

of  $-16.326$  D, supposed to be placed at the position of the second principal point of the eye, but a stronger concave lens, of no less than  $-21.234$  D, is required for distinct distant vision when worn 15 mm. in front of the first principal point, or 13 mm. in front of the cornea.\* It follows that in a case of axial myopia measured by a spectacle lens of  $-21.234$  D, the eye, after the removal of its crystalline lens, will be adapted for distinct distant vision without a glass; and a spectacle lens of  $+3$ . D or  $+4$ . D will then suffice for reading.

K. Bjerke<sup>12</sup> has collected, from different sources, 93 reported cases of myopia in which emmetropic refraction is said to have followed the removal of the crystalline lens by operation. In 29 of these cases (31 per cent.) the pre-existent myopia, as measured by a concave spectacle lens, is given as 20. D. In 44 cases (47.3 per cent.) it is given as between 20. D and 26. D, and in 44 cases (47.3 per cent.) it is given as between 14. D and 19. D. The tabulated figures would seem to point to about 19.5 D as the mean grade of myopia in which emmetropic refraction may be expected to follow the removal of the crystalline lens from the eye. The difference of about  $-1.7$  D, between the mean of the observed results and that calculated from the dimensions and corneal curvature of the schematic (average) eye, may be explained, in part at least, by errors of observation incident to the employment of collections of trial lenses of insufficient range and with too great intervals between the higher numbers. The very large number of cases (thirty-one per cent.) given as of 20. D, which corresponds to the strongest concave lens in the trial cases in ordinary use, points to a probable higher grade of myopia than that reported for these especially typical cases.† If we could assume a slightly greater radius of corneal curvature in the average highly myopic eye as compared with the emmetropic eye, the discrepancy between the mean observed grade and the calculated grade of myopia corresponding to emmetropic aphakial refraction would practically disappear. The assumption of an exceptionally short radius of corneal curvature in the higher grades of observed myopia, and of a curvature of exceptionally long radius in the lower grades, as tabulated, would similarly explain the comparatively few aberrant cases in which a very wide departure from the mean has been observed. As regards possible or probable differences in the focal length of the crystalline lens or differences in its effective power due to variations in its distance from the cornea, in individual eyes or as related to ametropia, trustworthy data are as yet almost wholly wanting.

**Prevention and Control of Myopia.**—In the evolution of the race the eyes have become admirably adapted to the

\* The assumption of a shorter distance from the cornea, in the case of a strong concave as compared with a strong convex spectacle lens, is justified by the fact that a concave lens, however strong, is very thin at its centre. But a double-convex spectacle lens of 11. D has a thickness of about 4 mm. at its centre; a plano-convex lens, and still more a meniscus, is even thicker.

As the optical distance of a spectacle lens from the eye is measured to the second principal (= nodal) point of the lens, which in the case of a double-convex lens lies nearly half the thickness of the lens within its substance, the optical distance of a double-convex lens from the eye is greater, by nearly half its thickness, than its distance, or that of a double-concave lens, as measured from the surface of the cornea to the back of the lens. In the case of a plano-convex lens, worn with its plane surface toward the eye, the optical distance exceeds the measured distance by about the thickness of the lens, and in the case of a meniscus, worn as a periscopic lens, the difference is still greater. Conversely, a concavo-convex lens, worn with its concave surface toward the eye, has its principal (= nodal) points outside of, and behind the lens, so that the optical distance of such a lens is less than its measured distance, and still less than the measured distance of any convex spectacle lens.

In all cases in which lenses of high power are worn, and especially when a thick convex lens is given in aphakia, or a very strong concave lens in myopia of high grade, the form of the lens becomes a factor of too great importance to be neglected.

† The appearance, in the table, of 11 cases of  $M = 16$ . D and 14 cases of  $M = 18$ . D, with only a single case of  $M = 17$ . D and 5 cases of  $M = 19$ . D, has been explained by Bjerke as resulting probably from the general omission of the numbers  $-17$ . D and  $-19$ . D from the series of trial-lenses in common use. The occurrence of 20 cases of  $M = 20$ . D, with only 2 cases of  $M = 21$ . D and 5 cases of  $M = 22$ . D, may be interpreted as indicating a similar source of error growing out of the general omission, from the series, of trial-lenses of higher power than  $-20$ . D.

requirements of binocular vision both at long and at short range. But the demands upon the eyes, incident to higher civilization, have doubtless been always in excess of the ability of certain eyes to withstand assiduous and prolonged application to near work. Certain myopes must always have had a notable advantage over emmetropes in many kinds of exceptionally fine work, such as engraving gems, embroidery, writing and illuminating manuscripts, etc.; and even now it is said that only myopes are successful in the production of the finest needlewrought lace. In view of the fact that the gravest disabilities of the myope appear somewhat late in life, it is hardly conceivable that the predisposing causes, of myopia can ever be appreciably lessened through the operation of natural or artificial selection. It remains to consider some of the more common exciting causes, incident to the lives of children, with reference to the possible amelioration of existing harmful conditions.

In civilized communities the school is an all-important factor in the life of the child, and it is during school life that myopia ordinarily develops and attains to a notably high grade. So striking is the observed relation of myopia to the grade of the pupil in school, that the designation *Schulmyopie* (school myopia) has been widely adopted by German writers. As regards ocular hygiene, the prevalent methods in teaching and the conditions under which they are carried out are radically faulty. As a rule, there is an excessive amount of book-work, required of all pupils alike and relegated in great part to hours of study at home by uncontrolled and often badly arranged or insufficient light; many of the best hours of daylight, during the school sessions, being too often given up to exercises or occupations unrelated or remotely related to the curriculum of studies. School-rooms, especially in large school-buildings, are often inadequately or unequally lighted, and the desks are not always so placed with reference to the windows as to afford the best illumination to the greatest number of pupils. Preliminary investigation of the vision of children entering upon school life, and periodical examination of the eyes from year to year, with a view to the early detection of possible visual defects, are scarcely thought of. Indifference, on the part of teachers, to recognized symptoms of beginning myopia; inciting children with known ocular defects to perform tasks which are necessarily attended with danger to the eyes; and, in general, sacrificing individual pupils to inflexible arrangements of class work are some of the besetting faults of routine wherever children are brought together in large classes.

A general recognition, on the part of physicians, that myopia is essentially a progressive and often a dangerous disease; that it may be prevented in certain cases and arrested in its progress in other cases, but never cured; that prompt attention and careful and continuous hygienic control, together with the exercise of the highest professional skill in the adaptation and renewal of glasses, are necessary in order to check its progress and guard against possibly grave pathological changes later in life; and that the haphazard resort for glasses to vendors who offer advice gratuitously, and make their profit by selling a possibly badly selected *prince-nez* or pair of spectacles, is an unintelligent evasion of a serious problem in therapeutics, will go far toward creating and disseminating juster views than now prevail.

The not uncommon habit, with children, of reading an interesting book by failing daylight or by insufficient or badly arranged artificial illumination, is especially harmful in the early stages, as indeed in any stage, of myopia; fine sewing or embroidery, as an habitual occupation for leisure hours, and long-continued application to fine work of whatever kind are also to be deprecated.

Imperfect vision at a distance, as demonstrated by easily available visual tests such as the test-letters of Snellen or as revealed by inability to follow blackboard exercises at school, should be promptly reported by the teacher, and the child excluded from school until an investigation of the condition of the eyes has been made by

an ophthalmic practitioner of recognized competency and any necessary treatment, by glasses or otherwise, has been prescribed and adopted. In this way astigmatism will often be detected and corrected, and other abnormal conditions which militate against the easy and safe use of the eyes may be ameliorated.

John Green.  
John Green, Jr.

[List of abbreviations used in this article: M = myopia; H = hypermetropia; A = range of accommodation; r = far-point (*punctum remotissimum*) of distinct vision; p = near-point (*punctum proximum*) of distinct vision; R = distance of r from the first principal point of the eye; P = distance of p from the first principal point of the eye; R - P = region of accommodation; D = dioptre or dioptries; h = principal point; h' = first nodal point; h'' = second principal point; k = nodal point; k' = first nodal point; k'' = second nodal point.]

- <sup>1</sup> Horstmann: Archives of Ophthalmology, vol. xiv., p. 45, 1885.
- <sup>2</sup> Cohn, H.: Unters. d. Augen von 10,000 Schültern nebst Vorschlägen zur Verbesserung der den Augen nachtheiligen Schulinrichtungen. Eine ätiologische Studie, Leipzig, 1867.
- <sup>3</sup> Erismann: Ein Beitrag zur Entwicklungs-Geschichte der Myopie, gestützt auf die Untersuchung der Augen von 4,358 Schülern und Schülerinnen. Graefe's Archiv für Ophthalmologie, xvii., 1., pp. 1-79, 1871.
- <sup>4</sup> Farnat: Annales d'Oculistique, t. x., p. 145.
- <sup>5</sup> Donders: On the Anomalies of Accommodation and Refraction of the Eye. New Sydenham Society, London, 1864, pp. 346-349.
- <sup>6</sup> Weiss: Ueber den an der Innenseite der Papille sichtbaren Reflexbogenstreif und seine Beziehung zur beginnenden Kurzsichtigkeit. Graefe's Archiv für Ophthalmologie, xxxi., pp. 239-320, 1885.
- <sup>7</sup> Iwanoff: Beiträge zur Anatomie des Chiasmuskels. Graefe's Archiv für Ophthalmologie, xv., pp. 284-298, 1869.
- <sup>8</sup> Donders: *Op. cit.*, pp. 39, 350.
- <sup>9</sup> Weiss: Zur Anatomie der Eintrittsstelle des Sehnerven. Verhandl. des internat. ophthalmol. Congresses in Heidelberg, p. 339, 1888.
- <sup>10</sup> Stilling: Verhandl. des internat. Ophthalmol. Congresses in Heidelberg, p. 97, 1888.
- <sup>11</sup> Fukala: Zur Verbesserung der Sehschärfe nach Myopieoperationen. Graefe's Archiv für Ophthalmologie, xliii., p. 206, 1897.
- <sup>12</sup> Bjerke, K.: Ueber die Veränderung der Refraction und Sehschärfe nach Entfernung der Linse. Graefe's Archiv für Ophthalmologie, liiii., 3, 1902.

#### MYOTICS. See *Mydriatics and Myotics.*

**MYRONIN** is a mixture of potash soap, carnauba wax, and doegling oil (chenoceti), and is employed as a very stable ointment base.

W. A. Bastedo.

**MYRRH.**—*Myrrha. Gum Myrrh.* "A gum resin obtained from *Commifera Myrrha* (Nees) Engler (*Balsamodendron M. Nees*.—fam., *Burseraceae*)." The variety of myrrh thus defined is that known in commerce as Somali or Herabol myrrh. It is official in all pharmacopœias, though these are *muca* at variance as to the species named as its source. There appears no good reason to believe that it is derived from any other than the species named in our definition, though the inferior varieties (Arabian and Yemen) and various spurious substances often sold for it are—some of them certainly, others probably—obtained from other species of *Commifera*. This plant is a spiny, large shrub or small tree of northeastern Africa. The myrrh exudes as a thick milky juice from natural and artificial fissures, and slowly hardens to a red-brown mass, which is then collected by the Somali natives, either from the plant or from the ground where it has fallen. "Drossy myrrh," containing a large amount of earthy matter, may result from the accidental entrance of dirt into these fallen masses or from its intentional admixture. The substance is chiefly carried to Aden, whence it is exported to Europe and America, either directly or, as was formerly usual, via Bombay. The "Turkish myrrh," which a generation ago was a favorite brand, was simply a carefully selected quality exported via Turkey. Either at Aden or in Bombay the myrrh is picked and assorted, yet when it leaves those places it commonly contains a considerable percentage of spurious or inferior fragments.

**DESCRIPTION.**—In irregular, more or less rounded nodules or tears, from 2.5 to 10 cm. (1 to 4 in.) in diameter, the surface more or less roughened by nodules and small cavities, as though eroded, red-brown, dull, and more or less gray from adhering powder; heavy, hard, and rather tough-splintery in fracture, the freshly fractured surface of a waxy lustre and oily feel, red-brown, usually variegated by gray crescent-shaped spots and

intersecting lines; thin fragments translucent, usually strongly so; strongly and agreeably aromatic, the odor characteristic; the taste bitter and somewhat acrid, and producing a hardening and slight wrinkling of the mucous membrane of the mouth, though different from the astringency of tannin; readily powdered when cold and dry, but with difficulty when warm and damp; the freshly fractured surface, moistened with alcohol, colored purplish, as is the brownish-yellow alcoholic tincture, by nitric acid (distinction from bdellium); yielding a brownish-yellow emulsion with water; the ten-per-cent. ethereal extract acquiring a violet color in the presence of bromine vapor; if six drops of a seven-per-cent. petroleum ether extract be mixed with 3 c.c. of acetic acid, and 3 c.c. of sulphuric acid be then added, forming a heavy lower layer, the latter takes only a light rose color, which does not deepen (*distinction from Bissabul myrrh*); not more than seven per cent. should be insoluble in alcohol, and the ash should not exceed six per cent.

**CONSTITUENTS.**—Good myrrh consists of from two to five per cent., or occasionally more, of the volatile oil *myrrhol*, and from twenty-five to forty per cent., rarely nearly fifty per cent., of resin, the remainder being mostly gum, with a very small amount of a bitter principle, and from two to six per cent. of ash. In "drossy myrrh," the earthy matter increases the ash, frequently to fifteen per cent. or more. In the poorer grades of myrrh the amount of gum is larger, at the expense of the resin. Myrrh resin is a complex substance, the composition of which is not fully understood. Myrrh oil, which is sold for use in perfumery, is yellow or greenish-yellow, thick and viscous, and almost as heavy as, rarely appreciably heavier than, water.

**ACTION AND USES.**—Myrrh is essentially an aromatic stimulant, with slightly bitter properties, and a mild disinfectant. Its stimulant properties are especially active on mucous or raw cutaneous surfaces with which it comes into contact, so that it is a favorite ingredient of mouth washes, hardening the gums and acting like a mild astringent, and an excellent cleansing and stimulating application to ill-conditioned sores, for which purpose the tincture is diluted to about one-fourth strength. Combined with cathartics, it enhances their activity and is at the same time somewhat carminative. When administered internally it acts as a mild stimulating expectorant and diuretic, through its respiratory and renal excretion. In connection with the latter mode of elimination, it acts as a stimulating emmenagogue. It has from ancient times been credited with specific emmenagogue properties, but these effects have probably been largely imaginary. In all its internal uses it is almost invariably combined with other drugs, as in the pills and the tincture of aloes and myrrh, the pills of iron and myrrh, the compound iron mixture, etc.

The principal preparation of myrrh is the official twenty-per-cent. tincture, the dose of which is 1 to 4 c.c. (fl. 3 $\frac{1}{2}$  to i.). The Tinctura aloes et myrrhæ contains ten per cent. each of aloes, myrrh, and liquorice root, and the dose is 4 to 8 c.c. (fl. 3 i. to ij.). The Pilulæ aloes et myrrhæ each contain 0.13 gm. (gr. ij.) of aloes, about half as much myrrh, and one-third as much aromatic powder, the dose being from two to eight pills. The Mistura ferri composita contains 1.8 per cent. of myrrh, 0.6 per cent. of ferrous sulphate, 0.8 per cent. of potassium carbonate, and 6 per cent. of spirit of lavender, with sugar, etc.

**ALLIED SUBSTANCES.**—*Bdellium* (elsewhere considered) is very similar in composition and properties to myrrh, but is very inferior, being less aromatic and one of its varieties being devoid of bitterness. The myrrh of the Bible is not our myrrh, but the Balm of Gilead or Mecca balsam, from *Commifera* ("Balsamodendron") *Opobalsamum* (Kunth.) Engler, now rarely seen in commerce.

Henry H. Rusby.

**MYRRHOLLIN**—a solution of equal parts of tincture of myrrh and castor oil, is used as a vehicle for creosote in tuberculosis.

W. A. Bastedo.

**MYRTOL.**—A constituent part of the essential oil, derived by distillation, from the leaves of *Myrtus communis* L. It is supposed closely to resemble eucalyptol. It is a clear liquid with a powerful but not unpleasant aromatic odor. It is recommended as a disinfectant and deodorant, but has no bactericidal action. In medicine it is used to replace the balsams in bronchitis, bleorrhagia, and vaginitis. In small doses it improves the digestion and stimulates the appetite, but in larger doses it irritates the stomach. Dr. Solomon Solis-Cohen has reported favorably of its use in subacute and chronic affections of the respiratory tract. It is administered in doses of from two to five minims, in capsules, repeated two or three times a day.

Beaumont Small.

**MYXŒDEMA.**—A chronic disturbance of nutrition characterized by accumulation of mucin in the subcutaneous tissue and caused by loss of function of the thyroid gland. Abundant evidence has proven that myxœdema of adults, cretinism, and the cachectic condition following removal of the thyroid gland for goitre represent the same morbid process occurring under different circumstances. Numerous experiments have demonstrated that similar conditions can be produced in lower animals by removal of the thyroid gland.

*Removal of the Thyroid Gland in Lower Animals.*—That the thyroid gland is essential to normal metabolism and even to life was shown by Schiff as early as 1859. Its removal is followed either by the acute symptoms known as tetany or by a chronic disturbance of nutrition, myxœdema. Within a few days, often a few hours, after extirpation of the gland in dogs, the animal is seized with tetanic contractions of the voluntary muscles accompanied by active tremor, and death follows, often caused by interference with respiration. In sheep, goats, and monkeys, rarely in dogs, death does not follow these acute symptoms, though this may occur, but a chronic condition supervenes; the animal becomes dull and apathetic, nutrition suffers, and the skin is dry and the hair falls out. The subcutaneous tissue becomes swollen and by chemical examination has been found to contain mucin in greatly increased quantity. Horsley has performed numerous experiments on monkeys; these animals survive the symptoms of tetany which frequently follows the operation, and within a few weeks or months develop in typical form the chronic condition described. The temperature becomes subnormal and exposure to cold hastens the progress of the disease.

Extirpation of the thyroid gland in young animals has a remarkable effect, observed by von Eiselsberg in sheep and goats and by Hofmeister in rabbits. Development is retarded and the animal remains small and stunted in appearance. The growth of the long bones is hindered by interference with the normal transformation of cartilage into bone. The undeveloped animal, like the adult, after extirpation of the gland becomes dull and inert and mucinous material accumulates, particularly in the subcutaneous tissue.

Extirpation of one-half of the thyroid gland does not cause the conditions described, but if considerably more than half is destroyed nutrition may suffer, though in some instances little effect has followed when only a sixth of the gland was retained. After partial removal that part which remains, together with accessory thyroid bodies which are not infrequently present, undergoes hypertrophy and replaces the extirpated parenchyma. Schiff first showed that if thyroid tissue were successfully transplanted into the peritoneal cavity of a dog, the thyroid gland of the animal might be removed without fatal effect. Numerous experiments have shown that both tetany and myxœdema may be prevented by transplantation of thyroid tissue. Vessale, moreover, demonstrated that injurious consequences of the operation could be retarded or prevented by the intravenous or subcutaneous injection of an extract made from the gland obtained from other animals, and it was subsequently found that equally beneficial results could be produced

by feeding animals with the raw gland or with dried extracts made from it.

*Removal of the Thyroid Gland in Man: Operative Myxœdema.*—In 1882 Reverdin described certain changes which follow total removal of the thyroid gland for goitre, and the following year, under the name cachexia strumipriva, Kocher described a chronic condition following thyroidectomy. The results which follow loss of thyroid function in man do not differ from those observed in lower animals. Symptoms do not follow partial removal of a goitre if a considerable mass of parenchyma still remains, while in some instances their absence is due to the presence of an accessory thyroid gland which undergoes hypertrophy. In some cases acute symptoms almost immediately follow the operation. The muscles, particularly those of the upper extremity, undergo tonic contractions accompanied by tremor; such attacks may be of mild intensity, but at times are of great severity, causing opisthotonos and death by implication of the diaphragm. More frequently, however, extirpation of the gland is followed by chronic symptoms which sometimes appear shortly after operation, but may not manifest themselves for months. The patient becomes apathetic and indisposed to exert himself, mental actions are slow, and voluntary movements are performed languidly. The temperature is subnormal and the patient feels cold. The subcutaneous tissue of the face and extremities becomes swollen and edematous in appearance, but does not pit on pressure. The skin is dry, the hair falls out, and the physiognomy assumes the appearance which, as will be pointed out, is observed in cases of myxœdema occurring idiopathically. The symptoms are analogous to those which follow thyroidectomy in lower animals.

In a case described by von Brunn a goitrous thyroid gland had been removed at the age of ten years, eighteen years before death. Development had been arrested and the dwarfed individual, who presented the appearance of a cretin, had the mental characters of an imbecile. Similar cases have been observed.

*Myxœdema of Adults.*—In 1873 Sir William Gull, in a paper "On a Cretinoid State Supervening in Adult Life in Women," described the symptoms of a disease to which Ord, several years later, gave the name myxœdema, since its most conspicuous feature is an œdema-like swelling of the skin caused by accumulation of mucin in the subcutaneous tissue. The resemblance between myxœdema, cretinism, and the cachectic condition following extirpation of the thyroid gland was soon recognized and was fully elaborated in the exhaustive report upon myxœdema published in 1888 by the Clinical Society of London. Numerous experiments upon animals, already referred to, have been undertaken in order to explain the pathogenesis of this disease, and have been so successful that an efficient therapy has been established within thirty years following its recognition.

Myxœdema of adults may occur at any age, but most frequently affects individuals between the ages of thirty and fifty years. The disease is much more common in women than in men, the ratio being about five to one. Heredity plays a part in its occurrence and several cases have been observed in the same family. Occasionally myxœdema has followed exophthalmic goitre, a disease in many respects the antithesis of myxœdema, while in one instance myxœdema has been observed in a woman whose daughter suffered with exophthalmic goitre.

Pathological investigation has shown the constant occurrence of a destructive lesion of the thyroid gland. The organ is diminished to one-half or even to one-fourth of its normal size; the tissue is pale and tough. By microscopic examination the interstitial tissue is found increased at the expense of the glandular alveoli, which are atrophied and in part destroyed; the gland is the seat of chronic interstitial inflammation comparable to cirrhosis of the liver or to chronic interstitial nephritis. Carcinoma and actinomycosis affecting the gland have in rare instances been associated with the disease. The subcutaneous tissue is distended and spaces occasionally occur

between the bundles of connective-tissue fibres, while late in the disease there is evidence of proliferation of fibrous tissue associated with atrophy of the sebaceous glands and hair follicles. The amount of mucin present in the subcutaneous tissue varies in different cases, and at a late stage of the disease may diminish in amount. In a case studied by Cranston Charles it exceeded the normal fifty times. The parotid gland and certain other tissues have been found to contain an increased quantity of mucin.

The symptoms of myxœdema are characteristic and in most cases the condition can be readily diagnosed. The onset of the disease is usually very gradual, but occasionally within a few weeks it is recognizable. There are at first languor and disinclination to exertion, associated with slowness in the performance of voluntary movements. The patient feels cold readily and may suffer much in winter. Myxœdematous swelling of the subcutaneous tissue is observable first in the face, the physiognomy assuming a characteristic appearance which produces a certain likeness among those affected with the disease. The features become coarse and broad, the lines of the face are smoothed out, and the face assumes a stolid expression. The lower eyelids are puffy, the lower lip is thickened and often everted, the nostrils are broadened. Subcutaneous swelling occurs in other parts of the body, the extremities being at times most markedly affected; the hands and feet are broad and clumsy. This œdema-like swelling has a solid character, and, unlike ordinary œdema, does not pit on pressure. The body weight increases in proportion to the gradual swelling. The skin is dry and the nutrition of its appendages suffers; the hair becomes dry and brittle and falls out and the nails are stunted.

The subjective sense of coldness is associated with a subnormal temperature, which not infrequently falls to 95° F. or even lower. The disease is said to progress more rapidly in winter than in summer, and an important factor in its treatment is exposure to a warm temperature. Slowness of mental action is a constant feature of myxœdema and memory becomes defective. The temper is usually remarkably placid, but is occasionally irritable, and dementia is by no means uncommon. Hemorrhages from the gums or nose or from the uterus during menstruation or after pregnancy are not rare. The circulatory, the digestive, and the urinary systems exhibit no characteristic alterations, though albuminuria often occurs. The functions of the sexual organs undergo no constant change, and the greater frequency of myxœdema in women has not been referable to changes in the female organs of generation. Patients with myxœdema seldom become pregnant, but in exceptional instances the myxœdematous condition has been found to improve during pregnancy.

The progress of the disease is very slow and the patient may survive ten, occasionally even thirty years. Death usually occurs with some intercurrent affection, not infrequently tuberculosis or nephritis.

*Cretinism or Myxœdema of Childhood.*—No essential difference exists between the disease myxœdema and the condition known as cretinism, save that the latter occurring during the early years of life is associated with arrest of development. Endemic cretinism occurs in Switzerland and in certain other countries, particularly in the deep valleys of high mountains where goitre is prevalent. Sporadic cases occur in the United States and elsewhere. The disease, affecting females more frequently than males, usually develops before the fifth year. Lesions of the thyroid gland which cause destruction of its parenchyma and which are analogous to those of myxœdema in adults, occur. In cases of sporadic cretinism the gland is undeveloped or atrophied. In about two-thirds of the cases of endemic cretinism there is a goitre-like enlargement, but doubtless the functional ability of the gland is much diminished; in one-third of the cases the organ has been found absent or atrophic.

The condition of the affected child is analogous to that produced in lower animals and in young children by the

operative removal of the thyroid gland. The stature is dwarfed and the limbs are short and thick. There is a corresponding arrest of mental development, so that the intelligence may not be greater than that of a child three years of age, while in many instances there is complete idiocy. The subcutaneous tissue is the seat of solid œdema, giving the features a coarse, repulsive aspect. Not infrequently cretins live to adult age or even to middle life, retaining their dwarfed condition of body and mind.

*Treatment.*—Experimental pathology and pathological anatomy, having demonstrated the identity of so-called idiopathic myxœdema and cretinism with the disturbance of nutrition which follows operative removal of the thyroid gland, have at the same time furnished an efficient method of treatment. The thyroid gland performs some function essential to normal metabolism. The effects which follow removal or destruction of the gland can be prevented by supplying to the body thyroid tissue or its products derived from another individual not necessarily of the same species. It has been found possible to transplant thyroid tissue, preferably that of the sheep, into the subcutaneous tissue of patients suffering with myxœdema, occurring spontaneously or as the result of operation for goitre, and well-marked improvement lasting for several months has followed. The transplanted tissue undergoes partial vascularization and functions like the normal gland, but atrophy occurs and the improvement is only temporary. Subcutaneous injection of extracts made from the thyroid gland was introduced by Murray, who employed with success a glycerin extract made from the thyroid gland of the sheep. Products of the gland administered by mouth have been found equally efficient, and the effects differ little whether the gland is ingested raw, partially cooked, dried and powdered, or in the form of a glycerin extract. The glycerin extract or the dried powder prepared as tablets is most conveniently used, the dose varying with different preparations. Toxic symptoms may follow the administration of too large quantities.

The effects of treatment in cases both of spontaneous and of operative myxœdema are remarkable. Within a few weeks subcutaneous swelling disappears, the face loses its stolid expression, and there is a rapid diminution of body weight. The mental condition improves and the temperature becomes normal. The treatment of cretinism has proved almost equally successful. With administration of thyroid extract the skin soon becomes normal in appearance and intelligence improves; growth occurs with surprising activity and the height may increase several inches during the first year. When treatment is begun at an advanced age its effects, as might be expected, are less satisfactory. In the treatment of all forms of myxœdema it is necessary to continue the administration of thyroid products after the disappearance of all symptoms, since throughout the remainder of life it is necessary to supply the deficiency caused by the absence or destruction of the thyroid gland.

Eugene L. Opie.

**MYXOMA.**—The name myxoma, or tumor composed of mucous tissue, was first used by Virchow, who separated from the other connective-tissue tumors a special class of formations to which he gave this name. Before this they had been described under various names, which generally had reference to the soft and jelly-like character of the growth. Laënnec gave them the name colloid, because the soft, trembling, gelatinous character of the tissue reminded him of partially solidified gelatin. Those tumors described by Johannes Müller under the name gelatinous tumor, or collonema, belong in this category, although the latter name seems also to have been used for soft tumors of other sorts, as the soft fibromas, etc. Paget has described them under the name fibrocellular tumors.

Virchow distinguished as a separate variety of the connective tissue, *mucous tissue*, which was characterized by containing in the intercellular substance a quantity of mucin. This tissue was most developed in the fetus,

where it formed the jelly of Wharton in the umbilical cord, and was also abundant in the subcutaneous tissue. In the subcutaneous tissue it afterward became converted into fat, and when it was found elsewhere in the body Virchow regarded it generally as an antecedent to fat formation. Its cells either take up fat directly, and so become changed into fat cells, or they proliferate and the young cells so formed become fat cells. In the adult tissues it occupies but a small field, being found only in the vitreous body of the eye and in the subcutaneous tissue in a few places, here principally over the pubes. Histologically the tissue consists of cells embedded in a homogeneous matrix. The cells may be of various shapes, round, spindle-, or star-shaped. Generally they have the latter form, and are abundantly provided with processes which freely anastomose with the processes of neighboring cells, and form a fine meshwork through the tissue. On section of the tissue abundant fluid escapes, which has the same properties as those fluids which contain mucin. The mucin in the ordinary secretions of mucous surfaces is the result of the action of the epithelial cells, and is formed in them; but in the mucous tissue it is not found in the cells, but in the intercellular substance. The mucin contained in the fluid has some of the chemical properties of albumin, but can be distinguished from it in various ways. On the addition of alcohol to fluids containing mucin, there is formed an abundant precipitate, which can be distinguished from the albuminous precipitate, formed in like manner, by the fact that it swells up and dissolves on the addition of water. The albuminous precipitate is not affected by water. Mucin is not dissolved by an excess of the organic acids, but is readily soluble in an excess of mineral acids.

The result of later investigations has been to throw much doubt on the existence of mucous tissue as a distinct type of tissue, such as Virchow has described it. Even in the place where he supposed it to be most typical, *i.e.*, in the umbilical cord, it has been shown that this is only ordinary connective tissue with an abundance of fluid in its meshes. A tissue almost analogous to mucous tissue is found in every subcutaneous œdema, and can be produced artificially by puncturing the skin with a fine hypodermic needle and injecting salt solution. A doughy swelling is so produced, and on section the injected fluid will not flow out again, but is held in the meshes of the tissue and along the fibres. On microscopic examination of sections, made by clipping out a piece of the swollen tissue with a pair of sharp scissors, the cells are found separated from one another, often anastomosing, and the fibres of the connective tissue do not appear so prominent. The fact that the supposed mucous tissue of Virchow contains mucin cannot be held as peculiar to it, and as distinguishing it from other forms of connective tissue. Mucin is found in all the connective tissues, and the gelatinous œdematous tissue does not contain any greater proportion of it than do other tissues of its class. The fatty tissue which Virchow supposed to be developed from the mucous tissue does not stand in any immediate connection with this, but, according to Ranvier, takes its origin from cells which from the beginning are destined to form fat cells.

Following this, Rumler and Koster have taken the ground that the myxoma is not to be considered a special type or class of tumors, but that it simply represents conditions which might arise in any of the tumors which contain connective tissue. This myxomatous condition of the connective tissue consists in its saturation with serum in consequence of circulatory disturbances in the tumors, passive congestion, etc. They regard this tissue, wherever found, simply as ordinary connective tissue infiltrated with fluid, or œdematous. In every tumor there can be numerous conditions which might give rise to this. The veins can easily be compressed by the growth of certain parts of the tumor, and we cannot suppose that the vessels of a tumor of any sort are less prone to allow of transudation, in case of passive congestion, than those of any other tissues. On the contrary, it seems probable, from the numerous areas of small-cell

infiltration in tumors of every description, and from the frequency with which red corpuscles are found in the tissues, that the vessels are easily traversed by the corpuscular elements of the blood, and where this is the case the fluid elements pass through also. The serum would be most readily taken up in the meshes of the connective tissue, enlarging these, and the connective-tissue fibres would be forced apart and rendered less distinct. The fact that we scarcely ever find a pure myxoma, such as Virchow has described, but almost always this so-called myxomatous tissue in connection with some variety of the tumors which contain connective tissue, as fibroma, sarcoma, carcinoma, etc., speaks much in favor of the correctness of this view of Koster. Still the term myxoma or myxomatous tissue, to denote this swollen and œdematous connective tissue, is a convenient one and will be retained, although the myxoma, in the light of these recent investigations, should occupy no place in the category of tumors. The myxoma was first described by Virchow, and his descriptions of it are in all respects so full that they have undergone but little modification by subsequent writers on the subject. The writer has thought it best after this preface, which sheds a clearer light on what has been a complicated subject in *oncology*, to give, in the main, Virchow's description of the tumor.

The cells in the tumor vary in shape and in numbers, this variation depending chiefly on the stage of development of the tissue. The younger the tissue is, the more the cells are inclined to be round and the more numerous they are. In the older portions the cells are rather star- or spindle-shaped, and have numerous processes which communicate freely with one another, producing a reticular or areolar tissue, in the meshes of which round cells are frequently enclosed. When these cellular elements are fewer in number, the whole tissue has a transparent, gelatinous appearance, and is similar to the vitreous body of the eye. This forms the variety *myxoma hyalinum*. Virchow has described several other varieties, which depend on various, for the most part minor, differences in the structure of the tumor.

*Myxoma Medullare.*—In this the cells are more abundant, and this gives the tumor a whitish, opaque, medullary appearance.

*Myxoma Fibrosum.*—In this the tumor contains a considerable amount of fibrous tissue, especially elastic fibres, which often form dense bands which appear on the cut surface.

*Myxoma Lipomatodes* or *Myxo-lipoma.*—In this the tumor contains a considerable amount of fat, either in the shape of small drops contained in the cells or as fully formed fat cells. There may be so much fat present that the tumor has most of the characteristics of lipoma.

*Myxoma Cartilagineum* or *Myxo-chondroma.*—A large proportion of the myxomata contain islands of cartilage. This is especially the case in the compound tumors of the parotid gland and of the testicle.

*Myxoma Cystoides.*—In some cases the cells of the tumor enclosed in the mucous tissue undergo mucous or fatty degeneration, and there are formed large cavities filled with viscid fluid.

*Myxoma Telangiectodes.*—As is the case with most tumors, the vessels here also may be enormously developed, and this name has been given to the condition.

Mucin is found in numerous other tumors, as a result of the physiological activity or of a degeneration of the tumor cells. It is found, for instance, in the cystic tumors of the ovary and in most other epithelial cysts. Virchow excludes these from the myxomata, and has limited this term to those tumors in which the mucin is contained in the interstices of the tissue and forms an integral part of the tumor. Billroth has included with the myxomata all such tumors, among them goitre. Just as the most typical formation of mucous tissue is found in the fetus, the most typical examples of myxomata are found in tissues belonging to the fetus. The myxoma of the chorion, forming what has been termed mole pregnancy, is the most typical example of this myxoma. Abortion takes place in this case at an early period, and

the chorion will be found covered with transparent, gelatinous vesicles, which are connected with the membrane by a narrow pedicle. Sometimes several of these vesicles are connected with the same pedicle, and are strung along it like rows of beads. The vesicles vary in size from a pin's head to a nut. On microscopic examination they are found to be covered with epithelium, and composed of a tissue similar to that of the umbilical cord, *i.e.*, branched cells lying in a homogeneous matrix. Other parts of the fetal appendages may be the

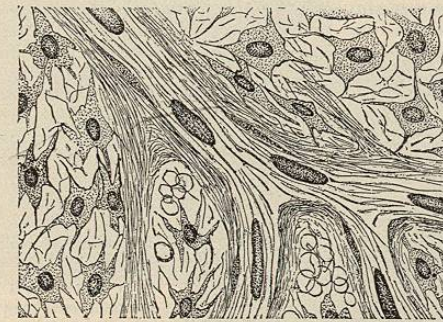


FIG. 3476.—Section of a Myxoma of the Subcutaneous Tissue of the Thigh.  $\times 300$ .

seat of similar formations. Cases have been seen in which the umbilical cord contained along its course a series of such vesicles. Also in the placenta itself there may be an abundant formation of mucous tissue in the form of circumscribed tumor masses. Retained portions of the placenta may form the starting-point of tumors which reach a considerable size.

In the adult the subcutaneous cellular tissue is the most frequent seat of the myxomata. Here they are principally found on the thigh, on the buttocks, on the labia majora, and on the lower lip. The fat in the orbit may be a point of origin for the tumor. Such tumors may reach considerable size; those of the size of a child's head have repeatedly been seen. These large myxomata have a distinctly lobular structure, and when they break through the skin they become ulcerated and often very foul. They may have a deeper origin, as from the intermuscular tissue. In some localities, where the skin covering them is not tense, they become distinctly pedunculated.

The long bones are often the seat of this tumor. In this place it seems to originate in the bone marrow. In these tumors various combinations, as with sarcoma and enchondroma, are seen. The spongy osteomata, with soft cellular marrow, may be confounded with them. The pure myxoma of the bones is a soft, spongy tumor, which ordinarily originates in the bone marrow, and in the course of its growth becomes covered with a thin shell of bone. At a later stage it breaks through this and grows as a soft mass. It is always accompanied by a new growth of bone, is generally lobulated, and here and there portions of the old bone may be enclosed in its substance. The tumor is soft and grayish-white or yellow. Virchow compares its tissue to the flesh of oysters. An abundant formation of blood-vessels may give a reddish tint to the tumor.

The myxomata often have a heteroplastic origin, and in these cases the starting-point is most frequently located in the central nervous system. A considerable proportion of the brain tumors belong in this category, especially those of the cerebral hemispheres. The dura mater of the brain and cord may also be the place of origin.

When seated on the peripheral nerves the tumor does not originate in the neurilemma, but in the interstitial tissue. Such tumors along the nerves are often mistaken for neuromata. They give rise to severe neuralgic pains, and are often multiple. All the nerves of an extremity may be affected, in some cases several being seated on a

single nerve trunk. In many cases the nerve does not pass into the substance of the tumor, but over it, and is generally flattened from pressure. It is often possible to dissect out the nerve from such a tumor and remove the tumor, leaving the nerve intact. The consistence of these tumors is so soft that they may be easily mistaken for cysts. They have a tendency to return after removal.

Myxomata may also be found in the glandular organs, where they arise from the interstitial tissue. Such tumors are found in the female breast. The tissue of the tumor grows into the milk ducts in the form of polypoid masses. The duct becomes dilated into a cyst, which is filled with the branching growth. The whole tumor may in this way be enclosed in one large duct, and may be removed from it, leaving a cavity with smooth walls. On microscopic examination the section often appears to be composed of small islands of myxomatous tissue surrounded by epithelium. The islands of tissue are the cross sections of the branching dendrate growth in the duct. This manner of growth is not peculiar to the myxomas of the mamma, but is seen also in fibromas and sarcomas in the same locality. The tumor finds the least resistance to its growth in the milk ducts, and grows into and dilates these. Jungst has recently described one of these tumors in which a great part of the tissue had undergone hyaline degeneration. When the superficial ducts are the seat of this growth, the tumor may project as a nodular mass from the breast. This is particularly apt to take place in the region of the nipple. The skin covering the tumor becomes thin and finally breaks, and a soft, fungous, often gangrenous mass appears. This may have an appearance very similar to that of an ulcerated cancer. If it is closely examined, spaces may be found in which a probe may be pushed deeply down between the single masses of which the tumor is composed.

The mixed forms of the tumor deserve especial attention, for they are much more common than the pure forms. They are most apt to be seen with tumors of the connective-tissue type, as the fibroma and sarcoma, but may be found with any tumors which contain connective tissue. In the spindle-cell sarcoma the tissue may be seen to pass into myxoma. The cells become separated from one another by an increase in the interstitial tissue and lose their spindle shape. In carcinoma the most typical mucous tissue may be found between the masses of epithelial cells. These mixed forms have been given special names, as carcinoma myxomatodes, etc. The fact of the presence of such tissue in a carcinoma or sarcoma does not influence the growth of the tumor, nor its prognosis, but may lead to errors in diagnosis. Wherever this tissue is present the tumor is softer. The mixed tumors of the parotid gland always contain a considerable quantity of myxomatous tissue.

In general the tumors described as myxomata are not malignant. Some, however, are. Those of the central nervous system are malignant from their position, and those of the peripheral nerves have a tendency to multiple formation and to return after extirpation.

The best and most typical pictures of this tissue are to be obtained by examining fresh sections made by the freezing microtome in salt solutions. After the tumor has been hardened in almost any of the hardening agents, the tissue loses its fluid and shrinks very much.

W. T. Councilman.

**NÆVUS.**<sup>1</sup>—(Greek, *σπίλος, σπίλωμα*; French, *naevus, couenne, envie, signe, tache congénitale, ou pigmentaire, ou de naissance*; German, *Mal, Muttermal, Muttermohl, Mutterfleckchen*; Italian, *neo [materno], nevo*; Spanish, *nevo, lunar.*) (Synonyms: Mother's mark, birthmark, etc.)

**DEFINITION.**—A *nævus* is a congenital alteration of the skin, confined to a limited area and characterized by an increase in the amount of pigment deposit, and by a certain amount of hypertrophy of one or more of the other elements of the skin, especially the vascular and connective tissues, as well as the hair, fat, nerves, and