

**A complete physico-medical and chirurgical treatise on the human eye :
and a demonstration of natural vision / [Gravers].**

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A COMPLETE
PHYSICO-MEDICAL AND CHIRURGICAL
T R E A T I S E
ON THE
HUMAN EYE.

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A COMPLETE
PHYSICO-MEDICAL AND CHIRURGICAL
T R E A T I S E
ON THE
HUMAN EYE:

AND A
DEMONSTRATION OF NATURAL VISION.

THE WHOLE ILLUSTRATED WITH
A VARIETY OF FINE ENGRAVINGS,
Representing the Anatomy of the EYE, and the Instruments
necessary for the CHIRURGICAL DISORDERS.

ON A NEW PLAN.

BY PETER DEGRAVERS, M. D.
Professsor of ANATOMY and PHYSIOLOGY.

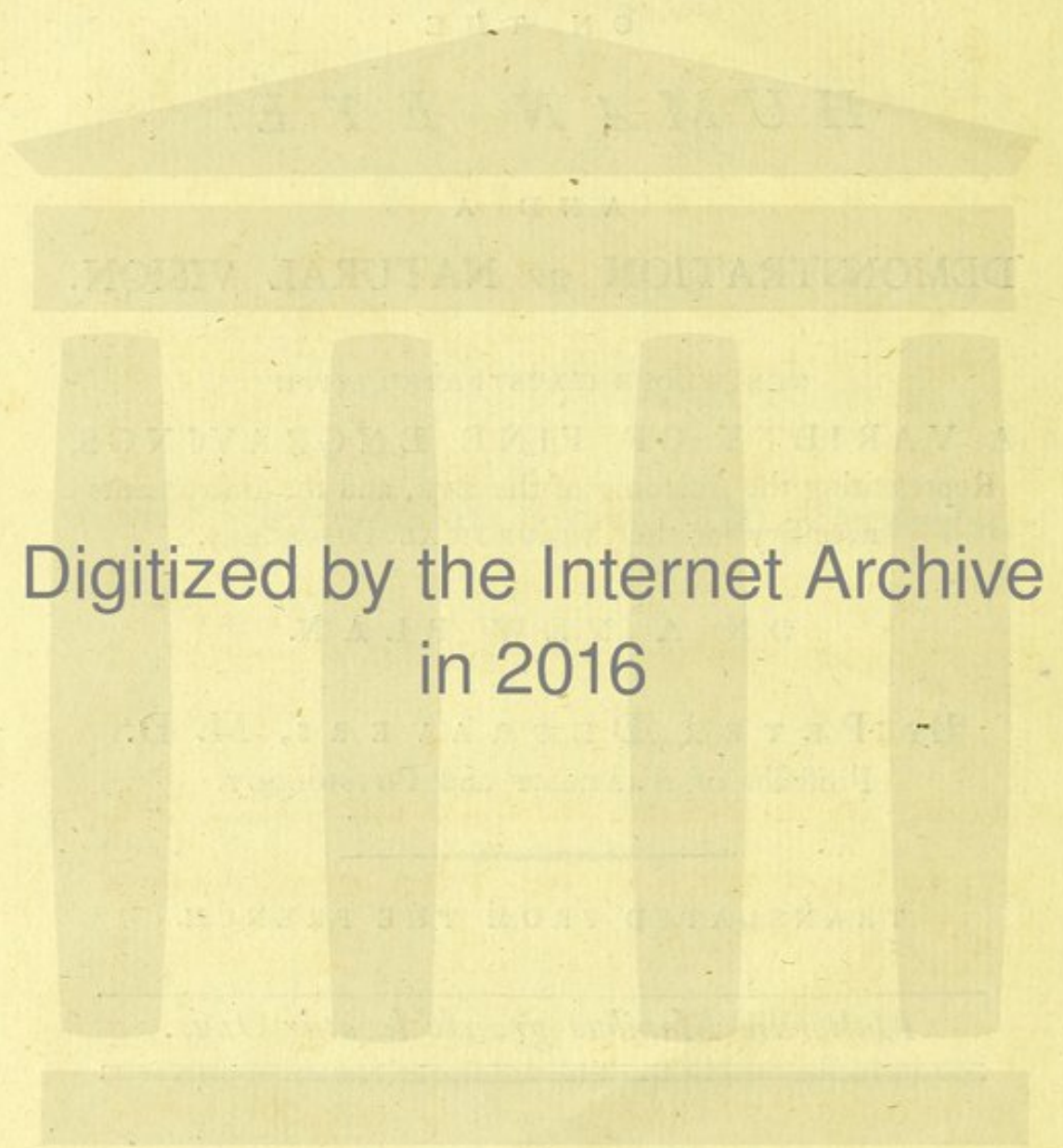
TRANSLATED FROM THE FRENCH.

Multorum Manibus grande levatur Onus.

L O N D O N:

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A P O L O G Y

FOR THE

T R A N S L A T I O N.

WHEN I wrote this Physico-Medical and Chirurgical Treatise on the Eye, I always entertained an idea to translate it into English, and afterwards to have it revised by a person able to the task; but having met with none who could keep to the sense, in reforming the style, I have been obliged to desist, and take the whole upon myself. I am too conscious of my deficiency not to ask my reader's pardon before-hand, and give him
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him warning of the fact, before to trespass on his time. The language, I believe, is what may be understood; and this being my principal aim, as well in the original as in the translation, I hope I shall be forgiven for so much undertaking, on account of my own work.

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N. B. The three last ought to be cut and folded before they are placed, as their edges cannot fall under the knife when bound.

P R E F A C E.

WHEN I first of all took it in my head to write this Physico-medical and Chirurgical Treatise on the Eye, I determined to print not only what was of my own invention, but the discoveries made by others upon the same branch. I have been so very often disappointed, when, upon reading new classic authors, to find above half the volume taken up with various digressions upon this branch of Physic and Chirurgery, which were nothing to the subject, that I have deemed them insufficient; having only been informed, that such or such a one was and is of such or such opinion; when I have expected to meet with a learned dissertation on a doubtful point. Indeed, when a reading gives us a different opinion and a choice of it, the editor does very well in taking notice of it; but when he only entertains us with the several ways of understanding the same subject, and gathers together the various blunders and mistakes of twenty or thirty different authors, they only take up the time of the learned reader, and puzzle the mind of the ignorant. I

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have often wondered at that ill-natured position which has been sometimes maintained in schools, and is comprised in an old Latin verse, namely, that a man's knowledge is worth nothing, if he communicates what he knows to any one besides. There certainly cannot be a greater pleasure to a sensible man, than if he can by any means gratify or inform the mind of another. I might add, that this virtue naturally carries its own reward along with it, since it is almost impossible it should be exercised without the improvement of the person who practises it. The reading of books, and the daily occurrences of life, are continually furnishing us with matter for thought and reflection. It is extremely natural for us to desire to see such our thoughts put into the dress of words, without which, indeed, we can scarce have a clear and distinct idea of them ourselves: When they are thus clothed in expressions, nothing so truly shews us whether they are just or false, by those effects which they produce in the mind of others. I am apt to flatter myself, that in the course of this my Treatise, I have treated of several subjects, and laid down many such rules for the conduct and instruction of a young beginner, which my other learned readers were either wholly ignorant of before, or which at least those few, who were acquainted with them, looked
upon

upon as so many secrets they have found out for the conduct of themselves, but were resolved never to have made public.

A complete Physico-Medical and Chirurgical Treatise on the Eye, for young beginners, has long been wanted; the tracts for that purpose hitherto published, as well by their length, as by methods not proportioned to their knowledges, being under the reach of their tender capacities, they were too often over-burdened by a multitude of perplexing particulars which they did not rightly understand. I have endeavoured to select the most striking cases to unite pleasure with instruction. The observations and reflections which follow every subject, are also drawn from the best authors, and those I have met with myself. If it had been thought prudent to have recourse to feigned cases, this work might have been greatly enlarged; but as fiction, however well it may be adapted, only lessens the force of the doctrine to be inculcated, it has been almost universally avoided; and nothing is inserted that has not its foundation in truth. The style must necessarily be various, on account of the multitude of authors concerned in Latin, German, French, and English; but real and sound Physic has always been attended to particularly, to engage not only the attention of youth, but that of the medical practitioners.

The art of healing, though grounded upon a great number of principles, wants yet to be supported by observations and experiments, the only basis by which we are enabled to distinguish right from wrong. This useful art would be still in its infancy, if all the discoveries, either in anatomy or in the old methods of proceeding, had not been made by the help of observation and experiment. There is nothing so useful to instruct young beginners, as histories of each disorder in particular. They inclose the sensible objects of bodies, the causes of the maladies, their phænomenon, and the effects which are the result of art. The physical experiments unravel to them the structure and springs of the parts, the properties of the fluid which flow into the vessels. But it is not sufficient to see and observe; they must yet reflect about what lays before their senses, and interpret the language of Nature. It is after such excellent precepts that this work is composed. Every sensible man must allow, that a small number of observations and experiments would not have been sufficient to destroy the errors published in a great many books; for which reason, I have added some dissertations and reflections upon anatomy, physiology, or physic; and, in short, on different points of practice, to complete the work, as far as it may now be susceptible

ceptible of being so. I have given but a short description of the human Eye at the beginning, to avoid repetitions, as I enter in a more extensive detail on the structure of each part, in proportion I shall think it proper and necessary, when I describe the functions, mechanism, some particular disorders, and their treatment. Next to that, I have given a short idea of the nature and properties of light, which is sufficient for my purpose. The treatise on the manner and phenomena of vision, being a subject that has been handed in different lights by a multitude of authors, is quite new, both in its principles and demonstrations. Then I have taken a general survey of the disorders of the eyes in general; to which is added, several observations to ground the mechanism of the lachrymal ways. After that comes the curative methods for each malady, whether simple or compound; and to crown the whole, as far as it lays in my power, I have given the remedies I generally make use of to cure them.

Theory and practice enlighten the physician in the numberless wandering ways; it is by their means that he avoids the steep places, and sets aside the obstacles which hinder him from attaining to the aim he proposes to arrive at. Though the way to the art of healing has been cut open by a
great

great many famous physicians, there are still but too many mazes wherein the eyes of the understanding cannot be quite cleared, unless it be by some new observations. It is indeed, but by the means of found ones, that the greatest part of the darkness in which error had wrapt up for many centuries, the structure, mechanism, and causes of the disorders, in one of the most precious of our organs, has been dissipated. It is not that we have been ignorant, even in the remotest times, of the anatomy of the eye, and its disorders, but this was only a superficial knowledge.

Every body acknowledges, it would be a wild notion to expect perfection in any work of man; and yet one would think the contrary was taken for granted, by the judgment commonly passed upon any treatise whatsoever. I hope this complete one will convince every able physician, that it is not for want of pains I have undertaken such an arduous task, which is perhaps above my strength; and as I hope it is conducive of forming great masters in this delicate branch of medicine and surgery, the public will think well of my labours and generosity towards it, as it will promote the benefit of mankind, by instructing young beginners at a small expence, both of time and money. Every station of life has duties which are proper to it. Those who are deter-
mined

mined by choice to any particular kind of business, are indeed more happy than those who are determined by necessity; but both are under an obligation of fixing on employments, which may be either useful to themselves, or beneficial to others. No one of the sons of Adam ought to think himself exempt from that labour and industry which were denounced to our first parent, or in him to all his posterity. Those to whom birth and fortune may seem to make such an application unnecessary, ought to find out some calling or profession for themselves, that they may not lie as a burden on the species, and be the only useless part of the creation.

When I consider the Empirics, I am apt to recall to my mind, that there is scarce a man living who is not actuated by ambition. When this principle meets with an honest mind and great abilities, it does infinite service to the world: on the contrary, when a man only thinks of distinguishing himself, without being thus qualified for it, he becomes a very pernicious or a very ridiculous creature. There is another kind of Empirics, who differ very much from the above; I mean those pretenders to physic and merit, by which they do not only deceive the world, but very often impose on themselves: that merit which conceals their own heart from them, and makes them believe they are more instructed than

than they really are, and either not attend to their murders or mistakes, as they term them, even their ignorance for science. There is yet another branch of pretenders, who, without either horse or carriage (as says a great man) lie snug in a house, and send notice to the world of their extraordinary parts and abilities, by printed bills and advertisements. There are men whose sagacity has invented elixirs of all sorts, pills, and lozenges, eye-waters and dentrific powders, and take it as an affront, if you come to them before you are given over by every body else. Their medicines are infallibles, and never fail of success, that is, of enriching the doctor, and settling the patient effectually, either lame, deformed, blind, or at rest. For my own part, as I have made it my business, in some measure, to detect such Emperics as would lead astray weak minds, by their false pretences to merit and skill, and take away from their hands such a delicate branch of physic, to lay it upon those of the persons bred up for such an employment, I shall not fail to lend the best light I am able to the students, and even the practitioners themselves, for the continuation of their improvements. How many are there whose whole reputation depends upon a trifling work! Besides all these numberless blinds, the desire of life and health is so natural and strong a passion,

passion, that I have long since ceased to wonder at the great encouragement which the practice of physic finds among us. Well-constituted governments have always made the profession of a physician both honourable and advantageous. Those who have little or no faith in the abilities of a Quack, will apply themselves to him, either because he is willing to sell health at a reasonable profit, or because the patient, like a drowning man, catches at every twig, and hopes for relief from the most ignorant, when the most able physicians give him none. Though impudence and many words are as necessary to these itinerary Galens as a laced hat, or some foreign dignities, yet they would turn very little to the advantage of the owner, if there were not some inward dispositions in the sick man to favour the pretensions of the Mountebank. Love of life in the one, and of money in the other, creates a good correspondence between them.

The reputation of men generally depends upon the first steps they make in the world; and people will establish their opinion of us, from what we do at that season when we have least judgment to direct us. I shall not here engage on those beaten subjects of the usefulness of knowledge, nor on the pleasure and perfection it gives the mind, nor on the methods of attaining it, nor recommend this particular branch of physic and surgery, all which have been the to-

pics of many other writers ; but I shall indulge myself in a work that is uncommon in its kind, and without its like in all languages whatsoever, and may therefore perhaps be more useful and necessary, on that account, for promoting the benefit of mankind. The man who is fitted out by nature, and sent into the world with great abilities, is capable of doing great good or mischief in it. It ought therefore to be the care of education to infuse into the untainted youth early notices of sound principle and knowledge, that so the possible advantages of good parts may not take an evil turn, nor be perverted to base and unworthy purposes. A work that is smartly touched, but not well studied in its principles, one may call it a witty work, though the author may, in the mean time, be in danger of being called ignorant : On the other hand, if it be thoroughly understood in the whole, well performed in the particulars, begun on the foundation of anatomy, carried on by the rules of physic and observation, and perfected by a good harmony ; this is what you may justly style a wise work, and which seldom fails to strike all our faculties, and make us pass a sound judgment upon it.

It is in every man's power in the world, who is above mere poverty, not only to do things worthy, but heroic. The great foundation of civil virtue is self-

self-denial ; and there is no one above the necessities of life, but has opportunities of exercising that noble quality, and doing as much as his circumstances will bear for the ease and convenience of other men ; and he who does more than ordinary men practise upon such occasions as occur in his life, deserves the value of his friends, as if he had done enterprises which are usually attended with the highest glory. Men, in the medical way, differ rather in circumstances than in virtue ; and the man who does all he can, in a low station, is more a hero than he who omits any worthy action he is able to accomplish in a great one. There are none who deserve superiority over others in the esteem of mankind, who do not make it their endeavour to be beneficial to society, and who, upon all occasions which their circumstances of life can administer, do not take a certain unfeigned pleasure in conferring benefits of one kind or other. Those whose great talents and high reputation have placed them in conspicuous stations of life, are indispensably obliged to exert some noble inclinations for the service of the world, or else such advantages become misfortunes. It was necessary for the world, that arts should be invented and improved, books written and transmitted to posterity. Now, since the proper and genuine actions would only influence virtuous minds, there

would be but small improvements in the world, were there not some common people of action working equally with all men, and such a principle is ambition, or a desire of fame, by which great endowments are not suffered to be idle and useless to the public. Men of the greatest abilities are most fired with ambition: on the contrary, mean and narrow minds are the least actuated by it. Whether it be, that a man's sense of his own incapacities makes him despair of coming at fame, or that he has not enough range of thought to look out for any good which does not more immediately relate to his interest or convenience, or that Providence would not subject him to such a passion, is a matter that I will not take upon me to determine. Were not this desire of fame very strong, the difficulty of obtaining it, and the danger of losing it when obtained, would be sufficient to deter a man from such a hard pursuit. How few are there who are furnished with abilities sufficient to recommend their actions to the administration of the world, and to distinguish themselves from the rest of mankind! And among those who are the most richly endowed by nature, and accomplished by their own industry, how few are there whose merits are not obscured by the ignorance, prejudice, or envy of their beholders! There are many reasons which dispose us
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to depress and vilify the merit of one rising in the esteem of mankind. All those who made their entrance into the world with the same advantages, and were once looked on as his equals, are apt to think the fame of his merits a reflection on their own indeferts; and will therefore take care to reproach him with the scandal of some past action, if they know of any bad one, or derogate from the worth of the present, that they may still keep him on the same level with themselves. The like kind of consideration often stirs up the envy of such as were once his superiors, who think it a detraction of their merit to see another get ground upon them, and overtake them in the pursuit of a great name; and will therefore endeavour to sink this reputation, that they may the better preserve their own. Those who were once his equals, envy and defame him, because they now see him their superior, and those who were once his superiors, because they look upon him as their equal. A man whose extraordinary reputation thus lifts him up to the notice and observation of mankind, draws a multitude of eyes upon him that will narrowly inspect every part of him, consider him nicely in all views, and not be a little pleased when they have taken him in the worst and most disadvantageous light. There are many who find a pleasure in contradicting the common reports

reports of fame, and in spreading abroad the weaknesses of an exalted character. They publish their ill-natured discoveries with a secret pride, and applaud themselves for the singularity of their judgment which has searched deeper than others, detected what the rest of the world have overlooked, and found a flaw in what the generality of mankind admires. Others there are who proclaim the errors and ignorance of a man with an inward satisfaction and complacency, if they discover none of the like errors and ignorance in themselves: for while they are exposing another's weaknesses, they are tacitly aiming at their own commendations, who are not subject to the like ignorance, and are apt to be transported with a secret kind of vanity to see themselves superior in some respects to one of a sublime and celebrated reputation. Nay, it very often happens, that none are more industrious in publishing the blemishes of an extraordinary reputation, than such as lie open to the same censures in their own characters, as either hoping to excuse their own defects by the authority of so high an example, or raising an imaginary applause to themselves for resembling a person of an exalted reputation, though in the blameable parts of his character. If all these secret springs of detraction fail, yet very often a vain ostentation of wit sets a man on attacking an established name,

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and sacrificing it to the mirth and laughter of those about him. A satire or libel on one of the common stamp, never meets with that reception and approbation among its readers, as what is aimed at a person whose merit places him on an eminence, and gives him a more conspicuous figure among men. Whether it be, that we think it shews greater art to expose and turn to ridicule a man whose character seems so improper a subject for it, or that we are pleased, by some implicit kind of revenge, to see him taken down and humbled in his reputation, and in some measure reduced to our own rank, who had so raised himself above us in the reports and opinions of mankind. From what has been already observed, I think it is the greatest folly to seek the praise or approbation of any body, besides the people of the same business; because no other person can make a right judgment of our works, and esteem them according to their merits. Other people see nothing but a book, and can therefore only frame a judgment of it from what the medical gentlemen say about it. Again, there are several men of merit who want an opportunity of exerting and showing themselves in action. Every science requires time and place, a proper object, and a fit conjuncture of circumstances, for the due exercise of it.

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If a man were only to deal in the world for a day, and should never have occasion to commerce more with mankind, never more need their good opinion or good word, it were then no great matter if a man spent his reputation all at once, and ventured it at one throw: but if he be to continue in the world, and would have the advantage of benefiting whilst he is in it, let him make use of truth and sincerity in all his words and actions; for nothing but this will last and hold out to the end. All other arts will fail; but truth and integrity will carry a man through, and bear him out to the last. I have been so very scrupulous in this particular of not hurting any man's reputation, that I have forbore mentioning even such authors as I could not name without honour. Besides, I would not presume to impose upon others my own particular judgment on any author, which do not equally strike the best judges. It will be sufficient for me, if I publish many useful discoveries which others have not had an opportunity of attending to, and I should be very glad to see any of our eminent writers do it on the same subject. The ancients constantly applied themselves not only to that art, but to that single branch of an art, to which their talent was most powerfully bent; and
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it was the business of their lives to correct and finish their works for posterity.

There can be no greater injury to human society than that good talents among men should be held honorable to those who are endowed with them, without any regard how they are applied. The gifts of nature, and accomplishments of art, are valuable, but as they are exerted in the interests of virtue, or governed by the rules of honor. But however just it is to measure the value of them by the application of their talents, and not by the eminence of those qualities abstracted from their use ; I say, however just such a way of judging is, in all ages, as well as this, the contrary has prevailed upon the generality of mankind. The unjust application of laudable talents is tolerated, in the general opinion of men, not only in such cases as are here mentioned, but also in matters which concerns ordinary life. If a physician were to be esteemed only as he uses his parts in relieving the sick, and were immediately despicable in a disorder which he could not but know was an incurable one, how honorable would his character be ? Triumph, applause, acclamation, are dear to the mind of man ; but it is still a more exquisite delight to say to yourself, You have done well, than to hear the whole human race pronounce you skil-

ful, except you yourself can join with them in your own reflections. A man's first care should be, to avoid the reproaches of his own heart ; his next, to escape the censures of the world : if the last interferes with the former, it ought to be entirely neglected ; but otherwise there cannot be a greater satisfaction to an honest mind, than to see those approbations which it gives itself, seconded by the applauses of the public. A man is more sure of his conduct, when the verdict which he passes upon his behaviour is thus warranted and confirmed by the opinion of all that know him. The man indeed who goes into the world only with the narrow views of self-interest, who catches at the applause of an idle multitude, as he can find no solid contentment at the end of his journey, so he deserves to meet with disappointment in his way ; but he who is actuated with a noble principle, whose mind is so far enlarged as to take in the prospect of his country's good, who is enamored with that praise which is one of the fair attendants of merit, and value not those acclamations which are not seconded by the impartial testimony of his own mind ; who repines not at the low credit and reputation which Providence has at present allotted him, but yet would willingly advance himself by justifiable means to a more rising and advantageous ground ;

ground; such a man is warmed with a generous emulation; it is a virtuous movement in him to wish and to endeavour, that his power of doing good may be equal to his will.

I take it to be the highest instance of a noble mind to bear great qualities, without discovering, in a man's behaviour, any consciousness that he is superior to the rest of the world: Or, to say it otherwise, it is the duty of a great person so to demean himself, as that whatever endowments he may have, he may appear to value himself upon no qualities but such as any man may arrive at: he ought to think no man valuable but for his public spirit, knowledge, and science; and all other endowments to be esteemed only as they contribute to the exerting those virtues. Such a man, if he is wise, or full of merit, knows it is of no consideration to other men that he is so, but as he employs those high talents for their use and service. He who affects the applauses and addresses of a multitude, or assumes to himself a pre-eminence upon any other consideration, must soon turn admiration into contempt. It is certain, that there can be no merit in any man who is not conscious of it; but the sense that it is valuable only according to the application of it, makes that superiority amiable, which would otherwise be invidious. In this light, it is con-

dered as a thing in which every man bears a share ; it annexes the ideas of merit, science, and fame, in an agreeable and familiar manner, to him who is the possessor of it ; and all men who are strangers to him, are naturally incited to indulge a curiosity in beholding the person, behavior, features, and shape of him, in whose character, perhaps, each man had formed something in common with himself.

Without entering any farther on a subject that has nothing to do with this work, I shall put an end to this my Preface, by asking pardon of my Reader, if I have not succeeded in his opinion ; but if he proves to be a learned physician, I hope all possible indulgence from him, on account of such a laborious task.

INTRO-

INTRODUCTION

TO THE

ANATOMICAL PART.

THOSE who are skilful in anatomy among the ancients, concluded, from the outward and inward make of an human body, that it was the work of a Being transcendently wise and powerful. As the world grew more enlightened in this art, their discoveries gave them fresh opportunities of admiring the conduct of Providence in the formation of an human body. There were, indeed, many parts of which the old anatomists did not know the certain use; but as they saw that most of those which they examined were adapted with admirable art to their several functions, they did not question but those, whose uses they could not determine, were contrived with the same wisdom, for respective ends and purposes. Since the circulation of the blood has been found out, and many other discoveries have been made by our modern anatomists, we see new wonders in the human frame, and discern several important parts, which

which uses the ancients knew nothing of. In short, the body of man is such a subject as stands the utmost test of examination. Though it appears formed with the nicest wisdom, upon the most superficial survey of it, it still mends upon the search, and produces our surprise and amazement, in proportion as we pry into it.

But to pursue this thought still farther: Every living creature, considered in itself, has many very complicated parts, that are exact copies of some other parts which it possesses, and which are complicated in the same manner. One eye would have been sufficient for the subsistence and preservation of an animal; but, in order to better his condition, we see another placed with a mathematical exactness in the same most advantageous situation, and in every particular, of the same size and texture. If the anatomy of the human body in general presents so many objects of difficulty to the understanding, how many more shall such a delicate part as the globe of the eye, when considered and anatomised in all its particularities? The following exposition of the Human Eye is, I hope, so well calculated for the instruction of a student, that it cannot but be well received and approved by the medical gentlemen themselves, who have at heart the improvement of this branch of anatomy.

A N A-

ANATOMICAL EXPOSITION.

THE Eye is situated in a cavity, which is called Orbit; it is made up of seven bones, *viz.* the os frontis, os sphenoidale, os mallæ, os maxillary, os unguis, os ethmoides, and a little portion of the palati. The os frontis forms the superior part of it, and a portion of the angles; the os sphenoidale, the external posterior and lateral inside; the os mallæ, a portion of the external angles, and the inferior part of the orbit; the os maxillary, the remainder of the inferior inside and portion of the internal angle; the os unguis, the anterior lateral part on the same side; the os ethmoides, the lateral and posterior inside; lastly, the portion of the os palati takes up the inferior and posterior part.

The particular situation of the orbits represents two funnels, placed laterally at a small distance from each other, and in such a manner, that their apices are almost joined, their nearest sides almost parallel, and the other side turned obliquely backward. The bottom is perforated by the *foramen opticum*

opticum *, through which passes a branch † of the second pair of the nerves, and the external side near this foramen, by two long, irregular, and orbitary fissures, one superior, called *sphenoidales*, the other inferior, called *spheno-maxillaris*. These fissures give passage to the nerves *motores oculi*, *pathetici*, *ophthalmici*, and to the portion of the *dura mater* which lines the orbitary cavity.

Under the arch of the orbit, near the temples, is a cavity ‡, wherein is situated the *glandula lacrymalis* ‡; and, towards the internal angle, a hole, or a small ring, where the pulley of the *obliquus major* is adherent. To the inferior part of the internal edge of the orbit, you see the channel called *Orbitary March*. In the posterior part, on the inside of the internal angle, are the holes *orbiter interni* §, through which pass a filament of the nerve *ophthalmicus* §. On the same side, but in the anterior part, you see the groove of the *os unguis*, and that of the *maxillary*. These grooves form the *lacrymal duct*, whose superior part is cut off; and near it, upon

* See (Tab. VI. Fig. 1.) the letter *a*, which indicates the optic nerve going through the foramen *opticum*.

† See (Tab. VI. Fig. 1.) the letter *N*.

‡ See (Tab. VI. Fig. 1.) the letter *B*, which denotes the place taken up by the *glandula lacrymalis*.

§ See (Tab. VI. Fig. 1.) the letter *k*, which marks *nervus quinti paris* that goes through the holes *orbiter interni*.

the os maxillary, where the *obliquus minor* is fixed, are many wrinkles to be discovered.

The Eye is composed of several tunics or membranes, transparent bodies, and a limpid humor. These tunics are set in one another at their adjacent edges, and closely connected in their whole extent by some nervous filaments, blood and lymphatic vessels, which send them a juice fit for their nutrition: the vessels are some ramifications of the carotid arteries, and the veins are discharged into the jugularies; the nervous filaments are some subdivisions of the *motores oculi*, *pathetici*, and *opthalmici*.

The optic nerve * is situated about the internal posterior and lateral part of the globe; it is the most considerable of the Eye, and vivifies it in some manner with an electrical fluid. When the tubes of this nerve are obstructed, this fluid becomes stagnant, and occasions blindness.

Twelve membranes make up the Eye, *viz.* the conjunctiva, albuginea, sclerotica, cornea, the tunic of the aqueous-humor, iris, choroides, retina, crystalloida, which is divided in crystallo-anterior and crystallo-posterior, the capsule of the vitreous body or hialoida, and the cellulary tunic or arachnoida.

The conjunctiva takes up from the limb of the

* See the letter *a*, Tab. V. Fig. 4.

cornea to the internal edge of the tarfi of the eyelids: it is of a soft texture, and mixt transparency; and is perforated by a great many imperceptible pores that correspond at the small glands contained into it, through which a kind of diaphane *serum* continually flows to produce the tears. The obstruction in the capillary blood-vessels of this tunic commonly causes the inflammation, pterygiums, &c.

In the internal angle under the conjunctiva, is a reddish protuberance, framed by a conglomerated gland, called *caruncula lacrymalis* *; it forms, together with the conjunctiva, a semilunar fold termed *vulvula lacrymalis*, where the tears gather themselves, to pass afterwards through the puncta † and ducts ‡ lacrymalia, *saccus-lacrymalis* §, and *ductus ad nasum*. This gland is composed of a great many small, oblong, and whitish ones; they furnish a sabaceous humor, which is a part of the lacrymal fluid; and sometimes after this humor is changed into a matter vulgarly called the gum of the eyes, which foretells the atony of the filters of this glandulous body: when it is destroyed, an habitual flux

* See the letter *c*, Tab. VII. Fig. 10.

† See the letters *d, d*, Tab. VII. Fig. 10.

‡ See the letter *e*, Tab. VII. Fig. 10.

§ See the letter *f*, Tab. VII. Fig. 10.

of tears ensues ; because the puncta and ducts lacrymalia, though in their perfect state, have not power enough to absorb the excess of this fluid.

Under that part of the conjunctiva which lines the globe, is the albuginea, which forms the white of the eye ; it is framed chiefly by the tendinous expansion of the *musculi recti*, and that of the obliquus major.

The sclerotica * takes up the lateral and posterior parts of the globe ; it is whitish and opaque in its whole substance ; its texture is very close, and its fibres directed every way ; it is less hard and thick in its lateral parts than in the posterior. This tunic is perforated † before and behind ; in the posterior part, to let pass the optic nerve ; and in the anterior, to adapt as in a groove the limb ‡ of the cornea, as the glass of a watch. When an ulcer has destroyed the thickness of that tunic in some part, a *staphyloma* happens in it, and is sometimes the cause of blindness.

The cornea § takes up the anterior part of the Eye, and is much thicker than the lateral parts of the sclerotica ; it forms a portion of sphere which

* See the letters *b. b. b.* Tab. IV. Fig. 1. and the letters *d. d. d. d.* Fig. 2.

† See the letters *f. g. h.* Tab. 1. Fig. 1.

‡ See the letters *f. f. f. f.* Tab. IV. Fig. 2.

§ See the letters *e. e. e.* Tab. IV. Fig. 2.

makes it more convex than the other tunics contiguous to it.

This tunic is made up of several pellicles situated one upon another, and united together by a texture of lymphatic vessels and nervous filaments. Each *lamina*, or pellicle, keeps its extent from the circumference to the center; and you may easily separate them one from another with a knife, or by maceration. Another way to know its structure, is, when you have cut this tunic in two portions, to introduce a small and round probe * between these pellicles. A great many ducts perforate this tunic, through which the exceeding part of the aqueous humor runs, and is the greatest portion of the tears.

A great many men have been of opinion, that the cornea was an expansion of the sclerotica; meanwhile these tunics are not continuous. You will be convinced of it, if you put into warm water, during four-and-twenty hours, the eye of a calf, and if you boil it afterwards for five or six hours; as soon as you take the eye out of the water, you'll have an opportunity of observing the cornea separated, if not entirely, at least a great part of it, from the tunic to which it was conti-

* See its description, Tab. —. Fig. 4.

guous. If the cornea was a continuation of the sclerotica, could it be possible to separate them in such a manner?

When the lymph is stagnant in the cornea, webs, specks, sometimes the ulceration of this membrane and opaque cicatrices are the unavoidable consequences : the obstruction in the excretory ducts occasions the hydrophthalmia or hydropsy of the globe of the eye.

In the concave part of the cornea, you see a transparent and elastic tunic, which is adherent to the plexus ciliares ; it is termed the tunic * of the aqueous humor. When an ulcer has eaten up the cornea without hurting that tunic, the impulsion of the aqueous humor forces it through the hole ; then you observe upon it, a tumor more or less considerable, called staphyloma. Several have been of opinion, that this tumor was only occasioned by the iris being out of its place ; it is very uncommon to see both these tunics form the same staphyloma. The irregularity of the pupil, together with the blackish color of the tumor, announces it produced by the iris : when it is occasioned by the tunic of

* This cannot be properly called a tunic of the aqueous humor, as it is only a loose one, that depends more on the cornea than any thing besides, as it keeps not the humor in any bounds. See the description of the staphyloma disorder.

the aqueous humor, then the tumor is greyish, and the pupil keeps its natural form.

Beyond the *cornea* you see a tumor variously colored, which is called iris *; between both these membranes, is a space called the anterior chamber †. From the center of the *cornea* to the hole of the iris, there is an interval of a line and a quarter, or a fifth. This chamber is full of a diaphane fluid, termed aqueous humor, which is a secretion of the vitreous and crystalline. As soon as the aqueous humor is renewed, the exceeding of it runs through the excretory ducts of the *cornea*, to lubricify the external parts of the globe, and at the same time help the refraction of the rays of light.

The Eye is called black, grey, blue, &c. from the color of the iris. The variety of this tunic is produced by the more or less quantity of *meconium*, which penetrates its substance. The iris has, almost in its center, a round hole called pupil ‡; it is contracted during sleep, as if the eye was exposed to a great light; its occlusion is the cause of blindness, but not without remedy.

* See the letter *n*, Tab. I. Fig. 1. and the letters *i. k. l. m. n.* Tab. IV. Fig. 1.

† See the space of the anterior chamber from E to I, Tab. VIII. Fig. 4.

‡ See the letter *y*, Tab. IV. Fig. 2.

The iris has circular and straight fibres* ; the former are interwoven, and situated at the circumference of the pupil ; the latter are placed in form of rays † in its whole extent : their basis is towards the limb of the *cornea*, and their extremity terminate at the circular fibres. When the radiated fibres begin to contract, they cause a dilatation ‡ in the pupil ; the circular fibres, on the contrary, being in action, the pupil has a less diameter §. This dilatation and contraction takes place alternately when the Eye is exposed to a feeble light, or looks towards a distant object ; *et vice versa*.

Some anatomists agree, that the iris has several fibres, to perform its motions ; others deny their existence, and have enquired after the cause which augments and diminishes its diameter. Many observations confirm us in the opinion of the former.

You will easily discover, in the eye of a horse or ox, towards the posterior part of the iris, the circular and radiated fibres ; and, at the same time, you will observe the texture of that tunic to be very different from that of the choroides : a strong proof they are contiguous, and not continuous.

* See the letter *n*, Tab. IV. fig. 1.

† See the letter *l*, Tab. IV. fig. 1.

‡ See the letter *c*, Tab. IV. fig. 1.

§ See the letter *y*, Tab. IV. fig. 2.

The following experiments are further proofs of it.

Cut the globe of an Eye into two hemispheres, about its middle part; convey a quill to the lateral and posterior part of the *plexus ciliaris*, and make some soft pressures upon that part; then you will have an opportunity of observing, that the *plexus ciliaris* separates itself from the choroides: When a large portion will be divided, take it with your fingers, the least pulling will be enough to let it give way from its adhesions, and part it from the remainder of the choroides; but you will see that the *plexus ciliaris* continues to be contiguous to it. These reasons are powerful enough to make one believe, that the *plexus ciliaris* is neither continuous to the choroides nor to the iris, but only contiguous to both.

The posterior face of the iris is covered with a black matter, supplied through the vessels of the choroides. This *meconium* is an accessory to the perfection of sight. When an ulcer has eaten up a portion of the thickness of the *cornea*, and the tunic of the aqueous humor, then the impulsion of this fluid forces the iris to pass through this hole, to a degree sufficient for forcing out a tumor more or less convex. This disorder is called *staphyloma* as aforesaid,

said, which is divided into several sorts, according to its form and bulk.

The edge of the great circle of the iris has a folding protuberance like a wrist-band, which is called *plexus ciliaris* *; it is united in its whole circumference, to the limb of the *cornea*, by some whitish filaments. In this part only the iris is adherent, and its remainder swims into the aqueous humor. The *plexus ciliaris* may also be looked upon as a muscle appointed to sustain forward the crystalline lens. The want of action in this muscle is the cause of the presbyopia.

The iris is held up by a transparent and elastic membrane, and has almost in its center a round hole, which is parallel to that of the posterior tunic. These distinct membranes have the same extent and adhesions: the transparent tunic of the iris is almost alike to that of the aqueous humor. The too great dilatation in the pupil, and its too great contraction, foretell a spasm in the fibres of the iris; unmovable between these states, the *gutta serena*; meanwhile, there are some particular cases wherein the Eye is afflicted with perfect *gutta serena*, though the pupil changes its diameter; that

* See between the letters *h* and *i*, Tab. IV. fig. 2.

is to say, dilates and contracts itself, according to the more or less quantity of light. The too great dilatation in the pupil is called mydriasis.

Between the posterior part of the iris and crystalloida, is a space termed the posterior chamber*; it is taken up by the aqueous humor which passes through the pupil, when it is in too great an abundance, to renew that of the anterior chamber. The posterior is very narrow, in proportion to the anterior: they are two reservoirs to supply the tears. When a purulent matter is shed into the chambers of the Eye, this disorder is called hypopion.

The choroides † is immediately under the *sclerotica*; these membranes have the same extent: The choroides is made up of two lamina closely connected together; one which touches the *retina*, is called *membrana ruyschiana*; the other, reticular. These lamina are formed by a texture of fibres ‡, nervos filaments ‡, lymphatic and blood vessels ‡: from the latter flows a black matter or *meconium*, which is diffused through the whole extent of these lamina, but in greater quantity, over the ruyschiana. This kind of ink is not to be found in the anterior

* See the space of the posterior chamber, letter *m*, Tab. VIII. fig. 4.

† See the letter *b*, Tab. II. fig. 2.

‡ See the letters *a, b, c, d, e*, Tab. II. fig. 3.

part of the choroides, which is opposite the pupil, in the eyes of quadruped and other animals; it is sometimes defective even in the eye of man. Though the choroides be composed of two lamina, it is however very delicate, and stronger in the posterior parts of the globe than in the lateral ones. When the *meconium* passes through the vessels of the vitreous body, or those of the crystalline, then it tarnishes their transparency, and is the cause of blindness. To this humor only is attributed the yellowish color, acquired by years, in the crystalline lens. The swelling in the vessels of the choroides, occasions always internal inflammations, suppurations, &c.

The *retina* * lines and takes up the same extent as the choroides: both these membranes end at the plexus ciliaris, where they are closely connected. The *retina* is of a soft texture, and like a kind of paste spread upon a fine reticular web: it is of a mixt transparency after death, and like an oiled paper. The *retina*, in living animals, is very bright, especially in the natural state, and loses of its transparency, as well as the diaphanous bodies of the eye, after death.

* See the letter c, Tab. II, fig. 1.

The *retina* is a production or expansion of the medullary substance of the optic nerve : in its texture, are very apparent blood-veffels, whose diameter diminishes in proportion as they go far from the optic nerve : it is the immediate organ of fight. This opinion is generally received, and is the only one which can be wisely admitted. The paralysis of the *retina* and optic nerve, bring on the *gutta serena*.

The vitreous body * is like a transparent jelly ; it takes up from the posterior part of the globe to the plexus ciliaris. The elasticity of this body comes from its structure ; it is made up of two tunics, and of a very limpid water, the very same kind as that of the aqueous humor. The external membrane, which is its general coat, is called the vitreous capsule or *hyaloida* ; it is perforated with a great many holes, some to give way to the vessels which go from the *retina* into the vitreous body to furnish it with the necessary juice fit for its nutrition, and renew the fluid contained in its cellular spaces ; the others are pores through which transudes the excess of this humor.

The cells of the vitreous body are composed of

* See the letter *c*, Tab. II. fig. 1. and the letter *a*, Tab. VII. fig. 1.

the internal tunic, which is called cellulary or *arachnoida* ; it is much more thin and delicate than the *hyaloida*. The cells of the vitreous body are very small; they differ from each other in their form and size; the fluid contained in them passes from one cell into another, through some very little pores or holes in the *hyaloida*, to renew the aqueous humor.

In the anterior part of the vitreous body, is a cavity termed *fossula* *, wherein the crystalline is lodged, exactly after the same manner as a diamond is set in a ring. This cavity keeps a conical form, as soon as the crystalline is out of it. The vitreous body, on account of its being less dense than the crystalline, proves the refraction upon both these transparent bodies very different from each other : for which reason, those who have undergone the operation of the cataract by extraction, cannot read easily without the help of a convex glass; meanwhile, some may do it as well without. The vitreous capsule or *hyaloida* is adherent to the *retina*, by a great many lymphatic vessels, but much more about the circumference of the *plexus ciliaris*. You may see, at the circular

* See the letter *b*, Tab. VII. fig. 1. which denotes the crystalline humor : the place it occupies is the *fossula*.

edge of the *fossula*, a coat * full of radiated *fulci*, which contain the *processus ciliaris* of the *uvea*. The diameter or thickness of the vitreous body is commonly about seven lines and a half.

The vitreous body is to keep the coats of the eye in a perfect state of tension, to hold the crystalline lens, help the refraction of the rays of light, supply, by the convexity of its *fossula*, the want of the crystalline lens when it is out of its room; lastly, to renew as aforesaid the aqueous humor.

The opacity of the vitreous body is known among the moderns under the name of *glaucoma*; its melting occasions not only the atrophy of the globe of the eye, but the irreparable loss of the organ.

The *processus ciliaris* † are many straight fibres, whose basis is adherent to the *plexus ciliaris*, and the remainder part of their extent to the vitreous body; they are as full of the same *meconium* as the *plexus ciliaris* and choroides. Several have been of opinion, that they were a continuation of the plexus; for which reason they termed the whole

* See the letter *d*, Tab. VII. fig. 1. and *h*, Tab. II. fig. 1.

† See the letters *e* and *f*, Tab. II. fig. 2.

corona ciliaris; meanwhile they are contiguous, and not continuous, because you may put them asunder very easily without tearing.

Extract the vitreous body out of an eye, then you will see the whole *processus ciliaris* attached to it, consequently their basis is separated from the plexus ciliaris. The use of the *processus ciliaris* is to sustain forth the crystalline, together with the plexus ciliaris. When these parts are paralysed, the eye becomes presbit, what commonly happens to old men; but the use of a magnifying glass, or remedies proposed in such a case, may be of great benefit: there are, however, some who have occasion for neither.

The crystalline * is not only lodged in the fossula of the vitreous body, but likewise wrapt up in a capsule called *crystalloïda*; it is made up of two spheroides and concave tunics adapted to one another about their edges. The portion which covers the fossula, is termed *crystallo-posterior*; the other, *crystallo-anterior*: the latter is less extensive and thick than the former.

The *crystalloïda* is perforated by a great many pores, through which passes the secretory humor of

* See the letter *b*, Tab. VII. fig. 1.

the crystalline, to renew the aqueous humor. The crystallo-anterior is composed of several lamina connected one upon another. You may divide them very well in the eye of a horse, after a maceration of six days in water. The crystalloida is adherent to the edge of the fossula, by a great many lymphatic vessels. You may see in the whole circumference of the limb of the crystallo-anterior, a great quantity of small grooves, wherein is set a little portion of the fulci-ciliaris. Sometimes after the extraction of the crystalline lens, the crystalloida becomes opaque, what we call a secondary cataract. It may happen too, that both become opaque at the same time; but this is a very uncommon case.

The crystalline lens is a small lenticular body, more convex in its posterior part than in its anterior: anteriorly it is almost flat and posteriorly parabolic. Its limpidity is analogous to the most diaphane crystal, but only in young men's eyes. At thirty years old, it begins to acquire a light yellow color, and, by degrees, increases till it be quite opaque. There are, however, a great many causes which may alter the transparency of the crystalline lens, and of course produce a cataract.

The crystalline lens is composed of a great many
segments

segments or curvi-lineal pellicles heaped one upon another, after the same manner as those of an onion. When it is dried by the sun or before the fire, you may separate them, if you squeeze it betwixt your fingers.

Between the crystalline lens and its capsule is to be found a space * full of viscous and limpid humor, discovered by the famous MORGANI. It flows through the pores of the *crystalloida*; and when they are obstructed, this humor becomes opaque on account of its stagnation; from thence ensues a limpid cataract, though the crystalline and its capsule be in their perfect state of transparency.

You may see under the depression, observable in the arch of the orbit near the temples, a conglomerated gland † of an oval, and a little flattened form, sometimes divided into several lobes. Many different inequalities, caused by the irregular assemblage of the small glands which compose it, are, moreover, to be seen: it is wrapt up in a capsule, from which a great many excretory ducts proceed, and run down almost in its whole extent, through the substance of the *tunica interna* or *conjunctiva* of

* See the crystalline letter D, and observe it described with two circles very near each other, which distance forms the said space, Tab. VIII. fig. 4.

† See the letter B, Tab. VI. fig. 1.

the superior eye-lid, and afterwards pierce it inwardly near the internal edge of the tarsus, from whence exudes a part of the tears. The *glandula lacrymalis* may not only become scirrhus but voluminous, and to such a degree, as to be able to squeeze the globe of the eye, and occasion its supuration.

The motions of the globe of the eye are ruled by six muscles, viz. four recti, and two obliques: the third*, fourth†, fifth‡, and sixth§ pairs of the nerves send them some nervous filaments.

The four *musculi recti*|| and the *obliquus major* are fixed by their posterior extremities at the bottom of the orbit near the *foramen opticum*; they are made up of straight fibres involved in a capsule, and their aponeurosis end at the limb of the cornea, where they form the albuginea. The position of the four *musculi recti* renders them almost of an equal distance.

The muscle which is situated at the top of the globe, is called superior ¶ or levator; it moves the

* See the letter *p*,

† See the letter *k*,

‡ See the letters *b* and *e*,

§ See the letter *l*,

|| See down the letter *e*, Tab. VI. fig. 2.

¶ See the letter *g*, Tab. V. fig. 2.

} Tab. VI. fig. 1.

globe upward. The inferior * or *depressor* is placed at the lower part of the eye; it brings the visual pole downward. The internal † or *adductor* is in the internal angle; it carries the globe towards the nose. The external ‡ or *abductor* is in the external angle; it turns the eye towards the temples. The successive action of the four *musculi recti* occasions a circular motion, and their simultaneous action fixes horizontally the organ.

The *obliquus major* § is likewise called *trochlearis*, because it passes through a small cartilaginous ring ||, as over a pulley, which is situated on the inside of the internal angle, and joins the globe of the eye by its aponeurosis.

The *obliquus minor* ¶ is situated obliquely at the lower side of the orbit, under the *rectus inferior*, which consequently lies between this muscle and the globe. It is fixed, by one extremity a little tendinous, to the root of the nasal apophysis of the os maxillary, near the edge of the orbit between the overture of the *ductus ad nasum*, and the inferior orbital fissure. The fibres of this muscle are straight and involved within a sheath.

* See the letter *b*,

† See the letter *i*,

‡ See the letter *m*,

§ See the letter *f*,

|| See the letter *I*, Tab. VI. fig. 1.

¶ See the letter *K*, Tab. VI. fig. 1. and *d*, Tab. V. fig. 5.

From thence the muscle passes obliquely, and a little transversally backward, under the *rectus inferior*, and is fixed in the posterior lateral part of the globe by a flat tendon, opposite and at a small distance from the tendon of the *obliquus major*; so that these two muscles do, in some manner, surround the outer posterior part of the globe.

The use of the oblique muscles is to move the globe towards the nose, especially when it is horizontal, and to render parallel the *axis* of the eyes. Every body knows, that the action of a muscle cannot be performed, unless its antagonist yields to the effort of the other. The spasmodic motions contract sometimes the muscles of the eyes to such a degree, as to be able to break the parallel of the axis, which is the fore-runner of some dangerous disorders, nay of the strabism at the same time.

The interstices of the muscles of the eye are taken up by soft beds of fat, which keep the flexibility of the muscular parts, and their motions free. These greasy bodies are also to preserve the globe from the hardness of the insides of the orbit, and stretch it forwards.

The eye-lids are to keep the organ from the exterior injuries, and water it uniformly with the tears, in order to preserve the brightness of the *cornea*, and moderate the action of light, air, and rubbing;
their

their exterior structure is made up of the continuation of the *epidermis*, skin, *membrana adiposa*, eye-brows, and *cilia* or eye-lashes.

The eye-brows are set upon the upper portion of the superior eye-lid, and are designed by nature as an ornament to the human species. The eye-lashes or *cilia*, when in a natural state, form a single row of hairs to each external edge of the eye-lids. When the *cilia* are bent towards the eye, this disorder is called *phthosis*.

The superior eye-lid is larger, and its tarsus thicker, than that of the inferior; the former has perpendicular motions, and the latter oblique ones. Both eye-lids have action and re-action, when they uncover the globe. The motions of the eye-lids are also termed winking.

The internal structure of the eye-lids is composed of three muscles, viz. two orbicular, and the other called *levator palpebra superioris*; of the *tarsi*, the *glandula sebacea meibomii*, their excretory ducts, those of the *glandula lacrymalis*, the puncta and ducts lacrymalia, and of a portion of the *conjunctiva*.

The superior eye-lid has two muscles, the one called *levator* *, the other *superior orbicularis*. The *levator* * is fixed at the bottom of the orbit, from thence it goes to the edge of the cavity: when it

* See the letter c, Tab. V. fig. 1. and B, Tab. VI. fig. 2.

is arrived under the arch, it bends to adapt itself to the superior eye-lids; its fibres run forward increasing gradually in breadth, and terminate by a very broad aponeurosis, in the tarsus of the superior eye-lid: this muscle being in action, lifts up the eye-lid.

The *orbicularis* of the superior * eye-lid is made up of curve-lines connected one upon another; their extent is from the internal angle to the external. This muscle is larger in the center of the eye-lid than in the angles, where it is fixed at a tendon in each angle. The action of this muscle is to bring down the superior eye-lid.

The inferior eye-lid † has but one muscle, called *inferior orbicularis* ‡, and less large than the superior: it has oblique motions, by which means it is impowered with action and re-action as the other. Every one of these muscles has a particular sheath, and their extent and structure are the same: the middle tendons are common to them all.

The *tarsi* § are thin half circular cartilages forming the principal part of the edge of each eye-lid; they are united together at the angles, which

* See the letter E, Tab. VI. fig. 1.

† See the letter b, Tab. VII. fig. 9.

‡ See the letter c, Tab. VII. fig. 9.

§ See the letters a, b, Tab. VII. fig. 8.

is termed Commissures. The superior tarsus is thicker than the inferior, and their extremities or commissures more slender than in the center. Each tarsus is disposed in such a manner, that its interior edge is a kind of groove to let the tears run towards the internal angle.

The eye-lashes are produced by some bulbs, which are set over the whole extent of the internal edge of the tarsus. When they take rise in the internal parts, this disorder is called *trichiasis*. The brushing which happens upon the globe tarnishes the *cornea*, and inflames the *conjunctiva*.

In the internal angle upon the edges of the *tarsi*, are two little holes, one at each eye-lid, called puncta * lacrymalia; each has a sphincter which contracts and dilates itself, and their ducts have a vermicular motion, which is repeated at each winking, what helps the passage of the tears into the *saccus † lacrymalis*, and from thence through the *ductus ad nasum* into the nostril.

The ducts ‡ lacrymalia are formed by a musculous membrane, whose fibres are straight, and those of their sphincters interwoven. These ducts join to-

* See the letters *d, d,*

† See the letter *f,*

‡ See the letters *e, e,*

} Tab. VII. fig. 10.

gether under the commissure of the internal angle*, to form but one duct, which is adapted to the lacrymal sac, to pour out the tears into it.

The *saccus † lacrymalis* is an oval, irregular, and a little flatted bag, or reservoir; it is made up of a spongy membrane, interwoven with fibres, blood and lymphatic vessels, and a great many small glands, through which flow an excretory humor more viscus than the tears: it is lodged in the groove of the os unguis, and the inferior part of it into the channel formed by the os maxillary and unguis.

The *saccus lacrymalis* has in its inferior part a duct, termed *ductus ad nasum*, which forms the reservoir of the tears. This duct has its diameter larger in its superior part, than in the inferior. The constant contraction of the sphincter forces the tears to stay in its caliber, and in that of the lacrymal sac. This disorder is called a retention of tears.

If you squeeze with your fingers the *saccus lacrymalis*, a purulent matter will discharge out of it: this malady is termed fistula lacrymalis. When this matter is too thick, it cannot get out through the puncta lacrymalia, what occasions a great dilata-

* See the letter c, Tab. VII. fig. 8.

† See the letter f, Tab. VII. fig. 10.

tion in the bag, because of an augmentation of the humor. Sometimes this fluid corrodes the sac and its teguments, and causes a general inflammation. This last case is an evidence of a complete fistula lacrymalis.

Having now dispatched the Anatomical Exposition of the Human Eye, I think it will not be amiss, for the benefit of the students who have not an opportunity of learning the Latin language, to lay down the anatomical terms in that dead tongue, in order they may not be puzzled by them when they read any other work upon this subject, as almost all the authors have preferred it to their own language. I am pretty sure this particular description, though in Latin, will be very easily come at by every reader, as the terms in both languages are very near the same, and is, besides, a good and short method of instruction: therefore it would be needless to make any further apology about it, especially as it is an explanation for the copper-plates, or *explicatio figurarum*.

DESCRIPTIO ANATOMICA

O C U L I H U M A N I :

O R,

EXPLICATIO FIGURARUM.

TAB. I. Fig. 1.

Origo Tunicarum Oculi ; facies interna Choroidis.

- a.* Nervus opticus discissus.
b. Vaginæ nervi optici lamina exterior.
c. ————— lamina interior.
d. Pia mater nervi optici.
e. Arteria centralis.
f. Pars laminæ cribrosæ, per quam substantia medullaris nervi optici transit.
g. Sclerotica posterius crassior, ubi cum vagina nervi optici connectitur.
h. Circulus

Tab. 1.

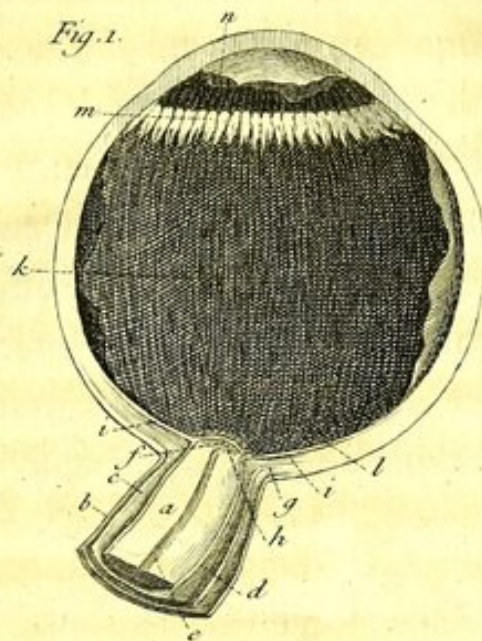
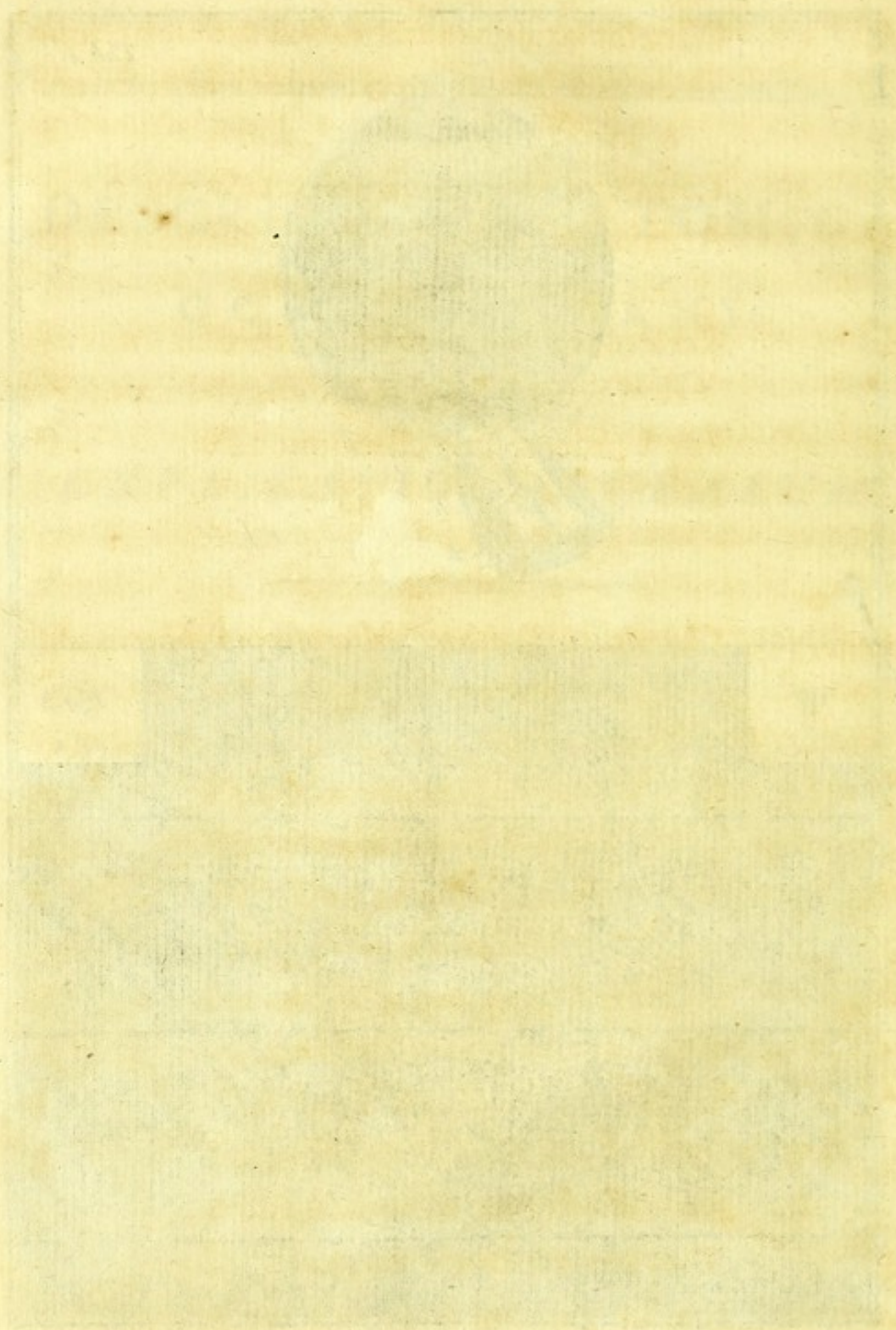


Fig. 2





- h.* Circulus laminam cribrosam ambiens, unde pia mater nervi optici reflectitur, & in
i. Laminam internam scleroticæ abit.
k. Arteriæ parallelæ, quæ in choroidis facie interna apparent.
l. Reticulum vasculosum obscure adumbratum, quo arteriæ choroidis obducuntur.
m. Plicæ processus ciliarium albæ.
n. Iris.

Fig. 2.

Reticulum Choroidi instratum Microscopio plurimum augente Visum.

- a.* Arteriolæ choroidis faciei internæ.
b. Reticulum vasculosum.
c. Magnitudo naturalis hujus portionis choroidis, cujus icon hic sistitur.

TAB. II. Fig. I.

Tres tunicæ Oculi altero ex Latere Ablatæ, ut Humores in situ naturali in conspectum veniant.

- a.* Nervus opticus.
b. Tres tunicæ oculi reflexæ.
c. Humor vitreus.

G 2

d.

Lens

- d.* Lens crySTALLINA.
e. Retina humori vitreo subiecta.
f. Retinæ terminus anterior.
g. Corporis ciliaris pars posterior striata.
h. Plicæ processuum ciliarium, radios albos
 referentes.
i. Locus, ubi ab utroque latere lentis radii
 albi a lente distantes apparent.
k. Pupilla per lentem pellucidam conspicua.

Fig. 2.

*Annulus processuum ciliarium lente visus, parum
 augente.*

- a.* Pars scleroticæ.
b. Pars choroidis.
c. Ora ferrata, quæ annulum a reliqua cho-
 roide distinguit.
d. Pars posterior annuli striata.
e. Pars anterior ex plicis processuum cilia-
 rium composita.
f. Plicarum pars anterior, latior, eminens.
g. g. Plicæ nonnullæ extremo bifido terminatæ.
h. Plicarum pars posterior, quam plures ra-
 diculæ constituunt.

i. Iridis

f

Fig. 3.

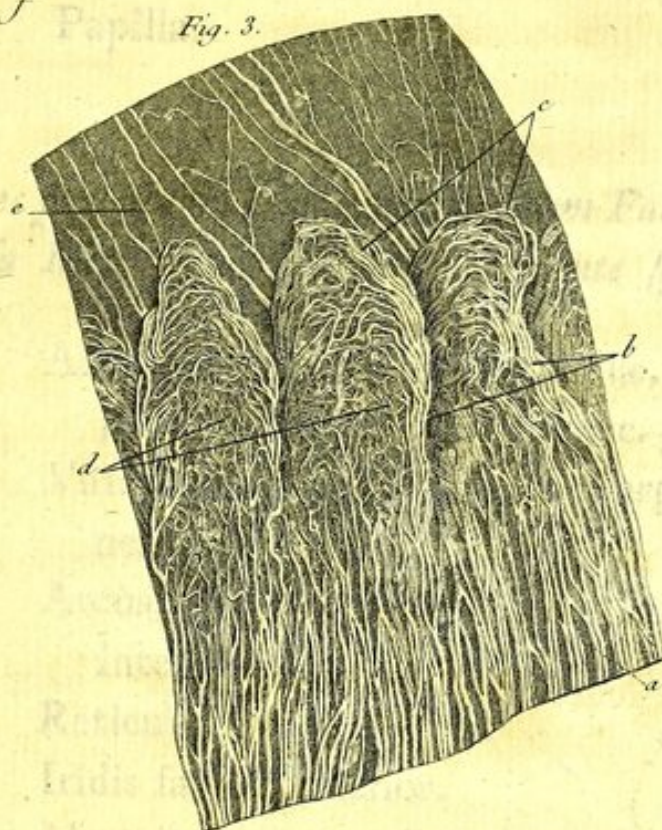
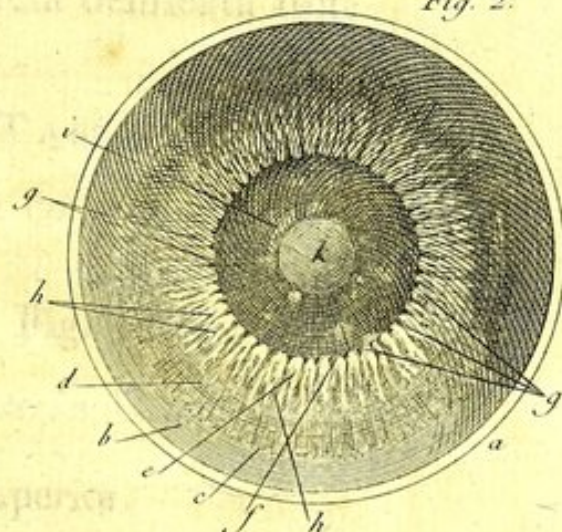
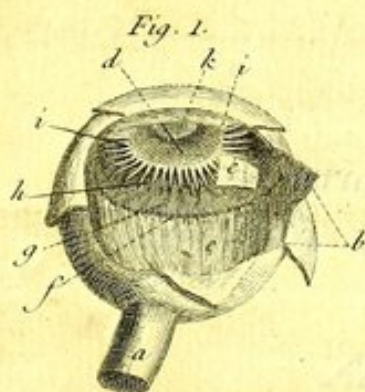
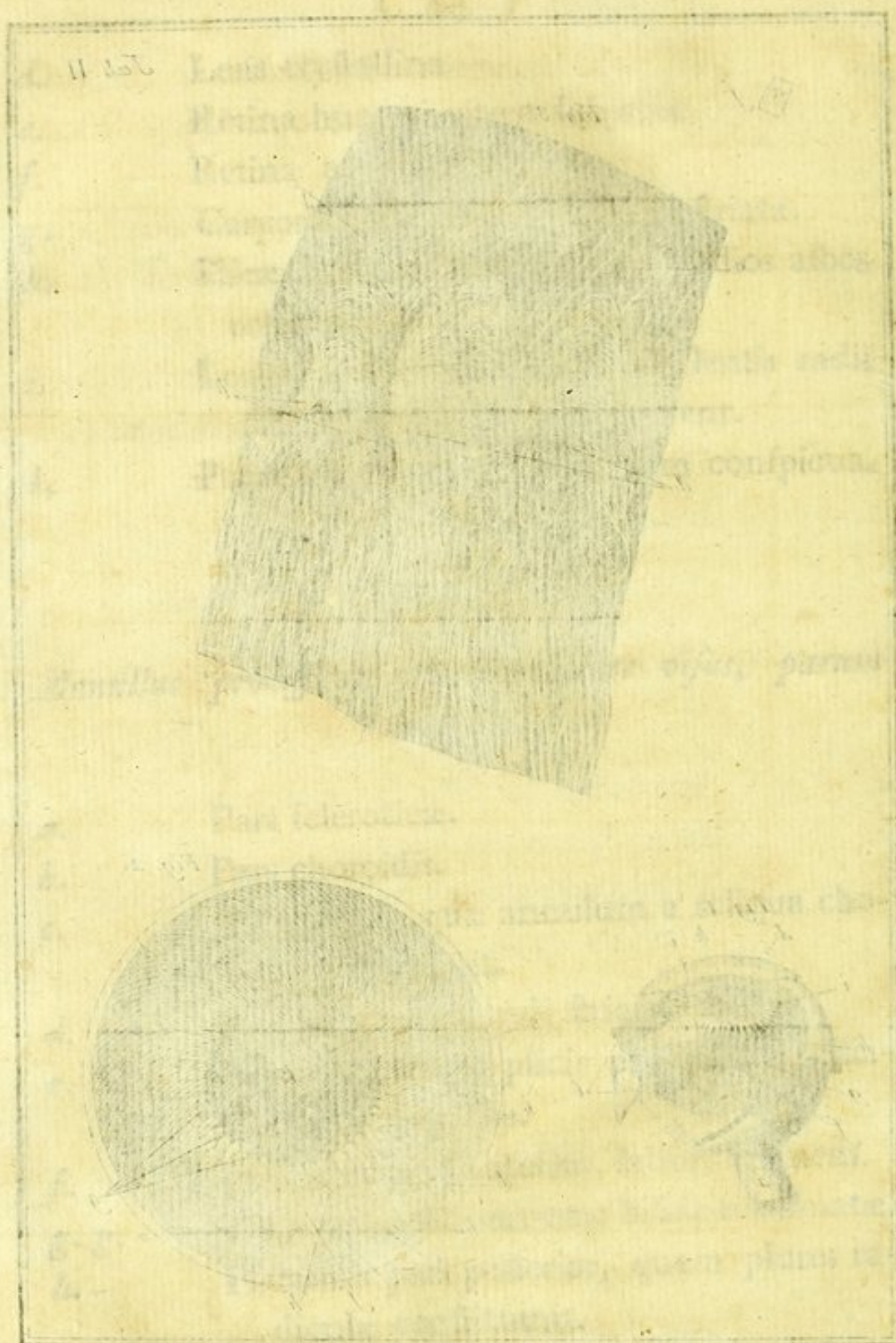


Fig. 2.





- i. Iridis facies posterior, uvea dicta, striata.
k. Papilla.

Fig. 3.

Plicæ tres processuum Ciliarium, quorum Fabrica Vasculosa Microscopio plurimum augente sistitur.

- a. Arteriolæ innumeræ parallelæ, in facie interna choroidis conspicuæ.
b. Vasculum majusculum in margine eminente decurrens.
c. Arcus, per quos vascula in apice plicæ inter se junguntur.
d. Reticulum vasculosum.
e. Iridis facies posterior.
f. Magnitudo naturalis hujus portionis, quæ lente aucta delineata fuit.

TAB. III.

Arteriæ & Venæ Oculi.

Fig. 1.

Arteriæ Oculi.

- A. Palpebra superior.
B. Musculus obliquus superior cum trochlea.
C. Musculus

- C. Musculus abducens.
- D. Musculus deprimens.
- E. Musculus adducens.
- F. Pars anterior musculi attollentis abscissa.
- G. Glandula lacrymalis.
- H. Bulbus oculi.
- I. Ambitus corneæ.
- K. Nervus opticus.
- L. Nervi quinti paris primus ramus abscissus.
- a.* Arteria ophthalmica.
- b.* Ramuli ad duram matrem nervi optici in
foramine optico.
- c.* Arteriola accessoria cum primo ramo
quinti paris orta a meningea & lacry-
mali ramo inserta.
- d.* Ramus lacrymalis.
- e.* Ramuli ad musculum abducentem.
- f.* Arteriola ciliaris tenuissima, orta a lacry-
mali, & in scleroticam desinens.
- g.* Ramus muscularis inferior.
- h.* Ramus illius majusculus, unde oritur ar-
teria centralis nervo optico tecta, &
- i.* Ciliaris inferior interior.
- k.* Ramus ad musculum adducentem & ob-
liquum inferiorem.
- l.* Ramus ad musculum deprimentem.
- m.* Arteria

- m.* Arteria ciliaris exterior.
- n.* Hujus ramus tenuior, qui inprimis per superficiem scleroticæ dispergitur.
- o.* Surculi ciliares scleroticam perforantes.
- p.* Surculus ad scleroticam.
- q.* Circulus arteriosus circa transitum nervi optici per crassitiem scleroticæ.
- r.* Ramus ad musculum attollentem abscissus.
- s.* Ramuli ad duram matrem nervi optici.
- t.* Ramus supraorbitalis nervi frontalis comes.
- u.* Arteria ethmoidea posterior.
- x.* Ramus ad musculum adducentem.
- y.* Ramus ad musculum obliquum superiorem.
- z.* Arteria ethmoidea anterior.
- 1.* Truncus infra trochleam ex orbita emergens, & in ramos palpebrales, aliosque anteriores divisus.
2. 2. 2. Ramuli cum musculis rectis oculi allati, qui prope corneam abeunt, in
3. 3. 3. Arteriolas ciliares anteriores, scleroticam perforantes.

Fig. 2.

Arteriæ Ciliares longæ & breves ; circulus Iridis.

- a.* Sclerotica reflexa.
b. b. Duæ arteriolæ ciliares longæ.
c. c. Rami duo majores, in quos quævis arteriola longa divaricatur.
d. d. d. Ramuli ex utroque ramo bifurcationis enati & ad circulum interiorem abeuntes.
e. e. Circulus interior,
f. isque duplex nonnullis in locis.
g. g. g. Arteriolæ ciliares anteriores, in circulum interiorem insertæ.
h. h. h. Arteriæ ciliares breves.
i. i. i. Mutua inter illas anastomosis pone orbiculum ciliarem.
k. k. Surculi in circulum iridis abeuntes.
l. l. Arteriolæ iridis.
m. m. Arcus, quibus circa annulum minorem iridis inter se junguntur.
n. Surculi ex illis arcubus versus pupillam tendentes.

Fig. 3.

Portio annuli minores Iridis, ope Microscopii visa & delineata.

- a. a.* Arcus, quos arteriolæ iridis constituunt circa annulum minorem, in præcedente figura litt. *m. m.* designati.
- b. b.* Ramuli ex illis arcubus versus pupillam tendentes.
- c. c.* Ramuli in annulo minori iridis transversim decurrentes, & ductu cum ora pupillæ parallelo, quos nonnulli pro fibris orbicularibus iridis habuisse videntur.

Fig. 4.

Venæ Oculi.

- A. Portico palpebræ superioris obiter delineata.
- B. Glandula lacrymalis.
- C. Musculus abducens.
- D. Pars posterior musculi attollentis disciffi.
- E. Pars anterior.
- F. Pars posterior levatoris palpebræ disciffi.
- G. Pars anterior.

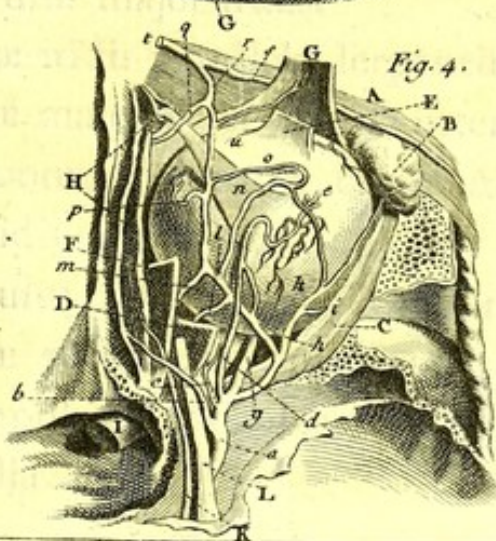
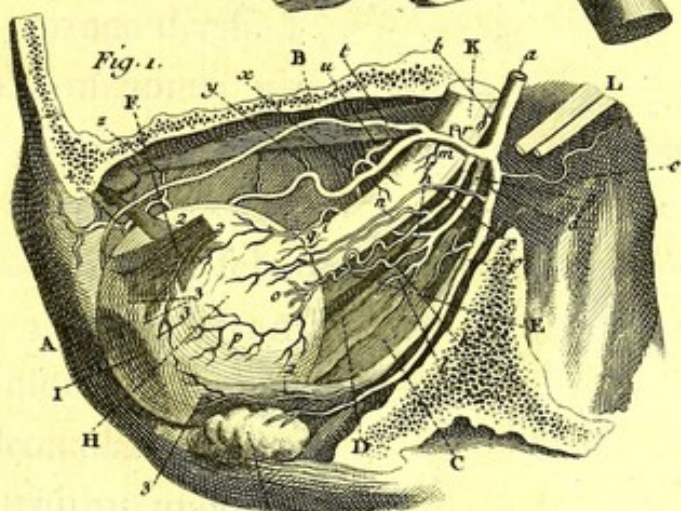
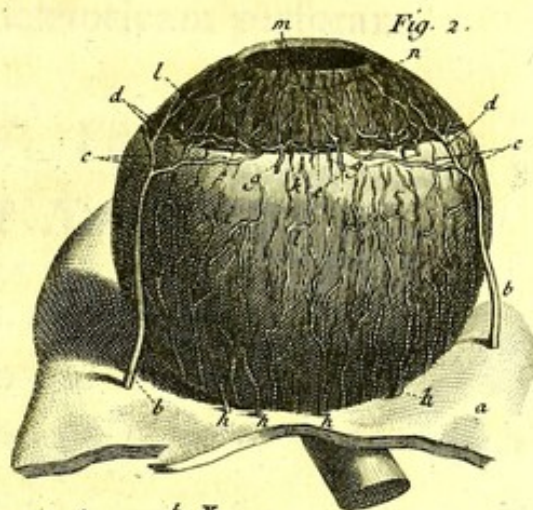
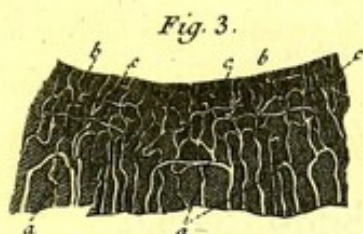
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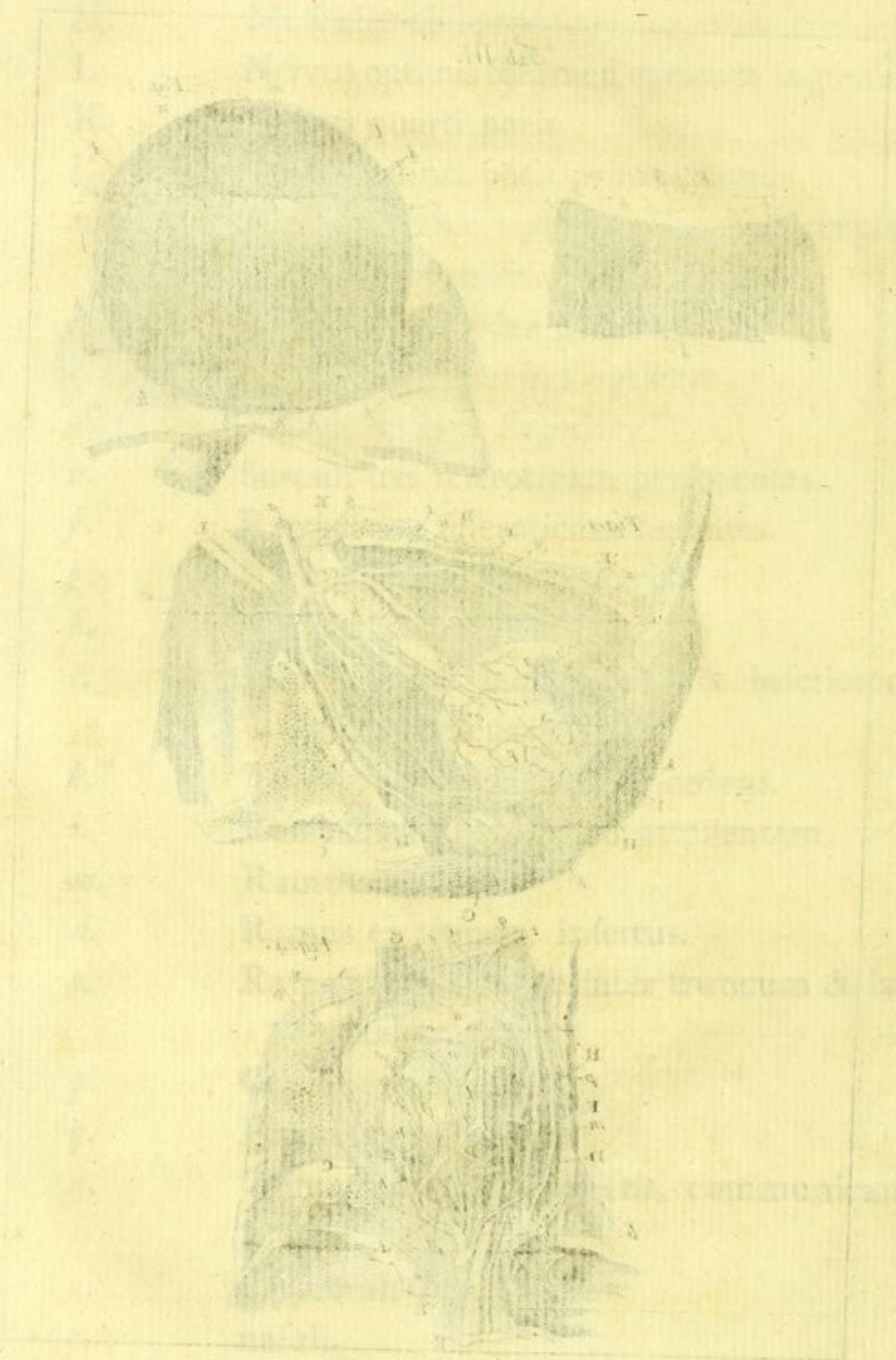
H.

Musculus

- H. Musculus obliquus superior cum trochlea.
 I. Nervus opticus foramen opticum ingressus.
 K. Nervus quarti paris.
 L. Nervui quinti paris primus ramus.
a. Truncus venæ ophthalmicæ ex receptaculo proveniens.
b. Venula ethmoidea posterior.
c. Ramulus ad nervum opticum.
d. Venula ciliaris superior.
e. Surculi tres scleroticam perforantes.
f. Ramuli per scleroticam ludentes.
g. Ramus inferior muscularis.
h. Ramus lacrymalis.
i. Ramus inter lacrymalem & inferiorem anastomaticus.
k. Truncus super bulbum incedens.
l. Ramulus ad muscolum attollentem.
m. Ramus interior.
n. Ramus ex trunco, insertus.
o. Ramo anastomotico inter truncum & lacrymalem.
p. Ciliaris interior.
q. Ethmoidea anterior.
r. Truncus ex orbita exiens, communicans cum
s. palpebrali superiori &
t. nasali.

u. Venula





u. Venula ciliaris anterior ex ramo muscu-
lari orta & scleroticam perforans.

TAB. IV. Fig. I.

Iridis Fabrica & Nervuli Ciliares.

- a.* Nervus opticus.
- b.* Sclerotica reflexa.
- c.* Nervuli ciliares alii majores antè in
ramos divisi.
- d.* Alii minores, vix ramosi.
- e. e.* Vascula duo venosa majora, obiter ex-
pressa.
- f.* Foramen in sclerotica, per quod vasculum
venosum transit.
- g.* Vasculum venosum minus.
- h.* Orbiculus ciliaris.
- i.* Annulus major iridis.
- k.* Fibræ iridis parallelæ serpentinæ.
- l.* Fibræ majores per arcus inter se junctæ,
quorum plurimæ circulum minorem
iridis constituunt.
- m.* Annulus iridis minor, interior.
- n.* Fibræ rectæ ex convexitate arcuum ad
pupillam tendentes.
- o.* Pupilla.

Fig. 2.

Venulæ Choroidis & Iridis.

- a.* Vagina nervi optici a dura matre, diffusa & reflexa.
- b.* Nervus opticus.
- c.* Venula centralis in nervi superficie decurrens, & prope oculum in substantiam nervi se demergens.
- d. d. d. d.* Scleroticæ quatuor anguli reflexi.
- e. e. e.* Anguli corneæ.
- f. f. f.* Circulus niger, qui corneam a sclerotica distinguit.
- g. g. g.* Foraminula scleroticæ prope corneam pro transitu vasculorum ciliarium anteriorum, arteriarum & venarum.
- h.* Foraminulum majus pro vase vorticoso.
- i. i.* Duo vasa vorticosa majora, ab altero latere in plurimos ramulos divisa.
- k.* Ramuli retrorsum euntes, quorum nonnulli occurrunt.
- l. l.* Venulis ciliaribus posterioribus, prope insertionem nervi optici scleroticam perforantibus.
- m.* Ramuli anteriores iridem adeuntes.

n. Vas

Fig. 1.

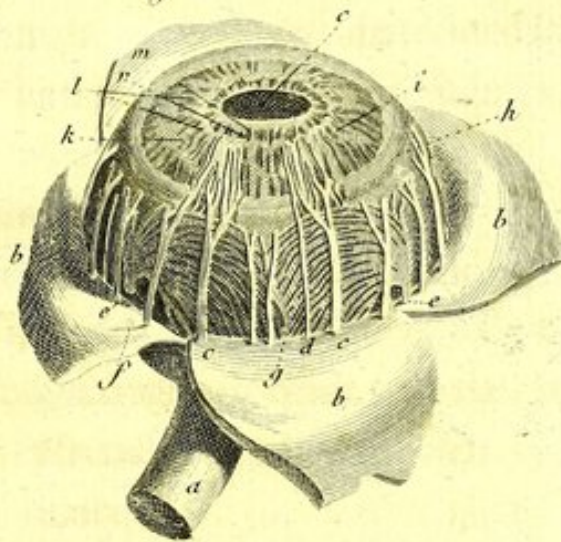
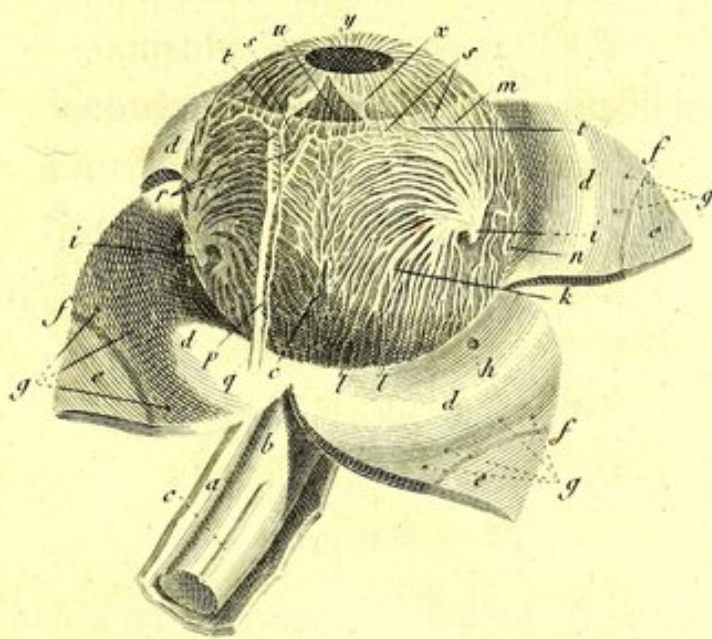
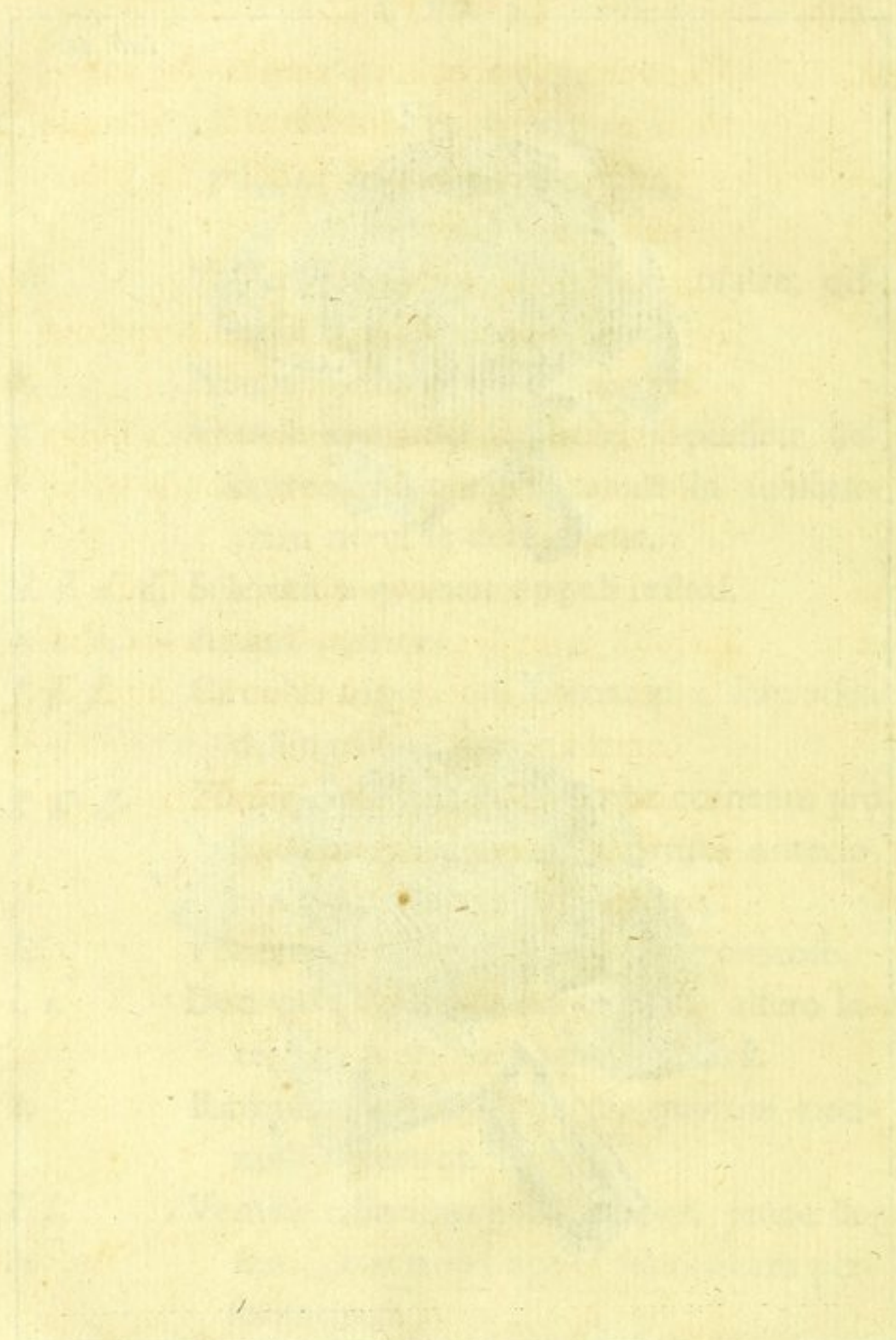


Fig. 2.





- n.* Vas vorticosum minus, minus elegans.
o. Venula accessoria intermedia, utrique
vasi vorticoso majori juncta, in pluri-
mos ramulos divisa.
p. Venula ciliaris longa.
q. Nervulus ciliaris venulæ longæ perpetuus
comes.
r. Duo ramuli, in quos venula ciliaris longa
sub cellulositate orbiculi ciliaris diva-
ricatur.
s. s. Venulæ tres anteriores ciliares abscissæ.
t. t. Ramuli laterales, quibus venulæ ex cho-
roide in iridem transeuntes inter se
communicant.
u. Venulæ iridis serpentinx parallelæ.
x. Lamella anterior iridis reflexa.
y. Pupilla.

T A B. V.

Musculi Bulbi Oculi.

Fig. 1.

Musculi cum Levatore Pulpebræ superioris.

- a.* Bulbus oculi.
b. Nervus opticus in cavo musculofo.
c. Nervus

- c.* Nervus opticus extra orbitam abscissus.
- d.* Portio duræ matris, quæ a nervo optico
abscedit, ut in periostrium orbitæ abeat.
- e.* Levator palpebræ superioris ex angulo divisionis duræ matris ortus & inlatam
aponeurosin terminatus.
- f.* Musculus attollens, magna ex parte levatore palpebræ tectus.
- g.* Obliquus superior per trochleam inflexus.
- h.* Insertio obliqui inferioris.
- i.* Musculus deprimens.
- k.* Musculus abducens capite duplici ortus.
- l.* Caput superius minus.
- m.* Caput inferius.
- n.* Intervallum utrique capiti interpositum,
per quod nervi in fasciculum collecti
transmittuntur.
- o.* Primus ramus nervi quinti paris.
- p.* Hujus primi rami, ramus lacrymalis abscissus.
- q.* Ramus frontalis abscissus.
- r.* Ramus nasalis.
- s.* Rami nasalis furculus, qui radicem longiorem ganglii ophthalmici constituit.
- t.* Nervus tertii paris.
- u.* Nervus sexti paris.

Fig. 2.

Musculi Oculi sine levatore Palpebræ.

- a.* Bulbus oculi.
- b.* Nervus opticus intra orbitam.
- c.* Nervus opticus extra orbitam.
- d.* Portio duræ matris, quæ in periostrium abit.
- e.* Levator palpebræ prope originem abscis-
sus.
- f.* Musculus obliquus superior per trochleam
inflexus.
- g.* Musculus attollens.
- h.* Tendo ejus prope insertionem dilatatus.
- i.* Musculus adducens.
- k.* Uterque musculus modo dictus prope or-
tum inter se connexus, ut inde pateat,
levatorem palpebræ in origine ad vagi-
nam nervi optici non pertingere, sed
utrique musculo esse impositum.
- l.* Musculus deprimens.
- m.* Musculus abducens.
- n.* Caput superius cum attollente connexum.
- o.* Caput inferius.
- p.* Intervallum utrique capiti interpositum.

Fig. 3.

*Tendo communis, unde Musculi abducens, adducens
& deprimens originem ducunt.*

- a.* Nervus opticus prope ingressum abscissus.
- b.* Septum osseum diffractum, foramini optico, & fissuræ sphenoidæ initio rotundo interiectum.
- c.* Dura mater abscissa, ubi in periostrium orbitæ abit.
- d.* Musculus attollens, ex divisione duræ matris ortus, abscissus.
- e.* Levator palpebræ superioris abscissus.
- f.* Tendo communis unde tres musculi abducens, abducens & deprimens oriuntur.
- g. g. g.* Propagines tendineæ ex ligamento communi ortæ, ad musculos suos abeuntes.
- h.* Musculus abducens.
- i.* Musculus deprimens.
- k.* Musculus adducens.

Fig.

Tab. V.

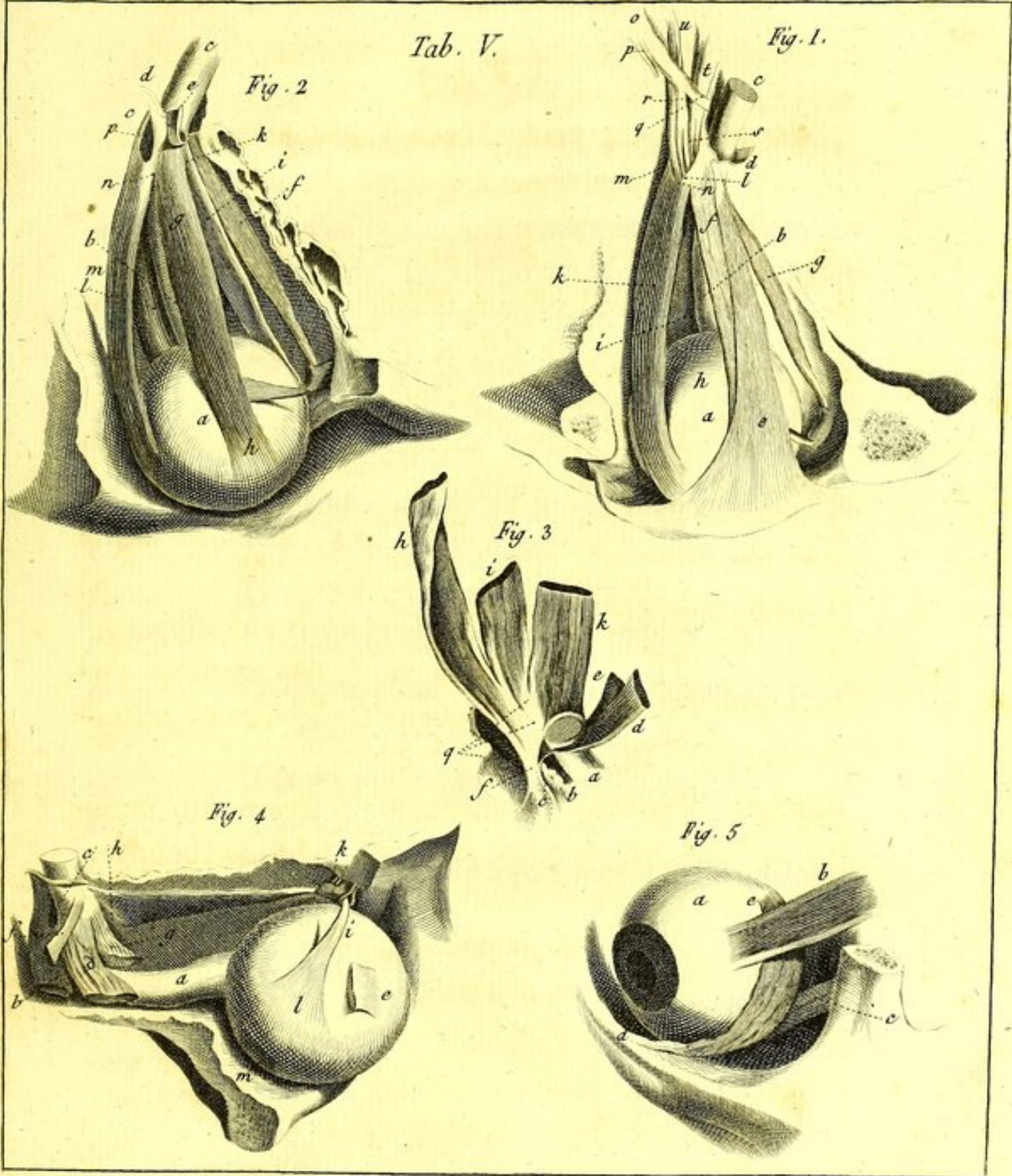


Fig. 4.

Musculus obliquus superior.

- a.* Nervus opticus situ motus & deorsum inflexus, ut origo obliqui superioris eo melius in conspectum veniat.
- b.* Musculus abducens abscissus.
- c.* Intervallum utrique capiti hujus musculi interjectum.
- d.* Musculus attollens prope ortum abscissus.
- e.* Insertio hujus musculi in bulbum oculi.
- f.* Levator palpebræ abscissus.
- g.* Musculus adducens abscissus.
- h.* Origo musculi obliqui superioris ex periorbitio parietis internæ orbitæ.
- i.* Tendo per trochleam inflexus.
- k.* Trochlea.
- l.* Tendo prope insertionem sensim dilatatus.
- m.* Insertio obliqui inferioris.

Fig. 5.

Musculus obliquus inferior.

- a.* Bulbus oculi.
- b.* Musculus abducens.
- c.* Musculus deprimens.
- d.* Obliquus inferior ex ora anteriori orbitæ
ortus.
- e.* Insertio hujus musculi in bulbum oculi.

T A B. VI.

Nervi Oculi.

Fig. 1.

Nervi Bulbi & Musculorum Oculi.

- A.* Bulbus oculi.
- B.* Glandula lacrymalis.
- C.* Musculus abducens.
- D.* Musculus attollens.
- E.* Levator palpebræ.
- F.* Musculus deprimens.
- G.* Musculus adducens.
- H.* Obliquus superior.

I. Trochlea.

- I. Trochlea.
- K. Pars musculi obliqui inferioris.
- L. Carotidis decursus in receptaculo.
- M. Carotis in cavitatem cranii penetrans.
- N. Arteria ophthalmica ex carotide orta.
- a. Nervus opticus foramen suum transiens.
- b. Nervus quinti paris in cavitate cranii.
- c. Nervi quinti paris ramus tertius.
- d. Ejusdem ramus secundus.
- e. Ramus primus.
- f. Primi rami *e.* ramus frontalis in duos ramos iterum divisus.
- g. Primi rami *e.* ramus nasalis.
- h. h. Rami *g.* ramuli ciliares super nervum incedentes.
- i. Rami *e.* ramus lacrymalis.
- k. Nervus quarti paris.
- l. Nervus sexti paris duplex in receptaculo.
- m. Radix duplex nervi intercostalis a sexto pari.
- n. Sexti paris insertio in musculum abducentem.
- o. Truncus nervi tertii paris.
- p. Tertii paris ramus superior, minor.
- q. Rami *p.* ramuli ad attollentem musculum.

- r.* Rami *p.* ramulus ad levatorem palpebræ.
- s.* Tertii paris ramus inferior major.
- t.* Rami *s.* ramus ad muscolum adducen-
tem.
- u.* Rami *s.* ramus ad muscolum deprimen-
tem.
- x.* Rami *s.* ramus ad obliquum inferiorem.
- y.* Ganglion ophthalmicum, nexu cum nervo
optico solutum, & ad exteriora revo-
lutum, ut divisio nervi paris tertii pa-
teat.
- z.* Radix brevior ganglii ophthalmici, a nervo
obliqui inferioris.
- 1.* Ganglii radix longior a ramo nasali quinti
paris.
- 2.* Nervorum ciliarium fasciculus superior,
quem quatuor hic nervuli faciunt.
- 3.* Fasciculus inferior.
- 4.* Fasciculi inferioris ramulus extrorsum a
reliquis secedens.
- 5.* Ramulus alterutri furculo *h. h.* ex nervo
nasali orto insertus, ad latus externum
nervi optici infra fasciculum superio-
rem adscendens.
- 6.* Fasciculi inferioris nervus ciliaris inferior
interior.

Fig.

Fig. 2.

Gonglion Optbalmicum cum Nervulis Ciliaribus.

- A. Musculus attollens paulo revolutus, ut facies inferior, cui nervus inferitur, pateat.
- B. Levator palpebræ.
- C. Portio carnea trochleatoris.
- D. Tendo trochleatoris cum trochlea.
- E. Portio musculi adducentis, cum ramo nervi tertii paris.
- F. Portio deprimentis cum ramo nerveo, quem insertum sibi habet.
- G. Musculus abducens ab interna facie visus.
- H. Insertio obliqui inferioris.
- I. Portio palpebræ superioris obiter expressa.
- a. Nervus opticus.
- b. Nervus quarti paris abscissus.
- c. Nervus sexti paris musculo suo insertus.
- d. Nervus tertii paris.
- e. Ramus superior.
- f. f. Rami e. furculi ad musculum attollentem.
- g. Rami e. ramus ad levatorem palpebræ.
- h. Nervi

- h.* Nervi tertii paris ramus inferior.
i. Ramus ad deprimentem.
k. Ramus ad muscolum adducentem, uterque obiter expressus.
l. Ramus ad muscolum obliquum inferiorem.
m. Nervi quinti paris ramus frontalis abscissus.
n. Ejusdem ramus nasalis.
o. o. Nervuli duo ciliares ex nasali orti.
p. Ganglion ophthalmicum lateri exteriori nervi optici annexum.
q. Radix longior a ramo nasali quinti paris.
r. Radix brevior a nervo *l.* musculi obliqui inferioris.
s. Fasciculus nervulorum ciliarum superior ex tribus nervulis compositus.
t. Fasciculus inferior major.
u. Surculus semper extrorsum flexus & longo ambitu ad bulbum accedens.
x. Fasciculi hujus ramus inferior interior, alterutri ramo ex nasali orto insertus.

TAB. VII. Fig. 1.

Membranula Coronæ Ciliaris, cujus ope lens Crystallina cum vitreo jungitur, & Canalis Petitianus flatu turgens.

- a.* Humor vitreus.
- b.* Lens cryftallina.
- c.* Annulus ferratus ex pigmento nigro conflatus, anteriori parti humoris vitrei & coronæ ciliari inſtratus.
- d. d.* Bullulæ, in quas membranula coronæ ciliaris, flatu immiſſo elevatur.
- e.* Vulnuſculum, per quod flatus immiſſus fuit.

Fig. 2. & 3.

Arteria lentis cryſtallinæ in facie ejus poſteriori conſpicua, & quidem Fig. 1. magnitudine naturali, & Fig. 2. microſcopio auſta.

Fig. 4, 5, & 6.

Tres figuræ lentis cryſtallinæ ex hominibus diverſæ ætatis, & quidem Fig. 4. ex infante recens nato, Fig. 5. ex infante aliquot annorum, Fig. 6. ex homine

homine adulto viginti circiter annorum, ut inde pateat, lentem semper esse eo convexiorem, quo propior homo est origini.

Fig. 7.

Lens crystallina quæ in aqua macerata in squamas triangulares debiscere incipit.

Fig. 8.

Glandulæ sebaceæ meibomianæ, a facie posteriori palpebrarum visæ.

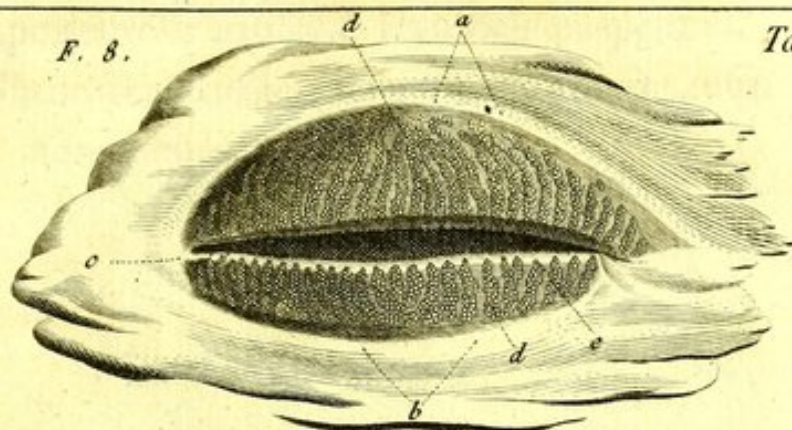
- a.* Tarsus palpebræ superioris.
- b.* Tarsus palpebræ inferioris.
- c.* Canthus internus.
- d. d.* Plexus glandulosi, qui vulgo glandulæ meibomianæ dicuntur.
- e. e.* Orificia illorum plexuum in margine extremo palpebrarum.

Fig. 9.

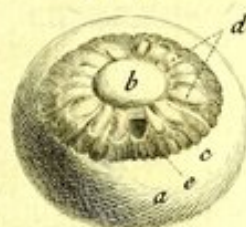
Insertio levatoris palpebræ superioris.

- a.* Canthus oculi internus.
- b.* Pulpebræ inferior.
- c.* Aponeurosis

F. 8.



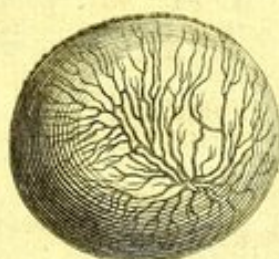
F. 1.



F. 4.



F. 3.



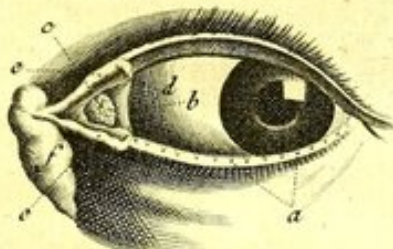
F. 2.

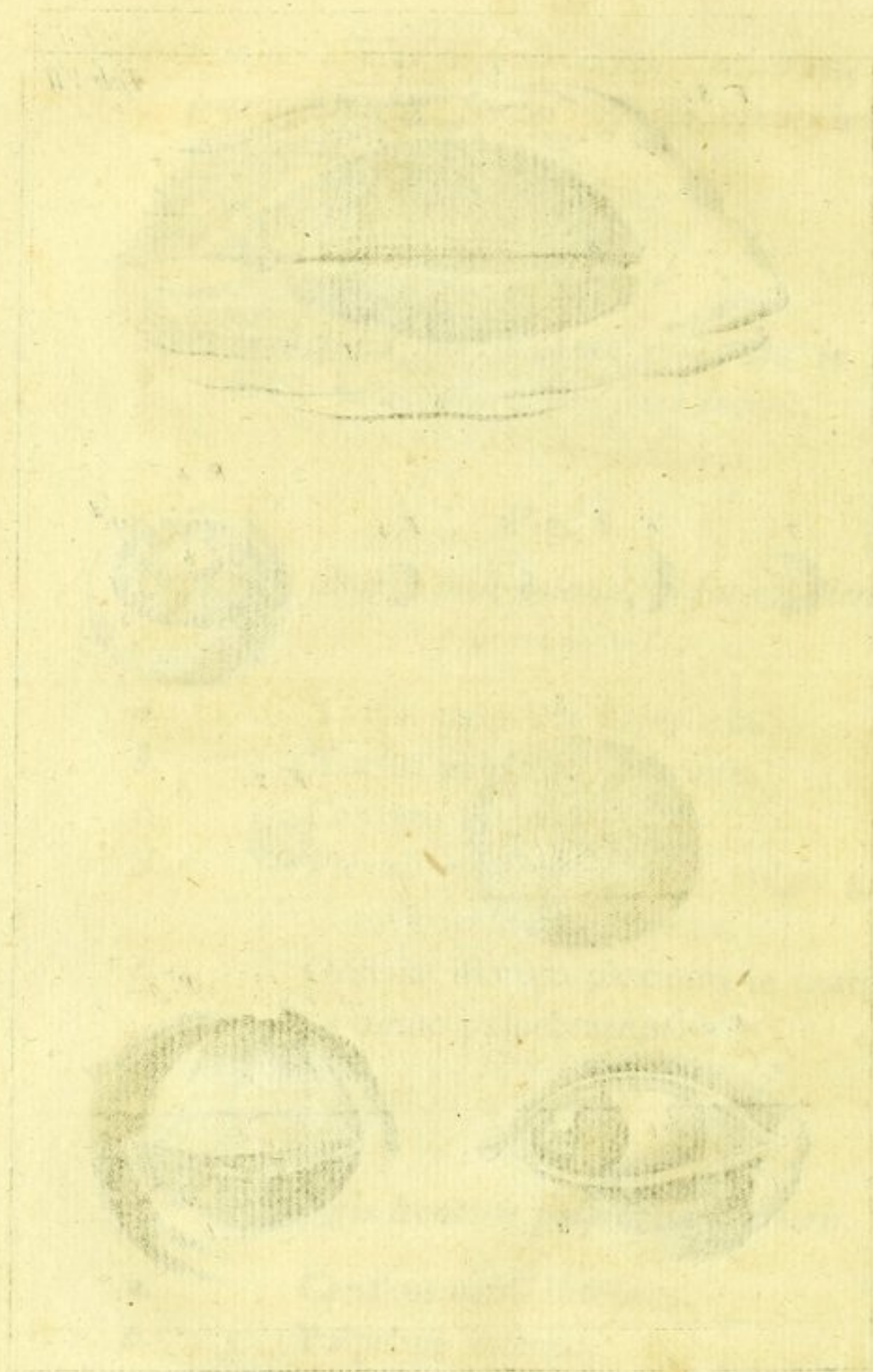


F. 9.



F. 10.





- c.* Aponeurosis musculi levatoris palpebræ.
d. Glandulæ meibomianæ per aponeurosin
conspicuæ.

Fig. 10.

Via Lacrymarum.

- a.* Orificia glandularum meibomianarum.
b. Membranula semilunaris ante caruncu-
lam lacrymalem.
c. Caruncula lacrymalis.
d. d. Puncta lacrymalia.
e. e. Duo canaliculi prope saccum nasalem in-
ter se conjuncti.
f. Saccus lacrymalis.

- c. Aponeurola nuchali levatoris palpebræ.
 d. Glandula meibomiana per aponeurolam
 conspicua.

Fig. 10.

N. Lacrymans.

- a. Orificia glandularum meibomianarum.
 b. Membrana lacrymans ante cornu-
 lam lacrymalem.
 c. Canaliculi lacrymales.
 d. e. Puncta lacrymalia.
 f. Duo canaliculi prope sacrum lacrymale in-
 ter se conjuncti.
 g. Sacculus lacrymalis.

INTRO-

K

INTRODUCTION

TO THE

K N O W L E D G E

OF THE

PROPERTIES OF LIGHT, AND THE THEORY OF
SIMPLE AND NATURAL VISION.

OUR sight is the most perfect and most delightful of all our senses. It fills the mind with the largest variety of ideas, converses with its objects at the greatest distance, and continues the longest in action without being tired or fatiated with its proper enjoyments. The sense of feeling can indeed give us a notion of extension, shape, and all other ideas that enter at the eye, except colors; but, at the same time, it is very much straitened and confined in its operations, to the number, bulk, and distance of its particular objects. Our sight seems designed to supply all these defects, and may be considered as a more delicate and diffusive kind of touch, that spreads itself over

an infinite multitude of bodies, comprehends the largest figures, and brings into our reach some of the most remote parts of the universe.

It is this sense which furnishes the imagination with its ideas; so that by the pleasures of the imagination or fancy (which I shall use promiscuously) I here mean such as arise from visible objects, either when we have them actually in our view, or when we call up their ideas into our minds by paintings, statues, descriptions, or any the like occasions. We cannot indeed have a single image in the fancy that did not make its first entrance through the sight; but we have the power of retaining, altering, and compounding those images, which we have once received, into all the varieties of picture and vision that are agreeable to the imagination: for by this faculty, a man in a dungeon is capable of entertaining himself with scenes and landscapes more beautiful than any that can be found in the whole compass of nature.

Every body knows that *things* would make but a poor appearance to the eye, if we saw them only in their proper figures and motions. And what reason can we assign for their exciting in us many of those ideas which are different from any thing that exists in the objects themselves, (for such are
light,

light, and colors of which I have been just speaking above) were it not to add supernumerary ornaments to the universe, and make it more agreeable to the imagination? We are every where entertained with pleasing shows and apparitions; we discover imaginary glories in the heavens, and on the earth; and we see some of this visionary beauty poured out upon the whole creation. But what a rough insightly sketch of nature should we be entertained with, did all her coloring disappear, and the several distinctions of light and shade vanish? In short, our souls are at present delightfully lost and bewildered in a pleasing delusion, and we walk about like the enchanted hero in a romance, who sees beautiful castles, woods, and meadows; and, at the same time, hears the warbling of birds, and the purling of streams: but, upon the finishing of some secret spell; the fantastic scene breaks up, and the disconsolate knight finds himself on a barren heath, or in a solitary desert. It is not improbable, that something like this may be the state of the soul after its first separation, in respect of the images it will receive from matter; though indeed the ideas of colors are so pleasing and beautiful in the imagination, that it is possible the soul will not be deprived of them, but perhaps find them exciting, by some other occasional cause, as they are at present

present by the different impressions of the subtle matter on the organ of sight. I have here supposed, that my reader is acquainted with that great discovery, which is at present universally acknowledged by all enquirers into natural philosophy, namely, that light and colors, as apprehended by the imagination, are only ideas in the mind, and not qualities, that have any existence in matter. As this is a subject that has been proved incontestably by many philosophers, and is indeed one of the finest speculations in that science, if you would see the notion explained at large, you may find it in the eighth chapter of the second book of Mr. Locke's Essay on the Human Understanding, it being not of my competency here.

Optics is a science which teaches the nature, properties, and laws of vision, arising from the rays of light, either reflected from the surfaces of bodies, or refracted in passing through them, and touching the *retina* on the bottom of the eye. This science comprehends also, in its most extensive acceptation, the whole doctrine of light and colors, and all the phænomena or appearances of visible objects. Optics, therefore, consists of three parts, *viz.* Catoptrics, dioptrics, and chromatics; but all these subjects being too much for my work, I shall only speak of the doctrines of light and natural vision.

OF THE
NATURE AND PROPERTIES
OF
L I G H T.

THE sun is the great illuminator of the day, a glorious planet, the spring of light and heat. This luminous globe sends forth flashes of lightening all over the world, and by its presence, constitutes the day. Its substance is a fiery matter, or fluid, which is continually expanded in the air, if not intercepted; because it lightens, and that its rays, gathered by concave mirrors, or convex glasses, burn, consume, and melt the most solid bodies, or even turn them into ashes or glass. It is from this luminous Being that light propagates itself every way, and that the rays which come from it, spread on all sides in right lines, and with a swiftness almost incredible; for if a dark room be suddenly opened, this very luminous matter or fluid

is

is immediately and uniformly propagated into it, according to the laws of reflection and refraction; and if you intercept the communication through which it went in, it vanishes as fast as it came in. Light spends about seven or eight minutes of an hour in passing from the sun to the earth; that is to say, in running over a space of 23,000,000 more leagues, swiftness 10,000,000 times greater than that of a bullet which goes out of a gun.

The attraction of one ray of light, considering its quantity of matter is to the gravity that has a projectile, considering also its quantity of matter, in compounded *ratio* of the swiftness of the ray, to that of the projectile, and of the bending of the line that the ray is drawing in the refraction, to the crookedness of the line that the projectile describes also on its side; provided, however, that the leaning of the ray on the refracting surface, be the same as that of the direction of the projectile upon the horizon; from this proposition it follows, that the attraction of the rays of light is more than 1,000,000,000,000 times greater than the gravity of the bodies upon the surface of the earth, considering the quantity of matter of the ray and of the terrestrial bodies, and in supposing that the light spends from the sun to the earth seven minutes of an

an hour. The velocity of light cannot be retarded, but only diminished to a degree of proportional transparency of the body which intercepts it; unless it be admitted in a dark room through a hole to which a denser body than the air is objected.

The rays of light are small corpuscles, which move with a great deal of swiftness from the luminous body. What ought to make us distinguish light into two species, is, that it is an heterogeneous mixture of rays differently refrangibles. That, whose rays are equally refrangibles, is called homogeneous, similar, or uniform light; and that, whose rays are inequally refrangibles, is called heterogeneous's. The light of the sun consists in rays, which differ from each other by indefinite degrees of refrangibility: the rays which differ in refrangibility, will differ also proportionally in the colors they are to represent when they will have been separated from each other: there are as many simple and homogeneous colors, as degrees of refrangibility. The rays of light are a compound of dissimilar or heterogeneous parts, some being very likely greater than the others: consequently the smaller those parts are, the more they are refrangibles; that is to say, the easier they divert from their rectiline ways; moreover, the parts which differ in refran-

L

gibility,

gibility, and of course in volume differ at the same time in color; from these principles, the whole theory of colors may easily be deduced. The expansion or space of the propagation of the parts of light, is not to be conceived. Dr. Hook shows, that it has no bounds but with the universe; and he proves it by the immense distance of some fixed stars, whose light is however sensible to our eyes by the help of a telescope. It is not only the great bodies of the sun and stars that are able to send forth their light to the remotest points of the immense spaces of the universe; the same may be with the least spark of a luminous body, even with the smallest globule the flint of a gun will produce out of the steel. A great many various examples testify the artificial production of light by the attrition of bodies which are not naturally luminous; as amber rubbed upon a woollen coat, glass upon a woollen stuff, glass upon glass, oyster-shells upon a woollen stuff, and woollen stuff upon another's, the whole in *vacuum*.

All fixed bodies, when they have been heated above a certain degree, become luminous; a quality they appear indebted to the motion of vibration of their parts. In short, all bodies which abound in terrestrial and sulfureous parts, produce
some

some light, if they are sufficiently agitated in what manner soever. Thus the sea becomes luminous in a tempest; the quick silver, when it is shaken in vacuum; cats and horses, when they are rubbed in obscurity; wood, fish, and flesh, when rotten. The different species of bodies produce different species of light, which differ either in color, strength, &c. and the same attrition has various effects, according to the different preparations of bodies that bear it, or the different manner of rubbing them; and that the bodies which have produced a certain light in particular, may be incapable by the friction to produce any more of the same specie. Mercury, amalgamated with pewter, and rubbed upon glass, produces in the air a great light. Gold also produces it, and to a greater degree. Finally, of all these species of light produced artificially, the most perfect is that produced by the attrition of diamond, which is as dazzling as that of a red coal which is forcibly blown upon.

The fundamental principle of the whole optic science, is, that light propagates itself according to a right line, in a manner that is less unknown to us; and the right lines, according as it propagates itself, are called rays. The leading principle

of catoptric is, that the rays of light are reflected by an equal angle to that of incidence. The rays of light which go from one *medium* in another, are broke in such a manner, that the sine of incidence is to the sine of refraction in constant *ratio*: this last is the principle of dioptric. With these very simple propositions, the theory of light becomes merely a geometrical science; and all its properties are demonstrated, without knowing positively in what it consists, nor how its propagation is effected.

Light is so subtile, that its particles are not susceptible of gravitation; because, when once expanded into the air, it cannot be dispersed, but only intercepted. The artificial light may be looked upon as an emblem of the primary's. The impression of the rays of light on the *retina* continue as long as they are admitted upon it, and immediately ceases, as soon as they are off.

OF
SIMPLE AND NATURAL
VISION.

VISION is as easy to conceive, as it has till now seemed difficult. If you will take upon yourself to observe attentively the history and present state of the discoveries relating to vision, you will see, that a great many false applications of the experiments made upon this head, have much contributed to put off the real knowledge of it; and then you will be no longer at a loss how to find out the causes, and even wonder why they have not been removed sooner. How came it to pass, that all the rays cross each other, before they arrive upon the *cornea*, or any other convex transparent bodies from the points of their emission! Is it because there is an inversion of pictures upon the *retina*, or that the representation of objects on a sheet of white paper, by means of a lens placed
at

at a hole in the window-flutter of a dark room, is perfectly fimilar to our eyes, according to phyficians, opticians, and philofophers? How came it they could grant, that objects are feen perfectly or imperfectly, when pictures are painted perfect or imperfect upon the retina! Is it becaufe the refractions of the rays of light through the tranfparent capfules and humors of the eye, unite and bring together the rays, which come into the eye from the feveral points of the object in fo many correfponding ones, and paint the image of the object upon the *tunica retina* that lines the bottom of the globe; which image being propagated by motion along the fibres of the optic nerve up to the brain, is the caufe of vifion? What a ftrange imagination, to fet forth that our fenfations are produced only by the concourfe of the animal fpirits in the nervous fibrils, and various contacts of objects that ftrike our fenfes! Is it on the probability that the animal fpirits are nothing elfe but an electrical fluid, which is the efficient caufe of our fenfations?—Every fenfible man who applies himfelf to fo delicate a branch as that of the treatment of the diforders of the Eyes, who has ftudied all the authors that have written upon this fubject, who knows perfectly well the fyftems, theory, and
 practice

practice of those that have acquired a great name and deserve the confidence of the public ; who has in view the perfection of this branch of physic and chirurgery, when he thinks it susceptible of it, cannot help seeing with astonishment so little progress in so many centuries. As for my own part, I will take upon me to advance, and prove, that all the systems, theory, and practice, though in many respects built and invented by physicians and philosophers of the most distinguished geniuses, are very far from the real knowledge of the anatomy and physiology of the human eye, and that they have lanced themselves in conjectures, and drawn consequences from them, as absurd, as they could be of very little use to the object of simple and natural vision, and promoting proper methods to cure its defects.

The works published by the modern writers are in a manner so opposite to those of the antients, that one needs not go far to find out the cause. The latter began by tracing plainly and exactly the discoveries ; their followers copied them with the improvements ; but if, as it happens now-a-days, they continue to contradict each other in order of acquiring a reputation, what shall be the consequence ? A stop to the progress of this delicate art.

This

This part of my treatise, though an abstract or compendium, may be considered as elements particularly depending upon this branch of medicine already too long in the dark, as it was dispersed in a great many books of different subjects. Besides, one might look upon it as new elements in the optical science, as the whole is founded upon the first principles adequate to it.

In so short a description of vision as this, my intention is not to display all the systems that have been invented, nor give the analysis of every one of those that have been published in the several treatises of optic, dioptric, catoptric, &c. to establish mine upon the ruin of them; because I should be obliged to waste away more paper and time than they are worth for my present work, as I reject them all. Such analysis and enquiry would be, I imagine, not only amusing, but useful, as it would be an ample instruction in this science; at least it would be more so than any rhapsody of general reflections, huddled together with little order, or design; for these leave no systematical impressions on the mind; nothing but a confusion of ideas, often bright and glittering, seldom instructive. But a work of this kind would be too voluminous, and too aspiring, for this little
essay

essay or *compendium*, and the humble author of it. I will therefore keep to my point, and content myself with making some of those observations alone, which seem proper to illustrate and prove what I have advanced, that natural and simple vision is not yet known, or at least explained as it ought to be, and that no author has given any physical reasons concerning it. In order, therefore, that I may give some more satisfying account how this noble sense is produced, I think it is absolutely necessary to premise the following principles.

The rays emitted from objects which surround us go to the *tunica retina* on all sides, and make an impression against our will, provided our eyes be opened; but of a quantity of rays which are emitted from a quantity of objects, there is but one of these objects that takes up our reflection. The rays emitted from an object, pass into the very bottom of the globe of the eye, if they are not intercepted in their direct way without the globe; because the capsules and humors it comprehends, are transparent.

Suppose, (Fig. 4. Tab. VIII.) an object, marked by a point indicated L, from which a single ray is emitted and sent forth into your eye, when you stand motionless; the ray shall pass through the

M
centre

centre of the *cornea* at the point E, the pupil I, through the cryftalline D, and croffing the vitreous humor G, it fhall flop on the *retina* R, and be abforbed there by the *meconium* that lines the *choroides*. As foon as the ray is arrived upon the immediate organ of fight, a fenfible touch, which is propagated to the brain, is given upon it; from thence SENSATION. This operation performed, you reflect about the object from whence the ray is emitted, whether upon its color, if you have a primary knowledge of colors, or about its roundnefs and other forms by the fame reason; then you form an idea of it in yourfelf; from thence CONCEPTION. If this ray was not abforbed upon the *retina* to the point R, it would continue its way to the furface of the *choroides* or *fclerotica*, if it was no more abforbed on the *choroides* than on the *retina*, without producing a complete fenfation: In this laft cafe, your organ is deprived of that agreeable fatisfaction which we call feeing, though * day from darknefs might be diftinguifhed.

* When I fay, *though day from darknefs might be diftinguifhed*, I mean to be underftood only with regard to a fingle point; for a critic could argue here, if one diftinguifhes the day, why does not he perceive the *point*, though in a dark manner? But this argument being not admiſſible by the fuppofition, I might be allowed to anfwer it by another hypotheſes, which would be without end; therefore I leave it entirely to the apprehenſion of the reader.

I will,

I will, however, make an observation here, which is, that there are some animals whose choroides are void of *meconium*, and who enjoy, for all that, the faculty of seeing. But such a fact cannot be any objection of weight, that, by its absence, a man whose organ would be deprived of it, could be bereft of sight; because it matters very little if the rays be absorbed by *meconium*, or by any other dispositions or constitutions of the parts which make up the eye of these animals *. What is most certain, according to many observations, is, that there are in general no man who can see in such a state; that is to say, without *meconium* on the choroides.

The single sensation produced on the immediate organ of sight by some rays emitted from an object, is not sufficient, even with the help of reflection, to make it conceivable in all its qualities and modifications, if you are totally ignorant of the

* The absorption of the rays of light in the ox's eye, is performed by a tincture of mixt green and blue; for which reason, I think those animals or others as have such eyes, cannot see the objects as distinctly as we do. Besides, the *cornea* being thicker, and the humors denser, the refraction is also in proportion to it; and the choroides being also different, must of course produce several varieties. My intention being confined to the natural vision of man, I shall not pretend to enlarge upon the subject, though it might be very curious and entertaining to many of my readers; but when I consider about many more interesting subjects which fall to my share, I presume it would be rude to detain them any longer about it.

various ideas it may present. A cataracted born-blind man who has undergone the operation of extracting, is an irrefragable proof of this assertion.

The basis of this system is, that the nervous *genus* is the allowed principle of our sensations; that our conception is effected by two operations, SENSATION and REFLECTION; that we feel without reflecting; but that this last operation cannot exist without the first, is a fact disputed by no body. Thus when we have reflected on any object whatever, a sensation must have preceded; consequently sensation and reflection are dependent upon each other to produce simple perception. A fool is susceptible of feeling when he is struck, but not of reflecting about the object that strikes him, and what may be the reason; because if he did reflect, he would cease being a fool the very moment of the reflection, which is a knowledge the mind takes of its proper operations, and their manner of operating. In our first born days, we have the faculty of feeling to a certain degree, without having that of reflecting; otherwise it would necessarily follow, that we have innate ideas, and that exterior objects do not produce our simple ones, what would be as ridiculous as absurd.

The

The whole extent of the *retina* is susceptible of receiving the impressions of the rays of light; but the more there are taken in, the more the sensation is felt. When an object is considerable in its extent, and near the eye, all the rays which are emitted from it in right and oblique planes, cannot have their passage in the bottom of the eye, without some of them be intercepted; therefore we cannot perceive and conceive the whole object at the same time, and such as it is, without surveying successively all the points * by the help of motions of the globe or head; because the rays that contributed to the reflection about that part of the object perceived, are independent of all those that cross each other by numberless inclinations, before they come upon the *cornea*; that is to say, the rays which are emitted from the superior extremity of the object, supposing it be placed vertically and of a long figure, do not come (after their insertion in the globe) to the inferior part of the circumference of pupil; and those emitted from its inferior extremity do not pass to the superior part of the circumference of the pupil, to arrive from thence on the imme-

* When I say all the points, I mean such a quantity of them as are in proportion to the pupil's diameter, with regard to the distance from the object to the eye, that produce a perfect vision of such a part of the object.

diate organ of sight, as I shall demonstrate it hereafter. Were it not thus, the person could perceive and conceive the object entirely and at the same time, without any motion of the globe of the eye; or of the head, or of both together; what cannot exist after the following experiment.

Describe upon a smooth white wall, exposed to a very clear light, a black transversal *line* of one inch in breadth, and six feet in length; shut one eye with the tip of your finger, and fix, at the same time, (if you can) the extremities of the black line with the other eye only at one foot distance; then you shall perceive, that the globe of the eye shut, moves under your finger, to perform the same motions of the open eye with which you endeavour, but in vain, to fix the black line entirely. Go back at six feet distance, one eye always open, and the other shut, you will observe, that the globes are not subject to so extensive motions as they were at one foot distance. Go back till you see the black line without any motions of the globes and head; then you will easily conceive, that the remoteness of the object and its diameter, are visibly become proportioned to that of the pupil; therefore all the rays emitted from this black line have their direct passage
into

into the bottom of the globe of the eye*: consequently all the rays, when near, being not able to arrive in directly, have no power on the reflection, since the eye is obliged to move for surveying every point of the object, to make you conceive a perfect idea of the whole by succession of time.

What may be the reason why the black transversal line is perceived at once, but without distinction, and with a sort of confusion in the mind, when at the first place, or at a middle distance? To this I answer, that the rays emitted from the transversal line, coming into the eye by different ways, and without intercepting each other from their several points of emission to the eye, (according to the position of the globe and objects) cannot all, though admitted into the bottom of the globe, perform a complete sensation, as there can be but

* Were I to enquire here minutely into the physical laws of the power of the rays, on the immediate organ of sight, emitted from objects at a given distance, I might no doubt determine by that method at what distance such an object, of such a quality, and of such an extent, might distinctly be perceived: but when I reflect upon the variety of the sensibility of the *retina* in mens eyes, together with the respective faculty of the contraction and dilatation in the pupils, my pen stops short with my abilities. If a man, able of such a nice task, were to undertake it, I am confident that optics would make a grand step of improvement by it, as opticians could easily determine what glasses might be properly made use of, either for magnifying or drawing near all kinds of objects, with respect to different eyes.

those

those which are in proportion of the diameter of the pupil, and come by or in direct planes on the immediate organ of sight; for though the oblique rays which are more extant than the diameter of the pupil to that distance, enter into the globe every way, and produce a weak sensation, nevertheless, they cannot take up reflection * at the same time to complete vision, like those which are proportioned to the diameter of the pupil, and admitted in direct planes into the globe of the eye. I am going to explain the whole in the following paragraphs.

Demonstration. Suppose (Tab. VIII. fig. 3.) a long perpendicular object *Z X*, from which are emitted seven horizontal rays close together and equal; suppose the pupil equal to five of them in diameter, and the globe situated as in the figure, being a fixed distance; the rays 1 *F*, 7 *G*, cannot go parallelly into the bottom of the eye, because they are intercepted by the iris to the points *F G*; but the rays 2 *A*, 3 *B*, 4 *C*, 5 *D*, 6 *E*, have the faculty of going in without being intercepted, if

* The sensation being performed on several parts of the *retina*, by several objects at the same time, the reflection being successive, cannot be but confuse at first; because the reflection must preferably be taken up by the strongest sensation, (which is undoubtedly produced by the direct rays that enter into the eye) than by that effected by a multitude of weak rays which come in the eye obliquely, and consequently cannot equal it.

the eye be found. The central ray is transmitted from its emission, into the bottom of the globe, without undergoing the least refraction. As for the other four, they describe a parallel one, as they go from the central convexity of the crystalline: if its convexity be less or more on one side of the crystalline than on the other, the rays are refracted in proportion, *et vice versa*.

After so clear an explanation, it is obvious to every body, that, to see the whole object without any motion of the globe, or object itself, it must be removed at a farther distance, in order its diameter be equal to that of the pupil; then there will be no difficulty of conceiving the transmission of the seven rays into the bottom of the globe, according to the rules of confusion in the points from which the rays are emitted, and which I shall demonstrate hereafter. If the globe, at the same distance, was to move perpendicularly downwards of one ray only, the 1 F shall be introduced in the bottom of the globe, and the 6 E, 7 G, shall be intercepted by the iris; of course the ray 3 B shall become central, supposing always that no other rays interfere in our demonstration. For besides the seven horizontal rays emitted from the perpendicular line Z X, that come straight and as in a plane

N to

to the globe, there are as many seven others which are emitted from the perpendicular line, as it is possible the object and eye itself may have positions, some of them being more or less inclined, according to the various positions of the eye, and those of the object.

Suppose the same globe in the same position as above, but an object forming a perpendicular line at the same distance from the eye; what can be the number of all possible rays, and their different effects, dependently or independently of each other, from their emission into the eye, as light propagates itself every way? I hope the following demonstration shall make it intelligible, even to the meanest capacities. Let us suppose an object A B (Tab. VIII. fig. 2.) forming a perpendicular line divided in twenty distances, which make one-and-twenty points, supposed closed to each other so near, as to admit of no distance ever so small, and that from these 21 points, 21 rays be emitted horizontally, as described by the figure: besides, let us suppose that the five central rays are equal in diameter to the pupil, and enter the globe in undergoing a proper refraction; it is very clear, that the horizontal rays 1, 2, 3, 4, 5, 6, 7, 8, are intercepted by the globe, as well as the rays 14, 15, 16, 17,

Tab. VIII.

Fig. 1.

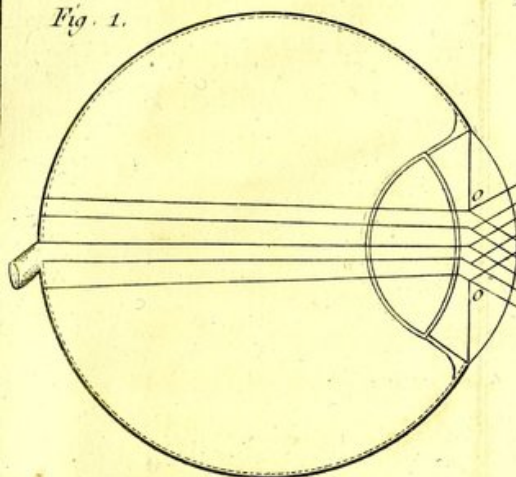


Fig. 2.

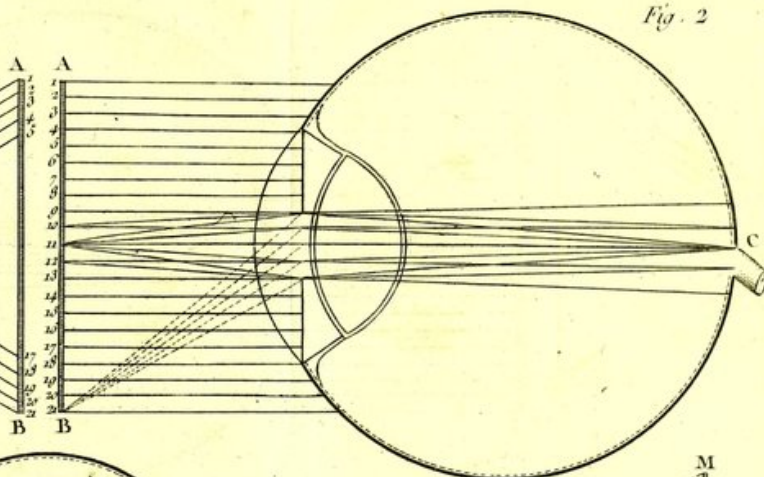


Fig. 3.

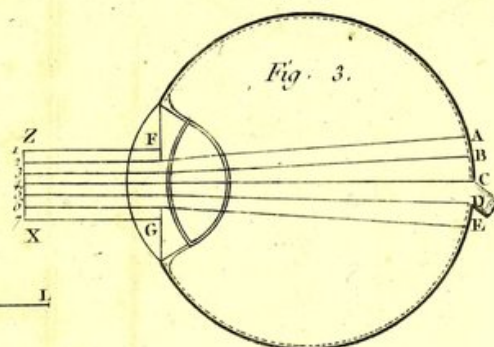


Fig. 4.

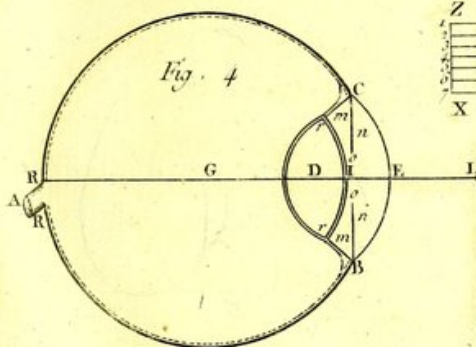


Fig. 5.

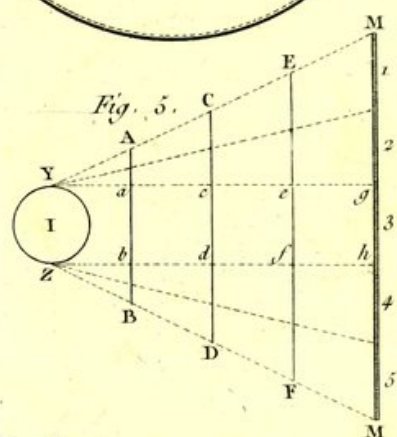


Fig. 7.

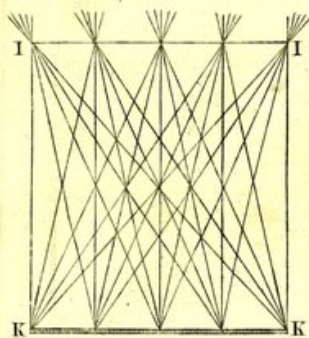


Fig. 8.

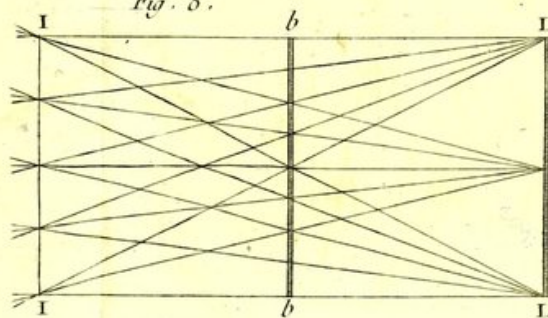
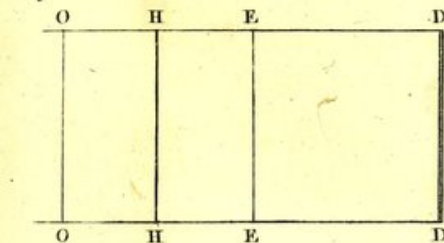
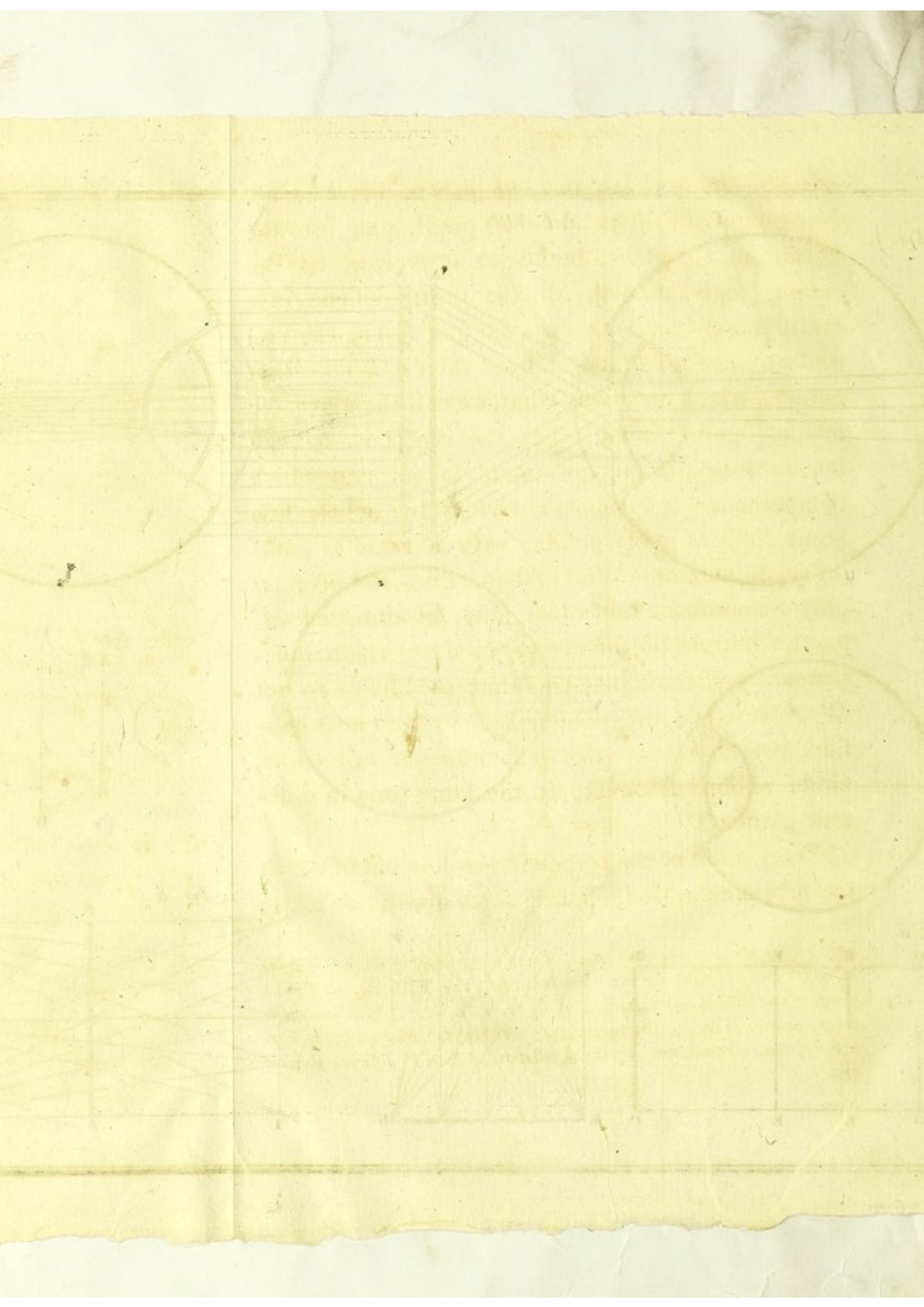


Fig. 6.





17, 18, 19, 20, 21; but the 9, 10, 11, 12, 13, being equal in diameter to the pupil, pass into the bottom of the globe, make an impression on the *retina* (together with all the other oblique rays emitted only from the points 9, 10, 11, 12, 13,) and produce a sensation: from thence a reflection ensues, which occasions what we call the agreeable satisfaction of *seeing*, what the object is, or may be, according to our notions of such a part which comprehends five points: but as the whole line sends forth as many possible rays as there is possibility of horizontal and oblique ones, let us now only demonstrate those that may be admitted into the bottom of the eye to produce vision independently of those that are intercepted by or go out of the reach of the globe; then we shall next consider how many rays this perpendicular line emits, either oblique or direct, at the same time in different planes *.

Every point of the perpendicular line out of which the rays are emitted, sending forth around as many

* I mean here, by the word *plane*, a bulk of rays taking all the same direction. For example, the 21 horizontal rays (Tab. VIII. fig. 2.) form a plane. The oblique rays 1, 2, 3, 4, 5, (Tab. VIII. fig. 1.) form an oblique plane, as well as the 17, 18, 19, 20, 21; which planes united together form a body, that I denominate by the appellation of *bulk of different planes of rays*.

as there are points in one circle, it is very easy to conceive, that five being the diameter of the pupil, none but five rays of all those emitted from each point, shall be admitted into the bottom of the globe: therefore, if we multiply five by five, the number of the pupil's diameter, we must conclude, that five-and-twenty rays of the perpendicular line are the only ones that are necessary to perform a complete vision of such a part of the object that comprehends five points, without any motion of the globe of the eye.

This being understood, it remains now to demonstrate, how many rays emitted from the same line, though admitted into the bottom of the globe, have no effect upon the retina, as every point of the line sends several rays every way. If the one-and-twenty points send one-and-twenty circles of rays, and that the pupil's diameter be equal to five rays, let us multiply one-and-twenty by five, the number shall be one hundred and five; out of which take away five-and-twenty that perform the natural vision, eighty rays from the line shall be the number that have nothing to do in the execution of the sensation, to operate it.

It follows, from what I have been demonstrating, that the planes of the 25 rays which operate
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the sensation, are transmitted into the globe from their emission, as they are described (Tab. VIII. fig. 7.) supposing no distance between all the rays, though I have been obliged to describe it so, to make it more sensible to the eye.

Moreover, as a circle of rays is emitted from every point (see the five rays emitted from the point 21 (Tab. VIII. fig. 2.) in a circle, independently of the horizontal one which cannot be admitted into the bottom of the globe) we must conceive a confusion of them; that is to say, that the rays run over each other through the same points of the pupil, and are transmitted and admitted in the bottom of the globe as in a direct plane or mass, except those that have nothing to do in performing a complete vision, as they go out or are intercepted by the globe.

After such an explanation of the passage and interception of the rays, there is another object to consider, and which is of no small delicacy to account for: Every body's experience is a proof that the rays of light have such a penetrating power, that they pierce through the eye-lids, and so are admitted into the bottom of the globe; but the sensation they produce upon the *retina* is very different from those which are taken in without any objection;

objection; therefore the sensation of the rays of light is always in proportion to the thickness of the atmosphere and objects that intercept them, before they arrive upon the immediate organ of sight.

To be convinced of the penetrating power of the rays through the eye-lids, shut your eyes, and expose them to a very clear light; then pass and re-pass any object very thick and impenetrable to the light, you shall distinguish the day or darkness, according to it will be off or on; consequently the rays which go through the eye-lids in the eye when shut, shall more easily pass through the iris, which is not so thick, and still more through the pupil, and all the transparent humors of the eye. There is, besides, another thing to infer from this, which is, that the rays of light may be hurtful to the immediate organ of sight, when too strong or powerful, if the humors through which they go, are also too transparent. So that we must look upon the equilibrium of our eyes as a very delicate and well-regulated one, that shews plainly the work of the all-wise Creator: therefore every body has a right to suppose, that when a physician knows perfectly well the mechanism and the natural state of this beautiful organ, he may the easier remedy its deformities and disorders.

But

But I must return to the further explanation of the emission of the rays of light, how and in what manner objects emit them, according as they are distant from our eyes. To comprehend it better, let us enquire into the cause why the distance of the object makes its diameter less according to our eyes. When you look at an object of a given extent to a determined and known distance, you must always understand, that so many rays are emitted from it, if there are so many points, and that these receive a sufficient degree of strength from the primary light, either directly or indirectly, in order that the rays emitted from them may be strong enough to operate a sensation upon the immediate organ of sight; for in a given position of the object, we ought to conceive a certain number of them, which shall diminish or augment in proportion of the different distances; that is to say, that the number of the points from whence the rays shall emit, and which we will suppose separated from each other, shall augment if you draw the object near the eye, and diminish if put back from its first place: because, being put off at a greater distance, it is clear, that the reflection of light shall be effected on several points, instead of one as before, in order that a ray being the con-

fused

fused emission of so many at such a nearer distance, be capable of producing sensation on the *retina*; for which reason, the object diminishes in appearance to our eyes as soon as it is put farther back, since two, three, or more points become but one at a less distance, from whence only one ray is emitted, able to produce a sufficient shake on the immediate organ of sight. From thence we must therefore conclude, that when an object is of a considerable extent and near our eyes, it is impossible we can see it entirely at the same time, without motions either of the globe of the eye or head, consequently that it can be admitted into the globe but a certain quantity of rays. We must also conclude, that the passage of the rays into the bottom of the globe, is always in proportion to the pupil's diameter and the object's distance, when a part of the object is perfectly seen.

Demonstration. Let us suppose (Tab. VIII. fig. 8.) an object *b. b.* representing a perpendicular line which comprehends only six points, from which six rays are emitted, the pupil *I I* being five in diameter; it is very clear, that the six rays but one shall be transmitted into the bottom of the globe, and the object shall be seen and conceived at the same time, without any motion of the eye or head,
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in five points only. Let us suppose the same object removed back one equal distance more from the eye, the six points of the object shall be confounded in three; then the pupil's diameter shall be too large of two points, instead of being narrower of one at the first distance. This diminution makes the object appear but one half of what it was; because the rays of light being less powerful when they reflect from a small point, must be multiplied in bigness, to correspond and be in proportion to the strength or sensibility of the immediate organ of sight.

The reason why we see objects of the same nature at given distances, when others are imperceptible to us, is very easily explained and conceived by this confusion of rays and diminution in their number. Let us suppose, that the pupil I (Tab. VIII. fig. 5.) be five lines in diameter, and the object M M twenty lines distant from the pupil; the third ray, whose diameter is equal to that of the pupil, being emitted from the middle of the object distant of four lines, shall be equally sensible to the immediate organ of sight, as five other objects, each of the same diameter and joined together, from which five rays shall be emitted at twenty lines distance from the pupil. To have a convincing

vincing proof of this fact, let us calculate the confusion of four inclined rays 1 Y, 2 Y, 4 Z, 5 Z; then we shall have an opportunity of remarking the exactness of our calculation of the several objects in AB, CD, EF, MM. If we compare the distance D*d* to that of M*h*, which describes the inclination and confusion of the rays, we shall see that the first is but one half of the second: If we compare the distance B*b* to that of F*f*, we shall see that the first is but the third of the last, because the objects are distant from the pupil one third less than the other; that is to say, that B*b* is to F*f* what D*d* is to M*h*; from whence we may conclude, that an object of the same nature is equally seen at five lines distance, if it comprehends five lines in diameter, and the pupil as many; as this same object would be seen at twenty lines distance, if it comprehended five-and-twenty lines in extent, since the confusion of the inclined rays is alwas in proportion to the distance and extent of the object from whence they are emitted.

But I shall observe here by the way, that two objects of the same extent, and at the same distances, but of a different nature, operate a great disproportion in the distances, as a light of one inch in diameter may be seen from one end of the horizon to the

the other, when any other object of the same diameter, and at the same distance, shall be even insensible to the immediate organ of sight at a hundred feet distance, supposing its quality not of a luminous one. There is also a very great difference when these objects are exposed to a stronger or weaker light; because the more an object receives of the particles of the primary light, by reflection or otherwise, the more it is able to emit of itself a greater quantity of strong rays, according to its extent, quality, distance, &c. &c.

Let us return to our demonstration. Suppose an object D D (Tab. VIII. fig. 6.) distant from the pupil of your eye O O of four given and known distances, but equal in diameter to the pupil, though at the furthest distance from it; what can be the number of points in your pupil's diameter, that shall become empty; that is to say, through which no rays, emitted from the object, shall go into the bottom of your eyes? If you suppose the object D D equal in diameter to your pupil O O at the furthest distance, containing eighty points, which send 80 rays into your eye; when you will place the object D D in E E, there shall be forty points in your pupil, through which no rays are transmitted; and when placed in H H, sixty; because the object in

this last place, though it contains eighty points from which eighty rays are emitted, is contracted in such a manner, that being nearer your eye, the points are multiplied, and produce, though smaller than they were before, a degree of light which is also multiplied in proportion, that shakes sufficiently the immediate organ of sight at such a distance, as to operate simple and natural vision.

We should not wonder why with both our eyes we can see perfectly only one object at the same time, though each eye is susceptible of receiving separately the impressions of the rays of light. If we examine two objects at once, one placed at our left hand and the other at our right, we shall conceive an impossibility of fixing them separately with each eye at the very same instant. But if, by a kind of violence with the tip of one finger, we break the parallel axis of one eye only, we are immediately sensible of the sensation received distinctly in each eye, without being able of forming a perfect idea of each object at once; because our eyes being accustomed to follow the same motions, that which is put out of its parallel axis is immediately hurt, and feels a greater sensation by it, than by the impressions of the rays emitted from the object itself; consequently the reflection must
be

be employed about the touch of the finger, and not the rays coming from the object. Besides, as we cannot reflect at the same time about two different sensations, though felt in the same instant, as I have explained above; it is, besides, necessary it should be so for the help of each eye, and to save us from a continual confusion; because, if we admit that squinting eyes, as it happens, see at once two different objects with each eye, we cannot, by the same reason, grant two reflections without any sort of interval whatever. You have a power of staring at a multitude of objects at the same time; but you cannot reflect about them, and conceive a perfect idea of them, all at once, or in the same instant. From all these principles, as well cleared as the subject will admit, every body must allow, that vision is not so difficult to comprehend as a great many philosophers, physicians, and opticians, have made it, by their long, needless, and tedious demonstrations, without accounting for the physical laws of this particular science.

Having candidly laid down the principles on which the theory, and phænomena of vision are to be thoroughly acquired, I shall now proceed, by prying into the causes that have given ground to the different systems, and demonstrate, at the same time,

time, what could be the reasons which led opticians in such great errors, as those they have fallen into. Nothing is so obnoxious to physic, and the human sciences in general, as to lay down for truths of fact mere systems grounded on calculations, and geometrical demonstrations, when facts, and experiments able to ruin them, are wrapt up, disguised, and very expensive. This is still worse, when such systems are transmitted to us with an air of the firmest assurance, by truly eloquent, and sublime men, whose superior talents have acquired the approbation and admiration of their cotemporaries; it is, then, with all due respect to these great men that we ought to oppose the stream, keep up the imperceptible right of Truth, and give an ample satisfaction concerning such facts, as the finest and most brilliant systems cannot maintain themselves. When we are once lanced out in a false system, the most gratuitous assertions cost nothing to defend it. What! Because the rays emitted from an object paint it, though small, on the retina, they have concluded that vision depended absolutely upon this picture? I will explain how this inversion is operated, and conclude, that the sense of seeing is quite independent from it.

Mr. Locke has given us a complete unravelling
of

of our ideas and perceptions, in his Treatise upon the Human Understanding: therefore, if the sense of vision must be compared and reasoned upon as that of touch, *in sensation*, it is clear, that all our greatest philosophers have not conceived and distinguished the effect from the cause. That any object is represented on the immediate organ of sight, or on any other surface, when its rays emitted from it pass through a convex glass placed at a hole in a window-shutter, is undeniable; but to conclude that it is seen and conceived from its being so represented, would be as absurd as to advance, that a dead eye should see just the same, since the picture is existing at the bottom of it, when its posterior tunics have been taken away. By what phænomena then is this picture operated?

But before to begin this explanation, I think it will not be amiss, to facilitate a full understanding of it, to lay down the following experiment, from which I shall be able to draw my consequences, and conclude, that the images, though represented downwards upon any surface, have nothing similar to the functions of the human eye, as to the operation of simple and natural vision. Make your room as dark as you can, perform a round hole of a quarter of an inch diameter in the shutter, opposite the top of
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some houses upon which the funnel of one or two chimnies are to be easily espied, present a white sheet of paper one foot and a half distant from the hole ; then you will have an opportunity of observing, that the top of the opposite houses are described inverted, and that the images of all the anterior objects are also represented, upon the sheet of paper, just of the same color as they really are : As an addition to the experiment, oppose a lens whose focus be six inches, at two inches inwards from the hole practised at the shutter, the sheet of white paper placed as it was before ; then you shall see the pictures of the exterior objects painted upon it a great deal more clear, than you was able without it ; and if you place another lens, whose focus be but three inches, at three inches distant from and with the first, you shall certainly see the pictures of the objects still clearer, than you did with one lens only. How is that operated, shall be the subject of the following paragraph.

All the objects (as I have already observed) which surround the hole, emit as many circles of rays as there are points contained on their surfaces, that are susceptibles of painting their several colors on the paper, which we will consider here as a point of absorption. If, in pursuing our inquiry, we look for the

the difference in the nature of the rays which are admitted to pass through the hole, and distinguish the number, either of direct or oblique, in order of acquiring which of them produce more painting; we shall undoubtedly find, that the number of oblique rays surpasses that of the direct ones; consequently, if of all these rays, the first surpasses in number the quantity of the last, it must necessarily follow, as the rays paint the images, that the pictures of the objects be inverted, as there are a greater number of these to operate painting. If, on the contrary, the direct rays were to surpass in number the oblique ones, the pictures of the said objects should certainly be represented on the paper as they naturally appear. Suppose now, as I am sure it does, that our organ receives the inverted picture of the object in its bottom; do you, or can you conceive, that the rays which produce this inverted picture, produce also a sensation of the object inverted? No, certainly; for were it so, we must necessarily conclude from thence, that one might see the object inverted—what does not exist in the least, unless it be in the imagination of those builders of absurd systems. If philosophers are fond of making hypotheses, their disciples are as zealous to defend them. The honor of a whole sect is thought

to be engaged, and every individual is piqued that another should shew that to be false, which he has all his life taken to be true: so that, notwithstanding all the graces of novelty, a new truth will have much to do to dislodge an old error. Instances of this sort are innumerable. Is it reasonable, when we cannot draw from observation and experiment such conclusions as may be safe foundations on which to proceed by a just method in the pursuit of truth, to assume certain principles, as if they were founded on the analytic method, which have been never proved, nor perhaps suggested by the phænomena, in hopes that they may be so afterwards? in a word, when the only clue we have fails us, which is most reasonable to stop short, or to push forwards, without any clue at all, into a labyrinth of nature? I make no scruple of deciding in a case so plain, that it would be a silly affectation of modesty to hesitate. When the phænomena do not point out to us any sufficient reason why and how a thing is as we discover it to be, nor the efficient cause of it, there is a sufficient reason for stopping short and confessing our ignorance; but none for seeking out of the phænomena, this reason, and this cause, which we cannot find in them. This is
learned

learned ignorance, of which the greatest philosophers have no reason to be ashamed.

But to return : The hole, practised at the window-shutter as described in the above paragraph, being neither susceptible of contraction nor dilatation, the rays emitted from the objects ought to be the same in number ; therefore an alteration in the pictures, supposing *things* keep their place, cannot exist, though light be successively strong or weak. Wherefore, is it possible for any man, who is perfectly acquainted with the anatomy and physiology of the human eye, to form a close comparison between it, and the *camera obscura*, without being taxed of a systematical genius, especially when a clear experience opposes naturally of itself ? In a *camera obscura*, the place of absorption is without any variation, with regard to the effect ; the *retina*, on the contrary, being situated on the choroides, which membrane is tinged with *meconium*, is the place of absorption in the human eye. What a difference ! If the objects are exposed to a strong light, their pictures are seen in proportion, on the place of absorption in the *camera obscura* ; but as the rays are constantly the same in number, so the images keep to their magnitude and appearance : on the contrary, when the objects emit such a pincil of

strong rays, the impression they operate on the immediate organ of sight is such, that the circular fibres of the iris take immediately a motion of extension, which produces a contraction in the pupil; then you easily conceive, that the same number of rays, emitted from the objects, are not admitted into the globe, what diminishes of course the sensation, without any alteration in the reflection. How nice is so admirable a mechanism! Is not such a fact, supported by experience, sufficient to ruin all the consequences of our present opticians? However, as this is a subject which was only conducive of instructing in the art of healing, and independent of my work, I will not take upon me to determine the question positively, but leave it entirely to the judgment of my candid reader.

Let us push our inquiry still further: That an image or picture of an object which sends rays on the place of absorption, is equally perceivable in the *camera obscura*, as it is into the bottom of the human eye, is undeniable: but to advance that this very image or picture of an object is the conveyance of the idea we form of it in our minds, is an absurdity that I can neither submit to, nor help proving to the contrary. When we compare the formation of the picture on the place of absorption
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in the *camera obscura*, with that on the immediate organ of sight, we understand plainly enough, that in this light they are equally the same: But when we examine the effects on both, we must perceive a vast difference, as one is capable of feeling, and the other totally deprived of it; consequently the sensation produced on the immediate organ of sight, comes from the shock of the rays upon it, as soon as they are absorbed by the *meconium*. This very shock then causes a vibration in the contiguous membranes, such as to act, as I said before, a contraction and dilatation in the pupil. Besides, another impossibility of occasioning a sensation might also happen, though the picture of the object be represented into the bottom of the globe, if the *retina*, or optic nerve itself, were hurt by any pressure, or afflicted by any disorder whatsoever. To conclude, and wind up this paragraph, I may certainly advance, that the shock produced by the absorption of the rays on the immediate organ of sight, performs sensation, and not the picture of the object on the *retina*, as has been advanced by philosophers, physicians, and opticians.

The variations and alterations of the *retina*, is liable to, in a human eye, have furnished, among physicians, as many absurd systems as those already mentioned

mentioned concerning the optic science. For my part, I will not trouble the reader about the different opinions adopted, but leave him his choice, when he has weighed the reasons by which they started them. If, besides, he were dupe enough of a species of writers, that are commonly denominated by the appellation of *oculists*, by reading their works, he would not only lose his time, but perceive that they have not written with all the accuracy he had a right to expect from men who have entirely devoted their lives about this single branch. He would very often meet with some strange and futile nomenclature, which they thought necessary, for erudition's sake, to adorn their works. He should encounter a long enumeration of disorders they had an opportunity of curing, and making observations upon; — Mr. A. B. and Mrs. C. D. &c. &c. — had been radically cured in a very short time, and so on. I think they have all forgot to say, *Such a vast number of other patients have been cured, that every one who will hear of this account, must immediately come*; insomuch that, instead of finding instruction in the art, he shall read but an useless history of Mr. Such-a-one, who has been under the care of such a *curer*, who, as a *finis coronat opus*, lives in such a street. If these writers were either
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brought up to a regular course of phyfic or furgery, it would be tolerable, as they fhould be looked upon as young fellows who intend to push themfelves in the world; but as they are, for the moft part, a kind of ignorant people who have a mind to impofe upon the public, I prefume to fay that phyficians, who refpect their art, will never look upon them, as practitioners to imitate.

But to return from my digreffion : If the *retina* be yellow, the objects, fay they, ought to appear fo too, becaufe their pictures being reprefented upon it, convey this fenfation into the mind, though the objects might be red, green, or of any other color.-- This is the kind of affertion you meet with in the beft authors in phyfics and optics upon that head. Having demonftrated above, that the picture of the object on the *retina* does not produce the fenfation, it would be needlefs to bring any other proof againft it, were it not conducive of enlightening and inftructing the reader. In order to do it more effectually, I will lay down the following experiment. Perform one hole of two inches diameter in a fhutter, and make the room as dark as you can; place outwards a white difcernible object of the fame diameter, at three feet diftance from the hole, and look at it with attention. If you are in perfect

fect health, you shall certainly see it white; but if you place at the said hole, a flat yellow glass, and look at the white object through it, you shall perceive it of the color of the glass. What is the reason? To this I answer, that the rays emitted from the white object at first, being always the same, the sensation must be so too; but if you change their color by the interception of a yellow glass, the rays susceptible of assuming immediately the color of the bodies they go through, it is natural that the sensation they produce be the very same, as they are last admitted into the bottom of the globe. You ought to look upon the *cornea* in this experiment, when a person is afflicted with the jaundice, as the yellow glass at the hole of the shutter; because this disorder being occasioned by some casseous concretions, which, obstructing the *duodenum*, from an obstacle to the flux of the bile, are compelled, by this means, to reflux in the blood and lymph: and as the *cornea* of the human eye is made up of pellicles ramificated with lymphatic vessels, it becomes clear, that the fluid contained in these little vessels, give a tincture to the whole body of the *cornea*; therefore the yellow appearance of the objects in the jaundice, is only, or at least more dependent, on the state of this last

membrane,

membrane, than upon the immediate organ of sight.

If physicians and opticians had consulted the phenomena of their own natural vision, which can alone afford us means of acquiring knowledge concerning so curious an organ, instead of harkening to such idle traditions, and raising chimeras of their own upon those of other men; if they had proceeded in the analytic method from particulars to generals, as far and no farther, it seems to me, that they could scarce have imagined the *impression* produced by the rays on the immediate organ of sight, absolutely distinct from that of the air on the *auditus nervus*. When you pass from a dark room to a well-lighted one, you cannot, for some time, see clearly the objects it contains; and if you leave this last room, as soon as your eyes are accommodated to the degree of light, to come back in the first, you ought to have generally experienced that you are not able to discern any object at all for a considerable time. What is the physical reason of this fact? If you pass from a dark room into a lighted one, all the objects which surround you, send immediately such a quantity of strong rays on the *retina*, that you are quite taken out of your reflection by their too violent impression; be-

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cause

cause the fibres of the iris being not as quick in their action to operate a motion of extension, which produces a contraction, as the introduction of the rays into the globe, the too great quantity of these rays cannot be intercepted in time, to become in proportion to the sensibilities of the immediate organs of sight: if, on the contrary, you pass from a well-lighted room into a dark one, the contraction in the pupils necessary to moderate the strength of the rays, when in the first room, operates such an interception of them at the time you arrive in the second, that the number is not sufficient to operate a sensation on the retina, as they are emitted from objects which receive themselves no sufficient power from the primary light; because you are obliged to stay a long time in the dark room, to give the fibres of the iris a proper time of operating a dilatation, in order to admit a sufficient quantity of rays on the immediate organ of sight, capable of producing a sensation upon it. There are some eyes, I know, whose pupils are more susceptible of contraction and dilatation than others; but this must be put out of the general rules I am now speaking of. If, now, we are to form a conclusion from all these phænomena, without any further reasoning about them than such as they justify,

justify, what must it be? It must be plainly this, that there is in the whole animal kind one intellectual spring, common to every species, but vastly distinguished in its effects; that though it appears to be the same spring in all, yet it seems to be differently tempered, and to have more elasticity and force in some, and less in others; and that besides this, the apparent difference in the constitutions and organizations of men, seems to account for the different determinations of the visual power, and the surprising variety of its effect.

If there were any possibility to ascribe the refractive power of the human eye, the sensibility of the *retina*, the suppleness of the fibres in the iris, and the thickness of the *cornea*, I make no doubt that I could give a satisfactory account of all the different sights men are in general provided with: but as I candidly confess my ignorance upon these points, I shall not pretend to trouble the reader about such doubtful heads, as some writers have. However, before I put an end to this part of my treatise, I will say one word or two on the effects of spectacles, or glasses on the eyes. It is a very nice case, if a physician has six objects to combine together, when he looks for the cause of the defects in the sight; it is more so, no doubt, when he is

obliged to draw from them nothing but mere conjectures. The variation of suppleness in the fibres of the iris, abstractedly considered, may be, in some measure, accounted for; especially if you make the following experiment, upon the eyes of a person well constituted, and in perfect health. Let the person be seated motionless before a window, when the light is continually and uniformly the same; put a pair of spectacles forty-eight inches *focus* upon his nose; examine with the strictest attention, if by putting them on and off, the pupils contract and dilate. This done, repeat the same experiment with several spectacles of known *focus*, such as 24, 12, 6, and even 3 inches; what shall be the result? The contraction in the pupils shall augment, according as the focus is more: What is the physical reason? To this I answer, that the thicker a glass is, and of course short focus, the more the rays of light, which go through it before they arrive on the retina, are intercepted; consequently an insufficient sensation, not operating a motion of extension in the fibres of the iris capable of performing a contraction, a dilatation must take place. The change of the spectacles for the same experiment, will always produce a variation of dilatation in the pupils of different mens eyes, as it is impossible to
meet

meet with two men, whose constitutions are the same in every particular. Such experiments will give you an opportunity of distinguishing the dilatative and contractive powers of the pupils, the stiffness, and suppleness of the fibres in the iris.

It would be now a proper place to speak of the effect of spectacles on the sight ; but as this subject belongs to the optician, I shall not incroach here upon his right. Besides, to avoid repetitions, I will not speak any more about the effects of the rays on the immediate organ of sight, and the change that happens in the fibres of the iris, it being facts which are obvious to every capacity, after what has been said concerning this subject.

Some physicians and philosophers have advanced, that the crystalline had a motion of forwardness and backwardness, if I may be allowed the expression, to facilitate the refraction of the rays of light, and receive them as soon as they enter the globe. That there are mobile cataracts or crystallines, is undeniable ; but that such eyes as have not a natural formation, do not or cannot see perfectly, if not at all, is a fact as evidently proved. In short, if you take the trouble of reading all the works written by oculists, you may expect to meet with
nothing

nothing worth reading from the beginning to the end, except one who wrote a great while ago. The defect of squinting eyes, that comes from an irregularity in the length of the muscles, has taken up and puzzled almost their whole works; and as to the description of the phænomena of vision, Mr. Locke, who was the proper writer to consult upon the subject, has been the only one that has not been mentioned by them all. When oculists have been sufficiently sensible that it was impossible to detect them in such a maze, they have ventured all sorts of systems. Thus have they in all ages amused mankind with systems of imaginary knowledge, raised in fantastical ideas and notions, rather than confine themselves within the limits of real knowledge. Instead of mixing our opinions by evident truth, and giving the mind any solid foundation whereon to rest, they have involved us in doubts, and eternized disputes. Like *Noctambules*, they have staggered about, and jostled one another in their dreams. Since the torch of experimental philosophy has been lighted up, these hypothetical reasoning have been exploded, or else confined under certain conditions, in all that relates to corporeal nature.

After

After all these reflections which I have laid before the reader, merely to deter him from the reading of such writers, as they occurred to my experience, nay, after all those which they suggest, or which a man of better parts, more knowledge, and more leasure, would be able to make, I doubt not but one of our most precious *senses* would have been better explained.

OF THE
D I S O R D E R S
OF THE
EYES IN GENERAL.

IT is as easy to distinguish, by looking into the eye with attention, if it be deprived or not of the faculty of seeing, as it is difficult to know the true cause. The want of contraction and dilatation in the pupil, foretels a deprivation of sight, whose causes may be infinitely numerous and diversified. It happens, however, that it is susceptible of contraction and dilatation, though the organ be deprived of sight; but it is easy to discern one and the other, in one and the other case. The immediate organ of sight is the only part of the human body, delicate enough to be sensible to the impressions of the weakest rays of light: therefore, the more rays there are united and absorbed by the meconium which lines the choroides, the completer

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the sensation, otherwise this last operation does not exist, as well as the reflection, which both contribute, dependently of each other, to make us perceive. If the rays arrive and are absorbed on the retina, the stroke it receives is sufficient to agitate the fibres of the iris; then a contraction in the pupil is operated. If the stroke become less, the fibres return in their natural state, what operates, consequently, a dilatation. The inquisitive observers will remark this contraction and dilatation augment or diminish, exactly in proportion to the coruscations of light; and if the rays arrive on the retina, without being absorbed there, they pass on the choroides, without producing a sufficient shake to put the fibres of the iris in a regular motion; insomuch that, the pupil contracts and dilates by fluctuation; a symptom which gives to understand, that the vessels, ramifying in the choroides, have no more their natural elasticity to keep the meconium upon its surface, in order of facilitating the absorption of the rays on the retina; or, in short, that this membrane is inflamed or unable to perform its functions by any cause whatsoever. This malady is no less common than dangerous. It is no sooner arrived to its last period, that it is deemed incurable, and characterised of a gutta serena, what should

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not be, as this is liable to lead the practitioners astray. So that, it is very easy to conceive how many times this mistake did, and still does, furnish occasions of Quackery, if you will take upon yourself the trouble of examining the conduct of the artful writers and practitioners upon the disorders of the eyes, either in their writings or practice. It is from their ignorance and cheat, that so many misuses have arose, and still exist; in fact, they have characterized of gutta serena every deprivation of sight whatever; when the globe of the eye was not exteriorly affected, except that of the cataract and glaucoma, which have been since discovered.

The gutta serena is either perfect or imperfect. The paralysis of the retina and optic nerve, more or less steady, constitutes one and the other. Menfes and hemorrhoides suppressed, blows on the head, apoplexy, overflowing of the milk, morphews kept in, scorbutic virus, venereal relics, &c.; obstructions, sanguineous and lymphatic tumors or others, either in the interior of the globe of the eye, or around the optic nerve, known by the opening of dead bodies, are capable to produce blindness. The perfect or imperfect paralysis in the retina and optic nerve, occasions the more or less of insensibility in them, to the impression of the rays of
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light, that give a sort of touch at them. Of all the symptoms that foretel us a disorder of the retina or optic nerve, there are no surer, than those of the state and motion of the pupil; because, after having observed, that nothing intercepts the rays, and that they are absorbed upon the immediate organ of sight, there may be no other token to lead you astray concerning it. If a *meconiumless* exists, the bottom of the globe of the eye looks grey, or of a very clear water color. The only case which obliges us to conjecture, is, when the meconium is of a grey color; because we cannot positively say if this blindness is occasioned for want of meconium, or by an affection in the optic nerve: we may, however, get very good intelligence from the patient's discourses, concerning this main point, and the different progress of the disorder. All this depends very much on the skill and penetration of an able man, especially if he has himself keen eyes. It is physically impossible to cure a gutta serena, considering the difficulty and impossibility there are of desobliterating such small pipes, placed into the bottom of the globe of the eye; especially when the obstructions are old, or the internal membranes tore to pieces.

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If the imperfect paralysis of the retina is the consequence of some lymphatic obstructions in the vessels which ramificate it, caused by a thickening in the humors, bleeding cannot bring to circulation all the coagulated humors that are contained in the extremities of such delicate and small tubes, whose diameters diminish in proportion to their length; because the swiftness of the evacuation is in compounded *ratio* of these vessels's diameter and fluid's coagulation, and that a contraction must necessarily happen and stop up these humors in the extremities of these tubes, whose diameter is smaller there, than at their source: consequently bleeding shall desobliterate, as it should, if the humors were in a limpid state. Another reason to avoid bleeding in such a case, is, that you deprive these stagnant and coagulated humors, by the evacuation of those that are clear, and which are as useful as necessary to them, in order of keeping them in a moisty state, without which the most mischievous accidents must be the never-failing consequence. Physic, in such a case, prescribes an emollient fumigation for external remedies, and diluting drinks for internals, whose end is to keep open the pores of the membranes of the eye, and facilitate the evacuation of the local stagnation by exsudation and insudation. The effect, though

though flow, is however very sure of success, when every particular incident is attended to with the greatest precision and skill. The sight, after the use of such external applications, becomes generally very dim; but, to counterballance this defect of sight, which is occasioned by a relaxation in the parts, you recommend spirituous or astringent lotions, or evaporations of such strong spirituous fluids over the eyes, as may well answer your purpose according to circumstances, which external remedies produce a contrary effect. I have given a complete explanation of the effect of these external remedies in the following observations; therefore I need not mention it here.

When the optic nerve is pressed in the bottom of the socket by some tumors or other accident, whose consequences are more important than the disorder to which you will remedy, this is a case that ought be excepted from the general rule. It is as impossible to cure the complete paralysis in the retina, as the gutta serena; every physician that boasts of a success in these two cases, is a downright empiric, or ignorant of the real case.

The glaucoma is an opacity of the vitreous body, which becomes afterwards of a green color. Let us distinguish the species and causes of this pernicious
malady,

malady, that every knowing phyfician deems incurable; in order that it may not be mistaken for a paralyfis in the retina, an affection in the optic nerve, or a want of meconium on the choroides. The vessels, which, from the choroides, pass to the retina, and from thence into the vitreous body to furnish it with the nourishing juices so necessary to keep up its perfect state of transparency, are liable to be obstructed after some internal inflammations. By these accidents, the vitreous humor becomes tarnished, for want of receiving its nutrition, and is not a long while to change this state for that of the opacity, which then intercepts all the rays of light. Are not the pores in its capsule, called hyaloida, susceptible to be obstructed? Cannot an abscess be fixed on the posterior part of this capsule, and produce there an opaque cicatrice, without any loss of transparency in the humors, in these two cases? Most certainly: Because the lymphatic vessels continue, in spite of these accidents, to bring in it their juices. If the whole part of the hyaloida, which is placed on the retina, happened to become opaque, or the vessels which ramificate it only obstructed, and that the humors of the vitreous body, and the anterior part of its capsule were transparent, would it not be very easy to mistake this disorder

order for a gutta serena, if but a superficial examination of the eye was made, or if the observer's eyes were not exceeding keen and good? Very likely. It is the very same mistake of the contraction and dilatation in the pupil, that have given reason to some antient and modern writers to say, that it was sometimes susceptible of it in the gutta serena : an error that brought a great many others after it. If we enquire into the cause of such a contraction and dilatation in the pupil (the organ being deprived of seeing) we must be sensible that the hyaloida being become opaque, or obstructed in its pores to its posterior part only, that it does not intercept entirely the rays of light which penetrate, for all that, on the retina, but whose impressions are not strong enough to produce a sufficient sensation for effecting perception. When the vitreous humor begins to tarnish directly to the point whereby the rays of light pass to arrive on the immediate organ of sight, the pupil is dilated by degrees to let them go in ; and when it is entirely dilated, and remain so, you may rather conclude, that this is a symptom by which the glaucoma began. One or several cells of the vitreous body may also become opaque, together with the internal tunic, called arachnoida, without the whole becomes

becomes so too. These different causes constitute the more or less perfect glaucoma, and diversify it either in dry or humid. Internal or external inflammations, very ill attended to during their existence, are the sources of the glaucoma.

The disorders of the crystalline are few in number, but very well known. Physicians are only divided in their opinions as to its nutrition. Some pretend that this lenticular body keeps its transparency by the help of the nourishing juices brought by some lymphatic vessels, which ramificate the capsule of the vitreous body and crystalloida, that go into the very interior of the crystalline humor; others that it is by imbibition, as it swims in the aqueous humor. Without being able to satisfy and convince every body by any physical reasons whatever, to the support of an opinion rather than of another, (as these lymphatic vessels are almost invisible and that the crystalline, which is a solid body, cannot of course admit in a great quantity of aqueous humor to keep it transparent) I advise my reader to persuade himself, that both means contribute to preserve its perfect transparency. The alteration of the crystalline, called cataract, is the most common disorder of this diaphanous body. The surer method for removing it, is the extraction :

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when the membrane which wrapt it up is become opaque, we call it *membraneous cataract*, though the crystalline be transparent. If it be stony, *stony cataract*, and so on of all the other forms or species it may assume; but when several of these disorders meet together, it is called *complicated cataract*. The most common symptoms are a dimness in the sight, though the pupil dilates and contracts, when the organ is exposed to a less or greater degree of light; some flies, filaments, and many other objects, whose forms vary in proportion to the spots which are existing in the crystalline, or on the crystalloida, that the patient imagines to see flying before his eyes. The different treatments change according to the alteration of the disorder, its periodical causes, and the patient's health, as shall be explained at large in the following observations on this head. If the cataract be formed by want of circulation in the humors, which is very often the case, it is very clear, that the remedies which are conducive to promote it, shall be the properest indications; but great precautions, skill, and experience are required, in order of chusing them right; for some of them may be very dangerous, as they occasion a running of meconium from on the choroïdes. All this depends very much on the great
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and particular care of the physician. The prescriptions of internal medicines, in such a case, are seldom of use. They, indeed, can retard the formation of the cataracts; but I have observed that, in general, they are formed in spite of the strictest attendance. This disorder cannot be distinguished but by those who have a great deal of experience and skill, and exceeding good eyes. It is amazing how the empirics are at their ease, when they have under their care a patient afflicted with a beginning cataract.

The iris is susceptible of inflammation, as well as all the other parts which compose the globe of the eye. When it is only fixed on its anterior lamina, it looks of a reddish color through the cornea; and on its posterior, you cannot know it but by the pains the patient suffers. The manner of curing this disorder is laid down in the following observations. When the inflammation is well attended to during the use of the remedies, no defect remain on the iris; but if a suppuration is the consequence, the abscess is generally opened of itself, and its matter emptied into the globe, without any detriment to the other parts. I will here observe by the way, that on the abscess's place, a whitish or blackish spot, called cicatrice, is the necessary consequence.

If the abscess be considerable, and the matter mischievous, it very often ends with the dejection of all the other internal parts of the globe of the eye, or at least of some of them.

The Hypopion is a gathering of corrupted matter, which continues for some time, or for ever, according to its quality in the aqueous humor, immediately under the cornea, or in the anterior and posterior chamber of the eye. This gathering may be the consequence of an abscess or extravasated blood, occasioned by a blow or a violent inflammation; besides, the consequence of the small-pox, and the extraction of the crystalline, &c. There are a great many methods of proceeding in the cure of this malady: first, it is absolutely necessary and important to be well assured of the cause. This gathering of matter may be evacuated, if it be fluid, by the use of warm emollient lotions or fumigations; sometimes bleeding will be necessary at the same time, if positively the violence of the inflammation requires it. If you do not succeed, and that the matter be solid and mischievous enough as to fear for the loss of the organ, you shall open the cornea to let it out, just as it is practised in the operation for extracting a cataract.

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The disorders of the cornea are very common. The albugo and spots which grow on this membrane, are the consequence of inflammations very ill attended to. The obstruction in the lamina, and vessels of which the cornea is composed, are the very causes of this disorder, as they destroy its transparency. After a violent inflammation in the eye, occasioned by the thickening in the humors which do not circulate freely, the inflammatory pustles, such as they very often happen on the cornea by several causes, and especially during or after the small-pox, are also conducive to it. The little scars made after the resolution of an abscess, and the cure of a wound in the eye; the action of sharp or corrodent remedies fallen by chance on the globe of the eye, or ignorantly applied on; in short, the abscesses or gathering of humors which are formed during or after the inflammation, even betwixt the *cornea's laminae*, when these humors in becoming hard by degrees, form almost always the opacity. The albugos and spots in and on the cornea, are always of a very difficult cure; but all do not oppose the same resistance. They are more or less easy to cure, in proportion to their extent and situation in the external or internal *laminae*. There are so many remedies equally good and proper to destroy these

these defects, that it is almost impossible to lay down an accurate account of them all, without falling in numberless repetitions; for which reason, I think, that, in such cases, the observations are a vast deal more instructing, without teasing the reader, than any detail whatever.

The Pterygium is a rising, fleshy membrane, which begins pullulating to one or the other angle of the eye, and extends slowly from the conjunctiva to the cornea, to such a degree, as sometimes to intercept entirely, or in some part, the rays of light. It is very often formed on the conjunctiva, and sometimes betwixt this membrane and the albuginea. People that are accustomed to periodical and habitual inflammations in their eyes, are the most subject to this disorder. The broken and corroded varicous-vessels, occasion a discharge of nourishing juices between the interstices of the membrane, which find their flowing intercepted, and become by degrees solid in producing some excrescences, which vary in color and bulk. The pterygium, as well as an infinity of tumors, which grow under the eye-lids, may be extracted without the least danger to the organ; and when the patient will not undergo the operation, you may destroy them with

with the use of caustic pommatus, according as it is recommended in the following observations.

The Staphyloma is a tumor produced by a membrane whatever, when pushed outwards by the humors of the eye. For example: the staphyloma of the iris is so called, because part of it appears without the globe through a hole, either in the cornea, sclerotica, or between one or the other of these membranes. The staphyloma of the sclerotica and cornea are so called, when one or the other of these membranes, become thinner in one place than in the whole extent, and are dilated by degrees, as to form a more or less considerable tumor over their natural convexity. The prognostic of these disorders is always unfortunate: for, besides the loss of sight and extreme deformity they occasion to the eye, they often produce head-aches, wakes, very violent and severe inflammations, suppurations; and it is not even very rare, if they degenerate in a cancer. You must pay a great attention to the size, causes and patient's health, during the treatment of this dangerous disorder.

The eye-lids which adhere to each other, or to the globe of the eye, by what cause soever, are so uncommon cases, that you meet with few observations upon them in authors, except their uniting by
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an agglutinous matter, which flows very often in the small-pox; but this is very light and superficial, as it cannot be looked upon as a true coalition. This deformity is sometimes to be met with in infants. The cure consists chiefly by separating with dexterity one eye-lid from the other, and taking proper means to palliate the violence of the inflammation, that such an operation must necessarily occasion. All this depends upon the skilful operator, who must take into consideration what may be the most proper means, in order of disuniting the eye-lids the better, and destroy their adherence from the globe, to set them in their natural liberty. As it is very difficult to satisfy an inquisitive reader by imaginary descriptions, I refer his curiosity to the following observation upon this head.

The Trichiasis, or Phalangosis, are three rows of eye-lashes, placed in such an inward disposition, that it is termed a disorder, as they continually inflame and rub on the globe of the eye, produce excruciating pains, and sometimes the loss of sight, if they are not plucked out.

The overturning and retraction of the eye-lids, are commonly looked upon without any hopes of a perfect or radical cure. This disease depends upon the inferior eye-lid, that exists in the orbicular muscles,

muscles, on account of their weakness or relaxation, especially in old people, without the least cicatrice. When the eye-lid overturns of itself, and shrinks in such a manner, as to cover no more the globe of the eye, and that the part of the conjunctiva which lines it inwards, is turned outwards; you have nothing left but the operation, after having tried, to no purpose, the use of emollient and humecting fomentations, agglutinative and astringent plaisters. In short, such cases are always of a very difficult cure: the main end is, to re-establish, as much as possible, the natural dimensions of the eye-lid.

The Schirhus in the eye-lids, is a very common disorder, occasioned by circulation and perspiration intercepted, thick blood which remains in a particular place for a long while, and becomes very often a hard tumor. Any lotion that softens, is of a great help in this case, but not sufficient to destroy the malady without return; then you have nothing else to do but to attempt the re-establishment of the glands of Meibomius, whose obstructions are the principal cause.

The Fistula Lacrymalis is a disorder existing in the canals leading from the eye to the nose. It is produced by an obstruction in the natural absorp-

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tion of the tears, and makes them trickle down the cheeks. This defluxion foretels sometimes a purulent serosity, or true corrupted matter contained in the sacculus lacrymalis, which flows from the great angle of the eye (either spontaneously, or in compressing the sacculus lacrymalis with the tip of the finger) over the cheeks. It comes very often from the ulceration of the lacrymal ways, and especially from that of the bag. The more an ulcer is of a mischievous nature, the more the fistula lacrymalis is to be feared. This ulcer corrodes oftener the sacculus lacrymalis, than the skin which wrapt up the bag and the neighbouring bones, what makes the matter flow up through the puncta lacrymalia. In a fistula lacrymalis, the purulent serosity goes out of the bag through the puncta lacrymalia; when the bones are at the same time corroded, there is a solution of continuity to the skin and complication with caries, then the matter runs down into the nose. A particularised explanation on the lacrymal ways, and some observations will be sufficient to give a comprehension of all the diversities that are to be met with in a disorder so very common and difficult of curation.

UPON THE
L A C R Y M A L W A Y S,

EVERY one may judge of the importance of the lacrymal organ, by its destination. Nature formed it to empty out, through different excretory ducts, a liquor fit to lubricate the eye, and the internal parts of the eye-lids: at the same time, this fluid keeps the transparency of the *cornea*; without its help, the functions of the eye would be suspended, or at least very much injured.

The harmony which exists between the *productive lacrymal ways*, and the *absorbent* ones, deserve all our attention. On the one side, you may remark a constant perspiration, and such as the proportion of the liquid, which drops from a great many pores, or excretory ducts, does not exceed the total of what may pass into the diameter of the absorbing pipes; on the other, two sufficient ducts to pump, or absorb all the lacrymal serosity, except what is evaporated into the air.

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Though anatomists have been employed this great while about that essential part, the description they have given of it, leaves still a good deal to desire for the perfection of our knowledge. The greatest number amongst them have said, that the immediate spring, or source of the tears, came from the *glandula lacrymalis*: nevertheless, the excretory ducts of the *cornea* furnish a great deal more of the lacrymal serosity, than the gland to which they have exclusively attributed that faculty. The excretory pipes of the *caruncula lacrymalis*, the conjunctiva, and those of meibomius glands, furnish at least as many tears as the excretory ducts of the cornea; insomuch, that it is very easy to prove, that the *glandula lacrymalis* does not produce one third of them.

The knowledge of a greater quantity of excretory ducts of the tears would not be of considerable importance, if it were only matter of anatomical curiosity; but it demonstrates the true cause of several maladies concerning the lacrymal ways, to which no attention had been paid, or which had been confounded among the rank of the other disorders of the eyes. In fact, no treatise has mentioned, 1st, the atony or dilatation against nature in the excretory ducts of the cornea, nor those in
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the conjunctiva; mean while, this disorder causes so great a quantity of tears, that it may have imposed upon several practitioners to such a degree, as to make them believe that there was an obstruction in the *ductus ad nasum*, whilst it might be in the most perfect state. If, in this case, the puncta and ducts lacrymalia do not absorb the exceeding part of the tears, it is because the proportions are not relative, there having more of the lacrymal secretion, than may be contained for pumping or absorbing into their diameter. 2dly, Our authors have also been ignorant, that an obstruction in the glands of Meibomius is the cause, that the oleaginous fluid furnished by them, is in a less quantity than necessary to defend the conjunctiva and the cornea, from the acrimony of the tears, and the injury of the air; for, from thence proceeds a flux of tears, and an inflammation in the eye, which stand against the use of the best and well prescribed remedies, till these glands be in their natural state. 3dly, They have not been less silent upon the true cause of the Hydrophthalmy. This disease is produced by the obstruction in the excretory ducts of the cornea; it is the retention of the superfluous of the aqueous humor, which extends the tunics
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of the eye at that time, and increases the bulk of the globe.

If we examine their description on the puncta lacrymalia, the sacculus lacrymalis, *ductus ad nasum*, and the mechanism which they settle to these parts for pumping the tears; if we compare what they have said, with what the anatomy and mechanism of these parts present us, we shall observe that they have neglected to describe a great many essential points which manifest themselves to the inquisitive eye. It is then of the greatest consequence to inquire into every subject which establishes the lacrymal organ, to make us acquainted with its true mechanism and functions, in order of distinguishing the various causes from whence proceed the maladies which disturb its harmony, and point at once and with more precision at the curative indications.

Nature has divided the lacrymal ways, 1st, in parts which furnish the tears, and those which are bathed by them; 2dly, in parts which pump or absorb this fluid.

On the productive Lacrymal Ways.

The tears which are occasioned by the introduction of an extraneous body into the eye, have this great while given an opportunity of supposing, that the lacrymal fluid had some other excretory ducts, than those of the *glandula lacrymalis*. The frequent inquiries and inspections of sound and sore eyes have at last cleared the matter.

S E C T. I.

On the Glands of the Conjunctiva, and their Excretory Ducts.

The whole surface of the *conjunctiva* is covered with a great many pores, or excretory ducts : But are these ducts a continuity of the arteries, or do they border upon some little glands? That is the question we must particularly pry into.

If the secretion through the pores of the *conjunctiva* was furnished by some arterioles, the consequence would be very sensible in the humid inflammation : the flux of the tears is occasioned by the atony of that tunic, and manifests itself by the
dilatation

dilatation of its excretory pores: in that case, a flux of tears would ensue; but this is what never happens.

Will any one object, that the excretory vessels in the conjunctiva are lymphatics, and not bloody, and conclude from thence, that the serosity which is furnished through the pores of this tunic, cannot be but diaphane, even in the atony state of that membrane? To this I answer, Every body knows that the inflammations are caused by the passage of the particles of blood into the lymphatic vessels, whose tunics have almost lost their oscillation. How could it be possible, in the case of a great inflammation, that the excretory ducts in the *conjunctiva* might, though their dilatation against nature, put an obstacle to the passage of the blood? Let us rather conclude, that this serosity is furnished by a great many glands spread in the whole substance of the *conjunctiva*.

Have you seen these glands that you settle upon this tunic? I answer, that it is impossible to distinguish them in their natural state; but when they are swelled, they are not only seen, but you may discover their very frame.

Upon the *conjunctiva*, at two lines from the limb of the *cornea* in the external angle, you will see
sometimes

sometimes little tumors very near each other; every one of them are of the size of a millet seed: take off this portion of the *conjunctiva*, and you will observe, 1st, that these tumors are in the substance of that tunic; 2dly, cut several of them, you will have an opportunity of discovering with a microscope, that they are, as to their frame, like those glands which are known to us; 3dly, having left the others to be macerated in water, they shall increase in bulk, and you will remark, that every one of them is wrapt up in a capsule, and that their internal parts do not differ from the first.

If these little tumors be some pustles, do you suppose they should have the frame and consistence of a very close web? Do you think they should have an exact conformity with the texture of the glands? Do but consider the eyes of several men, you will often remark some of these little tumors upon the *conjunctiva*. They are nothing else but some glands swelled to such a degree, as to give you an opportunity of distinguishing them from the little abscesses which attack that tunic. Pustles are purulent, or form some hydatides; these have a fluctuation, which does not exist in the tumefied glands.

Most part of the little abscesses which attack the conjunctiva, are caused by the swelling of the filters in the glands of this tunic, and by the introduction of the heterogeneous part, or by the deprivation of the lymph which is become stagnant. The acrimony and purulent matter, disturb and destroy the glandulous bodies. The pustles which afflict that tunic, are similar to those which form themselves all over the human frame.

It is needless to describe a greater number of these facts; because, without having recourse to the tumefaction of the glands in the conjunctiva, there will be no room to doubt of their existence, if you take notice, that this tunic is in every thing alike to most parts of the membranes in the human body, which have a great quantity of them.

For what reason would you exclude these glandulous bodies from the conjunctiva, since almost all anatomists agree, that they are to be found over the whole web of the skin? Is it because one is more united than the other? No, certainly. Have we not in all cavities whatsoever of our body, some tunics whose texture is a great deal thinner, or at least as delicate, which have some glands and excretory ducts, from whence flow, without intermission, a fluid fit to water all the contained parts
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in the spaces which inclose them, to impede the drying of the fibres which compose them, and that of the tunics which involve them? Every body knows, that the *faccus lacrymalis* and its ducts have some glands, from whence flows continually a secretory humor. Where is the cause, why the conjunctiva should not share the general perspiration? Did it not receive in its formation the same organization, and the same prerogatives, as the other membranes which are analogous to it?

The following experiments will prove, moreover, that its perspiration is also abundant, nay more sensible. Overturn the eye-lid of any one whose organ is sound; wipe it with a very fine piece of linen cloth, you will observe, with the help of a magnifying glass, or without it, some little drops which transude through the pores of the conjunctiva. These drops shall increase by degrees, till they form, in a little while, a sheet of water. Wipe now and then this part, you will distinguish a new secretion, which shall be as limpid, viscous, and brinish, as the first. You will remark too, that during this experiment, the eye is very much bathed in tears, on account of their abundant secretion, and want of action in the puncta and ducts lacrymalia, which are not in a direction to pump or

absorb the whole fluid furnished by their excretory pipes.

Let the eye-lid be overturned during twenty minutes or upwards, you will perceive not only a constant transudation, furnished by the ducts of the conjunctiva, but also the flux of the tears increasing till they fall drop by drop, with as much celerity, as if he was grievously weeping. The cornea shall loose of its transparency, by want of brightness under the water which covers it; but as soon as the eye-lid is in its natural state, its motion shall equally extend the lacrymal fluid, by which means this membrane will re-assume its former transparency.

This experiment is a proof, that if the glandula lacrymalis be alone able to furnish the tears, it should be necessary it had some more and other excretory ducts, than those which are known belonging to it. It follows also from this experiment, that the glandula lacrymalis, being not able to furnish the eye with lacrymal fluid, when the superior eye-lid is overturned, that the abundance of the tears which gather themselves to the valvula lacrymalis, come from some other sources.

If this lacrymal fluid, furnished by the glandula lacrymalis, were as abundant as it has been believed,

lieved, it would manifest itself by a copious secretion to the edge of the tarfi, when the superior eye-lid is overturned: but, on the contrary, you may remark, that these excretory ducts do not furnish more of the tears, than those in the portion of the conjunctiva of the superior eye-lid.

Here you may object, 1st, that the copious secretion of the tears, which happens during that experiment, is occasioned by the compression of the eye-lid overturned upon the globe of the eye; and that the tears must be in a less quantity, than when this eye-lid is in its natural position; 2dly, that the liquor produced by the glandula lacrymalis is intercepted, on account of the overturning, which must occasion a compression upon the excretory pipes, to a degree sufficient as to sink them down.

Answer to the first objection: 1st, the globe of the eye cannot be squeezed by the everturing of the eye-lid, because its web is very soft; besides it should be necessary, for the existence of this compression, that the eye-lid should be bent, whilst there is a space between it and the globe, what stands for a proof to the contrary: 2dly, if the eye were pressed, the eye-lid and the globe would be fixed, and their motions suspended: 3dly, the globe,
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on account of its rotundity, leaves in its superior part a space which cannot be filled up by the eye-lid: 4thly, the person whose eye-lid is overturned, feels no pain at all in this part, which should happen if the eye were squeezed by it: 5thly, every one knows that all compressions intercept more or less the flow of liquors in the vessels, from whence proceeds inevitably a change in them, and of course an inflammation. Let us conclude, then, that the eye is not squeezed during the experiment, and that the flux of the tears comes rather from the secretion which continually runs through the pores of the cornea, those of the conjunctiva, the caruncula lacrymalis, and thro' those called *glandulae sebaceae meibomii*.

Answer to the second objection: The overturning of the superior eye-lid cannot be an obstacle to the flow of the secretory fluid from the glandula lacrymalis; 1st, because there is no impediment; 2dly, the ducts of that gland cannot sink, though the eye-lid be overturned, considering that any fluid, by its impulsion, has strength enough to widen the insides of the pipes which must give way to it; lastly, because, if these ducts were to swell during that experiment, it should happen, after the re-establishment of the eye-lid, an abundant effusion
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of tears, on account of the discharge of these excretory ducts; whereas the exudation is much the same.

These are sufficient reasons and experiments to establish, beyond any doubt, that the glandula lacrymalis furnishes but a part of the tears. Will you object, that this experiment alone is not able to prove the existence of the excretory ducts in the conjunctiva, and that it might be possible these pipes belonged to the glandula lacrymalis? The following experiments are proofs to the contrary.

Overturn the inferior eye-lid; desire the person to lift up the axis of his eye, in order to give the conjunctiva a greater convexity; put, betwixt this tunica and the globe, some lint, to keep the tears out of that part of the conjunctiva which is the subject of your examination, and wipe it with a fine linen cloth; then you will observe, in its whole extent, a great many drops, which increase by degrees just as they are coming out, and in a little while join themselves to each other. Remark, at the same time, that this fluid is wholly alike to that which exudes out of the internal part of the superior eye-lid; and that the quantity seems equal in both, proportionally to their extent.

Introduce

Introduce a *speculum oculi* in the eye of a living animal, to remove the eye-lids from each other; dry, with a linen cloth, that part of the conjunctiva which covers the globe of the eye; then you will observe the same transudation as that in the interior part of the eye-lid. The dilatation of the pores in the conjunctiva is also a convincing proof of it; and the flux of the tears, which is the consequence, demonstrates also the very kind of this fluid, and what must be its destination.

SECT. 2.

On the Excretory Ducts of the Cornea, and the Origin of the Secretory Fluid to which they give way.

The cornea furnishes also a secretion, to which a great many pores, dispersed upon its surface, give way: and if a great number of anatomists have been ignorant, or said nothing about this function of the cornea, some have favored us with an account of it.

In all likelihood the aqueous humor is produced or regenerated into the eye by a kind of transudation, through the vitreous and crystalline humors; it

it is no other kind of fluid but the most limpid portion of the nourishing juice of these transparent bodies, which having filled up the space between the cryſtalline humor and cornea, that flows of itſelf through the pores of this membrane, to let ſome of the new humor in its place. You will be certain of it, if you take notice that the anterior part of the vitreous body, incloſes always in its cells an aqueous humor.

The filtration of the aqueous humor through the excretory ducts of the cornea, is very well eſtabliſhed; but this is not ſufficient: we muſt endeavour to prove that this fluid is the moſt abundant portion of the tears. To be convinced of it, clear and exact notions upon this head, are neceſſary. Let us conſider, 1ſt, the nature and quantity of the ſecretory fluid which runs through the pores of the cornea; 2dly, the reſervoirs of this humor; 3dly, the ſources which furniſh it.

Introduce into the eye of a living animal, a *ſpeculum oculi*, which may keep the eye-lids from each other, and make a ſoft preſſure round the globe; wipe the cornea with a linen cloth; then you will obſerve a great many little drops following one after another, which tranſude through its pores: in a little while theſe drops ſhall increaſe till they

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join,

join, and spread themselves all over the globe of the eye. If you continue this experiment for twenty or thirty minutes, and wipe now and then the globe with a linen cloth, the secretion shall be as equal as copious, without any diminution in the bulk of the eye. This experiment performed on the eye of a subject newly dead produces the same, with the difference of decay in the eye; which is a proof that this secretion is supplied with the exceeding part of the aqueous humor, which, in renewing itself continually in the living eye, hinders it from withering.

There will be no room to doubt concerning the abundant secretion of the aqueous humor through the excretory ducts of the cornea, if you take notice of the quantity of fluid furnished by the eye, when a cataract is extracted out of the organ. The cornea does not sink, though the aqueous humor is continually running out, till this tunic be entirely healed of the wound practised upon it.

This kind of secretion is not less abundant when an ulcer has corroded the thickness of the cornea; for the eye would be very soon melted away, if the impulsion of the aqueous humor did not compel a portion of the iris to go through the hole of that tunic, in order to stop the too quick effusion of it.

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The epiphora, (a dilatation against nature of the pores in the cornea) is another proof, that this secretion is the superfluous part of the aqueous humor, and how quickly it is renewed.

After such an exposition, you may consider the globe of the eye as the most abundant source of the tears, and the chambers of this organ as two reservoirs appointed to furnish this secretion: but now it behoves to know and enquire into the sources which renew it so quickly.

SECT. 3.

Of the Vitreous Body, considered as the most copious Source of the Aqueous Humor, and consequently of the Tears.

The vitreous body is composed of two tunics, one cellulous, which occupies the interior; the other capsular, which wraps up the whole. The cells are full of a diaphanous fluid, which filters imperceptibly, and flows from one cell into another, as far as the excretory ducts of its capsule. This fluid is conveyed into each cell through a great many lymphatic vessels, which, from the choroides and retina, end in the interior of the vitreous body.

Cut, in a circular manner, the middle part of the eye of a subject newly dead, without cutting, if possible, into the vitreous body; perform another half circular section in the posterior part of the globe, in order that both extremities join the first; remove lightly the divided portions, and you will see that the vessels, which from the retina end into the vitreous body, are all lymphatics, of a diameter more or less small, and very near each other, especially towards the *plexus ciliaris*. As soon as you will put away the retina from the vitreous body, the extension of these vessels shall sooner determine the rupture of some of them than of the others, according to the thinness of their tunics.

Take away the vitreous body, and wipe it with a linen cloth, you will observe that its surface has the most exact smoothness; its perspiration shall manifest itself all over its extent; squeeze it superficially in its centre with a buttoned probe, it shall yield to its pressure; but as soon as it is discontinued, its elasticity shall re-establish it.

You will conceive the cause of this elasticity, if you squeeze very hard betwixt your fingers the middle of the vitreous body. The touch will give you an opportunity to feel a little breaking, which proves the sinking of the part, and the rupture in
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the insides of several cells, wherein is contained the aqueous humor. This is a proof that the fluid has been forced into the neighboring cells.

These cells are so well supported and heaped one upon another, that they have the same faculty communicated by any motion to a globulous body, pushed by any cause whatsoever. You may comprehend, that after such a structure, the vitreous body must yield to the least compression, and reassume its former state, as soon as you cease to squeeze it. At the time of a strong pressure, the fluid must break the inside parts of the cells which contain it, and cause a sinking in that part, whilst those that are near them keep still their elasticity.

But the vitreous fluid must tear the insides of the cells which contain it, in removing from the point of compression, though light, since the tunic which forms them is very delicate? To this I answer; Every fluid is compressible, and when squeezed, it does not occupy so much room as before: besides, this aqueous portion conveys itself in the lateral parts, and runs into the neighboring cells through the little holes which exist in their sides; insomuch, that all this fluctuation is performed without rupture, and the fluid re-establishes itself as soon as the pressure is finished. This last case never happens,

pens, when the compression is too strong; because the inside of the cells cannot sufficiently spread of themselves, and with celerity enough, to obey the active impulsion acquired by the vitreous humor.

At the time of a quick pressure, this fluid tears and forces the obstacles which oppose its extension; from thence no elasticity, because this fluid is dispersed and unable to produce a retro-active effect, for want of being inclosed in the cellular spaces: the heap of the cells gives the elasticity to the vitreous body, as has been already observed.

The following experiment will afford you a clear idea of the communication which exists between the cells of the vitreous humor. If, after an extraction of the vitreous body, you put it in a spoon over two or three lighted coals, you will observe, when the ebullition begins, a decrease in the vitreous body, by the contraction of its capsule, which forces the fluid contained in the little cells, to go from one into the other through the excretory pores of the capsule, and to spread itself into the spoon; but the tunics of the vitreous humor shall (though the total exudation of the fluid) keep their roundness during their heat, and they shall sink as soon as the exterior air will penetrate them again.

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The cause of the changes, comes from the introduction of the igneous parts into the cellular spaces, which give the capsule a round form: but as soon as the particles of fire have no motion at all, and that the pressure of the air or of the atmosphere, obliges them to yield to their weight, they run through the pores of the capsule: from thence the total sinking of the tunics of the vitreous body.

Take out of an eye, the vitreous body, and put it upon a sheet of paper; then its tunics shall sink by degrees, till no fluid remains in its cells. Observe, during this experiment, that the vitreous fluid equally filters through the whole pores of its capsule, and that each cell furnishes so exact a proportion of this exudation, that it is impossible the sinking be quicker in one of these parts than in the other.

Let these tunics macerate into the water during three hours; you will observe, in taking them out, that the water has run into all the cellular spaces which shall be half filled. But the exudation of this water is much quicker than that which is natural to the vitreous humor. This gives to understand, that if the fluid of the vitreous body had not a certain degree of viscosity, its exudation should be

be very quick, cause the atrophy of this body, and the loss of the organ.

These three experiments prove, that the cells of the vitreous humor communicate to each other the fluid contained into them. Were it not so, should it be possible, that the water might equally run through them, to occupy a part of these cellular spaces? The following exposition confirms more and more that intercourse.

Perform a little hole in the tunic of a vitreous body void of fluid; convey with precaution some air into it with a pipe; and when these cellular spaces shall be full, bring these membranes to the hole of a window-shutter through which some rays of the sun can come over it; then, with the help of a microscope, you will remark, if you blow carefully from time to time into these tunics, that the interior air easily runs out, as the cells are very porous, and their size prodigiously varied. The vitreous body of an ox is by far to be preferred to any other for that experiment.

Their form shall be still more sensible, if you expose, in a warm room or to the rays of the sun, the globe of an eye frozen; for, as soon as you have cut it into two hemispheres, each piece of ice will afford you an opportunity of distinguishing the figures

figures and sizes of the spaces which contain them; some are round, others oval, triangular, and so forth. It is easy to take out these pieces of ice with the point of a pin, without hurting the tunics of the vitreous body.

The density of each of these tunics is different; the capsullary is much denser than the cellular: you will be convinced of it, if you cut into two parts a vitreous body newly extracted, and make a light pressure with a buttoned probe over its capsule; there you will feel a resistance, which shall keep the probe from piercing; and if you put it in the cells, it shall penetrate entirely into the interior part of the vitreous body, and almost without any opposition at all.

It is unnecessary to enlarge any further upon these notions; therefore, as nothing is wanting now, but the proofs that the secretion of this transparent body is appointed to renew the aqueous humor, it shall be my next consideration. After you have taken out of the orbit the eye of a subject newly dead, perform a section through the cornea, as to extract a cataract without touching the iris; put the globe, a little inclined, upon a small grate, and the whole over a tumbler; then it shall flow, drop by drop, a diaphanous fluid, like the aqueous
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humor,

humor, and, in less than six hours, the eye shall become flat: cut the membranes which compose the shell of the eye, you will find the tunics of the vitreous humor without fluid. Take equal parts of the vitreous fluid and aqueous humor; put them in different vessels, to be evaporated upon a small fire, till the diminution of the two thirds; after which time you will remark, that each of these fluids has got the same degree of viscosity as a light dissolution of Arabic gum, and that some crystals swim over when they are cold. Finish the evaporation, each of them shall produce an equal quantity of alkaline salt: weigh them, you will know that the salt consists of about the tenth part or upwards.

You conceive, after these experiments, that the fluid, secreted through the vitreous body, is to renew the aqueous humor: if you make a doubt of it, you may convince yourself, in observing the swiftness of this regeneration, when the humor has been entirely evacuated in the operation of the cataract by extraction. The abundance of fluid furnished by the eye, when the cornea is ulcerated, is also a complete proof of it.

As soon as the crystalloida is opened, when a cataract is couched with the needle, you may remark, if the fluid contained into it is opaque, that
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it is hurried away towards the anterior parts of the eye: it runs not only through the pupil in form of a vortex, but it spoils the aqueous humor of the fore chamber, and ends by precipitating itself downwards in form of a sediment. It is not light enough to run of itself into the fore chamber, were it not hurried away by the flux of the humor which is secreted through the vitreous body, when it renews the aqueous humor.

But if the tears furnished by the globe of the eye, are not in so great a quantity, as the secretion produced through the vitreous bodies (which have been the subject of the above experiment) this lacrymal fluid is very little in comparison to the exudation that has been observed upon the conjunctiva? I answer: It is impossible to set a just comparison between a living eye, and one deprived of life. The impression communicated to the vitreous fluid by the circulation of the lymph, which acts without intermission into the living eye, determines a more abundant secretion through the pores of the capsule of the vitreous body; whereas, in the dead one, it is but in proportion to the specific heaviness or gravity, if the vitreous fluid runs from the centre to the circumference: consequently this secretion is exceedingly slower and less, than into the other.

The spontaneous motion of the vitreous body is accelerated, in some manner, by the simultaneous action of the *musculi recti*; at each winking this action is reiterated, but more considerable, and repeated oftener, when an extraneous body is introduced in the eye, than by a flux of tears, either abundant or common. Besides, at each winking, the tarfi make a soft pressure over the globe of the eye, which produces a great secretion of the aqueous humor through the pores of the cornea. You will observe this pressure, when you are very sleepy. You may also conceive, that every time the corona ciliaris begins to contract itself, a greater exudation must happen, through the excretory ducts in the capsule of the vitreous body, and those in the crystalloida, than is commonly existing. Look, for instance, at a word of small print, and suddenly lift up your eyes towards a distant object; at that time you will be sensible of a motion of sinking which happens into the interior part of your eyes. If you look towards a distant object, and hastily upon a near one, then you will observe a contrary movement.

If the aqueous humor was not renewed without intermission, and if its superfluous did not run through the pores of the cornea, the most chronical disorders

disorders should happen to the eye, on account of the stagnant humors. When, for example, a cataract is couched, a degree of putrefaction in the aqueous humor should ensue, and of course the destruction of the organ.

Put a cataract newly extracted into a little glass bottle full of water and well corked, the liquid shall acquire in less than eight days a cadaverous putrefaction, and become yellowish and slimy. The effusion of a purulent matter into the chambers of the eye, would be the cause of the same disorder, and the loss of the organ. The resolution of this purulent matter cannot be effected but by the spontaneous motion of the aqueous humor, which forces it to pass through the excretory ducts of the cornea.

S E C T. 4.

Upon the Crystalline Humor, deemed as one Source of the Aqueous Humor, and consequently of the Tears.

The crystalline humor is lodged and confined in a cavity, on the anterior surface of the vitreous body, opposite the pupil; it is wrapt up in its capsule,

capsule, and bathed in a diaphanous fluid, found out by the famous Morgani. This fluid nourishes the crySTALLINE lens, as some say: but let the matter be what it will, it cannot be stagnant without becoming opaque: Nature has foreseen this alteration, in dispersing over the surface of the crySTALLOIDA a great many excretory ducts, to give way to the superfluous of that humor, as soon as it is renewed.

You may observe this secretion in exposing to a great light the vitreous body with the crySTALLINE humor extracted altogether. To that effect, wipe the anterior part of the crySTALLOIDA, you will see with the help of a microscope, a transudation which manifest itself through its pores. If you cut only the crySTALLOIDA, a limpid and viscous humor, which occupies the interstice of the crySTALLINE lens and its capsule, shall come out. It flows without intermission into the back chamber to renew a portion of the aqueous humor, which compared with the secretion of the transparent bodies will be found of the same kind.

Upon

SECT. 5.

*Upon the Globe of the Eye, deemed as the most
abundant Source of the Tears.*

The great number of excretory pores in the vitreous and cryſtalline capſules, give an idea of the quickneſs with which the aqueous humor is renewed, and how much its exſudation through the pores of the cornea, muſt be accelerated and abundant ; for which reaſon one may venture to ſay, that the globe of the eye furniſhes almoſt as much of the lacrymal fluid, as the other ducts altogether. If you doubt of it, overturn the eye-lid of a living animal, and put over the globe of the eye a very fine piece of cambrick, ſufficiently large to cover it ; then you will obſerve, that the tranſudation of the fluid which comes from the cornea, and penetrates through the linen, is much more abundant than that furniſhed out of the pores of the conjunctiva, nay, from the glandula lacrymalis. If the eye were not the moſt conſiderable ſource of the tears, from whence ſhould come thoſe that we ſhed when overwhelmed either with grief or joy? You conceive to the contrary, that in both
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these states of the soul, every part is in a spasmodic motion, and that the simultaneous action of the six muscles gives a stronger pressure upon the globe of the eye at that time than at others; what determines a greater exudation of the aqueous humor through the pores of the cornea, from whence comes this abundance of tears. Besides, the action in the *corona ciliaris*, by squeezing the anterior circumference of the vitreous body, and the lateral part of the crystalloida, may in some manner contribute to it.

If the globe of the eye furnishes a great effusion, He who weeps, feels a kind of pressure in the lateral parts of his eye, and some pains for some while afterwards; because, when the eyes want to make a motion, these pains are still much more sensible in the bottom of the globe of the eyes, especially when these organs are brought to a great light. This sensibility comes from a swelling in the vessels of the retina and choroides. The want of a free circulation manifests itself, even upon the vessels of the conjunctiva, which at this time becomes red, as if the eye were afflicted with an inflammation. Besides, you may remark, that the cornea has lost of its transparency as well as the diaphanous bodies of the globe. These signs are not to
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be remaked with a flux of tears in the eye, occasioned by an obstruction in the *ductus ad nasum*, or in the puncta lacrymalia: mean while, in these disorders, the weeping is almost continual, and it is not the tears alone which swell the conjunctiva, but the power of the simultaneous action in the muscles of the eye, and the great contraction in the corona ciliaris.

SECT. 6.

Upon the Glandula Lacrymalis, and the Caruncula Lacrymalis, considered as a Source of the Tears.

The glandula lacrymalis secretes without intermission, through its excretory ducts, an oily fluid which dilutes itself into the tears, and is a corrective to them, together with those furnished by meibomius glands. Without this oily humor, the whole lacrymal fluid would injure the conjunctiva, and occasion an abundant and continual flux of tears. When this disorder happens, the fluid which spreads itself over the cheeks, causes some excoriations in the skin, which announces how much the tears are naturally acrimonious.

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You may know what is the nature of the secretory humor in the caruncula lacrymalis, if you take it off from a subject newly dead, and squeeze it softly between your fingers; the fluid which flows from its excretory pores, is yellowish and similar to that extracted from the ducts of the ears: It is easily diluted into water.

The caruncula lacrymalis is formed by many little oblong, whitish glands, united together and pretty near of the size of a poppy seed, and every one of them have their particular capsule and excretory ducts; their orifices are seen upon the portion of the conjunctiva, which covers this glandulous body; you may distinguish their secretion with a microscope, in removing the eye-lids.

When the filters of this gland are in an atony state, the heterogeneous parts get into them; then the secretion furnished by the excretory ducts, is very abundant and like a purulent matter commonly called the gum of the eyes. In this state the humor does not dissolve into the tears, for which reason this disorder is never without a flux that discontinues as soon as the caruncula lacrymalis is re-established.

The caruncula is not only necessary to mitigate the acrimony of the tears by its secretion, but also

also a rampart to impede them from spreading into the great angle, and from thence down the cheek. The *vulvula semilunaris* formed by this gland, together with the conjunctiva, serves to direct the tears towards the puncta lacrymalia.

SECT. 7.

Upon the Glandulæ Sebaceæ Meibomii, deemed as a Source of the Tears, and their Corrective.

Moreover, it was necessary that the tears had some corrective able to assuage the sharpness of their acrimony; because the caruncula lacrymalis cannot produce a sufficient quantity of oleaginous humor to do it: besides, the situation of this gland is not fit to convey this humor and spread it over the whole surface of the globe of the eye. Nature has taken care of that, by the means of a great many glands, situated into the tarfi of the eye-lid; they are dispersed and contained in a great number of ducts, whose orifices open themselves upon the internal edge of the tarfi, at an equal distance from each other. These glands are in a greater number into the ducts, which occupy the middle of the tarfi, than towards the commissures. It is essential to observe

too, that there are a greater quantity of them in the superior eye-lid, than in the inferior. Each of these glands are commonly of the size, form, and color, of a little white poppy seed; every one of them has a particular excretory duct, which pours out the oleaginous humor into the common duct; and this, pours it out again to the edge of the tarsus, where it is diluted into the tears at each winking. The color and consistence of this humor is like the white honey, lightly mixt with amber; and it is not only fit to correct the lacrymal fluid, but yet to help the motion of the eye-lid, and moderate the action of air upon the visual organ. You may also consider this humor as a kind of plastering, proper to diminish the too great secretion of the tears. Meibomius glands are never obstructed, without the consequence of an immoderate flux of lacrymal fluid.

These glands are attacked with the same indisposition, as those of the *caruncula lacrymalis*, that is to say, with the gum of the eyes. This matter is not wholly diluted into the tears; for which reason, it gathers at the edge of the tarfi, and glues the eye-lashes to one another in the night-time, to such a degree, as to close the eye-lids so fast, that
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you can hardly open them, and take it off when dry.

If you compare the number and diameter of the excretory ducts of meibomius glands, and those of the caruncula lacrymalis, together with the excretory ducts of the tears, you will know that this sebaceous humor may amount to the eighth or ninth part of the lacrymal fluid.

You may, besides, convince yourself that the secretion of meibomius glands is diluted into the tears, if you examine that the eye-lids are sufficiently closed, to hinder the tears from falling over the cheeks; that the channel formed by the union of the tarfi, is not full enough of lacrymal fluid to force them, as to be distant one from another; that the middle of this channel is occupied, and the remaining part of it filled by the vapor of the tears that dilute the oleaginous humor of the glandulæ sebaceæ of the superior eye-lid: so that every thing proves the secretion of meibomius glands to be a part of the tears.

SECT.

SECT. 8.

Upon the Quantity of the Tears, their principal Functions, and by which Way this Fluid flows.

The tears are not only to water the external part of the eye-lids, to keep, soften, and moist them in a suitable state, and maintain the brightness and transparency of the cornea; but they help, besides, to moderate the action of air which strikes this organ, to carry along towards the internal angle, and from thence out of the eye, the extraneous bodies which introduce themselves in it. To that end, nature increases the secretion of this fluid, by a stronger simultaneous action of the six muscles of the eye, to assist the organ in getting rid of them. The tears help also the refraction of the rays of light. It was consequently essential, that the lacrymal fluid should be uniformly spread over the surface of the globe, and that the winking were repeated; in order the tears should not form some inequality, which, in causing false refractions, might be hurtful to the quickness of our perceptions. Moreover, the flux of the tears being continual, hinders those which water the
anterior

anterior of the eye-lids, to go back into the excretory ducts from whence they came. You may conceive the quantity of the lacrymal fluid in proportion to the rotundity of the globe ; and when it is too copious, or in a less abundance than in the natural state, various and dangerous disorders must ensue. In fact, the too great secretion of this fluid occasions the epiphora or flux of tears, which diminishes the perceptions. A less quantity than is necessary to water the eye and eye-lids, causes a great deal of pains by the immediate touch of these parts, especially in the time of their motions : This indisposition foretels a spasm in the fibres of the organ.

In the space of four-and-twenty hours the secretion of the tears produced by each eye, is commonly two ounces or upwards. To have the proof, put to the circumference of one of your eyes, a little drinking glass to keep the exterior air out, and let it remain so for half an hour ; you will observe a light vapor, which in a little time, forms some drops over the whole extent in the inside of the drinking glass ; these drops will amount to the weight of twenty, or five-and-twenty grains. If you examine the kind of this fluid, you will find it free from the viscous and salted parts which are mixt
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with the tears. It is doubtless one of the causes which renders more viscous the fluid squeezed out of the *faccus lacrymalis*, when the *ductus ad nasum* is obstructed. This fluid is also more viscous than the aqueous humor, which becomes so too, as soon as it covers the surface of the globe; because it is mixt with the secretion of meibomius glands, and that of the *caruncula lacrymalis*.

Every body knows, that the puncta and ducts lacrymalia absorb the tears, which cannot be evaporated: but it remains to know what may be their quantity; if you would acquire it, squeeze with precaution the *faccus lacrymalis*, and gather exactly the fluid contained in it, from twenty to twenty minutes: in the space of an hour and a half, you will gather the weight of thirty or thirty-five grains, what amounts to a drachm, with the portion evaporated: consequently the total of the tears, spread over the globe of the eye in the space of four-and-twenty hours, amounts to two ounces or upwards. People who make use of spectacles, have had several opportunities of observing, that the evaporation of tears tarnishes very much the glasses, as well as the circle which surround them.

It is needless to observe, that it was necessary the lacrymal organ had some ducts to pump the superfluous

fluious of the fluid for its perfection. Let us now consider what they are, and their mechanism.

On the Absorbent Lacrymal Ways.

The absorbent lacrymal ways are made up, first, of the groove in the os unguis, and the bony *ductus ad nasum*; 2dly, of the puncta lacrymalia, with their common ducts; 3dly, of the saccus lacrymalis; 4thly, the nasal duct. All these parts but the first compose one and the same continuity.

SECT. I.

Upon the Structure of the Puncta Lacrymalia, Saccus Lacrymalis, and Ductus ad Nasum.

The puncta lacrymalia are cartilaginous, and always open in a sound state. If they were membranous, the least compression would sink and put them in such a situation, that they should not continually receive the tears, as soon as they are gathered into the valvula lacrymalis.

The puncta lacrymalia are contracted, when an extraneous body touches them, and dilated when

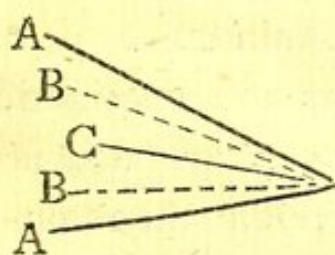
A a out.

out. They have very sensible vermicular motions, which happen at every winking. To be convinced of it, lift up the superior eye-lid, and touch the lacrymal point with a buttoned probe, this orifice will immediately contract itself. Overturn a little the inferior eye-lid, and try the same experiment upon the other; then you will have an opportunity of observing the same contraction, with this difference, that it will not shrink as much as that of the superior eye-lid. Lift up a second time the superior eye-lid with your fingers, then you will see a kind of nipple of a line and a half long, coming down on the inferior lacrymal point at every winking; and that the hole, which is at its end, is very open, and its diameter larger, than usually that of the lacrymal point. The direction of this nipple is towards the *valvula lacrymalis*, and a little inclined upon the groove of the *caruncula lacrymalis*. If you let the eye-lid more downward, it will come down into the *valvula lacrymalis*. As soon as the eye-lid is up, the orifice of the nipple is closed, and its exterior length diminished to such a degree, as to be entirely out of sight. This gives to understand, with very good reason, that there is a peristaltic or vermicular motion in the whole extent of the lacrymal duct, when this nipple gets in again.

Overturn

Overturn the inferior eye-lid during its action, you will see a nipple which goes out from the lacrymal point, as a kind of convexity from within the inside of the duct, and that this nipple is shorter, the diameter of its orifice larger, and its contraction less, at the time of its re-action, than that of the superior eye-lid; but it will disappear as quickly as the superior. Compare, furthermore, the puncta lacrymalia together, you will see that the inferior is twice wider than the superior.

If you remove with your fingers both eye-lids from each other, you will observe that the superior goes up and down perpendicularly, and the inferior obliquely. The action of the latter moves its tarsus from the external angle to the internal, in raising the lacrymal point upwards; its re-action makes it retrograde, and, for want of action, it remains horizontal.



The lacrymal ducts, in joining together in the internal angle, under the middle tendon, look like this figure. When the eye-lids are entirely open, their tarfi are in the situation A A; then the inferior lacrymal duct is horizontal, whilst the superior is inclined. When the tarfi are in the position

A a 2

B B,

B B, the inferior lacrymal duct keeps a small inclination, and the superior is less inclined than it was in A A. When the eye-lids are closed, the ducts are in C; then the superior lacrymal duct is horizontal, and the inferior inclined; insomuch, that the superior runs over the globe three times more than the inferior, to arrive at the point where the tarfi meet together. These changes happen at every winking, and produce some particular effects, like the nipples of the puncta lacrymalia.

By what mechanism the puncta lacrymalia do contract, dilate, and stretch forth their nipples, and pull them back to a degree that nothing of them remains, is a question we must enquire into. You will believe that these orifices have a sphincter, and their ducts a plane of straight fibres, if you examine their motions: this idea comes of itself, after the knowledge one has of the matter. As the speculation is not sufficient, we must have recourse to observation and experiments, to sustain it.

Every thing tells that the tears are detained, during some time, into the sacculus lacrymalis, as the urine is into the bladder; therefore the retention cannot exist without a sphincter in the lacrymal bag. The tears are also poured out into the nostril, but only when this sphincter is dilated by
the

the contraction of the *faccus lacrymalis*, occasioned by the pressure of this fluid over the bottom of its reservoir.

Infil in your eye some drops of a bitter liquor, and put your head inclined backward: this fluid will very soon go through the *puncta lacrymalia*. If the tears flow directly into the nose, and from thence into the throat, you will taste an insupportable bitterness: but if there is a space of two or three minutes before you taste it, you may wisely conclude, that this liquor has been detained into the *faccus lacrymalis*; consequently the tears gather in this bag to a certain quantity, till it contracts itself to open its sphincter, and let them run through the *ductus ad nasum*.

If the *ductus ad nasum* had always had its diameter open, a very sensible effect should have been the consequence at every time you would have blown your nose. In fact, the air, by going in through the *puncta lacrymalia* and nose, should force the tears to run back into the eyes. This is what generally happens to those who have occasion for a pipe, whether into the *ductus ad nasum*, or into an aperture performed through the *os unguis*.

If

If you squeeze with your fingers upon the *faccus lacrymalis*, to force its obstacle and give an issue to the tears through the *ductus ad nasum*, you will doubt no longer of a retention of tears into it, on account of a contraction in the sphincter. You conceive easily the impossibility to let the tears out by a simple pressure, through so great an obstacle, if the retention of this fluid is really occasioned by a total obstruction in the *ductus ad nasum*, phlegosis, or a callosity in this part.

Every body knows that there are some retentions of tears which do not yield to the strongest pressure upon the *faccus lacrymalis*; and even when you squeeze with your fingers this fluid, instead to flow down through the nose, it runs up through the *puncta lacrymalia*. This, however, is not a proof that the obstruction in the *ductus ad nasum*, is not occasioned by the contraction of its sphincter. If there are some subjects in whom the sphincter yields to the effort of the pressure, this is because its fibres are not in a spasm or erethism; for they have softness enough to be dilated, but not sufficiently to be submitted by a contraction in the bag, and the specific gravity of the tears contained in this reservoir.

Every

Every man may have had an opportunity of observing, that some people have almost a continual flux of tears during the day, and the *faccus lacrymalis* swelled; whilst this tumor disappears, as well as the flux, during the sleep, and that both these disorders appear again as soon as they are up. The glands of the *faccus lacrymalis*, tho' smaller, are analogous to those of *meibomius* glands and *caruncula lacrymalis*. If the latter furnish some purulent matter, commonly called the gum of the eyes, when these filters are obstructed, why those of the former should they produce none? It is most probable, that these glands furnish the same humor, when their filters are in an atony state, and that this humor is acrimonious enough to irritate the nasal sphincter, to such a degree, as to intercept, by its contraction, the passage of this purulent matter, as well as that of the tears.

These fluids extend the inside of the *faccus lacrymalis*, by gathering into it: this is what forms a tumor more or less considerable, especially when the membrane of this reservoir does not keep its natural oscillation. If the fibres which compose it have strength enough, the stagnant fluid goes up through the *puncta lacrymalia*; but when the humor which flows through the glands of the *faccus lacrymalis*,

is acrimonious to a degree greater than usual, then the sphincters of the puncta lacrymalia acquire the same corrugation. In this case the purulent matter cannot get through; it gathers, extends its reservoir, corrodes its anterior parts and teguments, and at last forces every obstacle to spread itself over the cheek. This thick and yellow matter may be mistaken for some pus, and make one believe there is an ulcer in the interior part of the sacculus lacrymalis.

It is a very uncommon case to see the os unguis rotten without an external cause. Let us suppose, for a moment, the inside of the reservoir ulcerated enough to furnish as great a quantity of pus, as that which goes out through the puncta lacrymalia in a fistula lacrymalis; in such a case, the loss of substance should be unavoidable, and the thinness of the membrane should discover the bone in a little time: from thence the most chronical disorders would ensue, by the impossibility of a heal in the sacculus lacrymalis; and the exfoliation of some bones, together with an irregularity in this part, and the effect of the tears, which should be no longer pumped. The depravation in the humors and their too great abundance, the want of systole in the tubes, the passage of the particles of blood
into

into their filters, the stagnant tears in the reservoir, the erethism in the nasal sphincter, the atony state in the membrane of the reservoir; lastly, the acrimony in the tears and gums, which irritate the nasal sphincter by their touch, and produce a stay in this lacrymal reservoir, are some other causes sufficient to produce several disorders in the glands of the *faccus lacrymalis*.

After such an account, every one may wisely conclude, that a retention of tears has been very often mistaken for the *fistula lacrymalis*. However, there is no impossibility to meet with an ulcer in the *faccus lacrymalis*, as well as in the other parts of our body; but the case is very uncommon. A disorder in the glands of the lacrymal reservoir, is often deemed an ulceration; and this is as common as the former.

SECT. 2.

Upon the Mechanism of the Absorbent Lacrymal Ways, which pump the exceeding Part of the Tears.

The *puncta lacrymalia*, the *faccus lacrymalis*, and the *ductus ad nasum*, compose but one channel,

B b

whose

whose form and use should be termed lacrymal syphon. Two things are necessary in a syphon to pump the tears; first, that it be full of fluid; secondly, that the branch which soaks into the liquid be shorter. When the syphon is full of tears, and the holes always open to the lacrymal fluid, the tears flow from the highest branch into the lowest, and this is sufficient to give the tears an opportunity of running continually into the nose.

The action of the eye-lids must be considered as one of the causes which force the tears to flow down through the puncta lacrymalia. You meet with a convincing proof of it in a retention of tears: in fact, the tears run into the sacculus lacrymalis during this disorder, and not by the mechanism of the lacrymal syphon, because it is shut: therefore the action of the eye-lids, in this case, is the only cause which forces the tears to run down through the puncta lacrymalia into the sacculus lacrymalis; for which effect, the eye-lids force the tears through the puncta lacrymalia, with the whole power of a spring set loose. Let us begin to describe the motions of this wonderful hydraulic engine in its natural state; this will be the only way to know the exact pathology which refers to the lacrymal organ, and improve in the physiology of this part.

As

As soon as the action of the eye-lids begins, the longitudinal fibres in the lacrymal ducts, acquire a quick movement of extension, which forces the anterior extremity of every one of these pipes, to stretch forth in the form of a nipple. This dilates at the same time its orifice, which, being a little inclined towards the globe of the eye, runs swiftly into the groove of the *caruncula lacrymalis*, and steepes into the tears, by the power of the oblique motion of the inferior eye-lid. At the same time of the re-action of the eye-lids, each nipple, in going back quickly towards its ducts, acts as a piston, able to pump a bulk of fluid relative to the superfluous of the tears. Besides, the contraction in the sphincter, which happens at that time too, quickens their intromission into its duct, and the systole and vermicular motion of it, hurries away the tears into the reservoir. This forcing and lifting pump renews this mechanism at every winking, what is sufficient to absorb or lift up the superfluous of the lacrymal fluid.

The two pistons of the lacrymal ducts are also in action, to pump the tears during sleep. It is not the oblique rising of the inferior eye-lid, which forces this fluid to run into the groove of the *caruncula lacrymalis*; but it is by the junction of the

tarfi, which form a kind of channel to direct the tears, together with the continual action of both the lacrymal pistons.

This mechanism is grounded upon the most exact rules of hydraulic and hydrostatic. You will be convinced of this assertion, when you compare the structure of the absorbent lacrymal ways, with that of a pump which draws up water by attraction and weight. To one of this kind, levers and power to put them in motion, are necessary; here, both are existing, or centered in the eye-lids. Pistons which go fore and back, in proportion to the action given by that of the levers, are also necessary; here, the lacrymal nipples act as pistons. But the pistons of a pump would be without effect, if they were not involved in a pipe, whose diameter should not be proportioned to the bulk of the piston. The same thing is existing in the lacrymal nipples, since they have no effect but when involved in their ducts. In order that a pump be forcing and lifting, the piston must stretch forth with a sufficient power, to squeeze the fluid appointed for its action, and compel it to go in with much celerity into the pipe of the pump: The lacrymal fluid performs it. To quicken the intromission of the fluid into the pipe, the piston must have a retro-gade

grade motion: It is the effect produced by each lacrymal nipple, in going back into their ducts. The pipes of a pump, are not only to help the aspiration of the fluid, but yet to convey it into the reservoir which is for that purpose: The lacrymal ducts answer this object, in pouring out the superfluous of the tears into the *saccus lacrymalis*. A reservoir has occasion for a spiggot, to make way for the fluid, or its superfluous: That of the tears has, in the *ductus ad nasum*, a sphincter which is opened or shut, when necessary to perform the same function.

You conceive, after this parallel, that the constant occlusion in the *ductus ad nasum* cannot be an obstacle to the passage of the tears from the eye into the *saccus lacrymalis*; because here, it is not necessary, as in the mechanism of the syphon, that the inferior branch be opened, to give the lacrymal fluid an opportunity of running through the ways appointed by nature for its absorption. In a word, the passage of the tears exists by the action of two lacrymal points, not only during sleep or awake, but in every situation of the body. This mechanism is fix and permanent in its manner of being, unless the parts be afflicted with some disorders. In fact, there is nothing but a
decay

decay in the puncta lacrymalia which may disturb this harmony; the spasm or atony in their fibres may also suspend it.

The tears cannot run out from the internal angle of the right eye, when you lie down on the right side; because, at every winking, the oblique motions of the inferior eye-lid lifts up this fluid towards the internal angle, to be pumped. They cannot also flow into the internal angle of the left eye, though you lay down on the opposite side; because the lacrymal pistons pump the fluid as soon as it gathers there.

The momentaneous action in the lacrymal pistons is sufficient to pump the tears while awake; because there is a certain quantity evaporated into the air. During the sleep time, a constant action in the eye-lids supplies for the air, as the secretion is less, on account of the stillness in the muscles. The action in the superior piston is quicker than in the inferior, because the specific gravity of this fluid opposes a resistance, when it is lifted up; and if the effort of the piston could not overcome it, the tears would not spout into the superior lacrymal duct. So great an activity was unnecessary in the inferior piston; because the fluid acquires in its fall new degrees of swiftness: besides, the piston and
systole

fyftole in the action of the duct, quicken it. The heterogeneous parts which compose the tears, as the falt, &c. increafe the fpecific gravity of this fluid, and of courfe its fall into the lacrymal duct.

After fuch an explanation and expofition of the difference which exifts in the diameters of the lacrymal ducts, you comprehend, that the inferior duct gives way to a greater quantity of tears than the fuperior; and that the inferior piston would not have been able to perform its functions, if its eye-lid, by its oblique motions, had not directed it into the groove of the caruncula lacrymalis, and given to its duct fuch a direction to its nipple, as it might be higher than the extremity of the angle, formed by the junction of the lacrymal pipes: in like manner, the fuperior piston fhould never have been able to pump the tears, if its eye-lid had always been kept open. Intervals between the winkings were alfo neceffary, for otherwife the puncta lacrymalia fhould pump the tears without intermiffion, and occafion, in many people's eyes, a kind of aridity, which would be hurtful to the organ.

The fmaller the globe of the eye is, the greater diftance the eye-lids are from each other, when the eyes are open, *et vice verfa*; infomuch, that there are a great many of the latter clafs, in whom
the

the inferior lacrymal point is so lifted up, that the piston is in a continual action.

A great quantity of tears in a voluminous eye, comes from a greater number of excretory ducts, dispersed upon the surface of the cornea, and that of the conjunctiva, together with the other parts whereon the excretory ducts of the tears are to be found. We may reasonably conclude, by closing the subject, that this lacrymal fluid falls into the throat, and from thence in the stomach, to help the digestion.

The Formulæ Medicamentorum were intended for the last part of my work, according to the distribution of my Preface: but it being more convenient here for the references from the observations, I beg the reader's pardon, and wish he would be so kind as to pass them for the present.

FOMULÆ

 FORMULÆ MEDICAMENTORUM.

No. I.

Ptifana Communis.

℞. Radic. Gramin. mundatar. contuf. & incif.	℥ iv.
Coq. in Aq. comm.	℔b. xij.
ad	℔b. x.
Infund. Glycyrrh. raf. & contuf.	℥ j.
F. S. A. Ptifana.	

This ptifan is of fuch a nature, that it opens the pores by the means of its fharp particles, cuts the thick and vifcous humors, either in the blood or lymphatic veffels; infomuch, that they can eafily circulate through them, after the ufe of it. Its dofe, for a common conftitution, is two quarts per day, drank every other hour by a gill; but, in order the patient be able to digeft well his meals let two hours diftance be before and after them.

No. II.

Ptisana seu Aqua Hordei.

℞. Hordei confr. & loti	℥ iv.
Coq. ad tertiæ partis consumpt. in Aq. comm.	℔. xij.
Infund. Glycyrrh. ras. & contus.	℥ j.
Cola & F. Ptis.	

This ptisan cleanses the body from sluggish and viscous humors. It is more deterfive than the above; its dose and manner of drinking is just the same; besides, it is exceeding good for the affections in the breast.

No. III.

Ptisana seu Aqua Orisæ.

℞. Orisæ mund. & lotæ,	℥ ij.
Bull. per semihor. in Aq. comm.	℔. xvj.
Adde, si lubet, Rasur. C. C. in nodulo inclus.	℥ jss.
vel ex præscripto Rad. Consolid. major.	℥ iij.
F. Ptis.	

This ptisan, for common drink, as the above. It is very asswaging in hemorrhagiæ and disenteric affections.

No. IV.

No. IV.

Ptifana Lapathi.

- ℞. Rad. Lapathi acuti mundat. & incif. ℥ iv.
 Coq. ad tertiæ partis confumpt. in Aq. comm.
 ℔. xij.
 Infund. Glycyrrh. raf. & contuf. ℥ j.
 F. Ptif.

This ptifan is of a great benefit for removing the jaundice and obstructions in the liver. Its dose is four gills per day, one by one, drank at equal times.

No. V.

Ptifana Laxans feu Regia.

- ℞. Rad. Lapathi acut. ℥ jss.
 Polyp. Quern.
 Chichor. Sylvestr. ana ℥ j.
 Fol. Orient. mund. ℥ vj.
 Sal. Cathart. amar. ℥ j.
 Bull. in Aq. comm. ℔. iv. ad ℔. iij.
 Sub finem Adde Anifi, ℥ j.
 Liquir. raf. & contuf. ℥ iij.
 Malum Citreum in talleol. sect. No. i.
 Colet, Liquor.

This ptisan is a gentle purgative, very effective and convenient. Its dose is three gills, each to be taken in a morning at half an hour distance from one another, after which the patient may drink and eat moderately at his meals as usual.

No. VI.

Decotum Cephalicum.

℞. Herb. Meliss.

Beton. ana

M. iv.

Summit. Florid. Galli luteii,

Stæchad. ana

M. ij.

Coq. leviter in Aq. comm. S. Q. ad lb. xij.

This decoction is very effective for removing head-achs and numbnesses of the senses; it fortifies the nerves and refreshes the animal spirits. Its dose is four gills per day at proper and equal distances.

No. VII.

No. VII.

Decoction Diureticum.

℞. Rad. Brusc.	
Asparag.	
Rubiæ Tinct. ana	℥ iv.
Fol. Pariet.	
Chritmi,	
Herniar.	
Raphan.	
Summit. Lupul. ana	M. ij.
Coq. in Aq. comm.	℔b. xvi. ad xij.

This decoction is attenuating, incisive, and works powerfully by the urine, especially when the reins and bladder are lined with clammy or gluish humors. It is also made use of with success in several kinds of hydropies, to carry off the thinner part of the mass of the blood through the urine. Its dose is six gills per day, taken separately, as circumstance requires it.

No. VIII.

No. VIII.

Decoction Ophthalmicum.

℞. Fol. Euphras.	
Plantag.	
Fænicul. ana	M. iv.
Chelid. maj.	M. ij.
Flor. Rosar.	
Cyani, ana	Pug. iv.
Coq. in Aq. comm.	℔. xv. ad xij.

This decoction is made use of with success in the inflammation of the eye-lids and conjunctiva. The use of it, is to wet softly the outward parts of the globe of the eye, when covered with its eye-lids, with a small hair pencil dipt in the decoction. But I shall observe here, that the patient ought to keep his eye shut till the eye-lids be quite dry of themselves, in order the lotion have a proper time to infiltrate through the pores of the skin. This lotion may be made use of as often as the case requires it, without any bad consequences.

No. IX.

No. IX.

Decoction Cassie.

℞. Siliq. Ægyptiacar. confract.	℔. ʒ.
Coq. in Aq. comm. vel feri Lactis Q. S.	
ad	℥ xij.
Colat. Solv. ex Præscript. vel Tart.	
Solub. vel Salis Polychr. Rupell	℥ ij.

This decoction softens and loosens the belly in a gentle manner. Its use continued for several days together, removes costiveness. The patient divides the above dose in two potions, and drinks them in a morning at one hour distance from one another; he may even divide it into three, if he likes it better, always keeping a due regulation of time.

No. X.

Decoction Sennæ.

℞. Fol. Senn. mund.	℥ ʒ.
Salis Veget. vel Sal Rupell.	℥ ij.
Bull. leviter in Aq. comm. S. Q. ad	℥ xij.
Infund. Semin. Anisi,	
Fœnicul. ana	Pug. j.
Liquirit. cont.	℥ ij.
Colet liq.	

This

This decoction is a strong and powerful evacuative for carrying off all kinds of humors. The dose of this prescription ought to be divided into two potions, and drank in a morning at two hours distance from each other.

No. XI.

Potio Cathartica Emolliens.

℞. Decoct. Cassiæ,	℥ vj.
Solv. Mann.	℥ ij.
Sal. Vegetab.	℥ j.
vel Salis Chathart. amar. vel Polychrest.	
Solub.	℥ ij.
Addi potest, ex Præscript. Syrup. de	
Cichor. compos. vel de Pomis vel de	
Rosis Solut. ℥ j. vel Q. S.	

This potion is purgative, and carries away the foul humors in a gentle manner, if the patient has been prepared to it by the use of some diluent drink. It ought to be preferred as a first purgation in acute and inflammatory disorders. The whole may be taken at one time.

No. XII.

No. XII.

Potio Hydragoga.

℞. Decoct. Senn.	℥ vi.
Solv. Mann.	℥ j ss.
Colat. Adde Pulv. Jalapp. vel Corna- chin.	℥ ss.
Dilue Syrup. de Rhamno Cathartic.	℥ j.

This potion evacuates powerfully the ferocities. It ought chiefly to be made use of in hydropical cases, and œdematous affections. The dose may be drank at one time as the above.

No. XIII.

Pulvis Sternutatorius.

℞. Radic. Ireos,	℥ j.
Fol. Majoranæ ficc.	
Florum Lili convall. ana	℥ ss.
Helleb. alb.	℥ j.
F. Pulv.	

This sternutatory powder is very beneficial for removing habitual and inveterate head-achs, apoplexy, and soporous affections; it produces fre-

D d

quent

Collyrium Temperans.

Solani, ana	℥ iij.
Trochisc. alb. Rhafis,	℥ j.
Sacchar. Saturni,	Gr. x.
M. F. Collyrium.	

This collyrium is generally made use of for the inflammation in the eye-lids. Its use is to wet them, with a soft rag dipt in it, three times a day, as long as the inflammation subsists.

Collyrium in Variolis.

Plantag. ana.	℥ ii.
Croci pulver.	Gr. xv.
M. F. Collyr.	

This

This collyrium is of very great service when the eyes are too watery, as it asswages the acrimonious humors, which, in this state, bathe continually the exterior parts of the globe. Its use as the above.

No. XVI.

Collyrium Resolvens.

℞. Decoct. vel Aq. stillat. Ophthalm.	℥ vj.
Ireos pulv.	℥ j.
Caphuræ,	
Croci pulver. ana	Gr. viij.
Spirit. Vini,	℥ j.
Sacchar. Candi,	℥ j.
M. F. Collyr.	

This collyrium ought to be particularly made use of when the ophthalmies come from the obstruction in the ciliary glands, as it proves of great success in these cases. If the globe of the eye be not affected, some very fine compresses lightly wet in it may be applied over the eye-lids, and fixed up with as little compression as possible.

No. XVII.

Collyrium Astringens.

℞. Aq. stillat. Rosar. rubr.	
Plantag. ana	℥ vj.
Tuthiæ præparat.	℥ j.
Vitriol. alb.	Gr. x.
Alumin.	Gr. vj.
Misce.	

This collyrium strengthens the membranes which make up the outward parts of the eye. It is used as the above.

No. XVIII.

Collyrium Vulnerarium.

℞. Decoct. vel Aq. stillat. Ophthalm.	℥ vj.
Radicis Aristoloch.	
Ireos pulver. ana	℥ j.
Elixir Propriet.	Gutt. xv.
Aq. Vulnerariæ,	℥ j.
Misce.	

This collyrium is used as the above; its propriety is to dispel inflammations when produced by extraneous bodies, wounds, or contusions in the eye.

No. XIX.

No. XIX.

Collyrium in Inflammationibus.

℞. Vitriol. alb.	ʒj.
Camphor.	ʒ ss.
Ireos Florent.	ʒj.
Inde in Ovi Albumine indurato, ex	
quo prius Vitellus exempt. fuerit.	
Macera, per 4 hor. in Aq. Plantag.	
	Rosar. ana ʒvj.
Contere Totum ad totius Solutionem,	
& Cola.	

The habitual inflammations, and what the vulgar call continual red eyes, can only be removed but by the re-establishment of the tone in the lymphatic vessels which ramificate the conjunctiva over the globe, and spread by degrees over the cornea, nay on the internal surfaces of the eye-lids; therefore, as this liquid has a propriety of cooling with that of deterging, it is recommended in such cases.

No. XX.

No. XX.

Enema Simplex.

℞. Aq. comm. vel Decoct. Furfuris, vel
Semin. Lini Q. S.
Fiat Enema.

This clyster ought generally to be given in the beginning of any chronical disorders, to facilitate the evacuation of the excrements in the belly and bladder, when patients are costive; besides this, it is also necessary to cool the humors during the course of the disorder.

No. XXI.

Enema Emolliens.

℞. Decoct. Emollient. Q. S.
Adde Olei Olivar. ℥ iij.
F. Enema.

Cum doloribus excruciantur Intestina, aut Inflammatione laborant abdominis Viscera Enematis Emollientibus demulcentur.

Decoct. vero Emolliens fit ex fol. Malvæ, Altxæ, Betæ, Violar. Mercurial. Senecion. ana Q. S.

No. XXII.

No. XXII.

Enema Emolliens Laxans.

℞. Decoct. Emoll. Q. S.

Dilue, ex Præscript. vel Mell. Mercurial. vel Nymphææ, vel Violar.

ad

℥ iv.

vel Electuar. Lenitivi,

℥ j.

vel Pulpæ Cassiæ, ad

℥ ij.

vel Siliquar. Ægyptiacar cum Nucl.

confract. ad

℥ viij.

Fiat Enema.

This medicine injected into the bowels by the fundament, is of a great help to a slow purgative, or very recommendable to dispose patients for copious evacuations, when other methods fail.

No. XXIII.

Injectio Vulneraria.

℞. Decoct. Herbar. Traumatic. comm.

℔ . j.

Mellis Rosat.

℥ ij.

M. F. Inject.

This injection is made use of to clean deep and fistulous wounds; it deterges also the faccus lacrymalis,

malis, and re-establishes it to its natural state. It may be injected, either luke warm or cold, through the puncta lacrymalia, or the inferior orifice of the ductus ad nasum; but it operates more powerfully, when employed warm than cold.

No. XXIV.

Injeētio Valneraria Composita.

℞. Radic. Ireos Florent.
 Aristoloch.
 Gentian. ana ℥ i ss.
 Coq. in Aq. comm. ℔. viij. ad ℔. vj.
 Adde Summit. Hyperic.
 Absinth.
 Centaur. min.
 Fol. Agrimon.
 Scordii,
 Hederæ terrestr. ana M. j.
 Coq. iterum ad ℔. v.
 Colaturæ singulis ℔. Adde, ex Præ-
 scripto, Vini alb. vel Spirit. Vin.
 vel Aq. Vulnerariæ, vel Tinctur
 Myrrhæ aut Aloes
 Q. Conven.
 F. Injeēt.

This

This injection is made use of as the above, and in the same cases; but it is a great deal more deterfive, and resists to the putrefactive humors till it carries them off along with it.

No. XXV.

Injectio Astringens.

℞. Decoct. vel Aq. still. Astringent. vel	
Aq. Plantag.	℔. j.
Mellis Rosac	ʒ ij.
Lapid. Medicamentosi,	ʒ ss.
Misce.	

This injection is deterfive; its use as above. It is also recommended as a lotion when the faccus lacrymalis is so far disordered, as to be fistulous in the cellular texture.

No. XXVI.

Fotus ad Erysipelas.

℞. Fol. & Flor. Sambuc	M. v.
Coq. ad tertiæ partis consumpt. in Aq. comm.	℔. v.
Colat Add. ex Præscript. Aq. Vitæ, vel Spiritus Vini Camphor. Q. Conv.	
E e	This

This fomentation is of a great benefit for removing the erysipelatous disorders; its use consists by wetting the parts several times a day; and in case it cannot be practised, a fumigation of the same fluid ought to take place, as it does not so much excoriate the epidermis. This operation of fumigating requires that the fluid should be boiling hot, and that the patient should expose the disordered parts over the steam, till a sufficient infiltration be operated, to dilate the parts as the case requires it.

No. XXVII.

Cataplasma Emolliens.

℞. Radic. Lilior. albor.

Alth. ana

℥ ij.

Fol. Malvæ,

Althææ,

Acanthi,

Senecion. ana

M. j.

Flor. Verbasc.

Chamæmel.

Melilot. ana

Pug. iij.

Coq. in Aq. comm. S. Q. ad Putrilaginem.

Magma Contunde, & per setaceum Trajice.

This

This cataplasme softens the tumors which arise from inflammations; they must be applied as warm as possible. But I will observe here, that in case the globe be inflamed, the emollient fumigation is preferable, as it answers both ways, without any bad consequence.

No. XXVIII.

Cataplasma Resolvens.

℞. Fol. Alth.

Perficar. urentis,

Parietariæ,

Scordii,

Abfinth. ana

M. j.

Flor. Chamæm.

Melilot.

Sambuc. ana

Pug. iij.

Semin. Carvi,

Anethi,

Fœnu græci, ana

℥ j.

Cumini,

℥ ss.

Bulliant, ad Putrilaginem, in Oxymell.

S. Q.

E e 2

Pulpæ

Pulpæ trajectæ adde Farin. Orob.

Fabar. ana ʒ ij.

Coq. cum Decocto ejusd. Cataplasmat.
ad debitam Consistentiam.

Adde Camphoræ in Spirit. Veni Solut. ʒ j.

Fiat S. Art. Cataplasma.

This cataplasm is made use of in case of cold tumors; its activity divides, attenuates, and dissolves very powerfully the thick and gluish humors which occasion those kinds of tumors.

No. XXIX.

Cataplasma ex Quatuor Farinis.

℞. Quatuor Farin. Resolvent. lb. j.

Coq. ad debitam Consistentiam in Vini
S. Q.

This cataplasm is not so active as the above; its propriety is to re-establish the motion of the eye-lids when suspended. Its use as the former.

No. XXX.

Fotus ad Erysipelas.

℞. Flor. Sambuc.	
Chamæmel.	
Melilot. ana	Pug. j.
Infunde in Aq. bull.	℔b. j.
In Colatur. Dissolve Sapon. alb.	ʒ ij.
Adde Spirit. Vin.	ʒ ij.

This fomentation is warmly recommended in erysipelatous cases; but I observe here, that the spirit of wine must be suppressed in the beginning of the inflammations, as it increases them instead of asswaging the disorder. The principal aim for removing them, is to avoid all kinds of heat in the parts, and relax the whole to a certain degree.

No. XXXI.

Pommatum deterfivum.

℞. Adeps vipera,	
Tutia preparat. ana	ʒ j.
Albus precipit.	ʒ ij.
Misce ut fiat pommatum, dein adde	
bals. commend.	Gutt. xij.
	This

This pommatum is a powerful deterfive in the inflammations of the conjunctiva; that is to say, when the lymphatic vessels, which ramificate this membrane, are too dilated and consequently filled. Its dose is a grain introduced under the eye-lid.

No. XXXII.

Pommatum Deterfivum.

℞. Axungix Suillæ non Salitæ	3 ij.
Bolus armen. Rub.	
Tutia preparat.	
Albus precipit. ana	3 j.
Misce ut fiat pomm. S. A; dein add.	
balf. commendato.	℥ j.

This pommatum does not operate so powerfully as the above; its dose and use the same.

No. XXXIII.

Fluidus Electri vim habens.

℞. Balf. Fioraventi,	3 iv.
Aq. Colog.	
Meliss. ana	3 j.
Lucis,	3 ij.
	Spirit.

Spirit. Vol. aromat. oleos.	3 ij.
Oleum cinnamo.	Gutt. vj.
Oleum myrrh.	Gutt. xij.
Misce & in flaguncula pone.	

This electrical fluid is excellent to promote circulation in the humors of the globe of the eye, and strengthen, at the same time, all its exterior membranes. Its use is to fetch up through the nose, by the means of the respiration, the volatile parts of this fluid, and avoid, as much as possible, its evaporation out of the bottle during the operation, which may be repeated six times; then the patient wets the palm of his hands, and presents them to his eyes, in order the evaporation be effected over the globe of the eye. When the volatile parts of the fluid are out, two other drachms of aqua lucis ought to be entered into the bottle, to avoid a recomposition of the whole.

No. XXXIV.

No. XXXIV.

Pilulæ Anti-syphiles.

℞. Mercur. sublim. corrosiv.	3 ℥.
dulcis,	3 j ℥.
Tere & Misce; dein adde	
Gummi Ammoniacum,	
Guayacum. ana	3 j.
Pul. Sennæ,	
Pyreth. ana	3 ij.
M. cum S. Q. Syrup. de rhamo ca-	
thartico F. massa. Pilulæ sunt	Gr. vj.

These pills are recommended by the most famous physicians, in all inveterate and desperate venereal cases; they are only used when the constitution of the patient baffles all other methods, or when an infinity of mercurial remedies have been applied without order. But I must observe, after many others, that they are sometimes productive of bad consequences, when used in common. Their dose is three pills taken every morning, and three before sleep time; a number that ought to be diminished according to circumstances. They may be continued for nine or ten days.

CURATIVE

C U R A T I V E M E T H O D S
F O R T H E
F I S T U L A L A C R Y M A L I S .

TH E disorders of the lacrymal organ, commonly known by the name of fistula lacrymalis, have been the enquiry of the most skilful practitioners, who have invented by turns different methods to restore the lacrymal absorbent ways in their natural state. If they have not always had the same success, we may say it was owing to the different diseases, which affect the reservoir of the tears and its attributes: for, if they were ignorant of such a theory as has been laid down, it is the strongest reason one can give of their having wandered in all ages, and thought these disorders to have something very intricate in their nature, and require a method of cure quite different from all the other maladies. It is no difficult matter to conceive, that so many different causes, speak so

F f many

many different medicaments, which ought also to differ from each other, in proportion to the defect one has to struggle with. None of the great surgeons has better distinguished these disorders from each other, than the famous PETIT; so that the discovery of the pathognomonic signs of each of them (which he possessed to the greatest degree) being very material, to meet with as many successes as he did, shall be my present consideration. These are the only means to perform a great number of cures, as one may be able, by such helps, to point right at the curative indications, offered in every disease of the lacrymal absorbent ways, and follow the steps of so uncommon a man.

The shedding of tears, which owes its existence to that of the hydropsy in the *saccus lacrymalis*, comes from the erethism in the sphincter of the *ductus ad nasum*, as it cannot contract and dilate, especially when filled up with any fluid; because, in this case, the specific gravity of the tears, being not sufficient to overcome the resistance opposed by the contraction of the nasal's sphincter, this fluid, instead of flowing into the *ductus ad nasum*, remains in its reservoir. This dilates the bag, and occasions in it a tension, inflammation, rupture, and fistula; as, during that time, the productive

tears

tears continue to furnish their wonted quantity, which being barred from running into the nose, fall on the cheek. If the cause of this shedding of tears is an obstruction in the lacrymal syphon, clear it up; then the tears shall flow into the nose, the shedding and retention of tears shall cease, together with the inflammation, rupture, and fistula lacrymalis.

If a weeping is occasioned only by a contraction in the sphincter, whose cause is an erethism, the cure shall not be difficult. At first, press on the bag to compel its contents to flow up through the puncta lacrymalia, and make several luke-warm injections through one of the lacrymal points or both, with the No. XXIII. p. 215. This cooling and resolute injection, destroys the spasm of the sphincter, cleans the bag, and re-establishes the lacrymal organ in its natural state. These injections ought to be repeated three times a day, without forgetting to make a pressure on the bag before. This trifling disorder requires sometimes four or six weeks of continual attendance. The method of proceeding in this operation is as follows. Take off the crooked syphon A A from the syringe described (Tab. —. fig. 8.) and put that of the fig. 13. in its place; then introduce the extremity

F f 2 into

into one of the lacrymal points, and push softly and uniformly the piston. When the injection does not flow down into the nose (what is conspicuous by its flowing up through the puncta lacrymalia) you finish it to press on the bag, and begin afresh, till you think proper to put an end of it for the day. It is needless to mention the position of the patient and operator, as both chuse naturally their ease.

It is no indifferent matter to be perfectly acquainted with the nature of the obstruction in the *ductus ad nasum*, in order of chusing the properest means for the cure. In case the purulent matter flows into the nose, when you press on the bag, you may take it for a sign, that the obstruction is not permanent. It very often comes from the thickening of matters, which fill up the channel, or may be looked upon as the forerunner of a chronic disorder; that is to say, the ulceration of the *faccus lacrymalis*. This case well known, seems only to require the deterfion of the ulcerated part. However, it sometimes happens, that the local defect is not of such a nature, as it can be removed by the injections, whose end is to clean and deterge the lacrymal ways. When the skilful Mr. ANEL thought necessary to clear up the great canal of the
tears,

tears, he introduced a silver probe through the superior lacrymal point down to the nasal channel, and injected afterwards with deterfive fluids, what was very often attended with a complete success; but if the nasal channel was obstructed by some callous tubercles or cicatrices, as it frequently happens in the small-pox, the obstacle was of such a nature, as not to be overcome by injections, and introductions of the probe, generally too weak to unstop it; then, in such a case, he did not succeed. This probe is commonly of seven inches long, its diameter in proportion to that of the puncta lacrymalia, buttoned at one end, and equal in its length (see Tab. —. fig. 14.) If sometimes the operator obtains his wish by the above means, he may be assured that there was not a total obstruction in the *ductus ad nasum*; for in case there should be one, he could not have desobliterated it, without the use of some strong probe.

To search in the *ductus ad nasum* by its inferior orifice, I advise every person to begin on dead bodies, in order of acquiring the use of it. The execution of this operation seems always so easy in these experiments, that one will very soon take upon himself to undertake it on the living; whereas he is to meet very often with no greater difficulty,

culty, than on the dead. He will, however, find some resistances, which he will always get the better of. I think it may be of great service to account for, and describe them, as they might sometimes, for want of knowing, put him out of his way.

The difficulties to the easy execution of this operation, come from the variations which are to be met with in the situation of the channels, the different degrees of alterations they have undergone, the proportions one must find between this channel and the probe, and the situation of the inferior shell of the nose, which is sometimes so low, that, for want of a due attention, the most skillful operator might pass over, where he could not meet the inferior orifice of the *ductus ad nasum*. This shell is placed so low in some subjects, that, to the anterior part, there is only one line distance from its inferior edge to the part of the maxillary bone which corresponds to it, and moulds the roof of the palate. In some other subjects it is so bent, that it forms rather, to the anterior part, a round hole than an oval aperture, which ought to be the natural state of this shell: to the contrary, it is sometimes so high, and the channel so short, that there is no difficulty to search into them. I must
yet

yet observe, that sometimes the partition of the nose, shrinks in bending into one of the nostrils, leans upon this shell, presses and sinks it in such a manner, that its inferior edge touches the portion of the maxillary bone, which constitutes the separation of the nostril and sinus maxillaris; insomuch, that the probe has a great difficulty to run into it. Moreover, if there be an adherence from the partition of the nose to the shell, and that it be anterior and inferior, it may be entangled in the crooked part of the probe, what would hinder it from going behind, where the inferior orifice of this channel is to be met with. Provided the reader be instructed in these anatomical variations, and intelligent enough as to discover with attention the more or less alteration the channel may have sustained, in proportion to the seniority and extent of the disorder, he shall almost always be able to introduce easily the probe in the sound state and in that of the disorder, with more or less difficulty, according as the channel's obstruction shall be more or less considerable. The introduction of the probe into the bag, cannot possibly be effected, when the channel shall be obliterated by a malady of an old standing.

The methods which were invented and practised by a famous surgeon of Paris, for the cures of these disorders,

disorders, were extremely simples, as they always consisted in desobliterating the *ductus ad nasum*. The instruments for that purpose, are some Algalies or hollow (see their description, Tab. —. fig. 1. and 2.) and massy probes (see their description, Tab.—. fig. 5. 6. & 7.) of different sizes, and proportioned to the sphincter's diameter. Besides, a slender silver wire, with one eye at one end, and buttoned at the other, (see its description, Tab.—. fig. 4.) a syringe with a crooked syphon, (see fig. 8.) All the probes ought to be bent, as a semi-circle; because they are easily introduced into the *saccus lacrymalis* through the inferior orifice, and exteriorly felt, as they jut out with the least motion towards the teguments. The injections made into the bag, through the inferior orifice, either with the syringe only, or through the hollow probe, go out through the *puncta lacrymalia*; and what remains in the bag, runs down of itself into the nose thro' the hollow probe. This is a sort of very useful seton, which keeps not only the channel in dilatation, but facilitates also a running of the lacrymal fluid.

These instruments must be of different sizes, as I said before; because if the malady consists in an obstruction of the *ductus ad nasum*, and that it
hinders

Fig. 1.



Fig. 2.



Fig. 3.



Fig. 5.



Fig. 6.



Fig. 7.



Fig. 4.



Fig. 8.

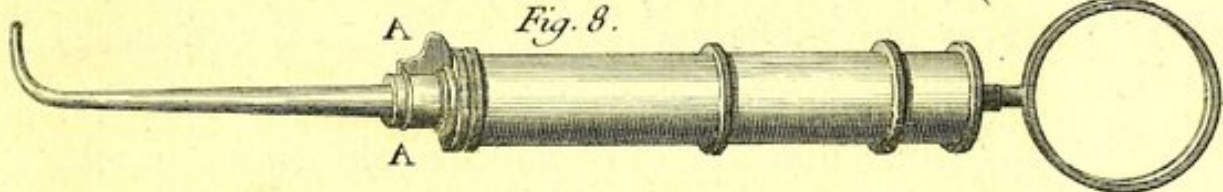


Fig. 9.

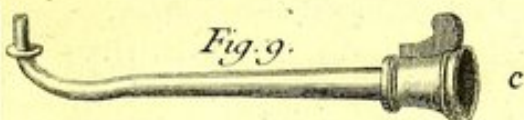


Fig. 10.



Fig. 11.



Fig. 13.

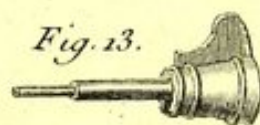
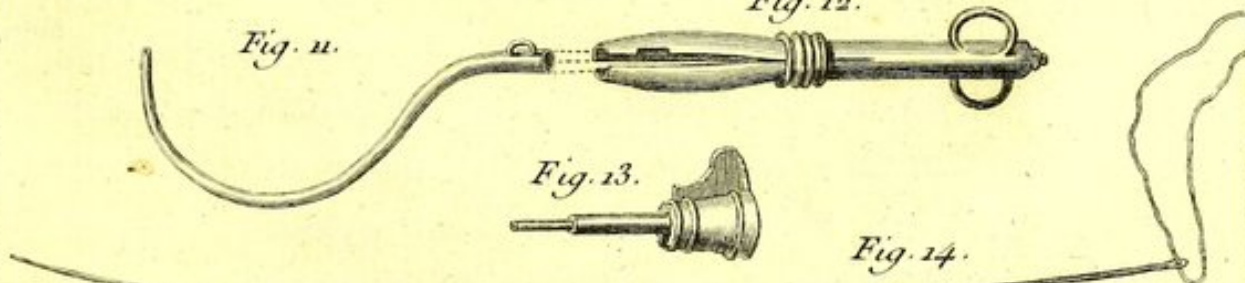
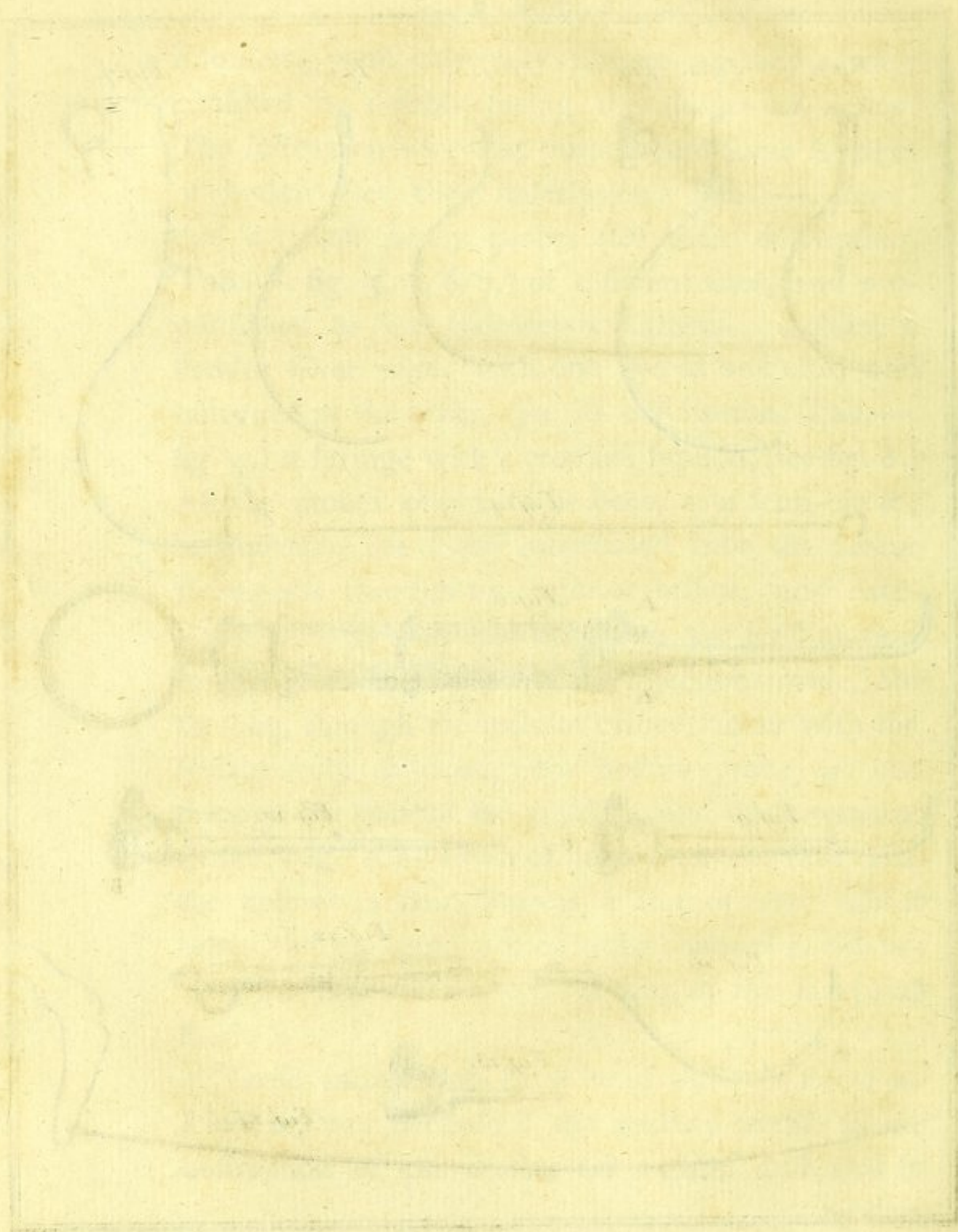


Fig. 14.





hinders an hollow probe from going in, one ought to make use of a maffy one, in order of destroying it the eafier. When the probe is once into the bag, let it be left there for fome days, to facilitate the first injections; or if this cannot be practifed, introduce a small ftraight and hollow probe through the fame channel into the faccus lacrymalis, and let it remain there till the cure be quite performed. In this manner one has the advantage that the patient may fyringe himfelf, and fave, by this means, a great deal of attendance. If the faccus lacrymalis be pierced on the fide of the os unguis, and that it be altered, I do not advife to make a hole in the fkin, and in the portion of the bag which corresponds to it, in order of applying proper remedies to obtain the exfoliation of it, as the injection alone is fufficient to produce juft the fame effect.

After having fpoken about the neceffity and poffibility of fearching the *ductus ad nafum* by its inferior orifice, nothing elfe remains now but to explain the manner of performing it. Simple as this operation feems, nevertheless, one muft be well acquainted with the ftructure and fituation of thefe parts, the variations they are fufceptible to undergo, and the proportions between the probe and *ductus ad nafum*, in order of obtaining a complete fuccefs.

This theory is quite necessary. I now suppose the reader has acquired all this knowledge, by the above descriptions. The patient being seated on a chair, the head half reclined back, the operator shall introduce the probe into the nose, in conducting the end towards the arch formed by the inferior shell of the nose, to seek for the inferior orifice of the *ductus ad nasum*. He will know that the end of the probe is in this channel, when it will no more play under the shell; then he shall push it in, by degrees, till its end be near the orbit; that is to say, the superior extremity of the *ductus ad nasum*. There are, however, many cases wherein the probe does not appear, though it be arrived to the superior edge of this channel; because it stops under a little portion of the maxillary bone, which forms the superior and anterior part of the *ductus ad nasum*. Then let him take up a little the end of the probe, and at the same time push it upwards; its top, which was only in the channel, shall go into the bag, where he may feel it with the finger. The hollow probe is introduced with the same precautions as the other. If one will have it entirely hid in the nose, he must make use of the probe-bearer, (Tab. —. fig. 12.) to place it. But I here give notice, that the probe so placed, is very troublesome to make
the

the injections. A small and round filetto, made of a whale-bone, to clear the hallow probes, is absolutely necessary; and this little stick must not go farther beyond it than one or two lines. As to the method of injecting with the syringe, and the crooked syphon, the same precautions ought to be observed as to searching. The same syringe is sufficient for any subject whatsoever, requiring only a change of syphon, according to the shell of the noses; for it matters only to place its top in the channel's entrance, and squirt the liquor with the sucker of the syringe, taking heed of not filling too much the *saccus lacrymalis*, for fear of a too great dilatation, which might make it loose its natural elasticity.

Each method may have its inconveniencies and insufficiencies, when the disorders vary. If the obstruction in the *ductus ad nasum* be complicated, one ought to make use of a massy probe, as I said before, to force open the passage: but there are inconveniencies and dangers by doing so; because, in searching on the living, one may not meet the orifice of the *ductus ad nasum* as easily as he would wish. It happens, very often, that he does find it out, but after many painful and troublesome gropings, and in perforating false ways; an

operation which may be attended with a great many accidents, on account of the tearing and irritation of the pituitary membrane. The most skilful operators, in such cases, are almost always liable to fracture, in attempts made with care and sufficient precautions, *a fortiori* young beginners. From these difficulties, the method of searching this way, has met with founded criticism from the most learned surgeons; but yet those who have invented, improved, and practised it with success, are, I think, sufficient grounds to promote and credit so useful an operation, when undertaken by steady hands, and profound anatomists.

The disorders of the bag may be of such a nature as not to be removed by the help of injections, or the searching with the massy probe; in this case Mr. Petit's method must be made use of, as the last resource. It is founded on the structure of the parts and mechanism of nature, to re-establish her functions. It has the advantage over the other, as it gives much less pains than that whereby one runs the risk of breaking the bones; and if it has not been generally practised, it comes from the varieties in the fistula lacrymalis. We ought to look upon it as a stem, whereon they have grafted several particular inventions more or less reflected, which,

which, far from destroying its good advantages, do honor to their inventors, as all these methods tend to repair and preserve the natural ways of the tears.

Practitioners agree on the necessity of opening the bag, by an incision, in case the injections cannot succeed. This happens always, when the interior of the *faccus lacrymalis* is become spongy and far ulcerated. This is very easily known, by the quantity of matter which gets out along with the tears. When the bag is open, it is very material to consider in what state may be its internal surface, and examine it, especially on the side of the *os unguis*. The rottenness of a bone so thin, ought to leave no remain whatever; but its orbital face may be discovered by the ulceration in the bag. This bone posteriorly sustained by the pituitary membrane and *periosteum*, in the circumference of the denudation, shall never be able to fall down of itself; and as it has no diploe, one cannot expect a fleshy coverture, which would help its consolidation with the neighbouring parts. In such a case, no other expedient is left but to destroy it. You may even have, at this rate, an intention to establish an artificial way for the tears. This depends on the state of the *ductus ad nasum*. We have many instances, and a full authority to prove,

prove, that Mr. Petit had operated several patients after this method without success, tho' the *ductus ad nasum* was very well cleared up, and that they were perfectly cured only after the os unguis had been sunk. If the *ductus ad nasum* were shut up by old cicatrices, and that by the above particular cases, it should be absolutely necessary to destroy the os unguis, I advise to do it in such a manner, as the tears may get their course by this new way.

Mr. Petit practised this operation, in the latter part of his life, with a different method to that of the year 1734. This is more simple, and proves the fecundity of the author's genius. An assistant puts his thumb on the commissure of the eye-lid, to the side of the little angle, and pulls them to bend the skin; what operates a small jutting out in the tendon of the orbicular muscle. The operator leads the extremity of his knife, from one of the sides of the groove (under the tendon) to the edge of the orbit; and at three or four lines from the commissures of the eye-lids, sinks it by degrees into the sacculus lacrymalis, without touching the bone, and performs an incision, which ends towards the tendon of the *obliqui inferioris*. If a little exterior aperture has been done, he crosses it in performing the incision. This over, and the back of the knife turned

turned on the side of the nose, he leads the sharp end towards the *ductus ad nasum*, and then introduces, by the help of the groove's knife, a wax probe, which he pushes inwards by degrees. It is observed, that this wax probe ought to be changed every day. He injects, from time to time, through the puncta lacrymalia, and the bag's aperture, a deterfive liquor, (No. XXIV. p. 216.) to cure the ulcer, and keep open the exterior aperture of the teguments with a small pledget, described Tab. —. fig. 3. When he thinks the channel well shut, and the ulcer cicatrised, he makes no more use of a wax probe, but only of a small plaister on the exterior wound, and continues still, for some time, to inject through the puncta lacrymalia. This method requires one knife (see its description, Tab. IX. fig. 9.) whose grooves must be on each side of its surfaces.

A practitioner must consider and weigh the several cases and methods offered above, and endeavour to know to what length they may be serviceable or necessary. There are such proceedings, as might be equally of use, but which do not deserve the preference over the other methods, though they could answer quite the same view. He ought to apply himself to the knowledge of the very cases
which

which require the application of one method before another, instead of rejecting any one of them. It is above contradiction, that to know and distinguish the nature of the disorders is quite necessary, in order of being not perplexed at first, in the application of the properest remedies; therefore, the curative methods for the fistula lacrymalis, requiring a variation according to the different cases, the practice for the cure of them shall be sure only in proportion to the justness of the pathologic knowledges, which consist in the preternatural constitution of a man's body or part, discovering the causes, nature, and difference of diseases.

These are not the only causes, which may confound the harmony of the parts that compose the lacrymal pump; the tumors which happen, or take rise in the great angle towards the exterior of the sacculus lacrymalis, being liable to act or work no less powerfully with the others in producing them, I shall mention here. These tumors are commonly ascertained by two causes, first, by a gathering of humors, which assemble themselves as in a centre, by filtrating between the reservoir of the tears and the teguments. It is, however, very rare to find these elevations open of themselves exteriorly, as they communicate to one of the lacrymal ducts.

ducts. Secondly, by the exostosis of the os unguis, or the apophysis of the coronal and os maxillary. Any practitioner may easily conceive, that a tumor situated in this part, ought, in proportion to its size, to squeeze the sacculus lacrymalis and the common duct, as to constrain the motions and functions of the lacrymal pump; consequently, that an epiphora, or flux of tears more or less abundant, which exists as long as this unnatural elevation is not entirely dissipated, must be the consequence. All these truths summed up to the memory, one ought to understand, that each of these disorders is to be distinguished by symptoms which belong to it; but, in order of making them very familiar to the reader, I will draw a parallel between them.

In a fistula, the gum of the eyes that runs up through the puncta lacrymalia (in pressing on the sacculus lacrymalis) is always in a little quantity, and comes up along with a very little portion of the lacrymal fluid; consequently there is no lacrymal tumor, at least, to be observed; but then the edges of the tarsi are more or less tumified, sometimes hard and overturned: besides, the vessels of the conjunctiva are varicous and inflamed, especially on the portion which lines the inferior eye-lid. To all these signs is added an habitual flux of tears;

H h

and

and when the glands of the *faccus lacrymalis* produce a puriform humor, the tumor of the great angle is more exposed to the sight of the observer. When he squeezes upon it, a slimy humor, of an unequal color, mixed of transparent, whitish, and sometimes yellowish parts, flows up through the *puncta lacrymalia*; but then the edges of the eyelids and the conjunctiva, are without alteration; insomuch, that if the patient takes care to squeeze very often the lacrymal tumor, an apparent sign of the nature of the disorder in the reservoir of the tears, by a single inspection of the organ, is no longer conspicuous. He shall know, that a tumor occasioned by infiltration and coming off of the teguments from the great angle, and distinguish it from the foregoing, by the pressure which does not at first diminish its bulk; whilst, as soon as he squeezes the lacrymal tumor, the fluid is emptied immediately into the nose, or flows up equally well through both the lacrymal points. The other tumor, on the contrary, cannot let out the fluid it contains, unless it be pressed hard upon, from its bottom upwards, and not so if squeezed quite otherwise. When this tumor is not too voluminous, a flux of tears is not always the consequence, tho' patients should neglect to squeeze it; because, in
this

this last case, the *faccus lacrymalis* may be emptied only when one has a mind to avoid a conspicuous weeping.

The *exostosis* of the *os unguis*, *apophysis* of the coronal, and that of the *os maxillary*, are very easily distinguished from the tumor in the teguments, as this last is flexible, whilst the *exostosis* is hard, and sometimes unequal in its surface. The *hydropsy* in the reservoir of the tears, is known by the reflux of a diaphanous fluid, sometimes mixt with some ropy matter, but never with puriform's.

The ulceration in the *faccus lacrymalis*, is to be distinguished by very different signs, from those that I have been just describing. It does not settle commonly in this part, except after wounds and contusions; and it arises very seldom by an organic defect. However, the venereal, cancerous, scrophulous viruses, &c, may ulcerate the reservoir of the tears, rather than any other corruption in the blood. But it is very extraordinary, when they attain, even with their malignity, to this very part of the great angle. The purulent matter of an ulcer in the absorbent lacrymal ways, is distinguished from the gum of the eyes and secretion of the glands in the *faccus lacrymalis*, by the whitish or slightly amber-greased color, whilst the pus is

sometimes greenish, of a deeper yellow, and bad smell, as in the other case. It is rare when the depraved humor in the glands of the reservoir of the tears is accompanied with a redness in the great angle and callosity in this part; for these accidents are commonly the consequence of an ulceration in the *saccus lacrymalis*, especially when it has an exterior aperture. I will observe by the way, that this aperture is almost never cicatrised without the help of Art; whilst that, which has been formed by the corrosion of the matter which flows from the altered glands in the *saccus lacrymalis*, is very easily cicatrised, and very often without the application of any remedies, to destroy the atony state of these glands.

Before to dismiss the curative methods for the fistula lacrymalis, I will make one observation more, which is, that there are some species of weeping, as troublesome to the patients, as they are difficult of curation: there are even some, whose cure it is very dangerous to undertake, because they very often produce a greater inconvenience than that which one has a mind to remove. If the cartilage of the inferior lacrymal point be destroyed, the least oscillation cannot exist, and the whole lacrymal fluid absorbed; consequently part
of

of it must run down through the natural ways, and the other over the cheek, when the superior lacrymal point pumps alone. If the inferior lacrymal point be in its natural state, and that its duct be obstructed as to hinder the passage of the fluid in the bag, a more considerable weeping than in the above case shall be the consequence; the cure of which shall consist in attempting to desobliterate it with the probe, Tab. —. fig. 4. and inject through the lacrymal point. If the obstruction be of such a nature, as not to be overcome, and that the injection, instead to go into the natural ways, does infiltrate in the cellular texture; then discontinue this operation, and let alone the patient along with the disorder. The inferior lacrymal duct and point are oftener out of order than the superior's. However, I do not think there is a greater difference in one than in the other case. I conclude, by giving an advice to every practitioner, to make an injection of common water through both the puncta lacrymalia, before to determine the character of any disorder whatever in the lacrymal ways; because, after such an operation, he may judge, with a degree of certitude, what can be the nature of the disorder he is to take the care of.

“ THOUGH

“ THOUGH I have excluded from my work all
 “ kinds of criticisms, I cannot help taking notice
 “ here, of the new pamphlets published from the
 “ beginning of this year, to the first of July, con-
 “ cerning this branch of physic and surgery. One,
 “ I would not have thought worth mentioning,
 “ had it not accounted for a gutta serena cured
 “ by positive electricity: The other, a warm pro-
 “ moter of medical electricity, would have equally
 “ commanded my silence, had it not pretended to
 “ ascertain many physical and moral impossibi-
 “ lities. As to the other performances, though in
 “ many respects better calculated for instruction,
 “ I rank among the number of those that are
 “ extremely deficient. To the first I object, that
 “ a blindness may have been cured by electricity,
 “ as well as some other disorders; but that a gutta
 “ serena has, is one of the greatest absurdities, or a
 “ downright ignorance. To the other, that a
 “ fistula lacrymalis is of such a nature as not to be
 “ removed by any shock whatever, when existing
 “ either in the lacrymal absorbent ways, or by a de-
 “ fect in these parts. I have, for the support of my
 “ assertions, the experiments lately made by M.
 “ Mauduyt, at the expence of the French govern-
 “ ment. See his extract for 82 patients electrified.
 “ A Paris, chez Philippe-Denys PIERRES, Printer.”

CURA-

C U R A T I V E M E T H O D S
F O R T H E
D I S O R D E R S
O F T H E
E Y E - L I D S.

THE eye-lids may be disordered by all kinds of tumors which affect every part of the human body. They are subject to St. Anthony's fire, phlegmone, œdema, schirrhous, cancer, warts, orgeolet, internal and external fleshy excrescences, anthracosis and adipous tumors. They are also liable to slackening and overturning, uniting against nature, convulsive motions, burnings, contusions, fistulas, purigenous ulcers, itch and tetters, disorders of the eye-lashes, and in short all sores.

If a sinking and inaction exists in the superior eye-lid, that its immobility, at the same time, occasions

sions an obstacle to vision, and that the globe of the eye be disordered by it; it will be necessary to distinguish, whether this falling down of the eye-lid be occasioned by an erethism in this part, a relaxation in the skin, or a paralysis in the muscle, which, for want of harmony with the other parts, prevents its moving up and down. As soon as this eye-lid is in a spasmodic state, one observes a stiffness every time it is lifted up with the fingers. In the single sinking it is otherwise; for the too great extension of the skin, causes only a soft and regular motion, very sensible to the touch. As to the paralysis in the eye-lids, all the remedies which destroy the above disorders, are absolutely of no use here. If the superior eye-lid be in a state of spasm, that it be sunk over the globe of the eye without having the faculty of lifting up naturally, and that no other malady besides be existing along with it, as a complication; it may be removed by the use of spirituous, or aromatic fomentations, No. XVIII. p. 212; and in case they are insufficient, introduce three times a day, under the superior eye-lid, some of the *pommatum deterfivum*, No. XXXI. p. 221. If one be disappointed in his wishes, there is no room to doubt, that the cause of the disease is a paralysis in the muscles; then no
other

other means remain but an operation, otherwise it must be given up. I will observe here, however, that this operation brings on a great many inconveniencies and disorders, which are very often more dangerous than that one has a mind to remove, though imperfectly; therefore I leave it entirely to the prudence and judgment of the operator to determine.

The causes of the overturning of the inferior eye-lid (except the paralyfis) are commonly a tumefaction in the conjunctiva, and particularly the portion which lines the interior of the eye-lid; a relaxation in these parts in old people, whose eyes are extremely watery and weeping; cicatrices which come from some wounds, ulcers, and burning: in these last cases, the overturning is more or less, in proportion to the loss of substance; so that the methods of cure for this disorder, offer different indications relatively to the cause which produces it. When it proceeds from the tumefaction in the conjunctiva, one ought to have a particular care to distinguish if it be inflammatory or not, if new or old. In the first case, bleeding, emollient fumigations, and relaxing topics, will be sufficient to dispel the obstruction, and permit the re-establishment in the parts. Such proceedings, however, would

not do for a tumefaction of an old standing; for, in this second case, one must employ some resolute and aromatic collyrium in fumigations, (No. XVI. p. 211.) tonic and stimulating topics, made up according to the No. XVII. p. 212.

The relaxation of the conjunctiva in old people whose eyes are watery, and the overturning of the eye-lid, which is always the consequence, are very difficult of curation: they ought even to be looked upon as incurable disorders, relatively to an extreme atony, especially when of an old standing. The relaxed parts, brought by degrees in a marred quality or vitiated state, cannot easily be re-established: for, in these cases, one ought never to expect any assistance from the art, unless it be with the help of spirituous liquors, tonic and strengthening collyriums, as the No. XXXIII. p. 222. which, in stimulating the solids, may diminish the malady, or at least its progress.

If the overturning be considerable, the internal part of the eye-lid much protuberant outwards, and that the eye-lids do not come together in covering the globe of the eye; then one may take off, with a knife, a portion of the membrane which forms the jutting out (in its whole length) betwixt the eye-lid and the globe of the eye. A disorder of this kind
seems

seems particularly more susceptible of curation than the others; and it is evident, that in such a case, one may not only relax, but at least re-establish the parts in their natural state. This operation ought to be performed with a narrow knife fixed to its handle; and if, a little time after, the membrane makes still a small jutting out; a second operation ought to take place. There are many cases wherein the deformity is hardly sensible after this operation. Its dressing consists in introducing under the eye-lid, three times a day, three drops of the collyrium, made up according to the recipe No. XIX. p. 213. The operator will have an opportunity of observing, by degrees, a shrinking in the eye-lid, and a closer application of it over the globe, as the patient makes use of this remedy.

If patients do not apply to physicians or surgeons for help, in the beginning of the overturning of the eye-lids, they stand a chance of having their deformity a great deal more difficult of curation than at first, and becoming schirrhous. This malady is very troublesome, and frightful to look at. However, one may not only apply remedies that will alleviate it, but even re-establish the eye-lids in their natural state. Such a cure may be looked upon of absolute necessity, as the globe of the eye

is very much injured by the contact of the tumor, which produces ophthalmies and pains that stand against the use of all remedies whatever, till the eye-lid be in a sound state. Before to undertake any curative methods, I would have every practitioner to examine, if the schirrhous proceeds from a general or local cause; I mean from a depravation in the lymph; as morpewous affections, scrophulous viruses; in short, from a metastasis or obstruction in meibomius glands, and those in the conjunctiva.

The internal causes are the plethory, as well as the other viruses which thicken the lymph; such as the venereal, scrophulous, scorbutic, cancerous, morpewous; or itchy humors, coarse and raw aliments always difficult of digestion, and which produce a chyle of the same quality, thicken the lymph to such a degree, as to occasion many obstructions in these parts. This complicated disorder, and want of harmony, happen the rather, as the elasticity and oscillation in the vessels are very much weakened. The external causes come from the use of too diffecative or resolute topics imprudently applied in the erysipelatous disorders of the eye-lids; for they sometimes change the malady in a schirrhous, by dissipating the most
fluid

fluid parts of the lymph. A cold may also condense the humors, and diminish the diameter of the vessels.

If the schirrhous be recent and without tumor; if it take up the whole extent of the edges of the inferior eye-lid; to be brief, if the eye-lashes be partly destroyed, and that the tears cannot have their natural way, on account of the destruction of the gutter which corresponds from the commissure of the external angle to the lacrymal points; these are sufficient grounds to believe, that the disorder is occasioned by the destruction of the gutter, or that it owes its existence to the thickening of the lymph in general. In this case, recommend the use of a pint of whey for three doses per day, drank two hours before and after each meal. During the same time of this proceeding, one may prescribe a gentle dose of No. V. p. 203. every other four days, as long as the patient's health will admit. The use of emollient fumigations, repeated in proportion to the hardness of the eye-lids, is also of great benefit. If, to the contrary, the disorder be of an old standing and local, that is, does not owe the continuation of its existence to the above-mentioned cause, what happens, however, very frequently; then one must not doubt, that
the

the means already taken notice of, are quite insufficient, though he may look upon them as indispensable and antecedent to the use of resolute and stimulating pommatums, which shall determine the cure. See the recipe, No. XXXI. p. 221.

If the tarsi of the eye-lids be overturned inwards by a tumor, and that the eye-lashes affect the globe of the eye; let the skin be bent outwards with the fingers, and apply a plaister on the cheek, to keep this eye-lid in its natural situation, and change it but when too slack. If after twenty or thirty days the eye-lid be relaxed, and that the conjunctiva be able to keep its natural state of tension by the means of a cataplasim, No. XXVII. p. 218. applied immediately on the part; then one ought to judge, whether there is a sufficient elasticity to make an equal amends for the strength of the conjunctiva, or not. This is conspicuous, when the eye-lashes are no more directed contrary ways, and do not brush the anterior part of the globe. Another method to remedy this disorder, consists in taking off, with curve scissars, the exceeding part of the skin in the eye-lid, and make several seams. This done, the operator covers the whole with a plaister, and a double piece of linen cloth, to keep it tight. Six or seven days after, the edges of the
wounds

wounds unite sufficiently to take away the seams. However, one shall continue the use of the above plaister, till the twelfth or fourteenth day, during which time the cicatrice forms itself. The eyelashes are no sooner in their natural state, that the patient is quite free from pains, consequently from the disorder itself.

As I have already spoken of the disorders of the eye-lids, p. 143. I refer the reader there, for particulars upon this head, in order to avoid repetitions. I will only make a few observations more, which are, that one cannot lend too strict an attendance to these disorders; for otherwise, a schirrhous in the eye-lids must be the never-failing consequence. Besides all the above precautions in the removing of such diseases, it is still of great importance to avoid a repercussion, without having thrown some corrective into the blood. Experience and discernment will lead a great way, and be the guide of an intelligent practitioner, for choosing always the properest remedies; but he ought to remember, that there are some complicated and old disorders, which will not, nor cannot yield to the best methods indicated by Art: These kinds of cases will, I hope, always be looked upon by the learned physicians as incurables.

CURA-

C U R A T I V E M E T H O D S
F O R T H E
E X T E R N A L D I S O R D E R S
O F T H E
G L O B E O F T H E E Y E .

THE caruncula lacrymalis is a reddish elevation, formed by a conglomerated gland, and covered with the membrana conjunctiva : it makes up, together with this last tunic, a semilunary gutter, designed to help the passage of the tears into the lacrymal points and ducts. This gland, placed in the great angle, is composed of many others, very small, and of an oblong whitish texture. They furnish a sabaceous humor, which makes a part of the lacrymal fluid. This humor is sometimes changed in a matter called the gum of the eyes : a disorder which foretels an atony in the filters of

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that

that glandulous body. When this gland is destroyed, the flux of the tears becomes habitual, because the lacrymal points perform their functions very imperfectly. If the small glands, which form the caruncula lacrymalis, are in an atony state, one may cure them with the use of tonics, such as the white wine, wherein a very little quantity of white vitriol is dissolved ; or any other remedy of the same class. This consists to let fall, on the affected part, two or three drops of it three times a day.

In the angles of the eyes, some little whitish and very painful pustles are sometimes to be observed, just in the same form as those little pustles, which may arise on every other part of the human body. They are not even a very long while before they are opened, and soon changed in small ulcers. Anodine and cooling collyriums, are the proper remedies, before their opening : on the contrary, one makes use of the drying and modifying ones, when opened. If the ulcers are purigineous, they become very troublesome, as they hinder the patient from rubbing his eyes. They are occasioned by a salted and brackish humor, which infiltrates itself into the caruncula lacrymalis. To remedy this disease, make use of the collyrium according to the recipe, No. XVI. p. 211.

It

It very often happens, that some fleshy excrescences arise betwixt the eye-lids and the globe of the eye. Some of them are solid, soft, and divided from each other, as the grains of a mulberry. The cause of their existence is commonly an ulceration, or a defective state in the juices: Those that are not voluminous, and occasioned only by an ulceration, will very easily disappear by the use of the ophthalmic pommatum, whose composition is described in the recipe, No. XXXII. p. 222. especially if the use of some emollient lotions before it be recommended. On the contrary, those that are considerable, and produced by a defect in the fluids, require absolutely an operation. To perform it, let the patient be seated on a chair, sufficiently high; an assistant overturns the eye-lid with two fingers, in such a manner as to expose the tumor entirely outwards, or at least as much as it is possible. This well executed, the operator takes hold of the tumor with a pair of tongs, or some other instrument, in order of raising it up for dissection, without leaving any part whatever: but I caution, that this is not so very easy to perform as one would at first imagine, especially under the superior eye-lid. If the patient will not undergo the operation, it may be consumed with the butter of antimony,

mercurial water, or any other caustic: but one must take a particular care not to touch any other part.

The inflammation in the conjunctiva, especially the part which covers the globe of the eye to the very limb of the cornea, has been very improperly divided by the ancient and modern authors. Without laying down the division as they have transmitted it to us, and asserting a just critic upon it, I will separate this external affection of the globe of the eye into two parts, wherein it shall be mentioned here. The other belonging to the nature of the internal curative methods of the eye, I will put off till its proper place.

Two causes may occasion the external inflammation: without investigating now their division and subdivision, I will proceed to the explanation of the above only, as the curative indications are almost the same. The first of these causes are blows on the eye, and extraneous bodies entered under the eye-lids; the second is a depravation in the humors. If it be produced by the last, let them be extracted as soon as possible; and if small or without acrimonious quality, the inflammation shall be slight and easy of curation with cold emollient lotions: on the contrary, if bulky and

and of a brackish or corrosive quality, and have remained long under the eye-lids, bleeding and a regular diet ought to be recommended altogether. It will be even very useful, in case the patient suffers violent pains, to fumigate the parts for ten minutes with an emollient decoction. These simple means are quite sufficient when conducted by a skilful physician, who knows perfectly well to multiply or diminish them as the case requires.

If the inflammation be the consequence of a depravation in all the humors of the body, it will be easy to foresee that the blood being not able to circulate, it comes from its too compact particles which are continually carried into the little vessels, whose diameter is so small, that the obstruction so formed is not removed by bleeding without some bad consequences, explained, p. 133. Besides, as there are some other methods which answer the same purposes, without being attended with these inconveniencies, one ought to give them the preference, unless there be some other stronger reasons to reject them. The cases wherein bleeding may be avoided, are when the blood is thick, and the inflammation accompanied with no smart pains; because the diluents and purgatives may be made use of, together with the emollient fumigations,
with

with the same security. If the inflammation be slight, some cold lotions repeated three or four times a day, will be sufficient to dispel it; however bleeding, with all these external applications, may be practised when patients labour under excruciating pains. With the diluent drinks, No. I. or II. p. 201. and 202. the blood and the other humors become fluid: That the operation of bleeding, practised in the first days of the ophthalmy, evacuates the biggest vessels, are facts allowed by every physiologist. If the blood has acquired an acrimonious quality, every one may conceive, that the lymph furnished by the glandula lacrymalis, being of the same nature, will irritate the membranes of the eye, and occasion a most violent inflammation. All persons addicted to drink a great quantity of wine, or any other spirituous liquors, may have had several opportunities of remarking, that their eyes become inflamed and painful, especially those whose eyes are prominent; but these kinds of inflammations do not exist six hours after an emollient lotion, which is a very strong proof of what is asserted above.

The cornea is subject to the ophthalmy, ulceration, opacity, and disuniting from the sclerotica. The ophthalmy or inflammation in this tunic, is
always

always the consequence of that in the conjunctiva; because the varicous vessels which ramificate naturally in this last membrane, slide in and over the cornea, to furnish it with necessary juices for contributing to keep its diaphaneity. The ophthalmia in the cornea requires the same medicaments as that in the conjunctiva, when the causes are the same. The pustles and abscesses which affect this transparent membrane, are much to be dreaded, and call for a speedy help, when produced by a total depravation in the lymph, or the malignant small-pox; otherwise they change in hurtful ulcers, whose cicatrices, if large and opaque, are an obstacle to vision, without almost remedy, when of an old standing. When the cornea is affected by some pustles and abscesses, emollient fumigations will be sufficient to resolve them, with the use of diluents and purgatives. If an abscess on the cornea cicatrises itself, and that it be an obstacle to vision, a disorder vulgarly called *albugo*, when placed on the internal lamina of this tunic; then its cure shall be extremely difficult, even morally impossible, if its diameter be as large as that of the cornea, and the patient of a bad constitution. But in case it be small in diameter, and on the external lamina, one may attempt its destruction with
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No. XXXII. p. 222. used three times a day. However, I will observe here, that they may be looked upon as being curable, if one happen to meet with patients who will be constant in undergoing all the pains that attend the application of such external remedies. If this membrane becomes opaque by the stagnation of the lymph, and an obstruction in the varicous vessels which ramificate it, the dissolving and attenuating medicines will re-establish its diaphaneity, together with the use of diluent ptisans, when the malady is recent. If the disorder does not give way with such means, recommend the use of brackish or volatile fluid, introduced three times a day, to the quantity of two drops, No. XXXIII. p. 222. If a heap of lymphatic vessels exists on the cornea, and that it forms what is commonly called a speck on the eye, of a diameter large enough as to hinder the rays of light from going into the bottom of the globe of the eye; then one ought to prescribe the collyrium made up according to the recipe, No. XIX. p. 213. in order of destroying the external lamina of the cornea. Its use, here, is to introduce three drops in the eye, three or four times a day. If this membrane separates from the sclerotica (to which it is contiguous) if not the whole circumference, at least in some
part

part of it, the humors of the eye shall go out of the globe, and occasion the irreparable loss of this beautiful organ, if proper means are not made use of to prevent it; but if it be of an old standing, and that its cause be a total depravation in the organ, then one ought to give up the cure, and pay attention only to the removal of the deformity, if possible. If any abscess be the consequence of this disuniting, and that an inflammation had been existing some time before, one ought to make use of the pommatum made up according to the recipe, No. XXXI. p. 221. preceded of a lotion with the collyrium, No. XIV. p. 210. Besides, the patient must keep a low and regular diet, and be purged from time to time, according to his constitution and the case in consideration. If some internal membrane be pushed outwards, in a manner as to form a tumor called *staphyloma*, and exceeds a bulk incapable to be inclosed with the eye-lids; a little incision, to let out the aqueous humor, must be performed for a re-uniting of the parts; and immediately after this operation, let a dose of the pommatum, No. XXXII. p. 222. be applied on the very part, whose effect will be to stimulate the membranes, and join them together. If the tumor

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appears

appears again, let the same operation and dressing be repeated; for the success depends on the physician's experience and surgeon's dexterity, who must know perfectly well what sort of dangers they have to struggle with, by the use of this remedy.

The staphyloma, properly speaking, is a tumor occasioned by the falling down or flackening of the uvea, through any hole in the cornea. One may easily know this staphyloma from any other, by a change of figure in the pupil. The more this tumor is big and placed outwards, the more difficult it is of curation. In the undertaking of such a disorder, one ought to pay a proper attention to the cause that produced it, the accidents which may accompany it, and its different kinds. If it comes from a blow on the eye, bleeding, and all that tends to alleviate inflammations, are pointed by art, as the best and surest means; and if the tumor remains after the removal of these accidents, one shall perform an incision, as I have observed above, in order of facilitating the running out of the aqueous humor, and the introduction of the uvea in its natural place. If an ulcer were the cause, and that the hole be of a considerable diameter, one ought to put in the eye a dose of the stimulating pommatum, No. XXXI. p. 221. as soon as
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the patient is free from the violent pains, without minding the inflammation. The history of such disorders, by way of observations, are more capable of instructing young beginners than any other supposititious descriptions: therefore, to avoid repetitions, I refer them to the subject, that treats of each of these diseases.

CURATIVE METHODS
FOR THE
INTERNAL DISORDERS
OF THE
GLOBE OF THE EYE.

THE hypopion, a disorder I have already spoken of, (p. 140.) is a very common one, and not easy of curation. It is now very material to observe, that the hypopion, though situated in the interstices of the pellicles in the cornea, is easily distinguished from the specks and cicatrices, in or upon this tunic, by the following signs: The cicatrices are white, and the specks greyish; the hypopion, on the contrary, is not only yellowish, but always attended with quick and shooting pains, violent inflammations in the conjunctiva, wakes, &c. However, the same accidents happen when a
gathering

gathering of matter, in the anterior chamber of the globe, is existing: but, in this last case, the matter occupies the inferior part of the said chamber; whilst, when it is infiltrated in the pellicles of the cornea, the opacity formed by it, remains more or less opposite the pupil.

The cause and nature of the opacity of the crystalline and its capsule, being sufficiently explained, p. 137, 138. &c. I will mention now the manner of extracting it out of the globe, when couching is not preferable; as this is very often the case, when the anterior chamber is not sufficiently spacious to permit the passage of the knife betwixt the cornea and iris, without any risk of hurting this last membrane. After that, I will proceed to the explanation of such precautions as I think absolutely necessary one should be perfectly acquainted with, to perform the operation of couching. An operator well experienced and instructed, ought to know every method. One manner of operating must never exclude another, when it may be good and fit for the case in hand. Besides, as it is not possible one might foresee every thing that may happen in a common practice, I will omit nothing here, to instruct the reader about a disorder

der and operation which commonly establish the reputation of oculists.

If the patient be of a good constitution, in health, and cataracted in the right eye only; if the anterior chamber be as spacious as commonly, and the cornea sufficiently convex; if the organ distinguishes light from darkness, and that the pupil contracts and dilates easily; it will be unnecessary to prepare him for the operation, by the use of cooling drinks, bleeding, or any other indications, which are only proper when of a sanguine, cacochymic constitution, &c. &c. This well considered, the operator shall chuse an apartment as well lighted as he can, but without any appearance of the sun during the operation; then he shall shut every window, except that before which he has a mind to perform, and take care to provide for curtains, or window-shutters, in order of intercepting the brightness of the light when convenient; this being of very great consequence, as I shall demonstrate hereafter. Let him cover the patient's head with a cotton cap, and tie to it two compresses, each of six inches long, and three inches and a half large, made with four folds of a very fine and dry linen cloth, to keep each eye from the light: besides, let the patient be seated upon an arm-chair, a little raised up, and
situated

situated in such a manner, as he may present his right shoulder towards the side of the window; then he will lift up one of the compresses which covers the cataracted eye, and tie up its inferior extremity to the cap, leaving the other down on the left eye, in order of hindering him from seeing. The operator pinches the superior eye-lid slightly, and raises it up with the thumb and index of his left hand; then he takes the *speculum oculi* (see Tab. IX. fig. 4.) in his right hand, and places it softly round the globe of the eye, under the eye-lid on the side of the external angle. Whilst the assistant, (placed behind the patient, to keep the head steady, and lift up the superior eye-lid with the index and magnus of the right hand, and at the same time sustain it on the coronal with the left hand, in such a manner, as to give himself the facility, with his own arms, to keep the patient's head very firm), the operator takes his knife (see Tab. IX. fig. 1.) with the left hand; this done, he brings down the inferior eye-lid with the index of his right hand which holds the handle of the speculum, leans during this time the three last fingers of the left hand, which holds the knife, on the extremity of the patient's os mallæ, in bending the magnus whereon his knife ought to be fixed between the nail and
 extremities

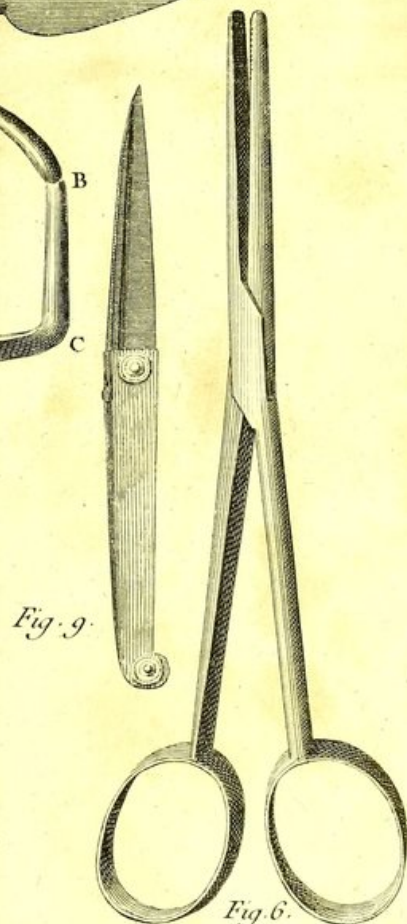
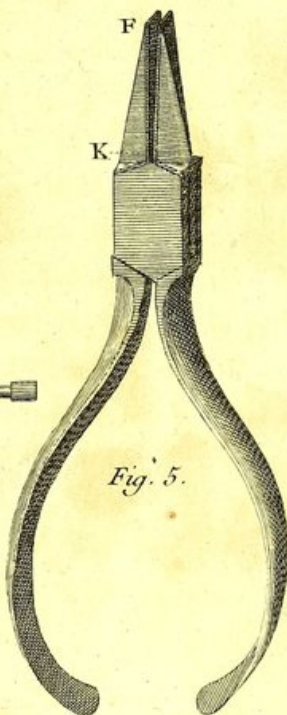
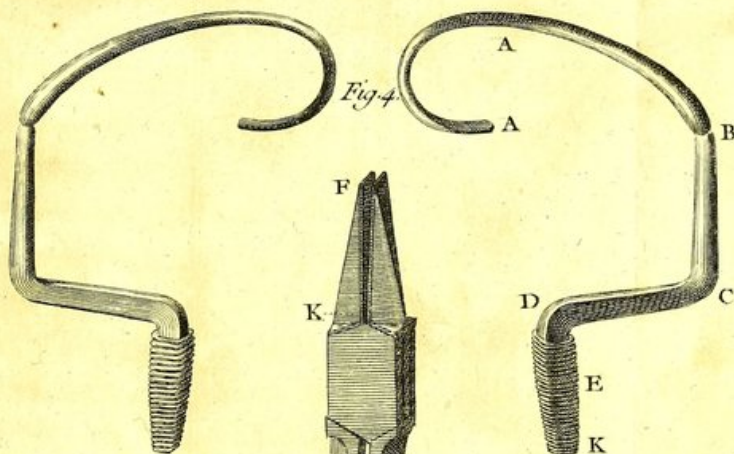
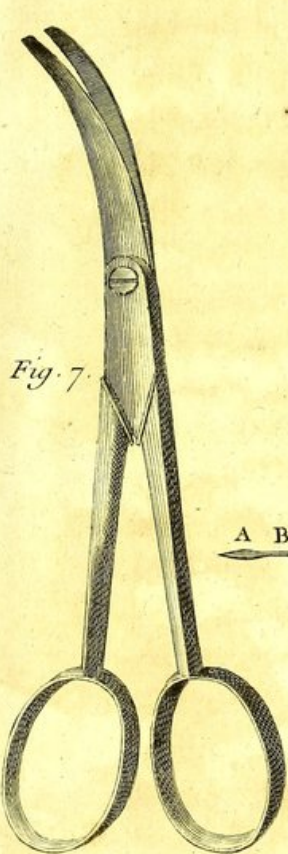


Fig. 6.

extremities of the finger. At the time of the insertion of the knife into the cornea, at a line and a half from the sclerotica, he makes a soft pressure with the speculum, in order of hindering the globe from turning towards the great angle, and discontinues it in proportion as he finishes the section. As soon as it is performed, that is to say, when the section is finished, and the knife from the eye, the assistant shall let the superior eye-lid come down, as slowly and with as great a precaution as possible, during the time the operator replaces the inferior in its natural state; after that, he takes away the speculum. Now, to give the patient an opportunity of coming to himself, he ought to stop for a minute.

To finish the operation, the assistant lifts up again the superior eye-lid, with all the precaution above described, whilst the operator brings down the inferior, with the index of the left hand; then, he introduces the kyfitome (see Tab. IX. fig. 2.) by its sheath into the globe, to the inferior part of the section, observing to place its extremity on the crystalloida, without touching the iris in going through the pupil. This done, he pushes the little button of the kyfitome, with the index, to have its blade out of the sheath; then he incises infe-

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riorly,

riorly, transversally, and at one cut, the capsule of the crystalline, and takes away the instrument. He ought to remember, that at this time he must diminish the brightness of the light, in order to produce a dilatation in the pupil, and facilitate the going of the cataract out of the eye, by the help of some soft pressures made under the globe. These pressures may be done with the extremity of the kystitome placed horizontally, or with the fingers; but they ought to be made softly, repeated as long as the cataract remains in the globe, and diminish in proportion it goes out of it. To receive this opaque body on the flat part of the instrument, is a good method. If some particles of the crystalline body remain under the cornea, he extracts them out of the globe, with the kystitome, made, at one of its ends, just as an ear-picker. If after this operation, the pupil appears of a blackish color, the operator may expect an ample success. This over, the assistant shall let the superior eye-lid come down softly, which, joining the inferior, keep the eye shut. At this time, the operator will untie the top of the compress, and cover the globe with it; in order that both eyes be motionless, to facilitate the cicatrizing of the incision performed in the cornea; for, if one eye was to move, the other would follow

follow the same motions, even against the patient's will.

Remarks. When the operator places the speculum oculi round the globe, he ought to employ no pressure, except when he runs the point of the knife into the cornea; and during the time of the beginning of this operation, he ought also to direct its points towards the opposite circumference of the pupil, in order of having the facility to countenance the folds of the iris, with the flat part of the knife, in case the impulsion of the aqueous humor (occasioned by the pressure of the speculum) brings it under its sharp side: for, to avoid the cutting of it, he will find very easy by lifting it up, by degrees, in conveying its point transversally, and at the same opposite part of the cornea. When the knife has gone through the cornea transversally, it is at that very time the speculum oculi ought to make no longer a pressure, though kept in the same position, till the cornea be opened inferiorly. The inferior part of the iris presents itself almost always under the edge of the knife, when the operator puts an end to the section; but as its blade is convex on that side, he finishes it in cutting round, observing, however, to do it the lowest possible, in order the division of

the cornea be not opposite the pupil. I think it is very necessary that the patient should be instructed in every point which concerns this operation; because he certainly shall exert all his abilities to hinder the globe from moving under the superior eye-lid. For which reason, he ought to be told, that the above situation of the globe, facilitates the operation, and that the pains he is to suffer are not really as violent as he might imagine.

The dressing which follows this operation, is next to be taken into my consideration, as being generally attended with numberless dangerous consequences, especially when a complication of accidents is existing at the same time. As soon as the operation is over, the patient shall be sent to bed in a very dark room, laid down upon his back, the head as low as possible, and always straight, that is, his body laid down horizontally; half an hour afterwards let him be bled in the arm, the repetition of which I leave to the judgment of the operator. Every two hours after the operation, he lifts up the compresses (but never allows the patient the opening of his eyes, as he would perhaps pay very dear for the gratification of his curiosity) to make a lotion on the exterior part of the eye-lids, with a very soft hair pencil dipt in a cold emollient infusion;

sion ; then he waits till they are dried of themselves, to let the compresses down, observing that they be of no weight over the globe of the eye, as any heaviness, in such a case, may be very hurtful. He shall continue this dressing regularly till the sixth or eighth day, at which time an overflowing of thick matter (but of no bad nature) commonly happens, which is the forerunner of a very lucky success : In the mean while, the patient must be kept to a low and regular diet, and particular care must be had to give him a nurse to watch him during the nights, in order to deter him from moving his head when asleep. After this time is over, he raises up a little the patient's head, to refresh him from the fatigues, and diminishes the quantity of the lotions, in proportion he thinks it necessary. If he thinks the wound in the cornea entirely re-united, and the cicatrice made, what is ascertained by a stop to the flowing of the aqueous humor ; then he allows the patient the opening of his eyes, in the dark, for ten or fifteen-minutes, from four to four hours ; all this managed in proportion to the time, and according to the diminution of the inflammation ; besides, the patient may be seated in his bed, and then go out of it, from time to time, till he finishes, by exposing his eyes to the strongest light.

light. With these precautions, a deal of trouble and pains, which are commonly attended with a loss of sight, are saved to the operated.

Remarks. If every particular above mentioned, did go on as well as a description, it would be very agreeable; but as a great many accidents and obstacles, which puzzle very much a young beginner, happen during the whole time of this treatment, I will now take them into consideration. The continuation of these emollient lotions, occasions commonly a slight but sharp excoriation on and round the eye-lids, and a lymphatic swelling in their texture; to get the better of these inconveniencies, one ought to make use, as a lotion, of the collyrium, No. XVII. p. 212. and diminish the quantity of the emollient lotions, when the inflammation presents no eminent danger. However, I shall observe here, that now and then, separately and alternatively, the emollient lotions ought to take place, together with the use of the said collyrium. This depends always on the cases that may require one or the other, by way of preference. All these lotions are only practised on the operated eye, except two or three upon the other, to mitigate the acrimony of the tears, as this eye remains continually shut. These contra-indications show plainly,
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that the effect of the first of these lotions is to relax, and the second to bind the parts together.

It happens very often, that the division practised on the cornea, cannot be joined and united entirely, if the aqueous humor be continually running out of the globe, either by the iris or some extraneous bodies being placed betwixt the limbs of the wound. In case this impediment be produced by any foreign bodies, they ought to be extracted, and the patient laid down again upon his back, both eyes shut, and bathed with the lotions, as above, till the running of the aqueous humor be quite ceased. If the iris leans on the cornea inwards, and produces a staphyloma; then a small incision on the tumor ought to take place, to let the aqueous humor out, and facilitate, by this means, the replacing of the iris; and in case this operation does not effect the entire re-uniting of the cornea, the incision must be renewed, and immediately after it, a dose of the ophthalmic pommatum, No. XXXII. p. 222. for one or two days, is required..

The pressure made with the speculum oculi, to fix the globe at the time of the section, does not produce an inflammation, as many would imagine. If any one will have a convincing proof of this assertion, let him introduce it in the eye of any
body

body whose eyes are found; then he will have an opportunity of observing, that the inflammation occasioned by it, will not last more than a quarter of an hour, or half hour, and the whole time without pains. Before to dismiss this paragraph, I will here observe, that when one has to struggle with a staphyloma and an inflammation at the same time, he must pay no regard to this last affection; for, considering two objects which require equally a speedy help, it will depend only upon his sagacity, to judge whether applying a dose of the said ophthalmic pommatum, which increases still the inflammation, be necessary, or not. A practice, grounded upon this theory, will very soon reconcile him to it. In fact, the inflammation diminishes to the third or fourth day, after the application of this remedy; because, being dissecative, it takes off the swelled and varicous vessels, and consequently puts an end to the disorder. This method is just as fire and water, if I may be allowed the expression, which one ought to manage with the greatest care and ability; for fear, that a more or less quantity of one or the other, may not produce greater accidents than those he intends to remove.

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The operation of extracting the cataract, is not always practicable: there are even many cases, wherein it would be quite as useless as impossible. When the extraction is thought impracticable, either because of a small space in the anterior chamber, a defect in the pupil, or an overturning of the inferior eye-lid; then couching ought to take place, if the cataract be solid, ripe, and of a common nature. This operation is practised in the following manner, when the patient is seated as for that of extracting above described. The operator places the fore finger of his right hand on the superior eye-lid, to lift it up, and his thumb on the inferior, to keep it down; then he takes the needle with his left hand, betwixt his thumb and fore finger, just as if it were a pen, placed in such a manner as the middle finger be at the upper extremity of the handle, and the fore finger not more advanced than the thumb: this done, he leans the two last fingers on the temple, in order to avoid any shaking of his hand, and bids the patient to turn his eye towards the nose; at that very time, he sinks the needle into the sclerotica, at two lines from the limb of the cornea, on the side of the external angle, endeavouring to shun the varicous vessels, if some appear at the very place of the in-

fertion of the needle. When it is arrived beyond the tunics, he turns it by half, and directs its flat point upon the superior part of the cryſtalline body, which he brings down under the pupil, in attempting to fix it there: after that, he ſets his needle horizontally, and gives it a half turn, to take it out as it went in, in order that it may wound no other part.

Remarks. If an effuſion of blood, into the globe, happens when the needle has been run through the coats, and that the aqueous humor be troubled in ſuch a manner as to hinder from ſeeing in the back chamber, before the depression of the opaque body; then, the operator ſhall take away his inſtrument, and proceed no further till that effuſion of blood be entirely reſolved by the uſe of ſome emollient fumigations. If the cataract, when couched, happens to replace itſelf in the ſoffula of the vitreous body, either totally or part of it, jumping may be recommended at different times, till it be down again; for though ſuch a method may appear very ridiculous at firſt, yet ſeveral phyſicians have obſerved, that it proved ſometimes beneficial, eſpecially when no adherence has been contracted; and in caſe this does not ſucceed, it ought to be couched a ſecond time with the needle. There
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are, however, a great many circumstances wherein either of these methods is quite useless; but, as I proposed them only in case the other cannot be practised, an operator ought to make the most of them, without any further wishes. Before to wind up this paragraph, I think it will not be improper to remark here, that a cataract couched to the bottom of the globe, does not dissolve itself, as has been thought by many writers. For the support of this opinion I have several instances, three of which no body, who reads the medical and chirurgical journals for these twenty years last past, will doubt. Three persons, at different times, died in the hospitals of Paris: they were remaked by the students, and their eyes opened before a numerous assembly of surgeons, who all saw the opaque bodies adherent to the bottom of the globe, though lodged there for seven years in the first, thirteen in the second, and seventeen in the last. However, I do not see any physical impossibility for its dissolution, if the crystalloids were tore with the needle, and the lens milky: as to the whole and sound crystalline, well wrapt up in its membrane, I think it would take more than a man's life-time, for its dissolution in the globe of the eye. (For the operation of couching, see the needle, Tab. IX. fig. 8. without its handle.)

The foundation of our knowledges in the art of healing is a just and exact anatomy : without such a help, the practitioner acts as in a maze, is apt to go astray, and make blunders every minute. It is allowed on all hands, that, for want of a due theory in the art, he produces many more accidents, and of a greater consequence, than the disorders he pretends to cure. According to these notions, every reasonable man who follows the medical business, shall freely grant, that he cannot examine too closely all the parts which the human body is composed of; in order of becoming well acquainted with the structure, extent, limits, and adherences they have with those nearly related to them. It is on account of these considerations that I have thought necessary to lay down a long and particular detail upon the crystalloida, as a great many anatomists differ very widely about the nature of this capsule.

The crystalloida is made up of two spherical and concave membranes; the posterior lines the fossula of the vitreous body; the anterior is less extent and concave than the posterior; but the first is thicker than the last: besides, they are united together by their neighboring edges, as it will be further demonstrated hereafter, than it has above. Almost
all

all the anatomists have advanced, that the crystalline has a particular envelope, which is covered with the capsule of the vitreous body: Experiments, however, speak to the contrary; for it is a fact sufficiently cleared up, that the crystalline lens has but one, and which stands by itself. The opacity, to which it is subject, being so visibly fixed as not to be able to extend further than the anterior or posterior circumference, was a sufficient reason to make practitioners understand, that in case this envelope had been an extension of those of the vitreous body, these should have been more or less affected along with it. Besides, if they had enquired and assigned a physical cause, why a cataract precipitates itself to the bottom of the chamber of the eye, without any help of art whatsoever, they would have undoubtedly foreseen, that the membranes of the vitreous body do not wrap up the crystalline; for, supposing this envelope had existed, how could it be possible to conceive, that the crystalline body would naturally and of itself go out of its place?

What I have to say, concerning the crystalline capsule, requires a particular order, and will be divided into two parts. The first shall contain different experiments, to demonstrate, 1st, That the
crystalloida

crystalloida is the single crystalline's envelope; 2dly, That this kind of bag is only contiguous to the tunics of the vitreous body; 3dly, That it is made up of two calottes, adapted and contiguous to each other, in the whole extent of their limbs. The second shall inclose many observations to bring these truths to a sufficient light, to which some analogous reflections upon that head shall be added: Moreover, I will describe the causes that determine the total, or part, of the crystalloida's opacity, together with the properest means fit to check this disorder, or re-establish the organ whose sight might be impaired by it.

First Part. Let any one perform a circular section in the cornea of the eye (when extracted out of its socket) of an ox newly killed, and introduce, through the pupil, a small handle of an instrument, and direct it obliquely towards the very circumference of the fossula, till it be arrived there. Let him separate softly the crystalloida from the vitreous body, with some small pullings or shakings, from right to left, *et vice versa*. As soon as the basis of the processus ciliaris shall no longer resist to the effort of the instrument, let him introduce it into the fossula, in turning, and leading it in such a manner, as to pass over the two thirds of the circumference

cumference of this cavity, to destroy the adherences which are to be met with, between the crystalloida and the vitreous body. If he places on the crystalline capsule a buttoned probe, he will have an opportunity of observing, that there is no floating portion of the membrane to be found. This furnishes a convincing proof, that the extension of the capsule of the vitreous body does not exist over the crystalloida. Let him overturn the eye, and pay attention to the few adherences there are between these two transparent bodies, as the point of their union is only existing in the circumference of the fossula of the vitreous body; let him separate them from each other, and put the crystalloida on a white sheet of paper; then, with the help of a good microscope, he will see the most exact polish all over its surface; in short, he shall remark, towards the circumference of the crystallo-anterior, some small grooves very near each other, and that every one of them have about the third of a line in length: their function is to keep fast and steady the basis of the ciliary fibres. If some remain still, let him take hold of them with a pair of small tongs, they will give way to the smallest effort; and he will find, by looking with attention, that a great many lymphatic vessels, though small and delicate,

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are prolonged till at a certain distance, that is to say, till their tunics will give way to the pulling, and be broke. If the crystalline capsule were an expansion of that of the vitreous body, it should naturally result from this, that a blunt instrument, such as a handle, could not well divide the tunic by tearing of it: Moreover, he will further observe, over the crystalline capsule, when taken out of the fossula, an exact continuity, near all the edges, which could not be performed by the most sharp instrument. Besides, if the crystalloida were not a particular envelope of the crystalline body, it would not be possible to divide it from the vitreous body with the handle of an instrument, without producing some inequalities; but, as a gradual pressure is sufficient to separate the two transparent bodies from each other, it follows necessarily, that one needs neither sharp nor flat instruments to perform a circular division.

Let any one cut circularly the middle part of the globe of an eye, that is, at about three lines from the limb of the cornea, without touching either the vitreous body, or the crystalloida; let him separate these transparent bodies, from the other tunics of the globe, and put them aside upon a clean plate, he shall see that the crystalloida is a
great

great deal more dense than that of the vitreous body. If he thinks that the ocular lens makes its capsule look thicker than it really is, let him touch slightly over the vitreous body with a buttoned probe, and pay a proper attention to its elasticity in comparison to that of the crystalloida, he will have an irrefragable proof of what is advanced above. To perform all these experiments, one ought to prefer the eye of an ox or horse, to that of a man; because the parts of the first being more voluminous than the last, one may distinguish them a vast deal better. Moreover, the crystalloida in these animals does not differ in the least from that in the human eye, except by its greater bulk. However, the above experiments practised on the human eye, shall certainly produce the very same remarks, provided one can distinguish as well.

To complete the above experiments, one ought to open, with a small-pointed surgical instrument, the crystalloida separated from the vitreous body, and, after its removal, take them deprived of their fluid, betwixt the fingers separately; he shall feel by the touch, that the crystalloida is thicker than the two tunics of the vitreous body; then, let him bring these tunics near a hole practised in a window-shutter, through which pass

some rays of the sun, he will have an opportunity of observing a multitude of pores, spread over the whole texture of these membranes; with this difference only, that the crystalloida has less of them than the tunics of the vitreous body. What, then, may be the cause of the difference that one remarks in the thickness and softness, which are to be distinguished in these envelopes? It is because they are of a distinct nature. Besides, let him macerate the globe of an human eye into some brandy, he will remark, some few days after, when he comes to cut it open, that the crystalloida has acquired an opacity similar to that which occasions the cataract, whilst the membranes of the vitreous body will keep their natural transparency. Let him sink a tooth-picker, by its point, betwixt the crystalline capsule, and that of the vitreous body, and cut the opaque body, to separate it from the fossula; he will find, that the posterior face of the crystalloida has acquired the same degree of alteration as the anterior. He may naturally conclude, after this experiment, that had the crystalline capsule been an extension of that of the vitreous body, this last membrane would have participated to the loss of transparency in the first; but, as this alteration has not been the consequence,

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it is a very clear proof, that the cryſtalloida is only contiguous to the vitreous body. He will ſee, moreover, that the cryſtalline capſule is formed by two ſpheroid and concave tunics, when he performs the following experiments.

Let the cryſtalloida be ſeparated from the vitreous body, and macerate in a little phial, full of common water; within a few days afterwards, he will have an opportunity of perceiving, that this envelope is opened in its lateral part. Let him take it out of the water, and divide it, ſetting aſunder the diſunitied parts from each other, he ſhall ſee, that the cryſtallo-poſterior is more extent and concave, but leſs denſe, than the cryſtallo-anterior.

Let him perform an incision, ſufficiently large, in the cornea of a living animal, and ſqueeze the eye by degrees, till the cryſtalline goes out of its envelope, without cutting into this laſt membrane; then he may remark, at the time of the preſſure, a great tenſion in the whole capacity, eſpecially towards the anterior part, and will eaſily conceive, that the vitreous body, by its elaſticity, operates at this very moment a compreſſion over the cryſtalloida, which is much the ſame as that performed in the external parts of the globe. Let him diminifh the preſſure, at the ſame time of its going out of

the fossula, in order of observing the demi-circuit formed on the limb of the crystallo-anterior; then the crySTALLINE will no sooner be extracted, than a mist, which did not exist before, shall appear beyond the pupil. Let him squeeze sufficiently the globe of the eye with the fingers, to extract the vitreous body, he will easily observe, that the crystallo-anterior is become opaque in its whole extent, whilst the crystallo-posterior has kept its transparency, as well as the vitreous body. The dilaceration continually operating at the inferior junction of the tunics of the crySTALLINE's capsule, proves clearly, that they are only contiguous; and the opacity which happens in the crystallo-anterior, during this experiment, is a complete proof of it. It is very material to observe here by the way, that if this tunic loses its diaphaneity when dilacerated, it keeps also its transparency when an incision is practised to facilitate the going out of the crySTALLINE: therefore, according to this remark, I think one will be sensible how necessary it is to make a large incision in the crySTALLOIDA, when he extracts a cataract. For want of such a precaution, he commonly occasions a secondary cataract, which, as I have observed, is not so easy an operation.

Second

Second Part. I was present when a blind lady underwent the operation of the cataract, by extraction. As soon as the section was performed, the aqueous humor ran down; and in proportion the cataract made its way out, it forced open the circular fibres of the iris. The section had hardly been finished, that the cataract went out, and precipitated itself on the cheek. We were very much astonished to see that this opaque body was exactly round, and its circumference neither gummy nor lenticular, as the ordinary cataracts. It was as soft as a bag full of water, and kept an hydatide form. When it had been put upon a sheet of white paper, the other eye was operated, and produced the same kind of cataract, but of a globulous form. We made a close examination of these two opaque bodies, and observed, with a microscope, that their surfaces were as polished as a looking-glass: it was not even possible to distinguish their posterior part from the anterior, nor to perceive the little excavations or grooves, wherein were placed the basis of the fibres of the processus ciliaris. After having cut open one of these opaque bodies, we then saw, that the crystalloids opened, produced a mucuous and yellowish matter, which spread itself over the paper. We observed also, that at the very instant
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the crystalline's capsule was divided or incised, that it sunk over the opaque lens, and had more consistence than in the natural state. One of us pressed over several places of the surface of the capsule of the second cataract, which always gave way to the pressure of the instrument; but, as soon as the impression was not sensibly discovered on that tunic, the comprimated part re-established itself in its first state. He performed upon this opaque body the same incision as the above; but there was no different remark worth making.

I have extracted two cataracts of the same nature as the above, except that they were a great deal more voluminous, and of a milky white color at their exterior parts. When I squeezed on any point of their surfaces, (for I put them on a sheet of paper) I observed a fluctuation to the very lateral parts; and when I finished pressing upon them, the globulous bodies re-established themselves. As soon as I had performed the incision in the first crystalline, a whitish and mucuous humor ran out of itself, in such an abundance, that it wetted a pretty good extent of the paper, though the diameter of the opaque body, which, of whitish and round as it was, became lenticular and olive-colored. I took up the crystalloida, and found it opaque in
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its whole extent, and thicker than in its natural state. The second cataract offered quite the same remarks as the first. There is no doubt, that the sphericity of these cataracts, was only occasioned by the crystalline capsule, and mucosity they contained. These are also irrefragable proofs, that the crystalloida stands by itself, and that it is not, as was believed, wrapt up exteriorly with the capsule of the vitreous body. If the crystalloida and its contents did not sometimes exfoliate, a cataract could never fall of itself to the bottom of the posterior chamber, by a violent commotion; but as we meet with a good many instances of that kind, we cannot reasonably refuse ourselves to evidences.

A young man, born blind, with two cataracts in his eyes, had the advice of several oculists, who told his friends, that nothing but the operation of extracting was capable to restore him his sight; but as he was a very boisterous boy, no one of them dared to operate him, considering that he was able to find his way; insomuch, that he remained deprived of sight till he was fourteen years of age, when an unexpected event procured it him. One day, as he was going out for a walk with some other boys, one of them, as they were strolling about in the fields, discovered a nest of birds on a
very

very high tree, and immediately acquainted his companions with his discovery. Our blind boy being senior, and the most nimble that way of them all, desired he might have the glory to climb up to it. He had no sooner reached at the branch where the nest was lodged, that, having lost his equilibrium, he fell from branch to branch, till he came to the ground straight on his legs. This fall frightened him in such a manner, that he lost his senses for a while, and measured the ground with his whole length by a second fall. As soon as he was come to himself, he told his companions, who were themselves taken out of their senses on account of his fall, that he saw several bodies in motion, and assured them, to their no small surprise, that he was seeing several objects which he was totally unacquainted with: Being returned at home, oculists were immediately called for, to know if they might expect a happy continuance with regard to the boy's eyes: they all agreed, that the cataracts, which they had seen before in his eyes, had totally disappeared, and were lodged, very likely, at the bottom of the eyes.

Such an observation shall certainly be no advice, for people afflicted with cataracts, to repeat the same experiment. This is too obvious for a
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single proof, that the crystalloida stands by itself, and that cataracts have their degree of maturity. In fact, if the crystalline capsule had been still adherent to the vitreous body and processus ciliaris, (as in the natural state) would it have been possible, though the commotion had been more considerable, that the cataracts had precipitated of themselves to the bottom of the posterior chamber? Certainly not. It is very natural to think, that at the time the boy took this lucky fall, the crystalloida were almost exfoliated from their fofula, as I said before: so that the commotion determined the cataracts to come down, being, besides, accelerated by the specific gravity of the ocular lens. One cannot suppose here, that the pretended portion of the capsule of the vitreous body, was tore by the means of the commotion: for, though the antient anatomists thought it did wrap up the anterior portion of the crystalline, it is very easy to refute such an idea by what follows, and many other assertions of as strong and powerful arguments, as those here mentioned. Could it be possible, that a commotion were capable to dilacerate a membrane, as that of the vitreous capsule, without any such ruptures in the soft and thin vessels of the brain, and other parts of our body,

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whose texture is as delicate? Could any one imagine, that Nature herself, being tired of blindness, determined the commotion and dilaceration of the vitreous capsule; in order that the opaque bodies might be precipitated the easier to the bottom of the globe, whilst she would have preserved the other parts of this organ? Indeed, this would have proved a very extraordinary phenomenon! But an objection presents naturally of itself to remove such a strange idea. Suppose the vitreous capsule should stretch itself to the very anterior part of the crystalline, and that it were dilacerated on account of the commotion; it would naturally follow, that this part would lose its oscillation: from thence an obstruction in the vessels, a stagnation of their fluids, and an opacity of this envelope. After all these considerations, one may reasonably conclude, that the vitreous body was not altered in the least, at the time of the removal of the crystalloida, and that this last membrane is the only envelope of the crystalline.

I was present when a young girl, born blind, underwent the operation of the cataract by extraction. The operator had no sooner opened the cornea and crystalloida of her right eye, than a milky humor spread itself all at once out of the globe, and wet-
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ted its inferior surface. When this fluid was entirely run out, we observed, beyond the pupil, an opacity in the cryſtalloida; but it was not poſſible to extract it, as the vitreous body produced a great quantity of its fluid, and experienced a viſible ſinking. The operator proceeded to the other eye, but did not open the cryſtalloida in order to extract it along with the cryſtalline; for the effect of which he introduced, through the pupil, immediately after the opening of the cornea, an inſtrument, made at its end juſt as an ear-picker, and directed it towards the inferior portion of the ſoffula of the vitreous body, in order of deſtroying the adherences that contracts its capſule with the cryſtalline. As ſoon as the inſtrument's end was in the interior of the ſoffula, he tore the cryſtalloida, out of which flowed a viſcous and milky humor, and produced the exfoliation of it. The interior of this tunic contained not the leaſt remain of the cryſtalline body, for which reaſon we conjectured it was liquified. If the cryſtalloida had been a continuation of the vitreous capſule, could it have been poſſible, that by ſingle touchings with the inſtrument, its exfoliation had taken place without a dilaceration to the circumference of this cataract? As none was exiſting, it is a convincing

proof the crystalline capsule is independent of the vitreous's, and that it stands by itself.

Several physicians were called for their advice in a cataracted case, among whom I was one. We remarked, that the bulk of the cataracted eye was equal to that of the sound one: the pupil of the first was not only dilated, but immovable to all degrees of light it was exposed to; a sure token of the complication of a perfect blindness. The crystalline looked opaque, and floated at the least motion of the globe: its whole surface was wrinkled and less voluminous than the common cataracts. The posterior part of this opaque body was pyramidal, and only adherent to the superior part of the ring of the fossula. The vitreous body was transparent, its fossula appeared convex, and the aqueous humor limpid: in short, this eye was affected with a movable and loose cataract. We asked him whether he had received any blows on this eye, or undergone the operation of couching; he answered in the negative, and added, that the disorder had occasioned neither pain nor inflammation. If the crystalloida were covered over its anterior part by a lengthening of the vitreous capsule, how could the crystalline body, with its capsule, have got out of
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the fossula, without exterior cause? The ulceration in the crystalloida is always attended with an extreme contraction in the pupil, and adherences contracted between the posterior faces of the iris and the crystallo-anterior. The accidental displacing of the crystalloid body proves, 1st, That this cataract has a maturity, which consists in the exfoliation of the crySTALLINE capsule; 2dly, That this envelope is not a continuation of that of the vitreous body. The following observations are further proofs and instances of it.

I have extracted a cataract out of the right eye of a gentleman of a very good constitution, and afflicted with no other disease besides. The opaque body was of a white perle color, and floated at the least motion of the globe. As soon as the section in the cornea was finished, I compelled, (with a blunt instrument) the opaque body to an exfoliation, to have it out of the globe. The sight was re-established that very instant, and the treatment after the operation was carried on without accident. The crySTALLINE was wrapt up with its capsule, but both were opaques; with this difference only, that the crySTALLINE lens was of an olive color, and the crystalloida of a perle color. This envelope was a great deal thicker than in the natural state, and no
remains

remains of a dilaceration were to be distinguished upon any part of its surface. I chose to exfoliate this body with such an instrument, because I conjectured it was not fixed in its fossula, as it appeared quite loose in its greatest extent.

About ten years ago, I was called to give my advice for a young man, who had from his birth two cataracts in his eyes. They were of so singular a nature, and so very uncommon, that nobody chused to extract them. When the young man directed the axis of his eyes downwards, the cataracts rose up of themselves, and the third inferior part of the pupil was quite discovered; but, if the globes were fixed horizontally, they came down and obstructed the pupil. Thus the young man was only able to see his way; and, as I said before, when the axis of his eyes were directed downwards. Though these cataracts had a kind of elasticity, and something extraordinary in themselves, I judged their extraction practicable, having remarked the pupils susceptible of contraction and dilatation, and the sound state of the globes. As soon as I had practised the section in the cornea, the aqueous humor ran out as usual, and at this very instant the cataract changed its position. This lenticular body having been constantly fixed opposite

fite the pupil, as long as the globe was horizontally
 fituated, raifed up for the firft time, and its infe-
 rior limb found itfelf towards the middle of the
 pupil. I preffed foftly under the globe of the eye,
 to oblige the opaque body to go through the pupil;
 but having obferved that the vitreous body present-
 ed itfelf at firft, and that the cataract had almoft
 entirely hid itfelf under the fuperior part of the iris,
 I altered my way of operating, by taking hold of
 the opaque body with a pair of fmall tongs, and
 extracted it out of the globe. I fucceeded as well as
 I could wifh. This over, I undertook the opera-
 tion on the other eye, which produced the fame
 remarks, except that the cataract divided itfelf in
 two portions. I took hold of the inferior, which
 was the moft confiderable, and brought it out,
 whilft the other went towards the top of the globe,
 juft in the fame manner as a blind let loofe to the
 ftrength of its fpring. What is moft extraordinary
 in this fact, is, that after the complete cure of this
 patient, I could not fee any portion of the cataract
 which remained behind, having taken its quarters,
 as I fuppofe, to the fuperior or inferior part of the
 globe. Thefe two cataracts were cryftallines and
 capfularies: their form prefented a fpheroid more
 flat than the common fort. What might be the
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cause of the mobility of the above cataract? To this I answer, that they moved of themselves, because the crystalloids were exfoliated to their inferior and lateral parts, whilst their superior were still adherent to the circle of the fossula of the vitreous body; so that, when the axis of the eyes were bent downwards, the inferior muscle of each globe being in action, occasioned in this part of the organs a point of compression capable to change totally the form of the fossula of the vitreous body, and give it a conical figure. The aqueous humor of the posterior chamber, having in this situation of the eyes a great deal more facility to pass in the anterior chamber, shook the inferior limb of the cataract; and being compelled there by the convexity of the fossula, it produced a change in the situation of the opaque body, by placing it backwards, and opening a way for the rays of light, which left each organ a power to see some objects: when, to the contrary, the globes assumed an horizontal position, the pressure of the inferior muscle not existing, and the aqueous humor exercising a sufficient pressure over the vitreous body, obliged its anterior part to re-assume a concave form; then the edge of the fossula came forwards, and the cataracts did fall down, where they were before.

In this state, the luminous rays were intercepted, and the perceptions suspended. What confirms me more in this opinion, is, that the aqueous humor had no sooner been evacuated, after the incision in the cornea, than the cataract raised itself up, tho' the axis of the eye remained horizontal; because, then, the vitreous body being no more kept close by the action of the aqueous humor, its elastic strength altered immediately the form of the fof-fula, which from concave became convex, and compelled, by this means, the opaque body to change its position. Therefore, after having well weighed the cases, when a cataract is floating, an operator shall never open the crystalloida to extract it; because this envelope, in such a state, is commonly opaque.

Having extracted a cataract out of the eye of a girl, I observed, during the operation, that the crystalline went very easily out of the globe, by the help of some soft pressures under it, after I had performed the section in the cornea: but as soon as this was over, I saw, beyond the pupil, an opacity in the anterior part of the crystalloida, which I extracted with a pair of small tongs, (see its description, Tab. IX. fig. 6.) and brought it out with the usual precautions. These consist in pull-

ing gently from left to right, and from right to left, as I have already observed in the above paragraphs: for with such precautions, the operator allows a proper time to the adherences which fix this tunic, to separate from the vitreous body. The above remarks have convinced me, that the crystallo-anterior may become opaque, while its posterior keeps its diaphaneity; and that this envelope must be made up of two membranes, one sometimes altered when the other is found.

It is not sufficient to know with certitude that the crystalloida is susceptible of opacity, before or after the displacing of the ocular lens; it matters yet to know the causes for which it loses its natural state: the internal are, 1st, the depravation of morgani humor, as I have already observed; 2dly, the obstruction in the vessels of this envelope, and the dilaceration in it, which all contribute to form its opacity. The external causes are, 1st, blows on the globe of the eye; 2dly, a too small incision in the crystalloida, when one operates the cataract by extraction; because a very little apperture not giving easily an opportunity to the crystalline body of going out of its envelope, it tears the insides and edges of the incision, when the operator presses under the globe of the eye to hurry its passage:
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from thence a dilaceration or bruise, which is sufficient to opacify this tunic. It is absolutely necessary to pay the greatest attention to the performing of the section in this capsule, and not to press under the globe of the eye, but when the incision is performed, and sufficiently large to let the cataract out. Without this essential precaution, one runs not only the risk to produce a secondary cataract, but a violent inflammation, or occlusion of the pupil. This last accident would be the most dangerous, as it should require another operation, more delicate than any one else, to re-establish the sight; I mean the perforating an artificial pupil. In performing a too small incision, and in pressing under the globe at an unseasonable time, the operator determines the melting of the globe, and its sinking in the orbit.

All these details, whose principal aim is to instruct the young beginner, are not always sufficient to acquire a perfection of practice in this branch of medicine and surgery: every disorder produces new phænomena to the observers who have even a most extensive one. When the section in the cornea, and the incision in the crystalloida, are performed to extract a cataract, the operator cannot yet positively say, if this capsule be opaque,

unless the crystalline be out, or the cataract floating. If the anterior part of the crystalloida be easy to take hold of, with a pair of small tongs, and that after its extraction, the crystallo-posterior be intimately tied on the fossula of the vitreous body, every prudent practitioner shall let the eye remain in this state.

I have read an observation in a pamphlet, very well authenticated, that a man having undergone the operation of couching without success, was afterwards operated by extraction with success. What can be the reasons why couching could not answer the operator's views in that case? Because the cataracts were milky, membranous, and did not yield under the needle. Here are the abstracts of both ways. The patient underwent couching five times upon one eye, and three on the other, without the operator being able to bring them down, nor even to tear the crystalloida, whose existence he was very likely ignorant of. The operation by extraction was as follows: As soon as the section in the cornea and incision in the crystalloida were performed, a milky humor ran out, and nothing else remained but the opaque crystalloida: the operator being prepared for the event, he introduced a pair of tongs in the globe, took hold of the capsule

fule with the extremity of this instrument, and, by the means of some gentle pullings from the right to the left side, extracted it entirely out of the organ. The other cataract produced no different remarks, except that the operator not being able to extract the posterior part of the crystalloida, after an attempt of a whole half hour, he gave it up.

It is not so difficult to acquire a certitude of the adherences which contract reciprocally the iris with the crystalloida, as to prognosticate that a cataract is arrived to a degree of maturity. When one has successively exposed a cataracted eye to a strong and weak light, and that the patient distinguishes day from darkness, he may hope for a success, tho' the pupil be immovable, by being adherent to the crystalloida, if the operator be able to destroy them, and surmount all these difficulties. These adherences of the iris to the crystalloida, are always destroyed with a silver blade, curved on its flat, as this cannot cut the iris to its circular part. I will, however, observe here, that the pupil may be immovable, without any adherence, as I hinted before, by a paralysis in the musculary filaments of the iris; for which reason, one cannot reasonably hope of re-establishing the visual organ, as this is
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what we generally call a complicated cataract, and of a very bad sort.

After what has been said, I may reduce and bring the cataracts into five classes, without including their complications and variations. The first consists in the single opacity of the crystalline, and may be looked upon as the most frequent: besides, it is not of the same color nor consistence in all men: it is whitish, and like curdled milk, till five-and-twenty years of age; on the contrary, from that age till the end of life, it is solid, and of a yellow more or less deep; in short, the crystalline may osify itself. The second is a complication of opacity in the ocular lens, with that of morgani humor and crystalloida: it has in most men a solid or liquid consistence. The third is occasioned by the single alteration in the anterior portion of the crystalline capsule. The fourth depends only on the loss of the transparency in the tunic which lines the fossula of the vitreous body; in short, the fifth is produced by the thickening and opacity of morgani humor.

The reader ought to have remarked in the above observations, that all these sorts of cataracts require some particular manner of operating. He will have many an opportunity of observing, that patients,
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in general, give a great deal more trouble, through their indocility, than the disorders themselves.

The operation of a cataract, by extraction, may also be performed in opening the cornea inferiorly; but it is attended with so many inconveniences, that I do not advise its practice. The method, such as that I have proposed, p. 271. is attainable without a great practice, as the fixation of the globe is the main point; but I must allow, that the performing of it in opening the cornea transversally, and without a speculum oculi, requires more dexterity and practice than a surgeon can acquire, if humanity be in his breast. I make no doubt, that an operator who does consider this, will save many a one from blindness, though he might claim the greatest praise by it, on account of his dexterity. However, if any one has a mind to operate constantly without a speculum oculi, I advise him to have the blade of his knife a great deal narrower, than that described, Tab. IX. fig. 1.

All that needs of an ocular demonstration, requires in that of a typography, some very long and often very tedious dissertations. Those medical gentlemen who have made a particular study of the disorders of the eyes, and acquired an extensive knowledge in them, must allow that nothing is so
varied

varied and difficult of description, as the signs and symptoms of the internal maladies of the globe of the eye; besides, it is a very hard case to point right at their curative indications, and account, by physical reasons, for the state of the patient and that of the disorder. As I have already given a description of the symptoms of the cataract and glaucoma, I shall now mention their difference, in attempting to enlarge upon this knowledge by observation, and show what a practice, founded on physical laws, may furnish.

Observation. A gentleman about forty years of age, begged that I would look at his eyes, previous to any account from him; in order he might know whether I could, or not, distinguish the real state of his eyes and sight, as no body had been able to give him satisfaction in this particular. As soon as I had closely examined his right eye, I told him that he could not possibly see well enough to distinguish objects, though he might see his way with it: As to the other eye, it was sound. I observed, that the right eye was exteriorly sound: that, interiorly, the pupil contracted and dilated perfectly well, when the eye was exposed successively to a strong and weak light. Being well acquainted of the possibility of a blind state, though a contraction
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and dilatation in the pupil might be existing, I endeavoured to discern one from the other, by enquiring into the state of the humors and membranes which contain them. To be brief, I discovered a kind of whitish pellicle, placed immediately after the posterior part of the crystalline, and directly conjectured, that it was sufficient to intercept the rays of light. However difficult the case was, I supposed the seat of the disorder to be rather on the crystallo-posterior, than on the capsule of the vitreous body, as the opacity was in some respect perceptible. What might be the cause of the extreme contraction in the pupil of the left eye, was a very curious and proper enquiry. I conjectured, that the straight fibres of the iris were undoubtedly a great deal longer than the circulary; because a dilatation took place, in proportion as the eye was deprived, artificially, of the strength of the rays of light. This opacity came on in the following manner: The gentleman happening to walk exposed to the sun, and when it was a very sultry day, experienced at once a great heaviness over his eye-brow, and into the internal parts of the globe of the eye and its socket. He imagined he was presented with a piece of clear gauze before

his eyes; but having rubbed it along with the imaginary object, he became conscious that some internal cause obstructed the sight of this eye, which remained in the same situation since.

Remarks. If such a disorder be so singular in itself, I think it will not be amiss to lay down the cause, as the same may be met with. Its beginning could be nothing else but the consequence of a slight inflammation, which was fixed on that part, and produced an obstruction in the excretory pores and lymphatic vessels of this capsule. I apprehended, that, had the eye been fumigated with emollient infusions, the obstruction would have been resolved, especially had diluent drinks been also made use of at the same time; because, in such cases, the stagnation of the lymphatic fluid, being not remedied at first, an opacity over such thin pellicles must absolutely be the never-failing consequence.

Observation. A gentleman, aged about forty years, of a very strong but cacochymic constitution, who had been for a long while afflicted with several complicated disorders at the same time, through irregularity, and the ignorance of different Quacks, called for my advice. Having examined his eyes, I found them sound exteriorly, and observed, interiorly,

riorly, that the pupils did contract and dilate perfectly and equally; that two spherical globules of air were floating in the anterior chamber of the left eye, and that the globe was not at all atrophied. These observations being made in a very light room, I renewed them in a dark one, to know whether I might have the very same results; but upon the trial, and to my no small surprise, I discovered them very different from the former, as the right pupil did not easily contract and dilate; and that the left remained more dilated and immobile than in its natural state, though I intercepted and exposed them by turns to the light. However, I discovered by these very symptoms, that one eye was deprived of the faculty of seeing, and the other declining in its sight. How and in what manner a physician ought to account for it, will be the subject of the following paragraph.

I asked the gentleman many particulars, concerning the beginning of the disorder which preceded that under my present consideration; to which he answered: A month before the defect of his sight, he found himself so ill for some days, that he could not possibly tell to what accident he might attribute it, having lived very sober; that a sensible dimness in his left eye, which he presumed

was the consequence of the first complaint, came on suddenly. The diminution of sight, he said, did not at first give him great concern, as both the exterior appearance, and the pains he felt over the eye-brows and in his head, were trifling and tolerable. In eight days the disorder made such a rapid progress, that he thought it prudent to call for advice, being hardly able to distinguish the largest objects with this left eye. The substance of what his physician told him, consisted, that it was an approach of a return of the gout, to which he had been subject these ten years past; upon which prognostic, he prescribed aperient medicines, together with bathing his legs in warm water, wherein a proportional quantity of mustard was entered. But having taken a wrong way, it is very clear the success could not crown his prognostication. Emetic then followed, but with a worse effect; for the gentleman, who could still distinguish the large bodies before the use of this vomitif, was totally deprived of that satisfaction. Afraid of losing the sight of the other eye, by the use of these remedies, he declared to his physician, that he had rather wait for blindness, than to be hurried into it in that manner; consequently he remained for some time in this alternative, without any trial of medicaments

dicaments whatsoever : Meanwhile, though he would not try any of these, he did not refuse to listen to advices ; for which purpose, he called upon every oculist whose names he was able to pick up, and satisfied himself with regard to the denomination of a complete gutta serena. By some, who understood the disorder in this light, he was advised bleeding at the jugulary two or three times, as the only remedy ; by others, who were of a different opinion, he was proposed to make use of numberless eye-waters of their own composition, which, if they did not procure any relief, could do no harm. After so many advices, not very much to his liking, he again called his first physicians, who insisted upon bleeding at the jugulary, as the most prudent and advisable means in such a case. But the gentleman being terrified at such an uncommon operation upon him, declared he would not submit to it, as there was no positive assertion of any real benefit resulting from it. At last, tired of shifting, he was prevailed upon, though with a great deal of reluctance, to bear the application of leeches at his temples, and that of a plaister on his shoulders, being means capable of supplying the effects of bleeding. These were then practised for several days ; but seeing he reaped nothing

thing by it, except intolerable pains and continual wakes, he said he was ready to abandon every medical operation, when I saw him for the first time.

After these my observations, together with the detail above mentioned, I told him that I apprehended the physicians had not thoroughly considered his case; for, though I could not assure him of a perfect cure, yet I certainly should check the disorder, without putting him to any trouble or pains. Here is the case as I understood it. I could not doubt that it was a lymphatic obstruction in the vessels which ramificate the vitreous capsule, and only fixed on its posterior part, to such a degree as to intercept the visual rays, without being able to absorb those of a greater power; because no other accident intercepting them, (what was conspicuous by the contraction and dilatation in the pupils) indicated, besides, no affection in the retina and optic nerve. I concluded that employing such remedies as might undermine the cause, I had a right to expect a success; so that, I prescribed the continuation of the aperient medicines, and the plaister behind the ears, removed there *interim* from upon his shoulders. The first was to prepare him for a strong purgative, and the second to take
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away the first as soon as possible. Four days after, he began to make use of the electrical fluid, No. XXXIII. p. 222. three times a day, and the collyrium, No. XIV. p. 210. one hour before every time: Four days after this, a strong purgative, No. X. p. 207. after which the plaisters were taken off; to which the diluent ptisan, No. I. p. 201. was substituted, and the aperient medicines no longer made use of. He had not continued regularly this way of medicamenting, than in a fortnight he had the satisfaction to see again the largest objects with his left eye, and with the right, as clearly as before the malady. The purgative, No. X. was prescribed a second time, and produced so great a benefit, with the continuation of the other, that every day he found himself better and better, both in health and sight, till a complete cure was operated two months afterwards.

Every practitioner who will not show himself imbued with the despicable principles of empirics, ought, in the history of a disorder, to expose its cause, state, what had been practised before he took it under his care, and, in short what method he used to remove it. To all these points, I think I have already satisfied; so that, it remains now to lay down the physical reasons by which the method operates,

operates, as well as the results, that one might expect from it.

As soon as I had been confirmed in my opinion, that the disorder was an obstruction in the lymphatic vessels which ramificate the hyaloida to its posterior part, as I have observed above; I did not doubt a moment, that this obstruction owed its existence to a want of circulation in the lymph; and as this state occasions a dimness in the capsules of the eye, the means which promote it, were naturally recommendable. After such a prognostic, grounded upon what I had remarked in the interior part of the globe, I prescribed the diluent drinks to re-establish the circulation in the lymphatic vessels; for the better effect of which I recommended, to second the first, a frequent use of the electrical fluid whose strength produced such violent shakes on the globe of the eye, that all the muscles contracting at the same time, compelled the humors to secrete a greater abundance of the lacrymal fluid out of the globe than usual, and give the regenerative powers an opportunity of supplying afresh, as to operate a supernatural circulation. Would this method have been sufficient to cure the disorder entirely? Most certainly not: because the cause being not destroyed, the effect, though suspended, might

might be susceptible of a quick return. It was for the defect of this prescription, that I insisted, for a long while, on the continuation of the diluent drinks for internal remedies, though the disorder was quite removed.

If the obstruction had been fixed to such a degree as to admit of no remedy, the use of the electrical fluid would have produced an atrophy of the globe without any success, which is an indicative symptom to leave it off. Its volatility may be diminished according to the occasion. All these points well weighed, and thoroughly considered by an able and discerning physician, such a disorder, though susceptible of being wrongly understood by many who make but indifferent observations, becomes a simple science of practice. For my own part, I look upon the plaisters applied either on the back, or behind the ears, as very absurd remedies in these internal cases, when there are so many gentler ways to supply them. Let us suppose, for an instant, that an obstruction be fixed in the bottom of the globe, or socket, together with any other causes which produce those kinds of momentaneous blindnesses, so numerous as many practitioners think of meeting with a gutta serena, is it not very clear, that if a success happens with the use of such re-

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medies,

medies, that such and such remedies have cured this disorder, when it might be rather attributed, either to the effects of nature, or other means, for which an indifferent practitioner never knows to account? This is positively how most physicians have been led astray. When abscesses, pustles, &c. exist in the bottom of the socket or globe of the eye, the patient experiences intollerable pains: the globe swells by degrees, till a suppuration takes place, with the irrecoverable loss of the organ. In such cases, then, the patient's life being in danger, those means are recommendable.

Observation. The more I advance towards the subject that treats of the affection in the retina, and the manner of distinguishing the symptoms which necessarily lead to the curative methods, the more delicate and conjectural it becomes; for which reason, I will keep within the bounds of some few observations upon this head, to render the matter less hazardous, and more substantial. A young gentleman called for my advice in the following case: After a strict examination of his eyes, I observed that one was not quite sound, and the other, without being atrophied, sunk in its orbit; that the humors and membranes were in their natural state, and the pupils hardly susceptible of contraction and dilatation,

lation, but not immobile, as to make me conceive, after a flight inspection, that the other organ was totally deprived of sight, what was, however, the real case.

Every practitioner will allow, that the present case was very easy to be mistaken for an affection in the retina, or optic nerve, when the patient will not acknowledge his defect of sight. But before I enter into the detail, I think it will be necessary to state an abstract of it. The patient caught a cold; some days after a dimness was the consequence: the disorder not being checked, increased by ending with the loss of the organ; blisters applied behind the ears, with many other appendages, without advantage; then bleeding, and the use of mineral waters: these promoted a dimness in the other organ, instead of procuring relief. This is what preceded my interview with the gentleman. I will now lay down the pathognomonic signs of the disease, as I understood it.

The perspiration being intercepted, as the consequence of the cold, at a time when both the blood and lymph were in an acrimonious state, (as I apprehended it by the patient's description) an inflammation took place, which dissolved part of the beds of fat into the bottom of the socket, ei-

ther by the use of the medicaments above described, or the disposition of the disease; so that the optic nerve which runs through them, being affected for want of its natural support, became less sensible to the communication of the impressions of the retina, produced by the rays of light, than to the sharpness of the humors and its bad state; consequently, it is easily conceived, that, being deprived of this support and ease, the pupil did not, nor could not, dilate and contract, as when the eye is in its equilibrium. A practitioner must have had frequent opportunities of observing, that the pupil, instead of contracting and dilating regularly, has no regular motion of contraction and dilatation, when the iris floats in the aqueous humor, for want of a communicative strength, able to put its fibres in regular activity; because, if he pays a proper attention, and remembers, as I said above, that the impression of the visual rays are communicated from the retina to the optic nerve, and from thence to the brain, to complete the sensation; he must certainly be conscious, that during this operation of sensation, the retina communicates its motion or vibration to the processus ciliaris, which is afterwards propagated to the uvea: for which reason, if in such a case, the
retina

retina is not yet affected by the same disorder as the optic nerve, the impressions and motions, tho' in part interrupted, do not hinder those produced on the immediate organ of sight, to set the fibres of the iris in slow and irregular motions: therefore this proves to be but a floating of the uvea, instead of a regular contraction and dilatation in the pupil. These symptoms, I think, are sufficient to make any practitioner distinguish an affection in the optic nerve and retina, from any other disorders of the eye; consequently, in the above disorder, to re-establish the organ in its first state, it would have been sufficient, not only to recommend the use of such internal and external medicines as allay sharp humors by sweetening or correcting, and such as bring the body to a due temperament; but yet to countermine such other effects which are continually arising either from such remedies, or habit of the patient. The dissolution of the fat, which lines the bottom of the orbit, was a symptom sufficiently indicated, by the sinking of the globe into its socket, and the want of regular contraction and dilatation in the pupil, the only visible consequence of that defect; to which, if proper remedies had been applied, no other inconvenience would have been the consequence. By reasons unnecessary

necessary to account for here, I did not take the disorder under my care.

Reflections. The most scrupulous observer must daily remark, that of all the symptoms which foretel an affection in the optic nerve, there are no surer than the state of the pupil; and that those which announce an affection in the retina, without that in the optic nerve, there are also no surer than the immobility of the pupil, when or though day from darkness may be distinguished. Because, in the first place, as soon as one is certain that nothing intercepts the rays, and that they are absorbed on the immediate organ of sight, the fibres of the iris receiving their motion from the retina, the contraction and dilatation in the pupil, is a certain indication of its being sound; on the contrary and in the second place, those fibres not receiving their motion, is a clear symptom, that the retina is totally affected, though the optic nerve might be sound. But before to dismiss this important subject, I shall observe here that there are several circumstances wherein it is impossible to see the bottom of the globe, and consequently discern one from the other. For example: if the pupil be contracted in such a manner as to be almost occluded, and immobile in this state; if the cornea be opacified, or
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the crystalloida and crystalline, &c. &c. how can it be possible to look into the bottom of the globe? Now, let us suppose that all these cases be out of the way, there are still a great many others, whose prognostication is impossible. For example: If the meconium be of a grey color, one cannot precisely foretel whether blindness be occasioned for want of this ink, or by an affection in the retina and optic nerve. There are also many other cases, tho' better known, wherein one is obliged to conjecture, either by the help of an intelligent patient or his own experience; but when a practitioner performs what sound physic, and good reasoning enable him, he can neither be blamed nor responsible when his human faculties fall short to guess all the different changes, which Nature is susceptible of assuming. It is for man alone to lament, that the All-wise Creator did not think fit to proportion his faculties with his wants, and to bear in patience and humility the several afflictions that God pleases to send him.

Observation. A country woman, aged about thirty years, and of a very sanguine constitution, went to a pond for washing, at the time her menses were flowing. As the day was mild and warm, she did not take any precautions for her situation,

situation, and walked into the water till it reached her knees. She had not been in it a quarter of an hour, that she immediately began to feel the consequences of it, by a sudden suppression: Palpitation of the heart, suffocation, intolerable headaches, and some momentaneous convulsions were the results of her imprudence. Two days after the accident and its appendages, she complained of a total defect in her sight, though her eyes appeared in their natural state. The physician who was sent for recommended a copious bleeding at the foot, thinking that the disorder, which he called *gutta serena*, was the consequence of a sanguine obstruction fixed round the optic nerves, and in the internal parts of the orbits. This produced very little effect; but having repeated it twice, the menses began to flow by degrees, till they were perfectly re-established; and within six days, the accidents diminished so much to the advantage and comfort of the patient, that she began to distinguish the objects. The disorder having been well prognosticated and regularly attended to, the cure was completed a week afterwards.

This observation, and a great many others of the same kind, has been published in all the periodical books and pamphlets that France produces,

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as an assertion, that no other method but bleeding could be the curative indications for a gutta serena. It was given out at the time of this discussion, whether bleeding was not more detrimental to the sight of man than useful; and as the dispute was supported and carried on by several physicians of abilities, this rendered it the more interesting, though the question remained, as it is still at this present time, unsettled. Now, if one considers the management of the physician, in the above case, he cannot refuse him those praises such a success deserved; but when he comes to weigh the opinion he gives out in this very observation for the curation of a gutta serena, (grounded upon this and such other cases) *that nothing but repeated bleedings are directly pointed at*, I am pretty confident he shall think quite otherwise. It is from this bad method of explaining and laying down the history of disorders, that numberless methods for the cure of the gutta serena have taken place. If the observer did relate plainly, that such a blindness, produced by such or such a cause, has been cured by such or such means, practitioners would clearly understand, that bleeding, advised by some, is absolutely necessary in such or such case, and contrary in such or such other. When some physicians have

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observed, that several people, blind of the gutta serena, have recovered their sight by frequent bleeding, and concluded there was no other means, they have done as bad a piece of service to human kind, as they thought it excellent: Therefore observation, and a proper method to do it, is now the only way to clear up this matter, or at least to render it less obscure: in fact, to relate that such or such a blindness, occasioned by such or such a cause, has been cured by such or such means, is proving clearly, that one has a mind to be really useful in society.

“ The observation mentioned in one of the
 “ pamphlets (quoted p. 246.) may be considered
 “ on this line; that is to say, that a gutta serena
 “ reported having been cured by the use of positive
 “ electricity, is apt to mislead a practitioner, for
 “ such a disorder may be looked upon as physically
 “ incurable: If it be incipient, the term gutta
 “ serena is misapplied.”

Observation. Blindness is not always existing through the same causes, though no sensible difference over the exterior parts of the globe appears to common people. Nature presents so many variations of this kind, that it is extremely rare when a practitioner, even in the most extensive practice,
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has met with all those cases. A young man about twenty, called for my advice in the following disorder, which every physician he had consulted before had deemed an incurable one. Having looked into his eyes with the most scrupulous attention, I observed that the globes were sound and regular exteriorly, that is to say, parallel both in their axis and size, though he was obliged to turn the head on the left side, to see with his right eye. I at first took the disorder for a strabism; but, upon further consideration, I was obliged to change my opinion. The discovery of the apparent causes of this phenomena seemed to me so curious and extraordinary, that I endeavoured to explore them, by every trial and experiment the occasion permitted; for which purpose, I placed the young man just opposite the window, in order to discern clearly, not only the symptoms from the causes, but the signs that might ground both. Having desired him to put one hand over the left eye, to keep it continually shut, I raised up softly, and with precaution, the superior eye-lid of the right eye with the fore finger of my left hand, and brought down the inferior eye-lid with my thumb; then I opposed my right hand near his eye, to intercept and expose it alternatively to the light, to know if the pupil was susceptible

contraction and dilatation : but when I had observed some difficulty, I immediately conjectured it came from a want of some meconium on the choroides ; having remarked, besides, that the bottom of the globe was blacker on the side of the great angle, than on that of the external's. This last remark grounded my conjectures, that the choroides was covered of meconium in its internal lateral part, whereon the rays of light came to strike on this part of the retina, and be only absorbed there. I proceeded afterwards to the examination of the left eye, wherein I observed, that the choroides was entirely deprived of meconium. This was very discernable by the whitish color in the bottom of the globe, immobility in the pupil, and blindness of the organ. But before to proceed, an objection naturally arises here: could not the retina be paralysed in one half of its extent? To this I answer, that since a motion of regular contraction and dilatation in the pupil, ascertained by the state of the immediate organ of sight, (as being sensible to the impressions of the rays of light when absorbed upon it) it was a sufficient proof in favour of the negative. If this contraction and dilatation had only existed on one and the same side of the uvea, supposed in paralysis, the objection might have

have some weight. I shall say, moreover, that this disorder derived its beginning from the young man's birth, and had augmented successively to the degrees I have just now mentioned.

I made many other curious remarks upon the sight of this young man; but as I am afraid of becoming too prolix, I shall finish this observation by what follows. I presented to him a crown piece placed horizontally at three and four feet distance from his eyes, which he declared only visible by his right eye, in turning his head from the right to the left, the axis being continually parallel. This done, I removed the crown to another place, where any other person might have been able to perceive it without motion either of the head or eye; but he said it was not in his power, without a motion of his head. In short, the several experiments I made furnished me with fresh proofs, that a want of meconium on the choroides, and not a paralysis in the retina, was the cause of his organ being deprived of the faculty of seeing the objects to all sorts of positions, without turning the head.

Reflections. When I had strictly examined the above cases, and weighed all the circumstances, it appeared clear enough to me, that this disease owed its existence to the want of meconium in
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the choroides, to operate the absorption of the rays of light upon the whole immediate organ of sight. The reality of this prognostication was obvious in the pupil's motion. When I pry into the remotest causes, I find that this disorder could not be occasioned but by a relaxation in the blood and lymphatic vessels which ramificate the choroides; and that, for want of a sufficient tone in them, this black humor could not stay upon the surface of this membrane; because, as I have sufficiently proved elsewhere, the sight must be diminished in proportion to the want of this ink, as it is absolutely necessary to perform the absorption. I may now safely conclude, that the different methods of curing the gutta serena have been discussed with some foundation, and, to express myself at large, have never been as duly attended to as they deserved to be completely settled.

Observation. The following cases do not a little contribute to confirm what has been advanced in the above. A woman, aged forty years or upwards, begged that I would look at her eyes, merely to satisfy her curiosity, as she was well assured, she said, by physicians of great abilities, that nothing could relieve her. I observed that the exterior of one globe was perfectly sound, together
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with the parts which surround it; that the pupil, however, was immobile, and the bottom of the globe of a whitish color, the choroides being entirely free from meconium. The other eye was found, both exteriorly and interiorly. Now, to acquit myself in the best manner possible on so important and curious a subject, and, at the same time, leave nothing to wish for an inquisitive observer, I will begin by explaining the effects of this disorder, together with its causes, and the method employed to cure it, according to the woman's own account.

The beginning, she said, was the result of a laborious and unlucky lying-in, attended in a careless manner. She was recommended by a person of note to an eminent physician, who prescribed the use of diluent drinks, together with some light purges for internal remedies, and the respiration of spirituous liquors, with astringent lotions for external ones. She recovered the sight of one eye, whose use she had entirely lost, and the other, whose state had been very much impaired, was quite re-established in its former state. A little time after, she again lost the sight of this organ, and the other kept well; for which purpose, she called for assistance to the same. She did not meet
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with the same cure as at the first time ; for she remained blind of this eye.

When I consider that vision cannot be effected without meconium on the choroides, I have a just right to conclude, that if its absence comes from an obstruction in the blood and lymphatic vessels, (as this case was certainly such) which bring this black humor ; it cannot be occasioned but by a cryspation in the tubes, and a defect of their contents. Besides, when I reflect that the course of this humor, if intercepted before it arrives on the choroides, continues its exsudation through the excretory pores and humors of the eye : I conclude also, that these membranes must inevitably be deprived of this ink, and that the rays of light, being no longer absorbed on the retina, the faculty of seeing must cease. I am very far from being surpris'd, that the respiration of a strong fluid has produced the recovery of the sight ; that it may have failed, answering the same purpose, to all appearance, in the same case ; because, every physician must allow, that a sagacity to distinguish, if it will do at one time and not at another, is such a profound skill, as it is not in every one to boast being possessed of. Upon this foundation, I think that the remedies being well indicated at first, they
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operated the desired effect; and if they did not the second time, the cause may be attributed to a change of the disorder, though in appearance the same: for, as I have hinted above, the malady being occasioned by an obstruction, the use of the electrical fluid properly prescribed, removed it at first: but, on a second repetition, the effect was very likely too violent, as it operated an exudation more copious than the regenerative powers of the meconium could supply; consequently, the choroides discontinuing to be tintured with this ink, and the rays of light absorbed on the retina, it is easily to be apprehended, that the faculty of seeing must of course cease. This is a clear demonstration, that the use and application of such remedies require the greatest care, intelligence, and skill; for otherwise it would be very rare, if they might be of any service in such doubtful cases.

The symptoms of this disorder, which I have already denominated meconiumless, are pains in the internal parts of the orbit, a whitish color in the bottom of the globe, and a diminution of sight, proportioned to the want of this ink on the choroides: Moreover, an atrophy of the globe, and a constant exudation of the lacrymal fluid through the pores of the cornea, are the forerunners of this

dreadful complaint, which, when arrived to a great degree, may be looked upon as incurable.

These few principles are sufficient, I hope, to convey an idea of the proper remedies fit for checking this disorder, and the manner of administering the electrical fluid, No. XXXIII. p. 222. without running any chance of making a bad use of it, and to discern one case from another. Besides, if one pays a due attention to the delicateness of the case, and the difficulty there is to give some spring or elasticity with this electrical fluid, when wanted, to all the languishing fibres which compose the internal and thin membranes of the globe, without producing a too great circulation in a meconiumless disorder; he must be sensible, that it is difficult to describe the use and effects of this electrical medicine, and that it can be accounted for but by giving the detail of some observations grounded on physical laws. Amidst all these difficulties, there is another to explain, which is of no small weight; it is the proprieties of this remedy. This electrical fluid, or spirituous liquor, used either by evaporation over the globes, or respiration through the nose, produces a coagulation in the humors, and an elasticity to the exterior membranes; because the oily parts, which compose this
remedy,

remedy, are brought up along with the volatile ones into the interior of the eye, by joining together : So that, if one intends to desobliterate the gelatinous humors, it will upon first consideration appear contradictory, considering this quality inherent in it : but when he comes to the experiment, instead of coagulating, he perceives the obstructions give way by degrees ; because, as I said above, the shock it gives to all the parts of the organ, produces such an action in the fix muscles, that the humors it contains are obliged to go out through the lacrymal ways, to be then supplied by the regenerative powers of the humors. This operation produces such a quick change, that desobliteration takes the better of coagulation in a surprising manner, and without any danger to the organ, when duly attended to.

But to return : I have observed this disorder very frequent in children ; and I think, that if the meconium be not so black in children till they are arrived at two years old, it is to preserve the shock of the rays of light on so delicate a part, in so tender an age. Curiosity led me very often at a gentleman's who had a child afflicted with this dreadful complaint. The first time I looked at her eyes, I was so much surprised to see her globes in

continual rotation, when she turned them towards the light, that I felt a great inclination to find out the cause. To be brief, I imagined that the bottom of the globes were not regularly lined with meconium; otherwise the globe would not have been continually in motion to endeavour to fix and absorb the rays of light on the retina. This action of rotation could be occasioned but by an endeavour of re-uniting the rays on the part of the retina whereon the absorption might be the most complete: Moreover, the contraction and dilatation in the pupils, which I remarked at different times, when the rays did more or less sensation on the immediate organ of sight, was a sufficient proof to ground my conjecture. I did not propose any trial of remedies, being myself conscious of their defect; and supported their hopes in the operation of nature, a credulity too often encouraged, when natural physic is against it. I have been consulted in a similar case, for a child of two years old. When he was exposed to the light, his eyes rolled with the quickest motions; when standing upon his legs, though somewhat supported under the arms, frightful convulsions during the whole time, and a sudden inflammation in the eyes, were the never-failing consequence. As soon as he was seated, the
convulsions

convulsions and inflammation disappeared, by degrees, in the space of ten minutes. The reader may well imagine that I did not propose any remedy, as such symptoms spoke clearly a complication of meconiumless, with an affection in the nerves.

Positive electricity, according to Mr. MAUDUYT's account, produces generally the departure of the disease from one part to another, with very little change or effect; for which reason he candidly says, that having been appointed by government to make the experiments, and state the facts without accounting for them, he leaves this delicate point to be settled by the several physicians who sent him the patients, as being better able to judge of their different maladies. For my part, as I am concerned in it, I have some right to transmit my opinion, that the use of positive electricity is very immaterial in the medical disorders incident to the human eye. As to the negative electricity, the experiment being not yet made, I will leave for another opportunity.

CURATIVE

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sideration of it, I have some right to maintain my
opinion, that the most proper remedy is to be
maintained in the medical character incident to the
disease. As to the negative electricity, the ex-
periment being not repeated, I will leave the

CURATIVE

CURATIVE METHODS
FOR THE
COMPLICATED DISORDERS
OF THE
EYE, AND ITS ATTRIBUTES.

IT is not sufficient to have investigated each kind of blindness in particular, and the disorders which are conducive to it; it is moreover necessary that I should speak of such as depend upon one another, and their complications. Every body knows, that there is no other organ in the human frame, which is subject to so many diseases as the eye. Some physicians and surgeons have thought, that the knowledge to discern the character of these various affections, and a proper method to remove them, was or ought to be a particular art, which did not require the physical and chirurgical science in

in general. Of what benefit would this branch be susceptible if separated from its stump? The improvements in all ages has sprung from the greatest masters who practised it in all its plenitude, and whose experience, relatively to the disorders of the eyes, has been enlightened by the principles that constitute indivisibly the science, without which it is impossible to exercise any part with judgment. The antients have learnedly spoken of some parts which compose the eye; it even appears that they practised some delicate operations to cure them when disordered. But as the abuse of some of the most useful operations becomes hurtful, as being too often improperly practised, or omitted, let us endeavour to distinguish which of the cases require the extirpation of the globe of the eye, being an operation of great moment, as the patient's life is commonly in danger. This done, the properest rules to perform it, shall be taken into consideration.

The falling of the globe, or its entire going out of the orbit, presents the very case wherein amputation is so well indicated, that it needs no farther advice. Several observations prove sufficiently, that the eye may be pushed by degrees on the cheek, by some tumor which arise in the bottom
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of its socket. To avoid here a confusion between the falling of the eye, its prominence, excess of bulk, and going out of the orbit, by the same denomination of *exophthalmy*, this term shall be employed to signify only its going out of the orbit by extrusion.

The beds of fat which surround the posterior part of the globe, are naturally flabby; and this is very well designed by nature, as they help exceedingly the motions of the muscles. A great many practitioners have observed, that this texture is adipous, and becomes fungous, or schirrhous in swelling. In this case, the eye appears weeping at first: as soon as it is pushed outwards, the eyelids cannot cover it; then it becomes inflamed. If the tumor makes a rapid progress, the pains are violent and intolerable. When the disorder does not yield to the general remedies, such as bleeding and purgatives, the extirpation is very often indicated, to rescue the patient from death. This is very obvious by the following observation. A woman had the globe of her eye jutting out by a gathering of humors, which inflamed the beds of fat. Besides, this disorder was attended with violent pains and wakes. The physician who had the care of it, allwaged these accidents by proper remedies for such a case; so that the progress of the

tumor was checked for a while. About three years after this treatment, the globe of the eye became lead-colored, and extremely pushed outwards, on account of a protuberant deformity which had been left behind: its membranes were tumified, and assumed a gangrenous quality. Some time afterwards, the patient experienced a violent fever, with intolerable head-achs. The physician and surgeon who attended her, unanimously thought proper to proceed to the extirpation of the globe; and the necessity of this operation seemed so pressing, that it was performed the very next day: four or five days after, the fever and all the other accidents were stopped, and the cure quite complete the 20th day following.

The principle of the disease is sometimes to be found in the outward parts of the orbit, near the bony laminæ which form the inside of this cavity: they are so thin, especially at the inferior and superior parts, that one ought not to be surprised when they give way to the efforts of a fungous tumor, by the compression of which they are soon destroyed, nay worn out. A man aged forty years, to whom a carcinomatous fungus in the maxillary sinus had destroyed the bony laminæ of the top of the orbit, was so much afflicted by it,
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that the globe of the eye was almost on the cheek : his face looked so hideous and disfigured, that it was frightful : There was at that very time rottenness in the maxillary bone, on the side of the palati and nasal cavities ; in short, the patient died by the accident of a cancerous ulceration in these parts. The exophthalmy was an effect of the excessive bulk of the tumor, to which the bones had not been able to oppose a sufficient resistance, and limit its progress. There is no doubt, that one would have prevented such dreadful consequences, in attacking the disorder on the side of the mouth. The carcinomatous vegetation was an accident of the disorder in the bone, occasioned itself by a venereal principle, which had been treated without method.

A child three years old, having his left eye entirely out of its cavity, and twice as large as a fist, died of this disorder, which only began to appear some months before. As soon as the skull was opened, a fungous tumor was discovered, whose basis was attached to the dura-mater above the orbit, without having produced any alteration in the brains. The protuberancy of the eye was only the accident of it ; and the amputation, though very rightly indicated at first, would very likely

have had no success. The cure consisted in destroying the fungous vegetations in the dur -mater. Since the brains were found after the extirpation of the eye, surgery would most likely have found some means to consume the tumor to its very root: the patient being given up to a certain death, it was sufficient to attempt the operation, in hopes of a success.

It is not an uncommon case to see the eye driven out of the orbit by the compression of an exostosis: if it be exterior, one may attack it with advantage, without making a sacrifice of this organ. A woman aged thirty years, afflicted with a fistula lacrymalis, had undergone, without benefit, an operation which was thought proper for this fistula. The bones swelled prodigiously: Fifteen years afterwards, the exostosis of the os planum and internal angular apophysis of the coronal, acquired the bulk of an egg. The globe comprimated laterally, had been pushed out of the orbit, and fell in some sort over the cheek, on the side of the external angle. This exostosis was attacked with a caustic: it suppurated, and in a treatment of three or four months, the exfoliation of a considerable portion of the tumified bones was effected. The
eye

eye was re-established in its natural place, and perfectly cured some time afterwards.

Practitioners have very often confounded the falling of the eye and its protuberancy, with the dilatation of the globe, which make it equally jut out of the orbit. These disorders, so different in their nature, have been pointed out by several authors under the same denomination. This confusion, as I said before, has not a little contributed to produce some ambiguity on the precepts, and consequently to make the theory doubtful, and practice uncertain. The term *hydrophthalmy* shall be used to express particularly the excessive bigness of the globe, by an augmentation against nature of the humors. This denomination, which in this case does not allow of any equivocation, as it would with the term *exophthalmy*, has been agreed upon by all regular physicians and surgeons. It is not always the whole globe which is pushed outwards; its bulk is yet augmented by an excess of fulness. The elevation of the cornea and deepness of the iris, are the characteristic signs of it: on the contrary, when the largeness of the eye comes from the excess of the bulk, acquired in the vitreous body, the iris is convex, and forwarded into the anterior chamber: with all these symptoms, the
hardness

hardness of the globe is sensible to the touch, unless this humor be fallen in a dissolution.

An intelligent practitioner will distinguish, by an extreme dilatation in the pupil, whether the vitreous body contributes to the prominency of the eye, or not. The augmentation of the aqueous humor is sufficiently marked by the elevation of the cornea, and deepness of the iris. The patient, in such a case, feels continually, in the bottom of the eye and head, violent pains, attended with fevers and wakes. This disorder is commonly chronic: it may, however, subsist in its state without change, when the eye is arrived to the last degree of extension.

The authors propose a great many remedies for this disorder, both general and particular, internal and topical, and varied according to the different indications. I will here give some few observations upon this head. Two young ladies were afflicted with the small-pox at the same time; one was twenty years of age, and the other four-and-twenty; the variolous matter fixed itself in a great abundance on the eyes; the pustles were dried over the whole body; and there would have been no doubt of an happy termination of the disorder, had not the eyes been very much affected with it.

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Their tumefaction occasioned a fever, and violent pains, attended with excessive heat and pulsation; so that the cutting open of the eyes were advised to save their lives. This advice was not followed, though it was given out, that the organs were without any resource. The sudden death of one of these young ladies gave great concern, for not having taken the above advice. As to the other young lady, Nature herself saved her from this dreadful case; for a spontaneous aperture was effected, through which the gathered matter ran out of the globe; but she remained blind, after having stood a great chance of losing her life.

This remark will have its use in all the cases wherein the surgeon shall be obliged to empty the globe, (if the organ be irrecoverably lost) to calm the violent accidents which are the consequence of an inflammation in this organ, in case of wounds, considerable contusions, and abscesses in the interior of the eye. It is sufficiently proved, by a great many observations, that the pains, fevers, wakes, deliriums, and convulsions, which sometimes accompany this state, do not stop but when a rupture in the tunics of the eye has taken place, either naturally or artificially. When there are no hopes of preserving the functions of this organ, the pa-
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tients will be rescued from many accidents, if an incision be performed. Some practitioners have also advised the extirpation of the globe for a single fungous excreffence, which arises on its surface, though there are a great many that one might destroy without an operation. It is then very material to lend the greatest attention for discerning the character, from the extent of the disorder; the indications are less distinguished from the bulk of the tumor, than from its nature and roots. It is by the help of commemorative instruction, on the rise and progress of this disorder, that one may be well acquainted with this last circumstance; the pathologic knowledges will shew the particular kind and species of tumors. These principles, deeply reflected upon, ought to be the basis of the judgment through which a practitioner shall determine, whether he must, and how he is to operate: it is but after some facts of practice, that he may settle and fix a solid doctrine upon the several different cases.

It is demonstrated that the fungosities in the eye, supurate very well after the application of dissecative remedies. These tumors having not their roots very deep, one ought to be contented, in this case, to separate the fungosity from the parts with which it is tied, and to consume or take away
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but one part of the globe. As to the treatment of the cancerous tumors in the eye, one ought also to discern the state from the case, to determine which method is the properest; for every one must know, that those which are not completely extirpated with all their roots and appendages, regenerate soon of themselves, and very often with more dreadful consequences or symptoms than at first. Therefore, if the operator suspects the propagations of the cancer in the eye, capable or susceptible to extend deeply, he must not hesitate to extirpate the globe entirely. We meet with numberless facts which do not leave one single doubt on the necessity and use of this operation; but the rules which he ought to follow for practising it methodically, having not been established in their whole extent by the antient authors, shall be taken notice of here. The infallible loss of some patients, for whom this resource has not been made use of, the happy cures which are owed to it, ought to encourage the modern surgeons to perfectionate this operation, and render it as simple and easy as it is useful.

The operator shall begin by incising the strings of the globe, together with those of the eye-lids, without it be necessary to have a particular instrument for this preliminary section; but it may be

Y y performed

performed with more or less method: inferiorly, it suffices to cut in the angle or fold which forms the conjunctiva and the internal membrane of the eye-lid; he ought not to forget at the same time the fixed string or tie of the *musculus obliquus inferior*, to the inferior edge of the orbit on the side of the great angle: superiorly, he shall direct the point of the instrument to cut the *musculus attollens* of the superior eye-lid, together with the membrane which lines this eye-lid; and in sliding a little the knife from top to bottom, on the side of the internal angle, he shall cut the tendon of the *musculus obliquus superior*. This performed, the eye is no longer fastened to the anterior circumference of the orbit: then it remains to cut the optic nerve, and the muscles which surround the bottom of this cavity. This may be done very easily at one cut with a pair of scissars, adapted for this section. (See its description, Tab. IX. fig. 7.) The side on which he ought to direct the extremity of the scissars in the bottom of the orbitary cavity, seems at first very immaterial. In the natural state, the obliquity of the plan of the orbit, and the situation of the globe near the internal inside, seem to prescribe the introduction of the scissars, by way of preference, on the side of the external angle, in directing

directing the cavity of the blades on the external lateral part of the globe: but as the protuberancy of the eye, its dilatation against nature, the tumefaction of the fat, and the schirrhous obstruction in the cellular texture, are confined in no bounds whatever; and that the fungous vegetations take their rise on the side, where is naturally the least resistance; the side of the external angle is that which he will find the most entangled. It is therefore at his disposal to enter in the orbit with these curve scissars, on the side which will be most convenient to him. The muscles and optic nerve being cut, the scissars shut, serve as a sort of spoon to raise up the eye outwards. To finish this simple operation, he shall take hold of the eye, with the left hand, and if the cellular texture be still tied to the neighboring parts, he shall cut it off along with the laminæ.

Such is the operation thought proper for extirpating methodically the globe of the eye, in case the disorder is limited to the parts which constitute this organ. The treatment which is to be pursued afterwards, ought to be conducted according to the patient's constitution and health. Bleedings, regular and strict diet, are of absolute necessity, to check the inflammation: the dressings consist in

an animated digestive, and a mixture of warm wine and brandy after it.

The necessity of extirpating the eye-lids with the globe, shall be determined by the exterior progress of the tumor, whether it be carcinomatous or not. The greatest difficulties to be met with, are not those which come from the extent of the disorder at the exterior: they are, as to this respect, before the eyes, and under the hand of the operator: the main point is, to consider what progress it has made in the orbit. It does not suffice to have extirpated the eye; the fat which surrounds the globe inwards, are very often swelled; if he were to leave them behind, they would prove the sprouting of a new tumor: nay, the glandula lacrymalis, provided it be tumified, ought also to be extirpated. The operator shall cut it off easily from its particular cavity, with the point of the same curved scissars with which he shall have extirpated the globe. They are very convenient to take off the schirrhous hardnesses, which might exist in the extent of the orbit; in short, for the extirpation of all the cancerous tumors. Of whatever efficiency an operation may be, a prudent practitioner will always attempt the cure of any disorder by some medicaments, before the undertaking of it. Every
method

method in the art of healing is equally in the power of an able physician or surgeon.

EXPLANATION OF TAB.—. PAGE 232.

Fig. 1. 2. 3. are hollow probes, or algalies, to search the ductus ad nasum through its inferior orifice.

Fig. 4. is a buttoned probe, to desobliterate the puncta lacrymalia previous to any injections.

Fig. 5. 6. 7. are massy probes to supply the hollow ones if too weak.

Fig. 8. is a syringe with the crooked syphon on.

Fig. 9. is a crooked syphon which may be fixed to the syringe instead of the other, when wanted.

Fig. 10. is a straight syphon, to which end some flax may be applied to keep it tight into the algaly.

Fig. 11. 12. is a hollow probe with its bearer.

Fig. 13. is a syphon to inject into the sacculus lacrymalis through the puncta lacrymalia, when fixed to the syringe in the place of the crooked one.

Fig. 14. is a probe to desobliterate the puncta lacrymalia, sacculus lacrymalis, and the ductus ad nasum altogether, when obstructed with some slimy or thick matter only.

EXPLA-

EXPLANATION OF TAB. IX. PAGE 272.

Fig. 1. is a knife to perform the section in the cornea of the left eye; the operator takes it in his right hand, the middle of its handle placed upon the third phalanx of the index, and places his thumb over its nearest pin C, the blade fixed betwixt the nail and skin of the extremity of the finger magnus near A, having the index backwards to oppose the pressure of the thumb; then he slides it on from A to B, according to the directions of p. 272.

Fig. 2. is a kyfitome to cut open the crystalloida; the operator takes it between his fingers as if it were a pen, the extremity of the finger magnus stretched near the sheath, the index placed upwards to push the little button, and the thumb a little higher; in this position he introduces it inferiorly through the lips of the wounds practised in the cornea, and directs its point on the crystalloida. See p. 273. 274. &c.

Fig. 3. is a knife to perform the section in the cornea of the right eye. The operator takes it in his left hand, and manages it as the other.

Fig. 4. 5. form the speculum oculi. The demicircle A A is horizontal, from A to B it is raised up diagonally of three parts of an inch, from B to C
of

of one inch and a quarter, from C to D of one inch and a half; so that, the whole elevation from its basis A A is one inch and a half, and may be more or less according to the patient's head. The tongs *fig. 5.* ought to be fixed in E K of the right *fig. 4.* to which place some waxed silk string is tied to keep it fast. When the operator handles it, he places his three last fingers downwards, the thumb fixed on the second phalanx of the magnus in surrounding both branches of the tongs, the index playing from A to D in order to bring down the inferior eye-lid with it, before to open the cornea.

Fig. 6. is a pair of tongs to extract the crystalloida.

Fig. 7. is a needle to depress the cataract. It is described without a handle, as an operator may adopt which form he pleases. When it is sunk in the globe to the point B, he turns it by half to have the flat part A over the crystalline. See page 281. and 282.

Fig. 9. is a knife to open the sacculus lacrymalis. See page 239. &c.

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of one inch and a quarter, from C to D of one inch and a half, so that the whole elevation from its base A is one inch and a half, and may be more or less according to the patient's head. The tongue, Fig. 5, ought to be fixed in B K of the right eye, to which place some waxed silk string is tied to keep it fast. When the operator handles it, he places his three last fingers downwards, the thumb fixed on the second phalanx of the middle finger, in turning both branches of the tongue, the index playing from A to D in order to bring down the inferior eye-lid with it, before to open the corner.

Fig. 6 is a pair of tongs to extract the crystalline lens. Fig. 7 is a needle to depress the cataract. It is described without a handle, as an operator may adopt which form he pleases. When it is sunk in the globe to the point B, he turns it by half to have the flat part A over the crystalline. See page 281. and 282.

Fig. 8 is a knife to open the sacculus lachrymalis. See page 239. &c.

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