.; 3, Sec. Hem; 2, Phlebit.; 2, Erysip.; 7, Irrit. or Spasms; 6, Con. Stump; 6, Gang.; and 1, Necrosis.

3, C. Rections.

Generally, 3 to 6 ligatures were applied.

Time of cure, 21 to 50 days.

Majority, chronic cases.

Average age, 35.

Deaths, 7. 2 from Amput. for Comp. fract. tending to Gang. æts. 60 and 21; 1 Amput. for Gang. æt. 52; 1 immed. Amput. Gang. supervening, æt. 17; 2, Amput. for dislocations, Gang. attacking the stumps, æts. 60 and 53; 1 excessive Suppurat.; and 1, Second. Amputat. (13)*

(1) Lancet, 1823-4, v. 1 and 2, p. 231. (2) Surg. v. 3. p. 608. (3) Elem. of Surg. pt. 3, p. 391. (4) Oper. Surg. p. 212. (5) Man. de Med. Opér. p. 292. (6) Mem. Oper. par Sabatier. (7) Gun-shot wounds, d. 222. (8) Surg. v. 1. p. 201. (9) Edin. Med. and Surg. Jour. v. 21, p. 35. (10) Lond. Med. Chir. Trans. v. 16, p. 152. (11) Surg. v. 3, p. 608. (12) Lectures by Lee. (13) Chirurg. Obs. by W. Bromfield, 1773, v. 1, p. 190; Guthrie on gunshot

* These results, meagre as they may be, confirm the views in favour of primary amputation, so ably and justly advocated by

The lateral double-flap operation, as practised by Key at Guy's; White, Westminster; Travers and Green, St Thomas's; Wardrop, Hospital of Surgery, Panton Square; Syme, at Edinburgh; and Macfarlane, at the Glasgow Infirmaries, has now almost been laid aside even by Roux, who revived it, and has given place to the antero-posterior flaps, or, more strictly, the *single flap* of Dupuytren or Liston, to the former of which, however, viz. the lateral amputation, the following results apply:—

Of xii Amputations,

1 had Un. by Sup. ; 1, Sec. Hem. ; 3, Phlebitis ; and 2 Sinus.

1, Resect. of Cir. Stump.

Generally, 1 to 3 ligatures were applied.

Time of cure, a few days.

Average age, 30.

Deaths, 4. 3 from Phlebit ; and 1 from Gang. æts. 35, 47. (1)

wounds, 3d Edit. pp. 305, 405 ; Lond. Med. Chir. Trans. 1830, v. 16, pp. 132, 146 ; Lond. Med. Chir. Rev. 1832, v. 18, p. 170 ; Lond. Med. and Phys. Jour. 1814, v. 31, p. 451 ; 1831, v. 10, p. 119 ; Lond. Med. and Surg. Jour. 1833, v. 2, p. 511 ; v. 3, pp. 95, 224 ; 1835, v. 6, p. 539 ; v. 7, pp. 411, 575 ; Lond. Med. Gaz. 1827-8, v. 1, p. 193 ; 1829, v. 4, pp. 61, 552 ; Lancet, 1825, v. 6, pp. 158, 219 ; v. 7, p. 169 ; v. 8, p. 282 ; 1826-7, v. 2, p. 493 ; v. 3 and 4, pp. 47, 69, 151 ; 1827-8, v. 1, p. 193 ; 1829-30, v. 2, pp. 255, 285 ; 1831-2, v. 2, p. 317 ; 1832-3, v. 1, p. 411 ; Edin. Med. and Surg. Jour. 1836, p. 10 ; Glas. Med. Jour. 1828, v. 1, p. 117 ; 1830, v. 3, pp. 102, 111, 422, 428 ; 1831, v. 4, pp. 216, 334, 431, 424.

Thomson (Obs. on Hosp. in Belg. 1816,) Cooper, Lawrence, Guthrie, Buchanan, Dupuytren, Boucher (Mém. de l'Acad. de chir. t. 2, 1753, p. 461,) and Larrey (Mém. de chir. milit. t. 1 et 3. p. 349.) By primary amputation, Percy, at the head of the military surgery in France, lost 6 out of 92, or about 1 in 15 ; Lucas, 5 out of 75, or 1 in 15 ; and, on the last days of July, all were cured, generally in the space of 25 days. Of secondary, 7 died out of 11 at Glasgow Infirmary (Glas. Med. Jour. v. 3 and 4, pp. 113, 220) : Pelletan, at the head of the Civil Hospitals in Paris, lost 5 out of 6, or 1 in every 1 and one-fifth ; and similar results have been observed by C. T. Kuhk at Hôpital La Charité ; and at Meath Hospital, Dublin, as is learned from its quarterly reports.

(1) Lancet, 1823-4, v. 1 and 2, p. 231 ; 1825-6, v. 6, p. 211 ;

While O'Halloran (1) found Loudham's amputation attended with no degree of success, and Busche (2) and Anderson (3) to possess disadvantages; Messrs Key, (4) Cooper, (5) and Druitt, (6) hold it to be one of the most successful operations. If the latter look but to the *ultimate* result, the assertion corresponds with general observation, for by this form of stump have 30 miles per day been accomplished, with trifling fatigue, by the aid of the common Hospital appendage;* whereas, by the other method, 10 miles were the calculated distance, even supported by all the trappings of Pott's "patent apparatus." (7) But as to the phenomena attending the cure, the circular incision *here*, in general affords ready union. Sir Astley Cooper (8) has remarked it; and in the case of Mackintosh, an old soldier, whose leg was amputated on an emergency, by a rough razor, not less rudely handled, in the space of two hours, the stump was cicatrized in three weeks. When, therefore, ready recovery is to be preferred either from the wish or the condition of the patient, this latter mode ought immediately to be preferred, for how can primary union be a general resultant on the application of an elliptical flap to a triangular surface. If at all hazards, however, the present dilemma be overlooked, in prospect of future permanent satisfaction, the oldest flap operation alone is capable of affording this result; and here it may be remarked, that this *particular* amputation has been the fertile source from which have flowed all *general* objections against the *double* flap.

The statistics now enumerated, were recorded in a more extended form; and being the ground-work of the original essay, allowed of a wide generalization of facts, and a comprehensive field for synthetic reasoning. Here, however, the results have

v. 10, p. 250; 1827-8, v. 2, p. p. 17; 1822-3, v. 2, p. 545; Edin. Med. and Surg. Jour. 1824, v. 22, p. 51; 1828, v. 29, p. 241; 1837, v. 47, pp. 12, 48, 49; Glas. Med. Jour. 1828, v. 1, p. 117; 1830, v. 3, p. 428.

(1) Surg. 1765, pref. (2) Lancet, 1827-8, v. 2, p. 204. (3) Glasgow Med. Jour. v. 1, p. 330. (4) Lancet, 1825-6, v. 10, p. 250. (5) Surg. Dict. 7th Edit. p. 75. (6) Surg. 1839, p. 411. (7) Lond. Med. and Phys. Jour. 1801, v. 5, p. 277. (8) Lectures by Lee.

* Oral information from patients in the Edinburgh Infirmary.

been more eligibly placed by being appended to the individual amputations they serve to illustrate; and it now remains to draw a general comparison of their respective merits.

Out of 199 cases by the circular incision,		Out of 165 cases by the double flap,	
42 or 1 in every	4.73-	had Un. by Suppurat.	21 or 1 in every 7.85-
15	13.26-	Sec. Hem.....	13
9	22.11-	Phlebitis.....	12
5	39.8	Erysipelas.....	3
19	10.47-	Gangrene	15
5	39.8	Abscess	7
19	10.47-	Spasm	None.
10	19.9	Conical Stump.....	3
16	12.43-	Necrosis	2
16	12.43-	Resections.....	1
<hr/>		<hr/>	
156	1.27-	Absolute ratio.....	77
46	4.32-	Total deaths.....	37
			2.14-
			4.45-

This, then, is experience, without which, as Locke and Bacon have declared, no science can be complete; and if these facts are as true as they have been impartially collected, they evidently show the *double* superiority of the flap over the circular incision. That scientific men should still adopt this operation in preference to the other, may now give reason for amazement; but to clear this point shall an endeavour be directed in the following pages.

Sir Isaac Newton expressed at one time that the adaptation of glasses to prevent confusion produced by the refraction of the lenses in telescopes would never be obtained, when Dolland, not eight years after, founded his invention of the achromatic telescope. Mr Robins, the reputed narrator of Anson's voyage, and one of the ablest mathematicians and best writers of his day, pronounced scurvy to be "irremediable;" and many are the discoveries and inventions that have transpired which the most enlightened minds never dreamed of in their philosophy. (1) Nor are such illustrations less wanting in the medical than in the literary and scientific worlds.

(1) Elliotson's Lumleyan Lectures on Diseases of the Heart.

Acupuncture and cautery were among the most potent remedies with the Chinese and Japanese, unused at the time of Heister (1768), now extolled by the profession. O'Halloran expressed that the healing of wounds by immediate coalescence without suppuration was merely chimerical; but *he* even lived to see the doctrine of adhesion followed up by a universal practice. (1) Mr Travers conceived that all principles of surgery were changed, when erysipelas could be cured by incisions. (2) The English translator of Cloquet's Anatomy for 1828, in his prefatory remarks, satirizes the idea of removing the upper jaw; but in the second edition of that work, just three years after, the critic seems to have been outwitted, for the passage is erased *in toto*; and Drs Veitch (3) and Perry (4) have insinuated claims, the former to the discoveries of Dr Jones, the latter to those of Amussat. Nor is this unsettled disposition—this false reasoning *a priori*—this tendency to build on another's reputation, less strikingly exemplified than in the history of amputation.

Aquapendenti, says Wiseman, (1734) speaks so confidently of Hildanus's mode of operating, that to "deny the thing would be to give him a lie." The amputations of Guido di Caulaico, in the 14th century, have found modern advocates, remarks a German writer, in J. Wrabetz, W. G. Ploquet, and M. Mariquet. But, if diversity of sentiment—an incorrigible tone for what is marvellous—ever existed in the human mind, it did in that of Bilguer, who, advocating the system of "no amputation," had even his stygian sentiments discussed by Le Dran, Faure, and Morand in the Royal Academy of Paris. (5)

O'Halloran (6) declared, that the plans of Celsus, Parè, Verduin, Loudham, Cheselden, Sharp, nor Louis, were of advantage; but his plan combined all the requisites so long wished for. Latta (7) conceived that a good stump could only be formed by cutting in a sloping direction—King and Costello, (8) by di-

(1) John Bell's Surg. 1801, v. 1. (2) On Const. Irrit. 1835, v. 2. (3) Lond. Med. and Surg. Jour. 1834, v. 5, p. 382. (4) Glasgow Med. Jour. 1831, v. 4, p. 101. (5) Mém. de l'Acad. de chir. t. 4. 1. (6) On Gang. (7) Surg. v. 3, p. 589. (8) Cyclopæd. Pract. Surg. pt. 2, p. 136.

viding certain layers of integument and muscle; and who could have anticipated, that the shoulder-joint amputation should have been so successful, till Le Dran first practised it; and who could have imagined that nearly one-fifth of the person could be removed at the hip joint with any probability of recovery, till the army surgeon Browly established the precedent by amputating at that articulation.

Wardenburgh reasons mathematically against the spiral stumps of Alanson. Benjamin Bell (1) borrowed the plan of Alanson and adopted it as his own; while Dupuytren (2) did much the same from Celsus. Dr Buchanan (3) had a "particular," and Simmons, (4) Guthrie, (5) Sir C. Blike, (6) and Professor J. B. Davidge (7) of Maryland, "peculiar" modes of operating. Gräefe, one of the best surgeons in Berlin, operated one way; Langenbeck another. The surgeons of San Telmo had all different practices; and Hennen (8) mentions, that on the Peninsula, and on the Continent, the spirit of rivalry was so great, that every individual had a particular plan of amputating. Thus, then, on the most unphilosophic grounds, have operators fabricated a conglomerated stump, arising either from prejudice, or forced singularity to gain a name, for, in the words of Pope,—

" 'Tis with our judgments, as our watches, none
Go just alike, yet each believes his own."

To apply this more immediately to the systems under consideration, a retrospect of the rise and progress of comparative amputation now requires to be instituted.

First, men alike destitute of ingenuity or design were found finishing, as it were, the efforts of nature, to detach a gangrenous limb, by dividing the bone. By and bye, as wisdom increased, —the skin and muscles were next attempted, but in close imita-

(1) Cyclopæd. Pract. Surg. pt. 2, p. 120. (2) Leçon. oral. &c. (3) Glas. Med. Jour. 1831, v. 4, p. 185. (4) Lond. Med. and Phys. Jour. 1805, v. 13, p. 57. (5) Lond. Med. and Surg. Jour. 1834, v. 6, p. 63. (6) Cooper's Surg. Dict. 7th Edit. p. 56. (7) Rees's Edit. of Cooper's Surg. Dict. (8) Mil. Surg. 3d Edit. p. 265.

tion of parent nature, by one direct incision to the bone; and this constituted the first surgical amputation. But as nature is more guarded in protecting the human frame than in repairing that frame when it is injured, imperfect cures must necessarily have arisen, from too strict adherence to economy. Such was not overlooked in the early ages, for surgeons perceiving the imperfect results attempted to remove them, not by inventing a new operation, but by improving on the old. In this manner, the circular incision was handed down from father to son, with almost superstitious ceremony; still it was found imperfect. Another circle was added and another, so that in the present day it resembles the tree or the horn: its age is indicated by its rings. Surely, then, old age ought to have commanded respect; but the greatest surgeon (1) of his day declared it superannuated, and hence sought redress in regeneration.

The flap owed its origin entirely to science,—was suggested by Loudham, and practised by the learned (2) yet modest, Yonge, who, without the declamatory pretensions of Sylvester O'Halloran, the devoted surgeon of Limerick, ingenuously avowed, “that without doubt, use and trial would discover more advantages and lesser inconveniences, which did not occur to his consideration.” (3) And so great advantages did this method appear to possess, that Garengot (4) amputated the thigh of a soldier at Mantes, and fearlessly left the arteries without securement. The soldier died from loss of blood—men ridiculed the operation, and attributed the result more to the nature of the treatment employed than to the resulting hemorrhage. Again, he amputated on the arm—tied the vessels, and the patient lived with a matchless stump. Sabourin of Geneva proposed it to the Royal Academy, and supported the force of his arguments by practical demonstration at Hôpital la Charité, before his judges, M. M. Duverney and Mery. (5) “Embodied by success,” its advocates increased, and in Germany, France, and Britain, its fame was spread, and its merits were appreciated.

The circle, with its millennial experience, in comparison of the

(1) Dupuytren. (2) Lond. Philos. Trans. 1712, v. 27, p. 426.
 (3) *Currus Triumphalis, é Terebinth.* (4) *Mém. de l'Acad. roy. de chir.* t. 5, 12mo. (5) *Ibid.* t. 2, p. 244, Paris, 1753.

ephemeral flap, whose years are little more than those of a century, is but of particular, the other of general application. That operation is complicated in performance, and has undergone indefinite modifications; this is altogether in accordance with nature, which delights in simplicity, and the double-flap yet retains its primeval elegance—is still uncompounded, (1) and, perhaps, for this reason have circulists in general employed flaps at the articulations, and unaccountably reserved the circle to combat with refractory bones. The flap is *real* in its advantages,—the circle but *chimerical*, and the skin covering of its devotees have reared them undying monuments of opprobrium. The former has been adopted by Liston (2) from witnessing the bad effects of the latter; by Dewar (3) in the country, and Mayo (4) in the city, from observing its serious results. Circular operators, from comparing one circular incision with another, (5) have adopted one method to the exclusion and condemnation of the rest; and when *rarely* they have compared the circle with the flap, facts were wanting—“the substance proof!” The circular incision, by a gradual and steady innovation, just as the old, imperfect, yet cherished weights and measures of a country must yield to the new, has been approaching the form of the flap by the crescentic incisions of Hey and Bell—the oblique of Alanson and Hennen (6)—the oval of Scoutittin, approximations to flaps from without inwards, as practised by Langenbeck and Lizars; (7) and by consulting the Operative Surgery (8) of Sir Charles Bell, and contrasting it with his Institutes (9)—following a similar course with the 3d (10) and 7th (11) Editions of Cooper’s Surgical Dictionary, it will appear how the flap is rising in the “public estimation.”

Finally, with the varied improvements of Paré, Wiseman, Petit, and Louis, the double incision of Cheselden, the triple of Hey and Bell, and the quadruple of Richter, the plan is acknowledged defective; (12) and if, then, these as the *mean* be added to

(1) Mém. de l’Acad. roy. de chir. t. 2, p. 215. (2) Edin. Med. and Surg. Jour. v. 21, p. 46. (3) Ibid. v. 24. p. 265. (4) Lond. Med. Quart. Rev. 1834, v. 2, p. 415. (5) Hist. of Amput.. (6) Mil. Surg. 2d Edit. p. 265. (7) Pract. Surg. 1838, pt. 1, p. 206. (8) 1800. (9) 1838. (10) 1818. (11) 1838. (12) Cyclopæd. Pract. Surg. pt. 2, p. 140.

the equally deficient *extremes* of Celsus and Dupuytren, (1) as a kingdom divided against itself, *all must* be abortive, leaving their victims to resemble those of the itinerant mendicant lithotomist, Frère Jacques, whose declaration was, "I have operated, but God must cure you."

The flap, however, has been admirable in theory, perfect in practice, and satisfactory in pathology, as traced from the first touch of the amputating knife, to the last of the dissecting scalpel, and appears preferable to any modification whatever of the circular incision.

Just as three memorable eras have arisen in surgery—the invention of the ligature by Ambrose Paré—the tourniquet by Louis Petit—and the flap by Loudham and Yonge—so have torsion and styptics made attempts to subvert the first, manual compression the second, and an incorrigible ancestral adherence to the circular incision the last. Yet each have been fraught with blessings to mankind—each has revived the Syracusan ejaculation—*Εὐχετα! Εὐχετα!*

(1) Cyclopæd. Pract. Surg. pt. 2, p. 142.

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