tion of seasons from the heat of summer to the cold of winter has a tonic effect, and is favorable to those suffering from anæmia, hepatitis, and malaria. Certain inflammatory chest affections, however, are liable to be caused in Creoles by a northern winter, as well as some cutaneous diseases dependent perhaps on the change in the amount of perspiration. It is often claimed that persons removing to the temperate zone are in special danger from phthisis. Dr. Saint-Vel (*loc. cit.*) says that the reverse of this is true. Some negroes die of tuberculosis in the hospitals, but there are usually circumstances of special exposure in these cases, while those negroes who are well cared for and live at service are remarkably free from phthisis. Confusion has perhaps been made of the negro with the monkey in this respect, but the tuberculosis so common in the latter animal is due to his confinement and to other conditions not obtaining in the case of the negro. The experience of all the Northern States of our country shows that the negro acclimates well in the temperate zone; but observations are wanting as to his power of adapting himself to really cold climates.

The Creoles residing in France are particularly long-lived. Their acclimatization is said to be more readily accomplished than that of whites returning after a long residence in the tropics; but, as a whole, the effect of removal from lower to higher latitudes is more beneficial than that of moving in the contrary direction. Arctic animals do less well in temperate regions than those from the tropics.

Hygiene of Acclimatization.—Hygiene can do something to overcome the obstacles in the way of acclimatization. It is especially important in combating dysentery, anæmia, and malaria. Contrary to what has been sometimes taught, a robust frame is an assistance to acclimatization. The immigrant to the tropics should, if possible, reach his destination in the cool season, that the transition may be as moderate as possible from his native clime. For the same reason the tropical emigrant should reach the temperate zone in the summer. In going to the tropics one should not deprive himself wholly of a meat diet, though of course less meat and very little fat are required. The food should be sufficient in all its constituents to keep up the strength. Alcoholic excess is to be especially avoided. The light wines are much preferable to spirits. A slight diarrhœa is to be checked at once, as otherwise it may run on to the severe chronic intestinal fluxes. The dwelling should be situated high, with the sleeping-room on the second floor. Alluvial bottoms are to be avoided as places of abode, and the domicile should not be erected in the track of breezes blowing over marshy districts. Exposure to the night air is unwise, especially when there is a fog hanging about. Food should be taken before going out in the morning, and a daily dose of quinine should be made use of.

Reference should be made to the probably important part played by certain insects, notably the mosquito, in the communication to man of malaria and possibly of other diseases that have given to some tropical regions an unsavory reputation for deadliness to Europeans. If the teachings of Koch and other believers in the mosquito inoculation of the malarial parasite be confirmed, the employment of nets and bars will assume an important part in the hygiene of acclimatization.

Direct exposure to the equatorial sun during the middle of the day should be avoided. Only the natives can withstand its fierceness. On the other hand, draughts, especially of night wind, should be as carefully avoided as in temperate climes. While the clothing should of course be light, it should be of cotton rather than linen, and merino undergarments should be worn, and changed frequently in order to keep the large amount of transuded moisture absorbed. Nostalgia, which retards acclimatization, should be avoided as far as possible. If society is wanting, work must be relied upon to take up the mind. It is said that the workers acclimatize more readily than the idlers in hot countries. Of the various forms of exercise, which is always so important from a hygienic point of view, riding and driving are especially desirable in warm countries. Cool and cold baths daily are of use. The advantages of hydrotherapy are often combined with those of high elevation in the sanatoria which are located in the mountainous districts (where such exist) in many warm countries, and whither the half-acclimated European repairs from time to time with much benefit to paludic, dysenteric, and hepatic affections. Finally, if dysentery obstinately recurs in the high altitude, or if the system does not throw off miasmatic impressions, it is better, after a reasonable time, to abandon the attempt at acclimatization and return to a temperate climate. The ocean voyage will be likely to cause some relief, and after a reconstitution of the bodily powers in the home country, a second attempt at acclimatization may be more successful.

Charles F. Withington.

ACCOMMODATION AND REFRACTION. See *Eye, Dioptrics of.*

ACCOMMODATION AND REFRACTION, DISORDERS OF.—ACCOMMODATION is the name adopted to designate the adjustive power of the eye for distinct vision at different distances. As used in modern ophthalmology, it may be more narrowly defined as the power of active optical adjustment of the eye for near vision. In the case of the normally proportioned (emmetropic) eye, the eye, in a state of rest, is adapted for distinct vision at a distance, the accommodation coming into play to increase the optical power (refraction) of the eye to meet the requirements of distinct vision at shorter distances.

The existence of an active accommodative adjustment, effected through an increase in the convexity of the crystalline lens, was demonstrated by Thomas Young (Philosophical Transactions, 1801), but the validity of his proofs was not generally recognized until fully half a century later. The first actual observation of the change in curvature at the anterior surface of the crystalline lens, by Maximilian Langenbeck (1849), was confirmed (1853) by A. Cramer, who, by the employment of more refined methods, measured both the increase in curvature and the position of the anterior lens surface. This was followed closely in time by the wholly independent and altogether admirable research of H. Helmholtz (1855), which definitively established the fundamental theory of accommodation on an exact mathematical basis. Tscherning, who has lately taken up the subject anew, (1894, 1895), has brought to light important additional details.

The changes in the eye in accommodation consist in (*a*) a notable increase of convexity in a central area of the anterior surface of the crystalline lens, (*b*) a much smaller but positively demonstrated increase of convexity in a central area of the posterior surface of the crystalline lens, and (*c*) a slight displacement forward (*i.e.*, in a direction toward the posterior surface of the cornea) of the anterior lens surface; the position of the centre of the posterior lens surface remaining unchanged.

Accommodation is accompanied by active contraction of the pupil, the effect of which is to stop off all but a comparatively small central portion of the crystalline lens, thus excluding the peripheral portions of the lens from participation in the formation of the retinal image. Both accommodation and the accompanying pupillary contraction are essentially binocular acts, and they are sensibly equal in the two eyes. They are, moreover, associated with convergence of the visual axes upon the object for which both eyes are accommodated, thus making it possible to see near objects single, as well as distinctly, with the two eyes.

These several adjustments, which go to make up the complex act of binocular accommodation, are co-ordinated under the control of the third (common motor) pair of cranial nerves. Thus the impulse to accommodate, in order to see a small near object distinctly, evokes not only the needful lenticular and pupillary changes in both eyes, but also the simultaneous action of both recti interni

muscles, resulting in convergence corresponding to the distance of the object. Similarly, the impulse to converge the visual axes, in order to make the two retinal images fall each at the central fovea in its own eye and so to prevent the confusion incident to double vision, evokes a simultaneous and equivalent accommodative change, with contraction of the pupil, in both eyes.

The physiological bond by which accommodation and convergence are co-ordinated is, however, elastic, within certain limits. Thus the relation of the two adjustments may be altered, for the time being, by looking through concave or convex glasses, or through divergent or convergent prisms, so as, with unchanged convergence, to force or to relax the accommodation, or, with unchanged accommodation, to increase or to diminish the convergence. Such experiments are, however, fatiguing, and cannot, as a rule, be long continued without giving rise to a vivid sense of discomfort and of functional disturbance.

Again, the relation of accommodation to convergence is progressively changing, from youth to old age, in connection with the physiological increase in the hardness of the crystalline lens, which nevertheless first makes itself seriously felt after middle life as an accommodative insufficiency under the familiar aspect of *presbyopia* or old sight, in which reading becomes difficult or impossible at the ordinary distance of holding the book.

Again, there are many persons, subjects of anomalies of the eyes which involve notable variations in the relation of accommodation to convergence, who nevertheless experience no difficulty in the habitual free use of the eyes in near work, or perhaps even imagine that they enjoy exceptionally good vision. These are, however, generally cases of a congenital anomaly, or else of one which is of gradual development, giving time for a correspondingly gradual change in the relation of the two adjustments one to the other.

The accommodative power which the eye can bring into exercise is called the *range of accommodation;* it is conveniently measured in units called dioptries, one dioptrie (1 D) being equivalent to a convex lens of 1 metre focal length.

The maximum range of accommodation for any eye is attained when the fellow eye is covered, or otherwise excluded from participation in the visual act, and is free to assume a position of extreme convergence. This maximum range is called the *absolute range of accommodation.* The range of accommodation for the two eyes together, under convergence for any particular distance, is called the *relative range of accommodation.*

The relative range of accommodation varies greatly for different distances. Thus Donders (1858) found that in a young person, of the age of fifteen years, it was possible to accommodate with either eye singly up to a distance of 3.69 Paris inches (about 10 cm. = $\frac{1}{10}$ metre), indicating an absolute range of accommodation of about 10 D. With the two eyes together, it was possible to see distant objects distinctly through concave glasses of any power up to a limit of 11 Paris inches (negative) focal length (about 29.7 cm. = $\frac{1}{3.37}$ metre), indicating a relative range of accommodation of about 3.37 D under parallelism of the visual axes. Under convergence for a distance of 3.9 Paris inches (about 10.5 cm. = $\frac{1}{9.5}$ metre) it was just possible to accommodate for that distance, but it was also possible to see distinctly, with the two eyes, through convex glasses of any power up to a limit of 9 Paris inches (about 24.3 cm. = $\frac{1}{4.1}$ metre) focal length, indicating a negative relative range of accommodation of about —4.1 D. Under higher grades of convergence, *i.e.*, for distances less than 3.9 Paris inches (10.5 cm.), it was impossible to accommodate, with the two eyes, for the distance of the point of intersection of the visual axes; in other words, distinct binocular vision was possible only at distances greater than about 10.5 cm. ($\frac{1}{9.5}$ metre), indicating a *binocular range of accommodation* of about 9.5 D. Under convergence for all distances greater than 3.9 Paris inches, it was found that the two eyes could accommodate for a distance less than that of the intersection of the visual axes, and also for a greater distance; in other words, the relative range of accommodation was in part positive and in part negative. "This distinction acquires practical importance from the fact *that the accommodation can be maintained only for a distance at which, in reference to the negative, the positive part of the relative range of accommodation is tolerably great.*"—Donders.

Fig. 10 shows, in the form of a diagram, the series of measurements of the relative accommodation in the case cited, as plotted by Donders; the ordinates indicate dioptries of accommodation, and the abscissas the corresponding degrees of convergence, namely, for distances of 1 metre and aliquot parts ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, to $\frac{1}{20}$) of a metre.*

By inspection of the diagram it is seen that the positive part of the relative range of accommodation—*i.e.*, the part above the diagonal line KK′—appears only in convergence for distances greater than about 10.5 cm. ($\frac{1}{9.5}$ metre); at 12.5 cm. ($\frac{1}{8}$ metre) the positive part is about three-sevenths as great as the negative; at 33.3 cm.

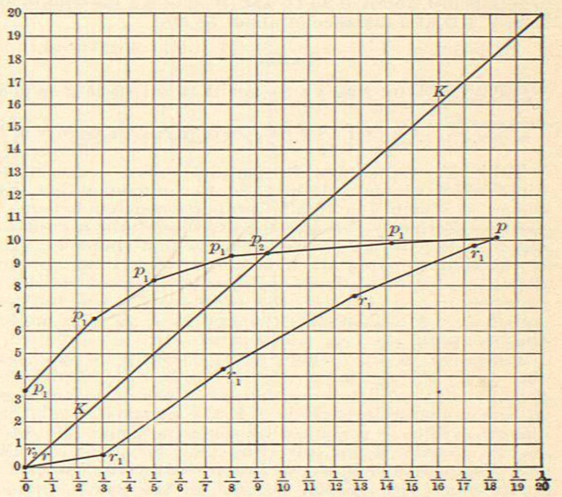

FIG. 10.

($\frac{1}{3}$ metre) the positive part exceeds the negative in the ratio of about 8 to 5.

These relations of the positive to the negative part of the relative range of accommodation correspond closely to actual conditions as learned from every-day observation of the working of the accommodation in young persons. Thus a child of say 12 years can ordinarily force his accommodation so as to see minute objects distinctly for a short time at a minimum distance of about 10 cm., using about 10 D of accommodation. At a little greater distance, about 12.5 cm., using about 8 D of accommodation, he can read for a much longer time, although not, as a rule, without a consciousness of effort leading to fatigue. At about 20 cm., using about 5 D of accommodation, the accommodation can often be maintained for hours together in close work, but not without incurring the risk of ultimate grave injury to the eyes when reading at so short a distance becomes habitual. The limit of ease and safety, for young persons, in long-continued use of the eyes in reading and study, is at about 33 cm. (about 13 English inches), or perhaps a little less, corresponding to an habitual use of not much more than 3 D of accommodation. At this limit of distance the relative range of accommodation is ample, and the positive part is at about its maximum.

* Fig. 10 has been slightly changed to conform to the metric system, which has come into general use in ophthalmology since the date of publication of Donders' work.

The letters r, r_1, r_2, and p, p_1, p_2 (Fig. 10) represent the *absolute*, the *relative*, and the *binocular* farthest and nearest points, respectively, of distinct vision. Under parallelism of the visual axes the absolute far point (r), the relative far point (r_1), and the binocular far point (r_2) all fall together at an infinite distance; but there is a positive relative accommodation of about 3.37 D. Under convergence for a distance of 10.5 cm. ($\frac{1}{9.5}$ metre), the relative near point (p_1) and the binocular near point (p_2) fall together at the same distance of about 10.5 cm. from the eye; but there is a negative relative accommodation, which here attains its maximum, of −4.1 D. The absolute near point (p) is attained only under extreme convergence (for a distance of about 5.5 cm. = $\frac{1}{18}$ metre), and falls, together with the relative near point (p_1), at about 10 cm. ($\frac{1}{10}$ metre) from the eye; under this maximum exertion the relative range of accommodation is reduced to zero. Under convergence for all distances greater than 20 cm. ($\frac{1}{5}$ metre), the positive part of the relative range of accommodation is large and nearly constant, falling nowhere below about 3.25 D, and reaching a maximum of nearly 4 D at a distance of about 38 cm.

TABLE A.

Accommodation in dioptries.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Distances in metres.	∞	$\frac{1}{1}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{7}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$	$\frac{1}{11}$	$\frac{1}{12}$	$\frac{1}{13}$	$\frac{1}{14}$	$\frac{1}{15}$	$\frac{1}{16}$	$\frac{1}{17}$	$\frac{1}{18}$	$\frac{1}{19}$	$\frac{1}{20}$

Table A represents, in parallel series, consecutive dioptries of accommodation and the corresponding distances at which a normally proportioned (emmetropic) eye sees distinctly through the exercise of the accommodation. It will be observed that the first dioptrie of accommodation covers all distances from infinity up to a distance of 1 metre from the eye; the second covers a distance, $1 - \frac{1}{2} = \frac{1}{2}$ metre; the third, $\frac{1}{2} - \frac{1}{3} = \frac{1}{6}$ metre; the fourth, $\frac{1}{3} - \frac{1}{4} = \frac{1}{12}$ metre; the tenth, $\frac{1}{9} - \frac{1}{10} = \frac{1}{90}$ metre; the twentieth, $\frac{1}{19} - \frac{1}{20} = \frac{1}{380}$ metre, etc.

Inasmuch as the distance of the near point (p) from the eye is the reciprocal of the number of dioptries of accommodation, it follows that when the effective range of accommodation exceeds 1 D the distance of p from the eye will be represented by some fractional part of 1 metre. Again, if, for any cause, the far point (r) falls at a distance (which we will represent by R) less than 1 metre from the eye, the distance of the near point (p) from the eye (which we will represent by P) will be less than when r is at infinity, but will still always have a real value represented by some fraction of 1 metre. The linear distance R—P, covered by any given range of accommodation, decreases, therefore, at a rapidly increasing rate for every change in the position of r nearer to the eye. The linear distance, R−P, is called the *region of accommodation;* its special significance will appear more fully in connection with the study of the Anomalies of Refraction, and of the changes effected by wearing spectacles.

REFRACTION is the word used in ophthalmology to designate the optical power of the eye when in a state of accommodative relaxation or rest. It is, in fact, the aggregate of successive refractions, (*a*) from the air into the cornea, (*b*) from the cornea into the aqueous humor, (*c*) from the aqueous humor into the crystalline lens, (*d*) from layer to layer of the crystalline lens, through a medium of progressively increasing refractive power (index of refraction) from its anterior surface toward its centre, and of decreasing refractive power from its centre to its posterior surface, and (*e*) from the crystalline lens into the vitreous body. Inasmuch as the curvatures of the several refracting surfaces and the indices of refraction of the several transparent media remain constant or nearly constant, after the eye has once attained to its full development, the absolute refraction, as determining the position of the principal focus, is practically a constant quantity for any particular eye.

The principal posterior focal length (focal length for parallel rays) of the human eye, measured from its second (posterior) principal point, is estimated at about 20 mm. ($\frac{1}{50}$ metre). To represent the sum of the several refractions in the eye by one refraction, at a single spherical surface, we have only to assume an infinitely thin cornea of 5 mm. radius of curvature and, suppressing the crystalline lens, to assume a length for the axis of the eyeball equal to 20 mm.* This simplified or *reduced* eye, again, may be represented by a thin convex lens of 66.6 D power, mounted 15 mm. ($\frac{1}{66.6}$ metre) in front of a screen representing the retina.

The measurements of the radii of curvature of the cornea and of the two surfaces of the crystalline lens are, however, found to vary notably in different eyes, and this without giving rise to any corresponding anomaly in the functions of the eye as a whole. The explanation is found in other, compensating variations in the size (length of axis) of the eyeball. Thus a very small eyeball, with correspondingly short radii of curvature of its refracting surfaces, *e.g.*, the eye of a mouse, may be as perfectly proportioned as a much larger eyeball, with correspondingly greater radii of curvature, *e.g.*, the eye of a rabbit. Estimates of the actual refraction, even in the case of the human eye, are therefore at best but average estimates; they are, moreover, of minor importance, and are practically disregarded in the discusssion of ophthalmological problems. On the other hand, any deviation from a correct proportion between the curvatures of the refracting surfaces and the length of the axis of the eyeball is of very great importance, for it is upon such correct proportion that the adaptability of the eye to the varied requirements of vision mainly depends.

We have then to recognize, first of all, a normal condition of correct proportion, *emmetropia*, E (from ἔμμετρος, proportionate, and ὤψ, eye), between the radii of curvature of the refracting surfaces of the eye and the length of the antero-posterior diameter (axis) of the eyeball. In emmetropia, a sharply defined image of a distant object is formed on the retina without the exercise of any part of the accommodation, so that the entire range of accommodation is available to meet the requirements of distinct vision for near objects. The region of accommodation includes, therefore, all distances from infinity up to the distance of the near point (p) from the eye, and is at its maximum (*cf.* Table A).

As opposed to emmetropia we recognize a condition of incorrect proportion, *ametropia* (from ἄμετρος, disproportionate, and ὤψ, eye), in which the principal focus of the eye falls elsewhere than at the distance of the retina. Ametropia occurs under two opposite types, according as the retina lies in front of or behind the principal focus.

Hypermetropia, H (from ὑπέρμετρος, over-measure, and ὤψ, eye), is the condition in which the principal focal length of the eye is greater than the length of its axis. The hypermetrope, if his range of accommodation is in excess of that required to advance the focus for parallel rays to the actual position of the retina, is able, through the exercise of some part of his accommodation, to see clearly at a distance. A part only of the range of accommodation is then available for near vision, and, through the recession of the near point, the region of accommodation is curtailed. In the highest grades of hypermetropia the range of accommodation is insufficient to overcome the refractive defect, so that distant as well as near objects are seen indistinctly; in the lower grades the recession is often not so great as to interfere materially with distinct near vision, so long as the range of accommodation remains normal or approximately normal. The accommodation is nevertheless overburdened in hypermetropia, and its exercise is often attended with a sense of strain or fatigue; with advancing age, the recession of the near point, due to the progressive diminution of the range of accommodation, gives rise prematurely to the condition of old sight (*presbyopia*).

In hypermetropia the disproportion is ordinarily due to an actual deficiency in the length of the antero-posterior

* The index of refraction from air into the aqueous humor is assumed to be $\frac{4}{3}$ = 1.3, which, though not absolutely exact, is a very close approximation to the true index.

diameter of the eyeball, and may properly be regarded as the result of incomplete development of the eye in its posterior segment. The crucial test of hypermetropia is the ability to see distinctly at a distance through convex glasses; its measure, in dioptries, is the strongest convex lens through which vision at a distance is unimpaired. (See *Hypermetropia.*)

Myopia, M (from μυώψ, winking or shutting the eye), is a condition the exact opposite of hypermetropia. As a visual defect, myopia was well known to the Greek and Roman writers on scientific subjects; it takes its name from the fact that short-sighted persons see distant objects more clearly when the opening of the eyelids is reduced to a narrow slit. In myopia the principal focal length of the eye is less than the length of its axis. The myope, therefore, even under complete relaxation of his accommodation, does not see distinctly at a distance; but he has perfect vision, without exercise of the accommodation, at some short distance defined by the position of his far point (r), which position is determined by the grade of myopia. The near point (p) of distinct vision, as determined by the range of accommodation and measured from r, falls nearer, therefore, to the eye than in emmetropia. The region of accommodation, *i.e.*, the difference in distance of the far point and the near point from the eye, is notably restricted, and in the highest grades of myopia is reduced to insignificance. In myopia of low grades, the disability of old sight (*presbyopia*) is first experienced at a later period of life than in emmetropia; in the higher grades of myopia, in which the far point (r) lies well within the ordinary reading distance, presbyopia, in the ordinary acceptation of the word, is an impossibility.

In myopia the disproportion is due to an elongation of the axis of the eye incident to distention of the eyeball, as a result, in most cases, of improper or excessive application to close work during the period of childhood and youth. Unlike hypermetropia, myopia is to be regarded as essentially a pathological condition; and it is generally progressive, increasing in grade from year to year provided that the active causes continue operative. The test of myopia is the inability to see distant objects distinctly except through concave glasses; its measure, in dioptries, is the weakest concave lens which brings distant vision up to the same standard of acuteness as at distances within that of the far point. (See *Myopia.*)

The positions of the far point (r) and of the near point (p), respectively, are measured, in metres and parts of a metre, from the anterior nodal point of the eye, which is situated in the crystalline lens about 0.25 mm. from its posterior surface. Representing these distances by R and P, respectively, the range of accommodation, expressed in dioptries, by A, and the degree of myopia or of hypermetropia, expressed also in dioptries, by M or H, respectively, we have:

In *emmetropia*, $\mathrm{R} = \text{infinity},$

$$\mathrm{P} = \frac{1}{\mathrm{A}}\text{ metre};$$

in *myopia*, $\mathrm{R} = \frac{1}{\mathrm{M}}\text{ metre},$

$$\mathrm{P} = \frac{1}{\mathrm{A} + \mathrm{M}}\text{ metre};$$

in *hypermetropia*, $\mathrm{R} = -\frac{1}{\mathrm{H}}\text{ metre},$

$$\mathrm{P} = \frac{1}{\mathrm{A} - \mathrm{H}}\text{ metre}.$$

As, however, the actual limit for distant vision is at infinity, this must represent the position of the far point (r) in hypermetropia; the expression of the real condition then becomes:

In *hypermetropia*, $\mathrm{R} = \text{infinity},$

$$\mathrm{P} = \frac{1}{\mathrm{A} - \mathrm{H}}\text{ metre}.$$

From a comparison of these equations it will be seen how, with the same range of accommodation, the region of accommodation is most extensive in emmetropia. In myopia the region of accommodation is greatly contracted through the approach of the far point (r), with but slight and, in the higher grades of myopia, unimportant compensation in the approach of the near point (p) to the eye. In hypermetropia the effective range of accommodation is diminished, and the region of accommodation is curtailed through the recession of the near point (p) from the eye, the far point (r) remaining, as in emmetropia, at infinity. When H is so large, or A so small, that A is less than H, the entire range of accommodation becomes negative, and distinct vision is impossible at any distance.

By the correction of the ametropia, by an appropriate concave or convex glass, the far point (r) is adjusted to infinity, and the position of the near point (p) is then determined by the range of accommodation (A). The equations for myopia and for hypermetropia then become identical with that of emmetropia:

In *myopia*, $\mathrm{R} = \frac{1}{\mathrm{M} - \mathrm{M}} = \frac{1}{0} = \text{infinity},$

$$\mathrm{P} = \frac{1}{\mathrm{A} + \mathrm{M} - \mathrm{M}} = \frac{1}{\mathrm{A}}\text{ metre};$$

in *hypermetropia*, $\mathrm{R} = \frac{1}{\mathrm{H} - \mathrm{H}} = \frac{1}{0} = \text{infinity},$

$$\mathrm{P} = \frac{1}{\mathrm{A} - \mathrm{H} + \mathrm{H}} = \frac{1}{\mathrm{A}}\text{ metre}.$$

We have thus far considered only the case of ametropia in a single eye, and have ignored all complications growing out of the fact that vision is actually the result of the concurrent action of the two eyes. In brief, it may be said that in order to see an object single and distinctly with the two eyes together, the eyes must be accurately directed each to the same point, and this point must be a point for whose distance each eye is accommodated. The close connection between accommodation and convergence may lead to important complications both in myopia and in hypermetropia. In myopia, there is comparatively little occasion for the exercise of the accommodation, but the need for convergence remains unchanged, or may even be increased by reason of the shorter distance at which the strongly myopic eye sees small objects. This, normal or excessive, convergence may in turn evoke accommodation for a still shorter distance, and so necessitate the holding of the book still nearer to the eyes, thereby inciting again to stronger convergence. The excessive accommodation which is thus excited may cause the myopic eye to appear more strongly myopic than it really is, and may lead, through long-continued tension of accommodation, to pathological conditions resulting in progressive increase in the grade of the myopia. On the other hand, the eyes may fall into the habit of relaxing the accommodation to the degree requisite for distinct vision at or near the far point, in which case the attendant relaxation of the convergence may lead to relative insufficiency of the recti interni muscles, with resultant muscular fatigue from the effort to maintain binocular vision (muscular asthenopia); or else the effort to maintain binocular vision may be abandoned, and a condition of actual muscular insufficiency (divergent strabismus) established. In hypermetropia the eyes accommodate even in distant vision, and must accommodate more strongly than in emmetropia in order to see near objects distinctly. Accordingly, in hypermetropia one of two complications may arise: either the convergence may be habitually adjusted to the distance of the object, in which case the correlated accommodation may be insufficient for continuous near work, and so the eyes may suffer from accommodative insufficiency or fatigue (*accommodative asthenopia*); or, on the other hand, the accommodation may be maintained to the degree requisite for distinct vision, and this excessive accommodative effort may evoke a tendency to excessive