IV. *Observations relative to the near and distant Sight of different Persons.* *By* James Ware, *Esq. F. R. S.*

Read November 19, 1812.

THE fact that near sightedness most commonly commences at an early period of life, and distant sightedness generally at an advanced age, is universally admitted. Exceptions, however, to these rules so frequently occur, that I flatter myself a brief statement of some of the coincident circumstances, attendant on these different imperfections in vision, may not be found wholly undeserving the attention of the Royal Society. Near sightedness usually comes on between the ages of ten and eighteen. The discovery of it most commonly arises from accident; and, at first, the inconvenience it occasions is so little, that it is not improbable the imperfection would remain altogether unnoticed, if a comparison were not instituted with the sight of others, or if the experiment were not made of looking through a concave glass. Among persons in the inferior stations of society, means are rarely resorted to for correcting slight defects of this nature; and, indeed, I have reason to believe the imperfection in such people is not unfrequently overcome by the increased exertions that are made by the eye to distinguish distant objects. This, however, is not the case, in the present day, with persons in the higher ranks of life. When these discover that their discernment of distant objects is less quick or less correct than that of others,

though the difference may be very slight, influenced perhaps by fashion more than by necessity, they immediately have recourse to a concave glass; the natural consequence of which is, that their eyes in a short time become so fixed in the state requiring its assistance, that the recovery of distant vision is rendered afterwards extremely difficult, if not quite impossible. With regard to the proportion between the number of near sighted persons in the different ranks of society, I have taken pains to obtain satisfactory information, by making inquiry in those places where a large number in these several classes are associated together. I have inquired, for instance, of the surgeons of the three regiments of foot guards, which consist of nearly ten thousand men; and the result has been, that near sightedness, among the privates, is almost utterly unknown. Not half a dozen men have been discharged, nor half a dozen recruits rejected, on account of this imperfection, in the space of nearly twenty years: and yet many parts of a soldier's duty require him to have a tolerably correct view of distant objects; as of the movements of the fugleman in exercise, and of the bull's eye when shooting at the target; the want of which might furnish a plausible apology for a skulker to skreen himself from duty, or to get his discharge from the service. I pursued my inquiries at the military school at Chelsea, where there are thirteen hundred children, and I found that the complaint of near sightedness had never been made among them until I mentioned it; and there were then only three who experienced the least inconvenience from it. After this, I inquired at several of the colleges in Oxford and Cambridge; and, though there is a great diversity in the number of students who make use of glasses in the various

colleges, they are used by a considerable proportion of the whole number in both Universities; and, in one college in Oxford, I have a list of the names of not less than thirty-two out of one hundred and twenty-seven, who wore either a hand glass or spectacles, between the years 1803 and 1807. It is not improbable, that some of these were induced to do it solely because the practice was fashionable; but, I believe, the number of such is inconsiderable, when compared with that of those whose sight received some small assistance from them, though this assistance could have been dispensed with, without inconvenience, if the practice had not been introduced. The misfortune resulting from the use of concave glasses is this, that the near sightedness is not only fixed by it, but a habit of inquiry is induced with regard to the extreme perfection of vision; and, in consequence of this, frequent changes are made for glasses that are more and more concave, until at length the near sightedness becomes so considerable, as to be rendered seriously inconvenient and afflicting. It should be remembered, that, for common purposes, every near sighted eye can see with nearly equal accuracy through two glasses, one of which is one number deeper than the other; and though the sight be in a slight degree more assisted by the deepest of these than by the other, yet on its being first used, the deepest number always occasions an uneasy sensation, as if the eye was strained. If, therefore, the glass that is most concave be at first employed, the eye, in a little time, will be accommodated to it, and then a glass one number deeper may be used with similar advantage to the sight; and if the wish for enjoying the most perfect vision be indulged, this glass may soon be changed for one that is a number still deeper, and so

in succession, until at length it will be difficult to obtain a glass sufficiently concave to afford the assistance that the eye requires.*

Although near sightedness is in general gradual in its progress, instances occasionally occur of its existence, in a considerable degree, even in children; in whom it is sometimes discovered almost as soon as they begin to take notice of the objects around them. This may be occasioned by some degree of opacity in the transparent parts of the eye; but such a cause of near sightedness is easily discovered by an examination, and is quite different from that state of the eye to which the term myopia, or near sightedness, is usually applied; by which is simply meant, too great a convexity either in the cornea or in the crystalline, in proportion to the distance of these parts from the retina. In such cases of extreme near sightedness in children, it is sometimes necessary to deviate from a rule, which in slighter cases I always follow, of discouraging the use of spectacles; since without their assistance, it would be impossible for them to prosecute their learning with ease or convenience.

Extreme near sightedness is sometimes occasioned by an evident change in the spherical figure of the cornea, and its assumption of a conical shape. This morbid state of the cornea is not only productive of near sightedness, but when the

* I have observed, that most of the near sighted persons, with whom I have had an opportunity of conversing, have had the right eye more near sighted than the left; and I think it not improbable, that this difference between the two eyes has been occasioned by the habit of using a single concave hand-glass; which, being most commonly applied to the right eye, contributes, agreeably to the remark abovementioned, to render this eye more near sighted than the other.

projection is considerable, vision is so much confused, that it affords little or no service, and cannot be amended by any glass. The cornea, in most of these cases, is preternaturally thin, and not unfrequently it is accompanied with symptoms of general debility; under which last circumstance chalybeate medicines, and bracing applications to the eye, have been found to afford considerable benefit.

Near sightedness, to an alarming degree, has sometimes attacked young persons suddenly. A remarkable case of this kind came under my notice a few years ago in a young gentleman at Westminster school, who had been attended by Sir GEORGE BAKER and Mr. SUTHERLAND, on account of a variety of anomalous nervous symptoms. These had wholly left him before I was consulted; and the consultation with me was solely for the purpose of determining whether he might be permitted to make use of concave glasses, and to return to the business of the school. The patient's health at that time not being perfectly restored, it was thought adviseable to send him for a few weeks into the country, and to postpone the use of glasses. This advice was followed; but in ten days the afflicted youth died suddenly. No anatomical examination of the head was permitted by the relatives. It seems, however, probable, that the near sightedness, as well as the previous indisposition, no less than the death of the patient, were occasioned by the pressure of a morbid substance of some kind or other on the source of the nerves in the brain.

Near sightedness is seldom alike in the two eyes, and a few cases have come under my observation, in which one eye of

the same person has had a near, and the other a distant sight.

It has been said by Dr. PORTERFIELD,* that the pupils of near sighted persons are more dilated than those of others. This, however, does not accord with the observations I have made in such cases.

It has also been commonly believed, that the size of the pupil is influenced by the distance of the object to which the attention is directed, this aperture being enlarged when the object is far off, and becoming more and more contracted as it is brought near. But though the activity of the fibres of the iris is sometimes sufficient to be visibly influenced by this circumstance, yet in the greater number even of those cases where the dilatation and contraction of the pupil are powerfully influenced by a difference in the strength of the light, the distance of the object considered alone, produces so little effect upon it, as to be scarcely perceived. That it has, however, in general, some degree of power on the pupil is highly probable; and an extraordinary instance of this kind exists, at the present time, in a lady between thirty and forty years of age, the pupil of whose right eye, when she is not engaged in reading, or in working with her needle, is always dilated very nearly to the rim of the cornea; but whenever she looks at a small object, nine inches from the eye, it contracts, within less than a minute, to a size nearly as small as the head of a pin. Her left pupil is not affected like the right; but in every degree of light and distance, it is contracted rather more than is usual in other persons. The vision is not precisely alike in the two eyes; the right eye being in a small degree near

* Treatise on the Eye and the Manner of Vision, Vol. II. p. 38.

sighted, and receiving assistance from the first number of a concave glass, whereas the left eye derives no benefit from it. This remarkable dilatation of the pupil of the right eye was first noticed about twenty years ago, and a variety of remedies have been employed at different times with a view to correct it; but none of them have made any alteration. It should be mentioned, that, in order to produce the contraction of the pupil, the object looked at must be placed exactly nine inches from the eye; and if it be brought nearer, it has no more power to produce the contraction than if it were placed at a remoter distance. It should also be mentioned, that the continuance of the contraction of the pupil depends, in some degree, on the state of the lady's health; since, though its contraction never remains long after the attention is withdrawn from a near object, yet whenever she is debilitated by a temporary ailment, the contraction is of much shorter duration than when her health is entire.*

Dr. WELLS, in his ingenious paper, published in the Second Part of the Transactions of the Royal Society for the year

* Several instances have come under my notice, in which the pupil of one eye has become dilated to a great degree, and has been incapable of contracting on an increase of light, whilst the pupil of the other eye has remained of its natural size. In some of these, the eye with the dilated pupil has been totally deprived of sight, the disorder answering to that of a perfect *amaurosis*; but in others, the dilatation of the pupil has only occasioned an inability to distinguish minute objects. Reading has been accomplished with difficulty, and convex glasses have afforded very little assistance. Though objects at a distance were seen with less inconvenience, than those that were near, these also appeared to the affected eye much less distinct than to the other. Most of the persons to whom I allude had been debilitated, by fatigue or anxiety, before the imperfection was discovered in the sight; and in some it had been preceded by affections of the stomach and alimentary canal.

1811, has taken pains to ascertain, whether the power by which the eye is adjusted to see at different distances, depends in any degree on the faculty in the pupil of dilating and contracting; and whether its fixed dilatation has any influence in preventing an accurate view of near objects. This last mentioned effect Dr. WELLS relates to have taken place remarkably in the case of Dr. CUTTING, whose pupil being fixed in a dilated state by the action of the extract of belladonna, perfect vision of a near object was removed, as the dilatation advanced, from six inches (which was the nearest distance at which Dr. CUTTING could distinctly see the image of the flame of a candle reflected from the bulb of a small thermometer,) to seven inches in thirty minutes, and to three feet and a half in three quarters of an hour. My eldest son, who has a very extensive range of vision, has made a similar experiment on his right eye with a similar result. Previous to the application of the belladonna, he could bring the apparent lines on an optometer (like that improved by Dr. YOUNG from the invention of Dr. PORTERFIELD, and described in the Philosophical Transactions for the year 1800) to meet at four inches from the eye; and, by directing his attention to a more distant point, he could prevent them from meeting till they were seven inches from the eye, after which they continued apparently united the whole length of the optometer, which was twelve inches.* He could see the image of a candle

* The two lines that are perceived on looking through the slits of an optometer, cross each other precisely in the point from whence the rays of light diverge in order to be brought to a focus on the retina. And their apparent union before and after this point is occasioned by the unavoidable thickness of the line drawn on the optometer.

reflected from the bulb of a small thermometer, five-sixteenths of an inch in diameter, at the distance of three inches and three quarters from the eye; and he could also see the same image at the distance of two feet seven inches. The belladonna produced a conspicuous dilatation of the pupil in less than an hour; after which, on viewing the apparent lines on the optometer, he was unable to make them meet at a nearer distance than seven inches, or to gain a distinct image of the candle reflected by the bulb of the thermometer nearer than this distance; but he could discern it at two feet ten inches from the eye, which was three inches further than he was able to see it, before the belladonna was applied. During the time of the experiment on the right eye, the left eye possessed its usual range of vision, but the sight, when both eyes were open, was rather confused, in consequence of the unequal foci of the two eyes; and it did not become clear until the pupil of the right eye recovered its usual power of contracting, which power was not acquired till the third day after the application of the belladonna.

It is remarkable that a different effect is sometimes produced on a near sighted eye by the application of the belladonna, from that which it has on an eye that enjoys a distant sight. Dr. WELLS made an experiment of this kind on a friend of his, who was near sighted; and he informs us, in the paper above referred to, that in this instance, the nearest point of perfect vision was moved forwards during the dilatation of the pupil, whilst its remote point remained unaltered. I have made a similar experiment on the eyes of several such persons; and though in two of these the result appeared to be similar to that which has been mentioned by Dr. WELLS, yet,

in the greater number, their sight, like that of those who were not myopic, has become more distant as the pupil became more dilated.—In one gentleman, in whom the lines of the optometer appeared to meet at four inches and a quarter from the eye, the pupil, in half an hour after the application of the belladonna, became completely dilated, and in consequence of this the sight at first was confused; but both on that day, and for two days afterwards, it was evidently more distant, and the apparent lines on the optometer could not be made to meet nearer than seven inches from the eye.—In a young lady, seventeen years of age, whose right eye was so near sighted that the apparent lines on the optometer met at two inches and three quarters from the eye, these lines, when the pupil was dilated (which took place in a small degree in less than half an hour), could not be made to meet in less than three inches and a quarter; and on the following day, the pupil being more dilated, the lines did not meet till they were at the distance of nearly four inches.—In a third instance, viz. that of a lady forty-five years of age, who had been remarkably near sighted from her infancy, and for many years had used concave glasses of the fifteenth number, (which number is ground on each side, upon a tool the radius of which is only three inches,) the sight was become so confused in both eyes, that she saw nothing distinctly, and was unable to read letters, of the size that are used in the printed Transactions of the Royal Society, either with or without a glass. In this case, after the pupils had been dilated by the application of the belladonna, the sight was so much improved that she was able to read a print of the abovementioned size at the distance

of two inches with either eye. I do not insist, however, on the present case, because, though there was not any visible opacity in the crystalline, this sometimes exists in a small degree without being perceptible even to an attentive observer; and it may be doubted whether the amendment in the lady's vision, were not occasioned solely by the retraction of the iris from before a part of the crystalline that was not yet become opaque: it being well known that the outer part of this lens not unfrequently retains its transparency for some time after an opacity has commenced in the part that surrounds its centre.

It is evident, that near sightedness has no dependence on the greater or smaller degree of convexity possessed by the cornea, when this circumstance is considered alone; since the length of the axis of the eye from the cornea to the retina, and the greater or smaller degree of convexity in the crystalline humour, must be also regarded, before the distance of accurate vision can be determined.

It is no less evident, that near sightedness is not necessarily occasioned by a morbid protrusion of the whole eye; since some persons are born with eyes of this description, and others acquire the peculiarity, when further advanced in life, in consequence of a morbid accumulation of *adeps* at the bottom of the orbit, without either of them being more near sighted than those who are free from this imperfection.

I have seen many instances in which old persons, who have been long accustomed to use convex glasses of considerable power, have recovered their former sight at the advanced age of eighty or ninety years, and have then had no further need of them. Dr. PORTERFIELD was of opinion that in such cases

the amendment is occasioned by a decay of *adeps* at the bottom of the orbit; in consequence of which the eye, from a want of the usual support behind, is brought, by the pressure of the muscles on its sides, into a kind of oval figure, in which state the retina is removed to its due focal distance from the flattened cornea. But if a morbid absorption of *adeps* at the bottom of the orbit were sufficient to restore the presbyopic to a good sight, it might be expected, that a morbid accumulation of *adeps* in this part would produce a presbyopic or distant sight. This, however, has not happened in any of the cases that have come under my notice. On the contrary, in some such persons a degree of near sightedness has been induced by the accumulation; and in others the sight, with regard to distance, has not been affected by it. It appears to me more probable, that this remarkable revolution in the sight of old persons is occasioned by an absorption of part of the vitreous humour; in consequence of which, the sides of the sclerotica are pressed inward, and the axis of the eye, by this lateral pressure, is proportionably lengthened. An alteration of this kind is also sufficient to explain the reason, why such aged persons retain the power of distinguishing objects at a distance, at the same time that they recover the faculty of seeing those that are near; since the lengthened axis of the eye leaves the power by which it is adjusted to see at different distances, precisely in the same state, in which it was before the lengthening of the axis took place.*

* Dr. YOUNG, in the paper to which I alluded in page 38, has described a great number of ingenious experiments devised by him, to shew that the faculty of seeing at different distances is produced by a power in the crystalline humour, to become more or less convex, according as the object is more or less distant from the eye.

Although old persons lose the power of distinguishing correctly near objects, and require for this purpose the aid of convex glasses, they usually retain the sight of those that are distant as well as when they were young. Instances, however, are not wanting of persons advanced in life, who require the aid of convex glasses to enable them to see near, as well as distant, objects. Dr. WELLS is one of these. He informs us, in the paper to which I have more than once ådverted, that when twenty years younger, he was able, with his left eye, to bring to a focus on the retina, pencils of rays which flowed from every distance greater than seven inches from the cornea; but at the age of fifty-five, he required not only a convex glass of six inches focus, to enable him to bring to a point on the retina rays proceeding from an object seven inches from the eye, but likewise a convex glass of thirty-six inches focus, to enable him to bring to a point parallel rays.—There are also instances of young persons, who have so disproportionate a convexity of the cornea or crystalline, or of both, to the distance of these parts from the retina, that a glass of considerable convexity is required to enable them to see distinctly, not only near objects, but also those that are distant; and it is remarkable, that the same glass will enable many such persons to see both near and distant objects; thus proving that the defect in their sight is occasioned solely by too small a convexity in one of the parts abovementioned, and that it does not influence the power by which their eyes are adapted to see at distances variously remote. In this respect such persons differ from those who have had the crystalline humour removed by an operation; since the latter always require a glass to enable them to discern distant objects, different from

that which they use to see those that are near. This circumstance, in my apprehension, affords a convincing proof that the crystalline humour is indispensably necessary to enable the eye to see at different distances.—It is also worthy of remark, that persons who have had the crystalline humour removed, have less power to ascertain the distance of an object when they look through a convex glass, than when they view it without this assistance; in consequence of which such persons seldom make use of glasses when they are walking: and the inconvenience of glasses is particularly experienced when they descend a flight of steps, or pass over uneven ground.

Near sighted persons do not appear to possess the same extent of vision that is enjoyed by those who have a distant sight. Being near sighted, I have repeatedly endeavoured to ascertain my own range of vision: and I find, by examining the focus of my right eye through the abovementioned optometer, that I see two converging lines, which appear to meet, with very slight variations, at the distance of three inches from the eye; and no effort I am able to make can keep these lines united further than the distance of four inches and a quarter. They then separate, and continue to diverge. With my left eye, the lines do not appear to meet nearer than four inches, and they continue united as far as five inches and a quarter, after which they also separate and diverge; so that the range of distinct vision in me does not extend further than an inch and a quarter in either eye; and within these distances I always hold a book when I read.—I find also the following rule, for determining the concavity of the glass that is best adapted for near sighted persons, to be perfectly correct with respect to myself, and, I believe, it may be safely

adopted by those who, from distance or any other cause, are unable to suit themselves at the shop of an expert optician. The rule is this. Multiply the distance at which the person reads with ease, (which, with my left or best eye, is five inches,) by that at which he wishes to read, which may be said to be twelve inches; divide the product, sixty, by seven, the difference between the two, and it leaves nearly nine inches for the focus of the concave glass that shall produce the desired effect. This is the exact concavity of the glass that I am obliged to use, to enable me to read with ease; and it answers to that, sold under the name of No. 6; which, I am informed by Mr. BLUNT the optician, is a double concave glass, ground on a tool of eight inches radius on one side, and eleven inches on the other, the mean between which is very nearly nine inches. With a glass of this description I can read the smallest print, but to distinguish distant objects I am obliged to look through that, denominated No. 9, by opticians, which is ground on a tool of nine inches radius on both sides. In this respect, my eye has varied from what it was a few years ago, when I was able to distinguish both near and distant objects correctly, through No. 8. This is ground to a radius of eight inches on one side, and six inches on the other, and with it I can still read a type like that in which the Transactions of the Royal Society are printed; but am unable to distinguish through it many distant objects, which I formerly used to see distinctly. —Hence it appears that my eyes have a confined range of distinct vision, extending only to an inch, or an inch and a quarter; and that they remain nearly in the same state in which they were many years ago with regard to near objects, but have lost a part of the power which they formerly

possessed, of adjusting themselves to distant ones. In this last respect, they differ from the eyes of those who have naturally a distant sight, since, as such persons advance in life, they usually retain the power of distinguishing distant objects, but lose that of seeing those that are near. It appears to militate also against the common observation, that as near sighted persons grow older they become less near sighted; since my eyes, on the contrary, are more near sighted, at the age of fifty-five, than they were at twenty-five, and I am now obliged to employ deeper concave glasses than I then used to see distant objects, though I am not able to see distinctly through them things that are near.

The alteration which has taken place in my range of vision, I have reason to believe, is not unusual. Dr. WELLS, in his paper on this subject, mentions the case of a gentleman, who, like me, was near sighted, and whose sight, as he advanced in life, had undergone a similar change.—The following is also an instance of this kind, that is still more remarkable. Mr. L. sixty-six years of age, who has spent a great part of his life in the West Indies, and whose sight, when he was young, enabled him to see both near and distant objects with great precision, began, at the age of forty, to experience a difficulty in reading and writing. He immediately procured convex spectacles of the first number sold by opticians, which glasses are usually ground to a focus of forty-six or forty-eight inches, and by the aid of these he continued to read and write with ease (distinguishing perfectly in the usual way all distant objects without them,) until he was fifty. At this time he first began to perceive an indistinctness in the appearance of things at a distance; and, on

trying with different glasses, he discovered that, by looking through a double concave glass of the sixth number, (which is ground to a radius of eight inches on one side and eleven inches on the other,) he was enabled to see distant objects distinctly. He has continued to use glasses of this description for the purpose of seeing distant objects from that time to the present; but is obliged to remove them whenever he reads, and still to employ the first number of a convex glass.—In this instance, a presbyopic was changed to a myopic sight, without any known efficient circumstance to produce it.—In the two following cases, a similar change took place; and in them it was attributable to known causes. A woman, about fifty years of age, of a full habit, who for several years had been obliged to make use of convex glasses, in order to read a small print, was seized with a dimness in the sight of the right eye, accompanied with a small degree of inflammation. The sight of the left eye having been long imperfect, this affection of the right eye occasioned a great depression of spirits. Recourse was necessarily had to copious evacuations, by means of which the inflammation and dimness of sight were soon removed; but afterwards the patient was much alarmed on finding that the spectacles she had been accustomed to wear, instead of affording their usual assistance, confused her sight. Upon this discovery, she was induced to look through her husband's glasses, which, in consequence of his being near sighted, were double concaves of the fifth number, and ground to a radius of eleven inches on each side. These did not assist her in looking at near objects, but by their aid she saw much more distinctly those that were distant; and, on attempting to read, nothing more was now necessary, than to bring

the book a little nearer to her, than she had been previously accustomed to place it.—The second case occurred in a patient about the same age, who, in the course of the last year, was attacked with an inflammation in both eyes. By the use of leaches and cooling medicines, it was speedily removed, and, afterwards, she was much gratified, by finding that the necessity for using glasses when she read, which had existed many years, was removed; and that she could see both near and distant objects correctly, without any extraneous help. The amendment in this lady's sight continued, however, only a few weeks; after which she was again obliged to use the same convex glasses in looking at small near objects, which she had used before her eyes became inflamed.—In addition to these cases, I beg leave to add the information I have received from an eminent mathematical instrument maker, about fifty years of age, who has long made use of convex glasses to assist his sight in reading. He tells me, that when he has been employed many hours together, for several successive days, in looking through a double microscope that magnifies twenty-eight times, (in order to enable him to mark the degrees on a small brass plate) he has afterwards been able, repeatedly, for a few weeks, to read without his glasses; but then the amendment gradually ceases, and he is soon obliged to return to the use of the same glasses that he had worn before.

In the instances that have been mentioned, the distant sightedness affected persons who were considerably advanced in life: but in the three that follow, a similar affection of the sight occurred in those that were young; and a like good effect was produced by the use of evacuating remedies. One

of these was a boy eight years old, who suddenly became presbyopic, and had repeatedly been punished at school, on account of his incorrect and defaced writing; the real cause of it, at that time, being unknown to his master. After the presbyopia had continued a fortnight, and different local applications had been used, without producing any sensibly good effects, the lad was cured by the application of leaches to the temples, and the administration of a few purgative medicines. The other instances occurred in two daughters of the same family. The eldest, twenty years of age, had never been able to do fine work, and for three years had been greatly assisted by convex spectacles. The youngest, a girl of fifteen, had become presbyopic about a year ago, and since that time had been obliged to use spectacles whenever she read, or worked with her needle. The young person, last mentioned, in the course of six weeks, (during which time she totally abstained from the use of glasses,) was completely relieved from the necessity of using them, by the application of two leaches to each temple twice in a week. The former, in the same space of time, experienced much relief from a similar treatment, but was still unable to do fine work without glasses, partly in consequence of the long continuance of the infirmity, and partly on account of her not having abstained with equal steadiness from the occasional use of them.

From the preceding statement, the following inferences may be deduced.

First; near sightedness is rarely observed in infants, or even in children under ten years of age. It affects the higher classes of society more than the lower: and the instances are few, if any, in which, if the use of concave glasses has been

adopted, increasing years have either removed or lessened this imperfection.

Secondly; though the usual effect of time on perfect eyes be that of inducing a necessity to make use of concave glasses, in order to see near objects distinctly, yet sometimes, even after the age of fifty, and after convex glasses have been used many years for this purpose, the eyes have not only ceased to derive benefit from them, when looking at near objects, but they have required concave glasses to enable them to distinguish, with precision, objects at a distance.

Thirdly; though the cause of this change be not always known, yet sometimes it has been induced by the use of evacuating remedies, particularly of leaches applied to the temples; and sometimes by looking through a microscope, for a continued length of time, in several successive days.

Fourthly; instances are not uncommon, in which persons, far advanced in life, (viz. between eighty and ninety,) whose eyes have been accustomed for a long time to the use of deeply convex glasses, when they have read or written, have ceased to derive benefit from these glasses, and they have become able, without any assistance, to see both near and distant objects almost as well as when they were young. Although it be not easy to ascertain the cause of this amended vision, it seems not improbable that it is occasioned by an absorption of part of the vitreous humour; in consequence of which the sides of the eye collapse, and its axis, from the cornea to the retina, is lengthened; by which alteration the length of this axis is brought into the same proportion to the flattened state of the cornea or crystalline, or both, which it had to these parts before the alteration took place.