ON THE DIRECT MEASUREMENT OF
OPHTHALMOSCOPIC OBJECTS.

By THOMAS REID, M.D.,

Surgeon to the Glasgow Eye Infirmary, and Waltonian Lecturer on Diseases of the
Eye in the University of Glasgow.

IN a lecture on the enlargement of ophthalmoscopic images, by Dr. Landolt, which appeared in the number of the BRITISH MEDICAL JOURNAL for January 3rd, 1880, the author says that the results obtained by the direct method are only relatively exact; "for, unfortunately, the fundus oculi does not present any object of constant size, or directly measurable". Now, it so happens that, by a particular application of the "law of Bravais", an image of known magnitude and constant size (say of a grating) can be projected on the fundus oculi, and seen by the direct method, simultaneously with any object there which it may be required to measure. The "law of Bravais", shortly stated, is as follows. When the distance between two dioptric systems is equal to the sum of their principal foci, parallel incident rays emerge from the compound dioptric system parallel; and the ratio of the size of an image to its object is constant, whatever may be their relative distances from the system—viz., that of their adjacent principal foci. In the case of the eye, when the convex lens used in the indirect method is so held that its principal focus coincides with the anterior principal focus of the eye—which is about 12 millimètres in front of the cornea—the conditions of the "law of Bravais" are fulfilled, and the ratio of the size of an object in the fundus to its aerial image is constant, viz., $\frac{\phi}{f}$; ϕ being the anterior principal focus of the eye, and f the principal focus of the lens.

The late Dr. George Rainy, shortly before his death in 1869, had a compound ophthalmoscope constructed on this principle, with which he proposed to measure the absolute size of objects in the fundus oculi, in all cases of axial ametropia, as well as in emmetropia; and, at the same time, to determine the refraction. The instrument consisted essentially of two plano-convex lenses, of $2\frac{1}{4}$ inches focus; one fixed in the anterior part of the tube, in the position required by the "law of Bravais" (the objective); the other (the ocular), at the other extremity, in a draw-tube, with a micrometer in its focus, to measure the absolute size of the aerial image. This having been found, the size

of the object in the fundus was easily deduced from the formula, $\frac{\beta}{\beta_1} = \frac{\phi}{f}$

in which β represents the size of the object, and β_1 that of its image on the micrometer. To avoid reflected images from the surfaces of the lens, the illumination was effected by three plane parallel plates set obliquely in front of the objective. When the instrument is in position, an image of the micrometer can be projected on the retina by transmitting the light sent to the eye directly through the tube. The ratio of the size of the divisions of the image to that of the micrometer is as before, $\frac{\phi}{f}$. But this arrangement, which, to a certain extent, resembles that of the Epkens' and Donders' instrument, is not very convenient in practice.

Fortunately, the ophthalmoscope of Coccia furnishes the required optical conditions. This instrument consists of a plane mirror with a condensing lens of short focus between it and the lamp. If, when the instrument is held in the position for direct examination of the eye (and corrected, if necessary, for refraction), the principal focus of the lens coincides with the anterior focus of the eye, the conditions of the "law of Bravais" are fulfilled; and if a micrometer screen be held between the lens and the lamp in the conjugate focus of the retina with the compound system of the eye and the ophthalmoscope, its image will be seen along with the part to be measured.

In practice, it suffices to attach a graduated rod perpendicularly to the handle of any ophthalmoscope with a plane mirror (a Jäger's in the present instance) to carry the lens and screen, which should be accurately centred with the mirror. The inclination of the supporting rod to the axis of vision may vary from 60° to 90° ; the mirror, in any case, being equally inclined to both. The adjustments are simple and easily executed. The principal focus, the lens in front of the mirror, as also the principal focal distance of the screen, are determined experimentally. The positions of the screen for different degrees of ametropia are readily found; for that of the principal focus of the lens coincides with the conjugate focus of the emmetropic eye, and marks the zero point on the supporting rod; the other positions are got from

the formula of Newton: $l l' = f^2$, in which, if l is taken equal to one dioptric, $l' = f^2$ a constant quantity which is the size of the divisions, each being equal to one dioptric. For example, with a lens of 75 millimètres, $l' = 75^2 = 5.6$ millimètres, the amount of displacement of the screen for each dioptric of ametropia. The degree of refinement to which the measurements can be carried depends on the size of the divisions on the screen whose image can be seen on the fundus under the low magnifying power of the eye itself. With a lens of 75 millimètres, divisions of .5 millimètre, whose image is $\frac{1}{2} \times .5 = .1$ millimètre, or about $\frac{1}{10}$ inch, can be distinctly seen. Measurements of the normal optic disc in emmetropic and slightly ametropic eyes gave, with remarkable uniformity, 1.6 millimètres for the vertical diameter; the horizontal, in some cases, being rather less. Well marked atrophy, with filling in of the margin, consequent on embolism of the retinal artery, measured 1.5 millimètres in the vertical and horizontal diameters.

In a case of amblyopia, with atrophy of the choroid, but without staphyloma, the diameter of the optic disc was two millimètres. The diameter of the superior and inferior branches of the retinal veins over the disc in the normal eye was found to be not more than $\frac{1}{10}$ inch, and the corresponding arteries about $\frac{1}{10}$ inch. In congestion of the veins, the diameter varied from $\frac{1}{10}$ to $\frac{1}{8}$ inch.

To check the accuracy of the measurements, plano-convex lenses of 4.5, 6, 7.5, and 15 centimètres were employed, which gave images of the screens of $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{10}$ respectively; the results obtained were practically the same. When the translucency of the disc is such that it cannot retain the image of the screen, there is some difficulty in measuring accurately the size of the vessels. For more accurate measurements and demonstration, it is necessary to fix the instrument on a stand. An arrangement,* similar to that of Follin's stationary simple ophthalmoscope, with a micrometer screen added, answers perfectly.

Plano-convex lenses were invariably used, because the first principal plane and optic centre lie on the vertex of the convex surface, and therefore admit of a more accurate determination of the focal length than is possible with biconvex lenses of short focus. Screens of different form and sizes, with divisions of from .5 millimètre to 2 millimètres, on the model recommended by Dr. Gowers, were employed. The screen should be moved by rack and pinion, so as to admit of the conjugate focus of the part examined being found, while the eye is under examination. The distance of the lamp should be so arranged that its conjugate focus coincides, as nearly as possible, with the optic centre of the eye—a position which gives the best illumination.

A lens of 75 millimètres was found to be the most convenient, giving as it does an image of $\frac{1}{3}$, which, either in its vulgar or in its decimal form, adapts itself perfectly to the metric system. For example: if the image of four of the 2 millimètres divisions of the screen measure exactly the diameter of the optic disc, its real size will be $\frac{4}{3} = 1\frac{1}{3} = 1.6$ millimètres, and with decimals, $8 \times .2 = 1.6$ millimètres.

It will be obvious, from the preceding, that this method is not applicable either to cases of refraction, of ametropia, or to the eyes of animals unless the optical constants have been previously determined.

ON COLOTOMY.†

By CHRISTOPHER HEATH, F.R.C.S.,

Holmes Professor of Clinical Surgery in University College, London.

No operation has probably undergone greater change of estimation of late years than colotomy. Confined originally to cases of obstructive disease of the sigmoid flexure or rectum, recourse was had to it only as a last resource, and when the patient was *in extremis*. I have, on several occasions, been called upon to operate under these circumstances, and the result has too often been disappointing. Not only is the risk of death from exhaustion very great, but there is also the great liability for the bowel to give way before, or soon after, the operation, either just above the stricture or at the cæcum, which latter seems to be especially liable to perforation by ulcer when much overdistended. At the same time, I have seen so many recoveries, with considerable prolongation of life, after colotomy, in apparently desperate circumstances, that I should not feel justified in refusing to operate, unless the symptoms pointed distinctly to perforation, and consequent peritonitis. Death from overdistension of the bowels is one of the most painful and distressing terminations of life we can have to witness; and, to obviate this alone, colotomy will be justifiable, even under circumstances of the greatest gravity.

But it is as a means of relieving the suffering caused by cancer of the rectum, or incurable ulceration, or recto-vesical fistula, and of thus pro-

* *Dioptrische Untersuchungen*, Art. xi and xii. Von C. F. Gauss: Göttingen. 1841. Also note appended to translation of the same by Bravais: Paris. 1856.

* *The Ophthalmoscope*, by Dr. Adolph Zander, p. 13.

† Read before the East Surrey District of the South-Eastern Branch.

longing life in comparative comfort, that the operation of colotomy has been proved so advantageous. Six months, twelve months, or more, may thus be added to the life of a patient suffering from cancer; and one patient of mine survived the operation two years and nine months in great comfort, although latterly the disease had encroached upon and perforated the vagina—a complication most offensive under ordinary conditions. To show how little a lumbar colotomy interferes with the health or comfort of a patient, I may mention that, in January 1872, I performed colotomy on a lady (a patient of Dr. Grigg), who was suffering constant torture from a recto-vesical fistula, following and connected with a pelvic abscess. She is perfectly well at the present time; has no pain or trouble; and is able to attend to her domestic and social duties without inconvenience. Another female patient, whose colon I opened, in 1873, for intractable syphilitic ulceration of the rectum, is living and well; but the rectum is completely closed by the cicatrization of the ulcers.

Recto-vesical fistula in the female must be very rare; but the distress caused by the escape of feces into the bladder, and frequent blocking of the urethra, is very great. In the male, recto-vesical fistula is more common, both as the result of abscess and of cancerous perforation. The operation of colotomy could, of course, be of service only in the cases in which feces passed into the bladder: for it could afford no relief to the irritation of the lower rectum, caused by the passage of urine into the bowel. In one case, however, of an old clergyman, with cancerous perforation, on whom I performed colotomy, with great relief to the escape of feces, I found that, as the patient lay in bed, the urine flowed backwards to the opening in the colon, where it escaped, with little or no irritation compared to that excited in the sensitive sphincter ani.

It is remarkable how insidious the symptoms of cancer of the rectum are—so that patients complain of dyspepsia, diarrhoea, and vague uneasiness about the pelvis, for some time before their attention is specially directed to any alteration in the size of the motion, or any difficulty in defecating. I know that one of our leading physicians, who very properly insists upon making a rectal examination, when the symptoms of dyspeptic diarrhoea cannot be otherwise explained, has, on several occasions, thus detected unsuspected cancer of the rectum; and it has happened to myself, in explaining the case of a patient suffering from early cancer of the rectum to her friend, to light up a suspicion of the presence of the same disease in the friend, which turned out to be only too true. Cancer may have attained very considerable proportions without producing the small feces, which are erroneously thought to be characteristic of the disease; and the tendency to diarrhoea, which is so often present, prevents, for the most part, any just estimate of the calibre of the bowel.

Epithelioma not unfrequently invades the anal portion of the rectum, and, possibly, but one side of it; and such a case is, no doubt, well suited for the removal of the lower end of the rectum—an operation which has of late been revived with some success. But when, as often happens, the cancer, whether scirrhus or the columnar epithelioma, involves the whole circumference of the bowel, as far as the finger can reach, with possibly a ring of cicatrization at the upper part; or, when the lower part of the rectum is quite healthy, and the finger comes upon a structure, so like the os and cervix uteri that one is almost doubtful of being in the bowel at all, then removal is quite impossible, and colotomy is the only operation available.

I do not, of course, mean that colotomy is desirable in every case of cancer: for the progress of some cases is slow; and much may be done to relieve pain and promote comfort by the use of morphia suppositories, or of starch and opium enemata, and the careful selection of bland and unirritating food and drink.

As regards the operation itself, I would say that, though it often is extremely easy and simple, yet, in some cases, it is of the greatest difficulty. In a case of obstructive disease, the colon is often distended and easy to reach; but, again, when distension is great, the colon may be contracted, and the small intestines overlap it completely, and cause great difficulty; or the peritoneum, distended with air, may closely simulate the bowel. Again: the anatomical arrangement of the meso-colon may be such as to render it impossible to reach the bowel without opening the peritoneum. Should the peritoneum be opened, I believe the best mode of proceeding is to bring up the colon to the opening, and stitch it carefully before opening the bowel—so that the two peritoneal surfaces may be well in contact and rapidly adhere, when a good result may be anticipated. It is said, by a distinguished lithotomist of the day, that every case of lithotomy has its own peculiarities; and the same may, I think, fairly be said of colotomy. Although my experience of the operation is now not inconsiderable, I must confess to a feeling of relief when I have fairly opened the colon without misadventure.

In the after-treatment of cases of colotomy, some little care is required in washing out, periodically, the diseased piece of bowel below the artificial anus: for, if this be neglected, the mucous secretion collects, and is apt to irritate. It is undoubtedly the fact, though it is difficult to explain it, that fecal matter does occasionally find its way into the rectum, in some cases; but the bulk of the feces is, of course, discharged at the loin, and with great regularity, and singularly little discomfort. A simple bandage, with a pad of tow or wool, applied over the anus, is sufficient to prevent injurious friction of the part; but if, as sometimes happens, there be a tendency to prolapse of the mucous membrane, another air-pad may be added.

THE NOMENCLATURE OF PNEUMONIA AND OTHER ALLIED LUNG-INFLAMMATIONS.*

By OCTAVIUS STURGES, M.D., F.R.C.P.,

Physician to the Westminster Hospital, etc.

It seems worth discussing whether the present names for pneumonia and other allied affections are the best that can be devised for expressing the actual facts of the case. The present nomenclature has not been deliberately planned, but has grown up by degrees as knowledge advanced or opinions altered. It bears marks of this mode of construction in its want of symmetry, complexity, and incongruity. At first, when the term pneumonia had a very loose signification, and was not even distinguishable from acute pleurisy, there was hardly room for any classification at all; but so soon as auscultation had taught us to recognise clinically many conditions of lung having an inflammatory origin, not only did each of these require a distinguishing name, but it became necessary to define pneumonia itself afresh in some stricter phrase, which should express this later and fuller knowledge of its particular phenomena. Thus pneumonia became known as "false" and "true," "active" and "passive," "croupous" and "catarrhal," until, in our own day, the condition that we all have in our minds in using the single word is found to need the company of no fewer than three attendants, and is spoken of as acute, sthenic exudative pneumonia.

It is easy to see that a system of classification thus contrived, and which gives currency to such complicated expressions, is not perfect. But there are other faults besides complexity. I need not now allude to our official nomenclature (that of the College of Physicians of 1869), for this is about to be superseded. I take rather the common nomenclature of the books. We have there—(1) *lobar* (or *croupous*) *pneumonia*; and (2) *lobular* (or *catarrhal*) *pneumonia*; or otherwise, as Dr. Bristowe would prefer, we have "diffused" and "patchy" pneumonia. There is then (3) "chronic pneumonia", with its synonyms "cirrhosis of lung" and "fibroid phthisis"; while for the other varieties of phthisis there is the adjective "pneumonic".

Dr. Walshe's nomenclature is somewhat different. "Chronic pneumonia" is by him defined as "the local attendant on adventitious products in the lung", but is reckoned a second time amongst "tissue-destroying diseases" (Walshe *On the Lungs*, p. 379). Acute pneumonia is distinguished, as I have said, as "acute sthenic exudative pneumonia", with topographical, subjective, and intercurrent varieties.

The chief objections to the mode of classification thus generally indicated seem to be these.

1. It draws a distinction between *croupous* and *catarrhal* pneumonia which cannot always be recognised clinically; while, by the introduction of such a term as *croupous*, it suggests a likeness which few would admit, and needlessly entangles together two diseases, croup and pneumonia, each of which has difficulties enough of its own to contend with.

2. It employs the term "lobular pneumonia" in a variety of ways, using it both for the secondary lung-consolidation which succeeds to acute bronchitis, especially in childhood, and is a fairly definite affection; and also to that disseminated patchy, lung-inflammation of adults which occurs with many and various associations, sometimes nearly resembling and sometimes not resembling at all simple pneumonia.

3. It employs the words "chronic pneumonia" in two separate senses, neither of which is free from objection. It is a local alveolar catarrh attendant upon tubercle and other adventitious products (Walshe, *loc. cit.*), and it is also a fibrosis or induration of lung-tissue. These two conditions are totally distinct, and the relation of either to the proper pneumonic process is doubtful and remote. The word "chronic pneumonia" carries a theory along with it; it also takes possession of a term for which there is other and legitimate use. The name would fitly describe that temporary delay or arrest of pneu-

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