

Lecture on the etiology of constitutional diseases of the eye / by John Tweedy.

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Tweedy, John, 1849-1924.
Royal College of Surgeons of England

Publication/Creation

London : Ballantyne, Hanson & Co., 1887.

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LECTURE

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ON THE

ÆTIOLOGY OF CONSTITUTIONAL
DISEASES OF THE EYE

BY

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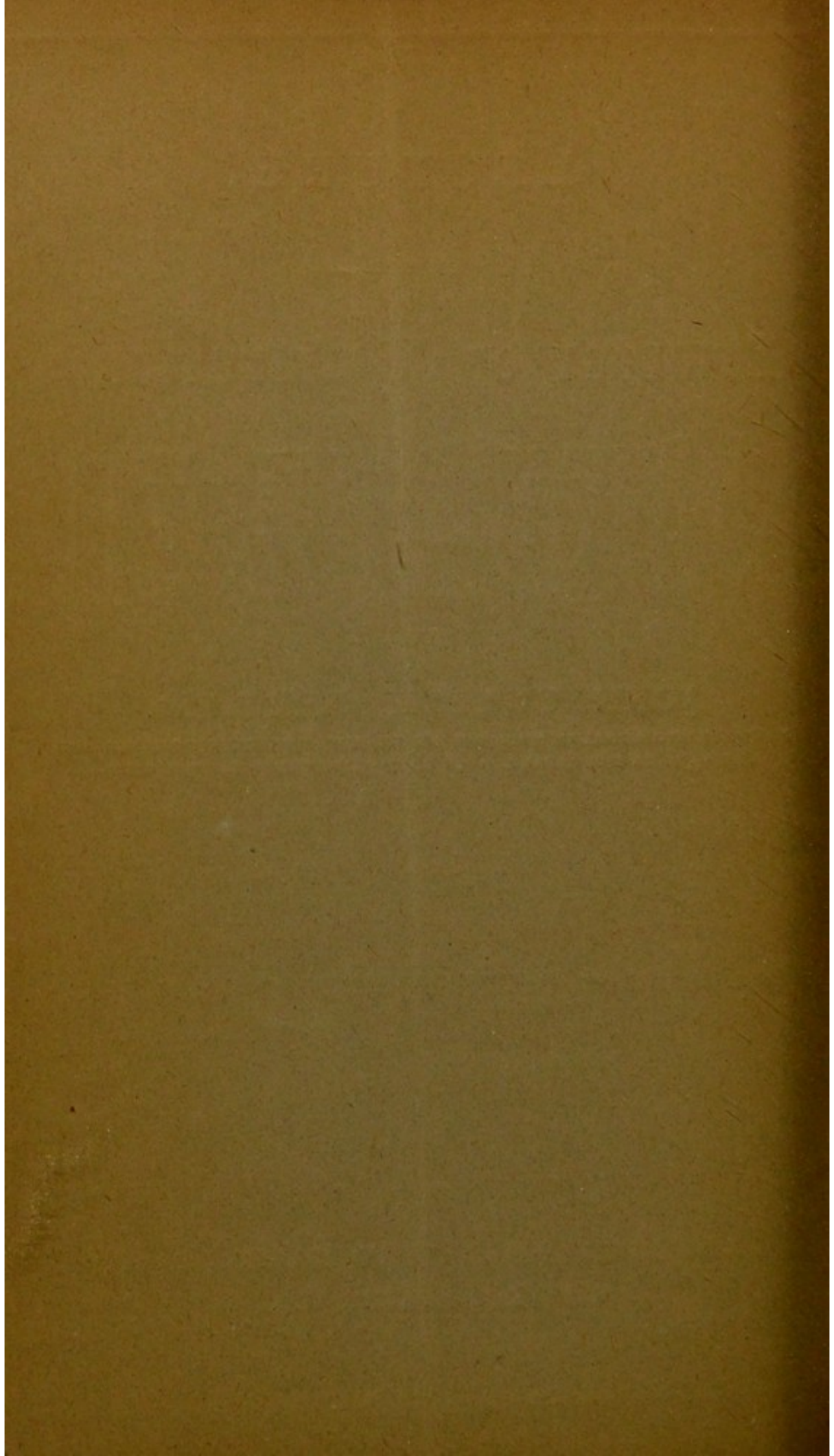
Reprinted from "THE LANCET" of Jan. 8, 1887.

LONDON

PRINTED BY BALLANTYNE, HANSON & CO.

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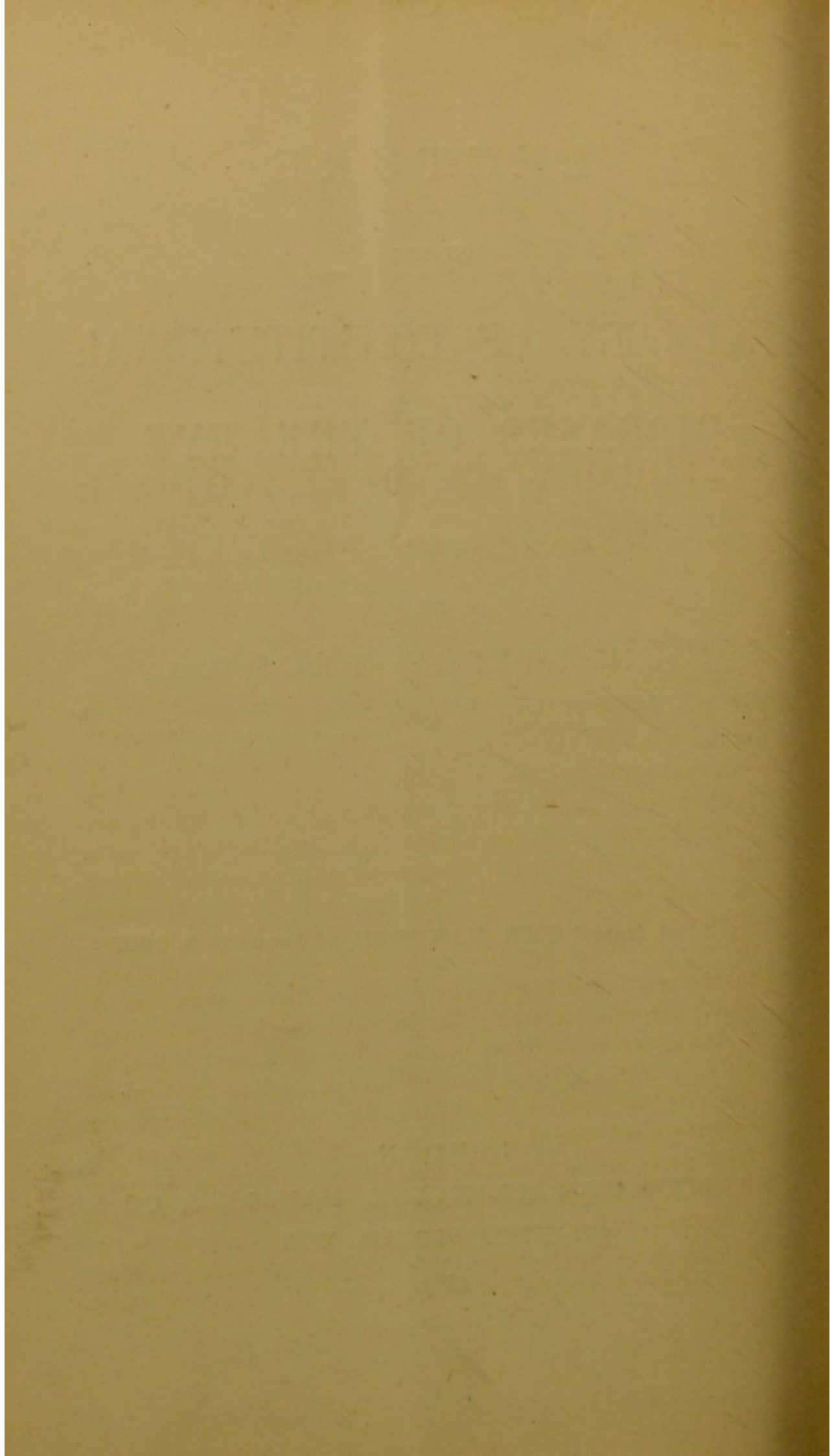
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GENTLEMEN,—Very little experience in the observation of diseases of the eye is needed in order to discover that while some of these diseases are strictly local or due to external causes, there are others which are associated with morbid constitutional states and apparently dependent thereon. Contagious ophthalmia, the effects of injuries, errors of refraction, and presbyopia are common examples of local affections; and the ophthalmia of strumous children, the keratitis, iritis, and choroiditis which occur in syphilis, the retinitis met with in kidney disease, the cataract of diabetes, are equally common examples of ocular lesions associated with abnormal constitutional states. A still closer observation discloses the additional fact that not only are the grosser parts of the eye, such as the cornea, the iris, the choroid, the retina, or the lens, affected in constitutional disorders, but that particular portions of these parts are implicated in particular constitutional conditions. The form of inflammation of the cornea which is so common in strumous children is altogether different, both as regards its site and the mode of its manifestation, from that form of inflammation which is met with in the subjects

of hereditary syphilis; and both these in turn differ from the special form of keratitis which occurs in sympathetic ophthalmitis, and in some cases of toxæmia, septicæmia, Bright's disease, and gonorrhœal rheumatism. Similar differences are observable in the various forms of iritis, choroiditis, and retinitis associated with different morbid diatheses.

What is the explanation of these coincidences and these differences? The answer to this question is by no means so easy or so obvious as might at first sight appear. But the inquiry suggested by the question is worth undertaking, because the conclusions at which we may arrive will not only explain the ætiology of the constitutional diseases of the eye, but will also throw light upon the nature and origin of other localised foci of constitutional diseases.

I may perhaps so far anticipate the result of the inquiry as to state that I believe the association of ocular lesions with general diseases is determined partly by anatomical connexions, partly by histological peculiarities of the textures severally involved, but chiefly by their embryological origins, relationships, and affinities.

The eye is peculiarly adapted for such an investigation as this. The optic nerve and retina are genetically direct and very early outgrowths from the brain; and physiology and pathology have both demonstrated what might have been *a priori* anticipated, that there is an intimate correspondence between the development and functions of the brain and those of the optic nerve and retina. This correspondence is further increased by the communication which exists between the lymph spaces of the eye and those of the brain and spinal cord. These embryological and anatomical conditions not only account for the occurrence of neuro-retinitis and other ocular changes in diseases or injuries of the brain and spinal cord, but also for the concomitancy of retinitis pigmentosa, coloboma of the retina and choroid microphthalmia, and other congenital defects of the eye with faulty development and growth of the brain.

The eyeball and its appendages draw their blood-supply

from two main sources—the internal and the external carotid arteries. By means of the bloodvessels and the fluid which circulates within them, foreign or other morbid materials may be carried along the blood current into the eye. Particles of fat, clots, *débris*, parasites, and emboli may block the central artery or other vessels, or be deposited in other parts; or hæmorrhages may occur in the retina or choroid in those states of altered blood, or altered relations between the blood and the vascular tunics, which occur in Bright's diseases, in leucocythæmia, in diabetes, &c.

Of the twelve pairs of cranial nerves, the eyeball and its appendages receive the whole or parts of six, as well as many fibres of the sympathetic, which influence the nutrition of the eye, controlling the size of the bloodvessels, and regulating the size, equality, and mobility of the pupil. It is not surprising, therefore, that the eye is very susceptible to all those influences, healthy and morbid, which affect the nervous system generally, or the special innervating apparatus of the eye, either at the centres, the periphery, or in any part of its course. Paralysis or spasm of the muscles of motion, of accommodation, or of the iris, with the attendant phenomena of strabismus, diplopia, myosis, mydriasis, nystagmus, ophthalmoplegia, pain, photophobia, neuralgia, anæsthesia, and some forms of trophic changes, such as inflammation and ulceration, are some of the more common neuropathic ophthalmic lesions associated with cerebro-spinal disease or with general diseases which especially affect the nervous system.

There is another factor in the ætiology of constitutional diseases of the eye which has not received, as far as I know, the consideration and attention which it deserves. There is a constant relationship between the differentiation of the muscular layer of the body and that of the nervous system. Muscles imply the existence of nerves, and throughout the whole animal kingdom an intimate connexion may be observed between the power of locomotion and the sense of sight. Sessile animals do not, as a rule, possess visual

organs; while free and active animals, even of lower organisation, have well-marked eyes. Some organisms which, like the medusæ, have an early sessile stage and are then eyeless, acquire ocelli when they assume a free mode of life other organisms, like young barnacles and balani, in passing from a free to a fixed state lose their eyes with their other higher sense organs. It is, at least, noteworthy that in most cases of locomotor ataxy the sense of sight is sooner or later lost. Indeed, not infrequently blindness occurs very early, and before the appearance of actual ataxia.

So that we see the eye is not a separate and autonomous organ, living, as it were, a life apart. Nor is it a mere appendage or accessory convenient and advantageous to the rest of the organism. On the contrary, it is in the closest relationship with the rest of the body, and participates in its various moods. This inter-dependence of the several organs of the body is at once an acknowledged fact in physiology and pathology and the basis of the doctrine of evolution.

The conditions which I have already enumerated are, however, only some of the factors in the production of so-called constitutional diseases of the eye; they are not all the factors. They are, indeed, only accidentals, as it were; the essential factor being the nature and constitution of the tissue-elements themselves.

No other organ of the body contains so many different kinds of histological elements or textures of so high a quality as the eye. Not only are there the coarser constituents of bloodvessels, nerves, muscles, and fibrous tissues, but there is in the cornea a rich network of protoplasm and lymphatic channels, in the choroid a collection of peculiar pigment cells, in the crystalline lens specialised transparent fibres, and in the retina some of the most highly differentiated tissue-elements in the whole body. It is, I repeat, the number and complexity of the different kinds of tissue-elements and their kinship with many systems of similar elements distributed throughout the body which render the eye so apt to participate in constitutional diseases.

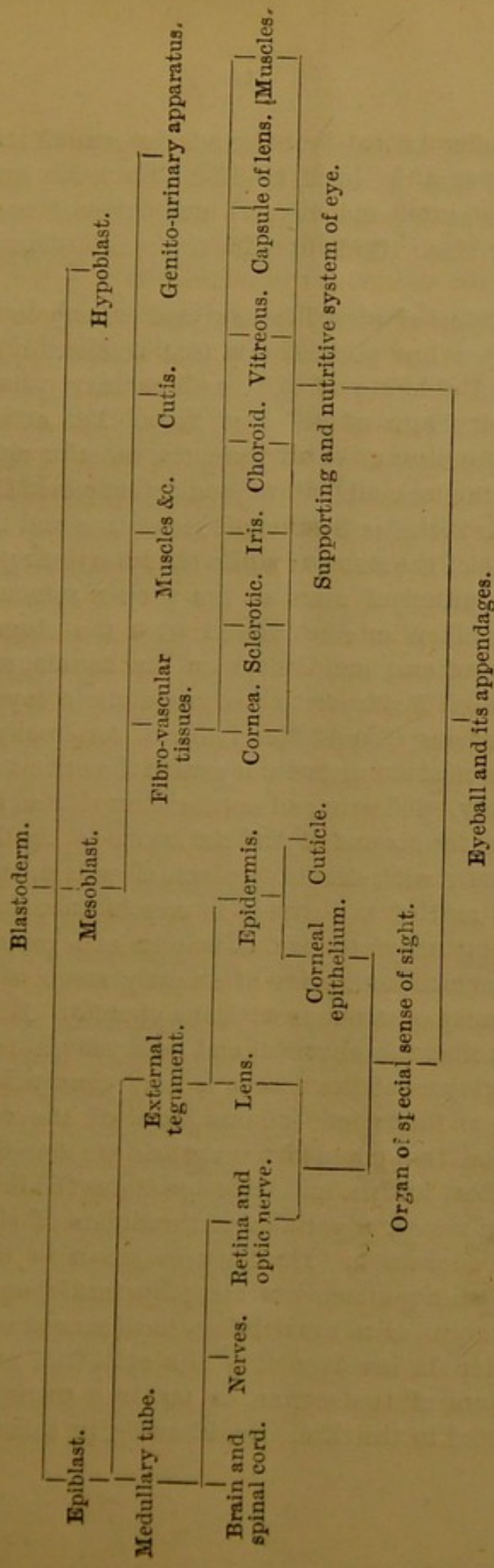
Healthy life and nutrition depend upon two conditions—first, the inherent properties of the organism; and second, the environment. So long as there is a sufficient correspondence between the organism and its surroundings health is fairly maintained, but when these relations fall out of correspondence, disease, decay, or death takes place. No organism, whether unicellular or multicellular, is endowed with the power of indefinite life. In complex organisms of even the best ancestry it is scarcely likely that all the systems of tissue-elements derived from the division of the parent cell receive at birth exactly the same share of vital energy (Ziegler). Other things being equal, the less favoured cells will succumb sooner than the more favoured to all those external agencies which are antagonistic to cell life. If these agencies exist as morbid qualities of the blood, the changes will, in accordance with what is called the law of selective assimilation, affect all the faulty elements in whatsoever parts of the body they may be located. Mr. Herbert Spencer has generalised the facts of selective assimilation somewhat as follows: "Just as the growth of an entire organism is carried on by abstracting from the environment substances like those composing the organism, so the production of each organ within the organism is carried on by abstracting from the substances contained in the organism those required by this particular organ; like units tend to segregate."

The law of organic assimilation prevails in pathological states no less than in physiological, and just as in healthy nutrition the structural elements of the body select from the nutritive particles and fluids circulating round them the pabulum proper to their composition and constitution, so in pathological states kindred elements in all parts of the body will be affected in a similar way. This is demonstrably the case in so-called blood diseases; the altered physical, chemical, or vital properties of the blood manifest themselves in local lesions of textures similar in constitution or function. The similarity of constitution is ultimately determined by the embryological origin of the tissues.

The blastoderm consists of three layers, called the epiblast, the mesoblast, and the hypoblast. From the epiblast are developed the brain, spinal cord, and nerves, the retina and optic nerve, the crystalline lens, the epithelium of the cornea, the sense-organs, the enamel of the teeth, and the cuticle. From the mesoblast the osseous skeleton, muscles, bloodvessels, lymphatics, the muscular and fibro-vascular portions of the skin and of the alimentary canal, and the genito-urinary apparatus. The hypoblast gives rise to the epithelium lining the air passages, the alimentary canal, and the principal gland ducts, and cellular elements of the associated glands. (See schema.)

A glance at the accompanying schema will show that the retina and optic nerve are not only closely related to the cerebro-spinal system, but that they and it, together with the crystalline lens and the corneal epithelium, have also a kinship with the cuticle through their common origin from the epiblast. With this help we can understand the frequent association of zonular cataract with fits and other neuroses, and a deficiency of dental enamel. So also it will be seen that the stroma of the cornea, the sclerotic, the iris, choroid, vitreous, capsule of the lens, as well as the vascular and muscular tissues of the eye, have relationship with all the other textures of the body, including the genito-urinary apparatus, which are derived from the mesoblast. The eye has no elements derived from the hypoblast. Thus we see how a histological, physiological, and also a pathological relationship is established between the epiblastic elements of the eye and epiblastic tissues in the rest of the body, and between the mesoblastic tissues of the eye and all other mesoblastic tissues. All the textures of kindred origin retain a strong family likeness throughout their existence and behave more or less similarly in similar contingencies, in spite of differentiation of structure and specialisation of function. The qualities which they have in common manifest themselves in disease as well as in health.

In applying this doctrine to actual facts, it should be remembered that all the organs and tissues of the body



are not indiscriminately affected in constitutional disorders, but that in each disorder the local lesions have determinate seats, and involve only tissues or organs of a particular kind. So it is with the constitutional diseases of the eye.

In elucidation of what I have stated it may be mentioned that Waldeyer has pointed out that sections of the cornea treated with chloride of gold and carmine present three well-defined strata of different tints. The anterior layer comprises the corneal epithelium, the anterior elastic membrane, and the immediately adjacent portions of the stroma; the posterior includes Descemet's membrane and the adjoining portions of the stroma; while the intervening layer consists of the principal mass of the proper substance. This experience, taken in conjunction with the observations of Manz, Langerhans, and others on the development of the cornea, has led Waldeyer to designate these layers respectively, cutaneous, choroidal, and scleral. As already indicated, it is certain that the anterior layers of the cornea are almost, if not entirely, epiblastic, and are therefore related very closely with the epidermis and superficial layers of the dermis, and more remotely with the cerebro-spinal system, and with the lens. The rest of the cornea is mesoblastic, the posterior layer having acquired the character and properties of a serous membrane, and being at an early stage of embryonic life apparently continuous with the choroid. It is an interesting fact that this chemical and embryological differentiation of the layers of the cornea is very closely imitated by the various forms of inflammation of the cornea. In strumous children cutaneous eruptions are common; hyperæmia, eczema, herpes, and impetigo about the lids, lips, and nose being almost invariable concomitants of the so-called strumous ophthalmia. The essential lesion in this form of ophthalmia is a vesiculo-pustule (*phlyctenula*) on the cornea, or at its margin, or on the circumcorneal zone of conjunctiva. The phlyctenula involves only the epithelial and anterior elastic layers of the cornea, or portions corresponding to those affected in the skin. So, likewise, in inflammation of

the cornea dependent upon neuropathic causes, as disease of the fifth nerve, or ophthalmic herpes, the corneal change is here also primarily superficial—the epiblastic portion. In the keratitis of hereditary syphilis, on the other hand, it is the stroma of the cornea and the posterior layer which are involved—the mesoblastic portions. Now, syphilis is essentially a disease of mesoblastic textures; and those portions of the cornea, and indeed of the whole eye, which are affected in syphilis will be found to be of mesoblastic origin. The notched, pegged, and stunted teeth of inherited syphilis depend not upon faults of the epiblastic enamel, but upon those of the mesoblastic dental papillæ. The epiblastic portions of the eye may become secondarily involved; but here, as in the brain and spinal cord, the lesion begins in the mesoblastic elements—bloodvessels, &c. Inflammation of the posterior layer of the cornea (which is called by the various names—keratitis punctata, aquo-capsulitis, and serous iritis) will in the majority of cases be found to be associated with constitutional states in which inflammation of serous membranes are apt to occur—namely, rheumatism (simple or gonorrhœal), Bright's disease, septicæmia, &c. Corresponding differences and coincidences could easily be pointed out for all other parts of the eye, and for all its constitutional diseases, but these must suffice as general illustrations.

In conclusion, however, I would suggest that the doctrine which I have propounded is available not only for the purposes of ætiology and nosology, but also for those of practical and didactic therapeutics. Many drugs and other remedial agents are already known which appear to have a special affinity for particular tissue-elements, and as therapeutical science advances their number will increase. The phenomena of “selective assimilation” would seem to indicate in localised lesions of constitutional diseases the exhibition of those remedies which are known or believed to influence the nutrition and action of kindred elements in any and every part of the body.



