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Curious Observations
In that difficult part of Chirurgery,
Relating to the Teeth.
Shewing,
How to Preserve the Teeth and Gums from all Accidents they are subject to.

A S,

1. An Account of their Nature. 2. Their Alteration, with their proper Remedies. 3. Their Cause of Corruption and Puriification. 4. Directions for restoring or supplying the defect of them in old or young. 5. Considerations on the Tooth-Ache, Lofenes of the Teeth, the decay of the Gums, with their Remedies and Restoratives. 6. The use of the POLICAN or Instrument wherewith, they are drawn on all Occasions. Lastly, Teeth in Children, what they are in the Original, and how they come to Perfection, in what order produced, the means to hasten them, and render them safe in breeding.

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A Physick Discourse, wherein the Reason of the bearing of the Pulse, or Pulsation of the Arteries, together with those of the Circulation of the Blood are explained, and the Opinions of several Ancient and Modern Physicists and Physicians, as Galen, Gellatius, Celsus, Lover, Willis, &c. Upon this Subject are examined.

Dublyn, Printed and are to be sold in London, by William Whirwood in Duck-Lane, 1687.
TO THE
MOST HONOURABLE
AND
TRULY LEARNED
The Physitians, Chirurgions and Apothecaries
Of the City of DUBLIN.

GENTLEMEN,

WHEN I see your INDEFATIGABLE
care in procuring men (that without
which all the World is nothing) HEALTH, the
PRIMARY cause, sole Foundation and Prop of
Humane FELICITY; and how the experience
of so many years manifests to all men, by the
happy success of your Undertakings, and your
great Charity to the Poor, that your private in-
tentions do correspond admirably well with your
external actions; and that all your endeavors
are real and unselfed: I am persuaded, that
whatever can in any wise contribute to the pro-
moting of your most Noble and Generous De-
sign, can't but be acceptable to you. Where-
fore having with the same passion, for the pub-
lick
lick Advantage, composed the following small Treatise, I take the liberty most humbly to present it You; that (as You are the best judges of the thing) so You may by Your judicious and impartial censure of it, inform the world of its worth; that no person may be deceived in it. For my intentions in publishing it, being to advance the common Good; if I thought it did contain any thing contrary to that design, I should be the first that would endeavour its suppression.

But, GENTLEMEN, besides the foregoing reasons, which I had of offering You this first essay of mine, I did it also to acquit myself in some measure of my duty towards You; and to assure You further, that I am in all respects,

GENTLEMEN,
Your Most Humble, Most Obedient,
And Most Obliged servant

CHARLES ALLEN.
The P R O E M.

Scope is to present the uses of Teeth; the use of which is necessary in the preparing of food; that the want of such a help (if not supplied by strong digestants) hinder a true conciliation of the Aliments in the Stomach; whence do proceed Indigestions, and abundance of Crudities very noxious to the body of man; as being the seed of most of those inumerable Diseases and Infirmities, whereby life is not only made troublesome to us, but also considerably shorter than it would otherwise be, which is so consonant to truth; that vulgar observation itself has turned it into a common Proverb: For they use the uses of one whose Teeth are naturally thin, that he is short-lived; whereof the reason is, that such persons do not chew their meat well. Moreover, the uses of Teeth renders the pronunciation both troublesome to one self, and unintelligible to others. In a word, the corruption, and want of them, is as great a deformity, and as much prejudice to one, as anything whatsoever can be.

SECT.

The Operator for the Teeth.

SECTION I.

Of the Nature of the TEETH.

What men are wont to call Science, or the Cognition of any being, is by them commonly divided into two several parts: one whereof is termed Theoretical, and the other Practical. The first includes the reasons and causes of things, with the order and manner of their progress in coming to be what they are. The second regards only their Properties and Effects, and what they are actually in themselves, without inquiring how they come to be so made, or thus qualified. As for example of those two branches of Human Learning, (in respect to Physical matters) when Philosophers go about to inspect the nature of the Lodestone, they search into its Origin, tracing out the several causes of its Formation, even to their first rise or spring-head; from whence they draw arguments for the solution of all the Phenomena thereof; whereas Mariners consider it only as a certain Stone that draws Iron to it self, having the power of communicating its properties to the said Iron; and which, if not hindered (by its own gravity, or any other impediment) will always turn one of its sides towards the North, and another diametrically opposite to the first towards the South; which satisfies them for the use they make on't, in directing their courses through the Sea, without caring what may be the cause of so admirable
The Operator for the Teeth.

mirable virtues in the Magnet. Either of which constituent parts of Knowledge being separated from the other, cannot afford a full and satisfactory account of a thing: And therefore being about to treat of my Art, I should by consequence begin with its Theory, and discourse of the Elements, Principles, and first Rudiments of the Teeth; which make the Subject thereof. Unfolding the reasons of their constitution and frame, and how they come to have several Roots, and to grow above the Gums, with what ever else may be the cause of their specific being; and thence pass to the Practice. But some Considerations obliging me to defer treating of the former Part, or Theorie, till a better opportunity, I design only to lay down in this Paper some of the most principal Points relating to the other, namely, the Practical part of my Profession. In doing which, although it would be enough for us to speak of things, as in the state wherein we find them: yet for the satisfaction of the Reader, and out of a real desire to serve him; we shall not confine our Discourse of such Reasons as are necessary for the well understanding of what we shall say. So that although this Treatise will be imperfect, as wanting many things, yet what it shall contain, will be as useful and advantageous as if it were accompanied with all the rest. However, according to the method we have prescribed our selves here, we are to proceed next to the consideration of the Structure, and constitution or nature of the Tooth.

In Analyzing the Tooth, its substance is not found to be uniform every where, but manifestly distinguishable into two different sorts of make: one of them being harder, whiter, and of a finer texture; and the other softer, more obscure, and of a coarser composition. The first makes up the head of the Tooth, or that part of it that stands out naked above the Gums; and the other its stump, or that part on't which is hidden within the said Gums. The exposed part of the Tooth consists also of two different sorts: To wit, its fleshy Cover or Café, and its inward substance; the first is as it were an hard Perioleum, that invests the head of the Tooth on all sides, lying on it much after the same manner that Enamel does upon Gold, or any other thing. This natural Enamel which I call the glos of the Tooth, is of a far harder, whiter, more dense and lucid nature than the inward substance lying under it: which for its several uses may properly be compared to the Cuticula, or Scarf-skin, for like unto this it is bloodless, and altogether destitute of sinews, serving to cover and defend the extremities of the Vestels, contained within the inward substance, from external injuries, and to render the Tooth more beautiful and strong. It has pores for the perspiration of the excrements of the Tooth, which pores are not always of the same figure, nor magnitude, but vary almost in every body. The said glos or fleshy substance is likewise very various in point of thickness, from which differences, do arise the diversity of its colour in several men. The inward part of the head of the Tooth, though
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inferior to its cover or gloss in brightness and solidity, yet its substance is nevertheless much more compact, and clearer than that of the lump: and contains two several forts of pores, or small channels, both of a conical figure, having their Bases in the convex superficies of the Tooth, and their Apexes in the concave superficies of the inward substance, immediately under its glairy integument. Through some of which channels the blood is carried by many and very small Arterial Sprigs, from the middle of the Tooth to its extremity: and through the others the same blood is sent back again from the said extremity towards its middle, by some capillary veins, as shall be said hereafter.

As to the root or stump of the Tooth, it is the darkest, most soft, and porous portion of its whole substance; and yet is closer and harder than any other bone of the body, having also two forts of channels, but of different situation from one another: for some of them have their Bases (like those above described) towards the cavity of the Tooth, and contain the branches of the Artery, that carry the blood quite through the substance of the Tooth, to the Gums, as shall be explained in its place; but the others contrary to any of those already mentioned, have their Bases towards the external superficies of the Tooth; the use of which last conduits, is to transmit to the Gums the blood that is returned to the heart from the membrane that invests the cavity of the Tooth. This rooty part of the Tooth consists in the small Teeth of a single body, and in the big ones is divided into two, three, or four branches, called roots or fangs: along the middle of each of these fangs, there is a little channel that goes up to the head of the Tooth, where they are united together, and make but a single cavity, wherein are carried the vessels of the Tooth, passing first through the hollowness of the stumps. Every Tooth has its particular cell or socket within the Mandible, distinct from all the rest (by a thin production of the jaw-bone parting between the Teeth, from one side of the said bone to the other) wherein most of its stump is comprehended, the rest being encompassed about with the Gums.

SECTION II.

Of the Alteration of the Teeth, with their Remedies.

From the consideration of the nature of the Teeth, let us now pass to that of the first step of their degenerating, or mutation. For the better understanding of which, we shall take notice, that as our body is made by nature, that it wafts continually by the dissolution of some Particles, separating themselves from its Mate, without intermission; (transfusing for the most part through the pores of the skin) and that of these particles (which being divided from the whole, become Exscreences) are kept too long within the body, (by reason of the Opiation of the said pores) it seems fits, and great disorders in our blood, and vital as well as animal Functions: So likewise from the
The Operator for the Teeth.

The substance of the Teeth are emitted certain Efluxums through their pores, the transpiration of which, being hindered, (by the obstruction of those invisible passages) the Teeth become liable to all those infirmities hereafter to be mentioned.

The substance of the Tooth being rigid and inflexible, it cannot be Opilated by contraction, or attrition, as the skin usually is but only by the intrusion of some extraneous matter into its pores, or the incrustation of some fliny stuff upon its superficies; which is done when we eat anything of a glutinous nature, for then some of its most vicious parts do stick, and cleave about the Teeth; and by the mixture of some tartarous particles coming from the Lungs, the heat of the mouth, and a certain petrifick juice distilling into the mouth, out of the Saliva-Ducts, is turned into a stone-like substance, commonly called the Scales or Scurf of the Teeth: these scales grow thicker and thicker continually, and if left alone, will cover the Teeth all over, except just at the top were they grind on against another.

Having thus taken notice of the production of those scales, let us now consider of what ill consequence they may be to the Teeth. The first whereof is the Opilation of their pores, from whence proceed all the rest: for by that the exit of those Excrementitious particles before mentioned being hindered, it causes them to fragnate within the body of the Tooth, and then corrupting, do corrode it by degrees; beginning first by the alteration of its colour from white to yellow and from yellow to black; and then follows the real decay of its substance, &c.

The said humor is not only destructive to the Teeth, but extends also its malignity to the Gums; some of its particles being fubtil enough (after a due fermentation) to pass through the scales, and thence sliding between the Gums and the Teeth, they eat clear away the ligaments that tye them together, dividing them one from another to the very jaw-bone: which is sufficiently proved by the excision and rawness of the Gums, and their being so tender and loofe from the Teeth where ever such scales are found: and especially if they be grown to a considerable thickness.

It happens sometimes that the usual passages of this corrupted humor being stoppt by the scales, (when they are hard, and cloofe enough) is thereby repercuffed, and made to take its course towards the middle of the Tooth, discharging it self therein between the Concever superficies of the Tooth, and the Tunicle investing the same; where it occasions very great pain and at last by its fretting, and corrosive quality, gnaws and consumes quite away the said membrane, as also the vessels of the Tooth; and then passing out of the said Tooth, it diffuses itself through the Alveolus or socket, where exerting its dangerous faculty, it destroys utterly whatever causes any connexion between the Teeth, the jaw-bone and the Gums, as the Periosteum, &c. After which the Teeth do consequently fall out for the most part found, and unaltered, except only in their colour, which becomes yellowish) by reason that the aforesaid
The Operator for the Teeth.

Of the Corruption of the Teeth, with their Remedies: Whereunto is Annexed the Description and Use of the Punicum.

Having in the former Section considered the Teeth, as at the beginning of their decay, in such a condition as tho' they suffer some light change in their accidents, yet their substance, form and proportion remaining still the same, is only called alteration; that is, in a state wherein indeed they are invironed, and assaulted by their greatest enemies, but yet in a capacity of being restored and preserved from their harms. But now we shall consider them as overcome by all those threatening evils, and really corrupted; in which case, all that can be done, is to prevent their total ruine.

And as there are some not so far gone, but that they may still do good service, if timely helped, we are to use our utmost endeavours to do it; which to effect, we shall, in the first place, clear their outside from all foulness, and then with a proper Instrument scrape off whatever is rotten within, washing them very well afterwards with some convenient liquid, to scour and smooth away what the Instrument may leave behind: and then if the Tooth be so hollow that it may be shopt, it must be fill’d up with such ingredients as are neither corrosive, nor ill tasted, and of a consistence firm enough to be used in the same manner as he well knows himself, I call an Opiatum.

Sect. III.

Your Teeth being once clean, you may preserve them with this composition: Take Magistery of Pearls, Powder of Coral, and Dragon’s Blood, of each equal quantity, and as much Red-Rosewater as will incorporate them together; and make the Compound of a mean consistence, between hard and soft. I have to that effect a very excellent Deodour, which being used only once a week will keep the Teeth clean and white; and by the constant using of it, fetch up their colour, if lost; (so in a considerable measure) this is the same that in my Fills (to keep my Mouthers clean, the improper...
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... as of those that will be their Patients) subjourn here, the description and use of the Policam; which is one of the best of them.

The Description and Use of the Policam.

The Construction, and usual shape of the Policam, is a thing so well known by every body, that it would be needless to insist at all upon it. And therefore, without losing time in such superfluous Discourses, we shall here take notice of some other things appertaining to the said Instrument, more material and useful: as the due proportion that its parts ought to have, considered in themselves, and in respect of each other.

In the first place then, (supposing that you know the stuff wherewithal it must be made, which ought to be a tough steel, or steel and iron together) let the tree of the Policam be about four inches long, and so perforated, that the distance between the centre of the hole (wherein goes the pin, upon which are fastened the two branches) and one of the extremities, be a line greater than the other. Let one of the two branches be two lines longer than the other; let also each claw be three lines long. And finally, let the distance between the bolster, or semicircle of the longest side of the tree, be two lines. And you will have four distances between the claws and the bolsters, which is sufficient to draw all sorts of Teeth. For with the first, which is of two lines, you may draw the

With
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With the second, of three lines, you may draw the Canini. With the third, of four lines, the Double and Treble Teeth. And with the fourth, of five lines, the Quadruple ones.

Your Poliean being thus made, if you have a mind to use it, you must to apply the Claw to the inside of the Tooth you intend to pull out, that its branch may stand exactly upon the middle of the said Tooth, gently leaning your Bolster upon the next to it, the better to take your measures; and then draw the Tooth out. But take heed you do not draw obliquely, but in a direct line from the Tooth outwardly; for in drawing laterally, you might chance to force the Tooth to be drawn, upon the next to it, that you would draw them both together, or at least loosen very much the found one, and put a far greater force upon the other in drawing it, than is necessary. Which would occasion an infinitely greater pain to the Patient, than if you had done it rightly.

Thus much have I thought fit to tell you concerning the nature and use of the Poliean; which if you observe punctually, you need never fear the Drawing well of any Tooth. As for the rest of the Instruments now in use, with several others of my own Invention, I shall give you the particular Description, and use of every one of them in the next Impression of this Discourse; if you think this worthy of your acceptance.

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S E C T. IV.

Of the Restoration of the Teeth.

When our decay'd Teeth are so far gone before we think of any Remedy for their preservation, that whatever we can do, proves but fruitless; And that notwithstanding all our best endeavours, they perish, and rot away; or that some intolerable pain has made us to draw them; we are not yet to despair, and esteem our selves toothless for all the rest of our life: the loss indeed is great, but not irreparable; there is still some help for it, the natural want may be supplied artificially, and herein Art imitates Nature so nicely, that when the succedaneous Teeth (if I may so speak) are well set in, they cannot be distinguished from the natural ones, (neither in colour, firmness, nor proportion) but by them that know of them. Being thus exactly fitted to their place, they will keep the next to them, and by consequence all the rest of that Jaw abundantly firmer and stronger than they would otherwise be.

The Advantages that may be attributed to the artificial Teeth, are many; as that they keep the othersfast, as we said just now, that they are of a great ornament, and help pronunciation extremely, &c. But all that is with a Proviso, that they be well made, and according to the best Art; for otherwise they might prove quite contrary.

Besides this Artificial way of repairing the loss of Teeth,
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There is another that may be called Natural; which is done by taking out the rotten Teeth or flumps, and putting in their places some found ones, drawn immediately after out of some poor body's head; which thing (as difficult) I know to be feasible enough, not only by my own reason that tells me so, but by experience it self; as (to say no more at present) may be inculcated in the case of a certain Lady, who thinking to have two Teeth growing one on the top of another, came one day to my Master to have one of them drawn: my Master told her that they were not two distinct Teeth, but only a double one; but the Lady being not satisfied with this, desired him to take out the Teeth he had told her of, let it be what it would. The Teeth being drawn out, and proving as my Master had said, it was quickly for again into the Jaw; and with the use of some convenient and proper Remedies, became in few weeks to be as firm again as any of the rest.

And yet although the event of this particular had not proved so prosperous as it did; its success would not detract in me the possibility of such a transplanting, or Inoculation of Teeth: (if I may be permitted to use such terms) that was not the only motive I had to believe it; and I have not infracted the story of it here as an Argument to prove invincibly what I say, but only as an proper Example to render probable to others what I know to be true. However, I do not like that method of drawing Teeth out of some folks heads, to put them into others, both for its being too inhuman, and attended with too many difficulties; and then neither could this be called the restoratiun of Teeth, since the repARATION of one, is the ruine of another; it is only robbing of Peter to pay Paul. But if instead of humane Teeth, there is use made of those of some Brutes, as Dogs, Sheep, &c. In such case I do not only approve of it as lawful and facile, but do also esteem it as very profitable and advantageous; only care is to be had, that the thing be undertaken, and carried on by one that at least knows something of Anatomy, and has a right sense of the thing to be done, being furnished with whatever is necessary in an Operation of that nature.

And that (if my Opinion may be any wise serviceable in such an Attempt) I may contribute something towards the improvement of so useful an Invention; I think one is, to proceed in it somewhat after this manner. First, I would chuse an Animal whose Teeth should come nearest to those of the Patient; as a Dog, a Sheep, a Goat, or a Baboon, &c. and having tied his legs together, I would fasten his head in some convenient place, so that he might not stir in the least, and by some proper means keep his mouth open as long as I should have occasion: that done, I would open the Gums round about the Tooth to be taken out of his head, not only to the very Jaw-bone, but as far between the said Bone and the Tooth, as the finest Instrument could go, leaving a very little portion of the Gums about it; and then having used the same circumcission, in dividing the Patients Tooth from the Gums,
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Gums, and the Jaw-bone, I would draw it forth, and put immediately in its place that of the Brute; animning it very well and straight between the other Teeth: and then with the use of suitable Remedies, I do not question in the least but that it would unite to the Gums and Jaw-bone, and in a little time become as fast as any of the others: which performance might properly be termed the natural Restauration, or Renewation of Humane Teeth.

Sect. V.

Of the Tooth-ake, Looseness of the Teeth, and decay of the Gums; with their Remedies.

The Tooth-ake is occasioned many and very different ways, but that I may render what I have to say upon it, as perpicious and intelligible as I can; I think it very convenient we should take a special notice of the vessels that come into the Tooth, and of their respective Functions. The first and chiefest whereof is an Artery, whose Office is to bring directly from the heart hot and spirituous blood, out of which (although it is not the general Opinion) the Tooth is at first made, (as well as the rest of the whole body) and ever after preserved and repaired by the supply of nourishment, and vital principles it afford continually: To this effect the whole Artery divides it self into an infinitude of small branches, which being diffaminated throughout the whole substance of the Tooth, distribute to each part as much of their blood as is necessary to make up the incessant loss, they are subject to; and the rest is returned through innumerable hair-like veins into the great ones, and thence to the heart again, but in two different manners: for the superfluous part of that portion of the blood, that is carried by the Capillary Arteries to that part of the Tooth standing above the Gums, is sent back again through some Capillary veins towards the middle of the Tooth; where uniting together, they make but a single channel; and this is it we commonly call the vein of the Tooth, which we shall here take for its second vessel. But the remainder of the blood, that goes to the relief of that part of the Tooth that is within the Gums, passing quite through the substance of the Tooth, is carried by the Capillary veins to the veins of the Gums, Cheeks, and Lips; and hence it is that whatever pain is at any time occasioned in any of those parts, (either by bruise, excessive heat, or cold, &c.) comes to be soon after communicated to the Teeth.

The Third and Last Vessel of the Teeth is a Nerve, one of the extremities whereof is expanded through the Membrane that invets the cavity of the Tooth, and that, that contains its Vessels; and the other is rooted in the Brain, from whence it takes its Origin, and where the Animal Spirits being elaborated, are sent from by the Nerves to all the parts of the body, to administer life, and the cause of motion to them, &c. although in some (as the Teeth) the faculty of motion is not exercised.

From
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From this consideration of the Vesicles of the Tooth, we may gather the following reasons of its Dolour; as first, that if either through the too great quantity, or ebullition of the blood, the Artery is so dilated and swollen, that it fills up the hole at the end of the stumps where it enters the Tooth, and consequently so compresses the vein going out the same way, that the circulation of the Blood is thereby hindered; the continual flowing in of the Blood will extremely puff up, and distend the membrane that contains the vesicles, and consequently cause a great pain in the Tooth, which will last till either the preternatural state of the Blood be changed, or that the Arteries which we have said to pass through the rooty part of the Tooth be so stretched and widened, that by them the Blood may be discharged into the Gums, Cheeks, and Lips; where it will then cause a swelling greater or less, according to the quantity of the superfluous Blood.

And if at the beginning of this disorder, when the Vein is first impeded in its Function, the motion of the Blood is so rapid, and its influx into the Tooth so impetuous, that before it can make its way through the small Arterial Twigs into the Gums, it does extremely extend the coats of the Artery, the Interstices between their Fibres will thereby become wide enough to give passage to some of the thinnest parts of the Blood; which gathering at the end of the root, between the outside of the Artery, and the common Coat investing all the Vesicles, will there putrify, and cause a great and very lasting pain in the Tooth; during which, if the Tooth be drawn, the said gathering will appear at the end of its stump like a little Bladder.

You shall know this sort of Tooth-Ache by the high beating of your Pulse, the fulness of the Veins, and an often beating in the affected Tooth; with a continual, tho not very extreme pain. And then for the Cure of it, you must first bleed the Gums, and sometimes open a Vein in the Arm also, and wash your mouth with Kope-water and Vinegar, of each equal quantities mixt together; putting a little Cotton dip’d in Oyl of Box into the Tooth, if it be hollow.

Furthermore, if that portion of the Blood, which is diffused through the suffusion of the Brain for the production of the Animal Spirits, is so depraved, that all the firing it receives, through the hidden meanders, and recesses of the Brain cannot clear it from its impurities; and that notwithstanding all the contrivances of Nature it is depoited into the ventricles of the Brain, (tho under another form yet) still impregnated with its ill qualities: such sort of Animal Spirits being compounded of Heterogeneous parts, if not timely discharg’d of their malignant and offensive Corporals, (through the usual Emanations) will either by their fermentation in the Ventricles of the Brain, cause an Head-ake; or by the oppression of its pores, cause a giddiness; or else puffing out of the Brain into the Nerves, will by their irregular motion, and preternatural extension of the coats of the Nerves, and other Tunicles, breed a disturbance in all the parts they go to, but more particularly in the Teeth, in which they always
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always excite very great pains. For discharging the peccant humour, between the membrane that invests the inside of the Tooth, and that incloses its vessels, it occasions a perpetual torment in them, till it be expelled from thence by transpiration.

This second kind of Tooth-ake will be known by a disturbance in the head, which precedes it most commonly; a forensis in the joints, and a certain drouthiness, and lingering pain all over the body, as if one were inclined to an Ague, with a sharp and very excruciating pain in the disempowered Tooth, which comes by fits, soon ceasing, and often beginning anew. As for its Cure, it may be effected by Sternotomy, the friction of the moze of the Neck with warm clothes, and the application of aperitive Remedies, to open the pores of the Tooth: and if it be hollow, you shall put in a drop of Oyl of Camphire, whereunto has been infused some Henbane-root. These are the two general causes of the Tooth-ake; all the rest proceeding from them, some few excepted.

There is what I had a mind to say at this present concerning the Tooth-ake. But you must note further, that as it is not enough for one that intends to travel a Country over, to understand the Map of that Country; but he must also inquire often of the people he meets with as he goes on his journey, for the way to such and such a place: so although I have given you a true account of the Tooth-ake, and have delivered here the right method for the curing of it, yet that Disease is for the most part accompanied with several circumstances, that can't be learnt but from experience it self. Thus sometimes the Gums will be Indurated, sometimes pale, and sometimes red, and inflamed. Sometimes the Tooth is loose, and riven above the others. And sometimes its root is discovered, and bare of flesh. Sometimes its rotten, and other wise found, as to its substance. In fine, sometimes the pain is accompanied with a great fluxion of Rhums, and sometimes with a dryness of the mouth, &c. Each of which concomitants requires a particular consideration, and peculiar Remedies: considering always these things, with reference to the age, constitution and habit of the Patient.

Again, it is but rarely, that a Tooth-ake is found simple, or unaccompanied: (as we have suppos'd to be, those of which we have treated above) that is, occasioned by one cause only: but it proceeds most commonly from several; and especially if the pain be inveterate, or of a long standing. And then, the symptoms of this complicated Disease, are mixt in the same proportion as their causes; which renders the Cure much more difficult, and subject to more observations. And therefore, if any one has a mind to render himself perfect in these things, he must not only follow our method, that directs him to the true knowledge of them, but the dictates of his own senses also, by which he will avoid all the obstacles he may meet with by the way. Notwithstanding all which, people being commonly unwilling to undergo all the trouble attending a methodical Cure, and withal apt to think, that one does them
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no good at all, unless he gives them care presently; I have been forced to abandon the Art in my practice, and to invent certain general Remedies, which nevertheless applying with circumspection, and as I think occasion requires, hardly ever fail of producing the intended effect: sometimes in an instant, but most commonly within less than half an hour. True it is, that were it not for my former practice, and long habit in those things, I neither could have, nor expect to good a success.

And yet I will not deny, but that the said remedies happen sometimes to operate a great deal sooner than ordinary. But that comes to pass by reason of some unexpected, or unobserved accidents: and I think it ought to suffice, that the Cure be at last performed. Yet this does not satisfy every body. If the Remedy does not immediately cure such as are impatient or incapable of reasoning, they faintly condemn it as a thing ineffectual, and altogether void of any virtue. Upon which, believing the Stories of some impertinent (the perhaps well affected) friend, they make use of such things, as commonly hinder the effect of the Remedy. And if it happens sometimes that notwithstanding those impediments, our remedy produces its effect, they never fail of attributing the Cure to their own endeavors.

However, I must ingenuously confess, that my Remedies do not take effect always. And that there are some sorts of Tooth-ache almost incurable, unless it be palliatively; and that it self, not without a great deal
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Practitioners in those concerns it is impossible ever to perform the Cure of any Distemper.

Yet, that you may not think me remiss in any thing belonging to my Profession, that may concern your welfare; and by reason that you may chance to find your selves in a place where there will be no Arip to help you; I will here communicate to you a general Remedy against the decay of the Gums, and looseness of the Teeth; which I am sure, if you use carefully, will often answer your expectations: At least it will be such, that it shall always do you some good, and never any harm. But I must tell you beforehand, that if your body be Scarified, and full of ill humours, you must first be Blooded, and Purg'd, according to the directions of a good Physician: and then you may use the said Remedy as followeth.

Take of Mistletoe, Myrt, Pine-Apple, Dragons-blood, in drops, all reduced into Powder, of each equal quantity, red Coral prepared, flowers of Pomegranate, of each double the quantity of the other Ingredients; and steep them all in a proportionable quantity of Spring-water upon warm Embers, for the space of a natural day; and then filter the Infusion through a woolen-cloth, and keep it close in some convenient vessel. And when you have a mind to use it, you shall take two or three spoonfuls on a day, keeping it in your mouth a quarter of an hour every time; which you must continue to do while necessity shall require it.

I might have told you at the beginning of this Section, where I spake of the vessels of the Teeth, that their Artery comes from the Carotids; the vein from the Jugular, and the sinew from the fifth pair of Nerves; but if you are skilled in Anatomy, you know it better than I, and if not, my telling of it to you would signify nothing at all, unless I should in the same time, give you an accurate description of all those vessels; tracing them from their Origin, even to the very last of their divisions, and furthest extremities; which would be improper in this place.

Sect. VI.
Of Children’s Teeth.

Having hitherto spoken of the Teeth in reference to adult persons, and such as are past childhood: we shall explain in this Section, as succinctly, and withal as clearly as we can, what is necessary to be known touching their growth, and change in children; a thing of no small consequence, since the life of Infants is therein so often concerned.

The Child being born, remains Toothless, till he is about five or six Months old: at which time his two foremost Teeth in each Jaw begin to appear, without keeping any constant order of Precedence: sometimes those above coming out first, and sometimes those below. After them follow all the rest successively in both Mandibles: so next to these come the four other Incisors, the four Canin or Dog-Teeth, and the first eight Molars, (which are properly the double Teeth) and then come the four biggest Teeth of all, which may be called...
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And therefore I will to that end deliver here in few words, what reason and experience have taught me concerning the same; proceeding thus.

In the first place, I would advise such as may be concerned in this Affair, to take a special care in observing when the Child's Teeth begin to trouble him; which (befides his frowardness, and excelle crying) may be known by his fakation or drivelling (as Nurse are wont to file it,) and the inflammation and swelling of his Gums; and as soon as you perceive it to be so, you are to wash his mouth now and then with the following mixture: Take seven or eight as new Figs as you can get, and boil them in a pint or more of Whey, till they grow very soft, and then squeeze the Whey, and as much of the substance of the Figs as you can through a cloth; of which liquor take half a pint; of Honey of Roses, and Syrup of Violets, each half an ounce; and three or four spoonfuls of Plantain-water: mix all together, and keep it close in a Bottle. The best way to use it, is with a stick of Liquorish beaten at one end into small threads like a Comb-brush, or little Broom, with which, being dip't in some of the said Liquor, you shall wash and rub the Childs Gums, (especialy where they are tumified) at least five or six times a day, continuing so to do, till you perceive the Gums to grow white above the Teeth; which is a sign of great pain in that part, and that the young Teeth will in a little time break through the Gums) and then take a Lancet, or a very sharp Pen-knife, and divide the white place, cutting it down.

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called Quadruple Teeth, as being about three times bigger than the small ones: and after that the eight left Teeth do follow; which in respect to the Incisors may be termed treble Teeth. But these treble ones usually vary very much in time of growth, for it is but rarely that they all come forth in the same year, the four last of them being out before the one or two and twentieth year of our age; for which reason such Teeth are called by some, Teeth of Wisdom, because that by that time, we should have a full use of our rational Faculty, though God knows how often it proves to be true.

The eight Incisors, and the four Dog Teeth come the first year; the eight double Teeth the second year; and the four Quadruples, with the four first Treble ones, the third. During the time of their eruption, and especially when the four Quadruple ones break forth out of their Sockets, children are subject to Fevers, and great alterations, which weaken them extremely, and often puts an end to their days; which comes to pass most commonly, for want of help to facilitate their issue out of the Gums.

And as I look upon the knowledge of Childrens Teeth, as a subject properly belonging to my Profession; so I think my self oblig'd to amend, amplify, and render it as conducitve to the preservation of the life, and health of Children, and to the preventing of all those Infirmities where with they are afflicted, (upon the account of the first coming, and shedding of their Teeth) as my weak endeavours can make it.
down to the head of the subjacent Tooth, with two Incisions crossing one another at the centre of the white spot, continuing to use the mixture as is aforesaid, till the Tooth appears above the Gums; observing to use the same method at the coming out of every Tooth, which you may know by the foregoing tokens.

Now the Teeth being all come out (except only such as remain latent within the Jaw, till about the two and twentieth year of ones age) they keep firm and strong till the child is a matter of fix or seven years old, and then most of them grow loofe, and a while after are cast clear out. The treble Teeth never change, the Quadruples very rarely, but the Incisors, the Dog Teeth, and the double ones always do sometimes whole, (and then the second Teeth, or those that are to succeed them, are a long time before they grow up again;) but most commonly their head only comes off, the other part remaining still for the making up of the next Tooth; like unto the first production of a Vegetable Seed, or tender Sprig of a young Plant; for as the upper part of this being withered in the Winter following, by the rigorous cold of that Season, drops off in the next Spring: (by reason that its texture being yet loofe, and less firm, the pores or fap carrying vessels, are over much dilated by the great influence of the nutritive juice, and so give admittance to some indigested and grosser particles than is convenient for the nourishment of the Vegetable: which particles being irregular, and unactive, their motion is soon stopp; when as a great cold intervening, compresses a little the young Plant round about, so that they are concealed, and become fixt in their Darts, or leading pipes, whereby that part being deprived of its due nourishment, fades away, and dries up,) and is succeeded by a new Sprout shooting out of the stump, or remaining part. So likewise the young Teeth coming into the cold air, when they are yet tender and less solid: those of them that are more susceptible of alteration, and more exposed to the inclemency of the weather; (as must be those before, which by reason of their finalness and situation, cannot but be more subject to adventitious accidents,) are thereby chill'd and reprefed, and their parts thrust near one another, and driven back towards their centre, from whence the substance of the Tooth becoming closer, and the intervals between its parts narrower, and interrupted in several places, by the irregular motion of some of the minute of those parts, (which by reason of their untableness, and fluxibility, being disposed to advance and obey the action of external Agents more than the others, do move disorderly, and spoil the structure of the root,) the small Veins and Arteries therein dispersed, will become so extremely compressed, that the blood they contain (which in Children is most commonly gross and impure, as is apparent by their stupidity, and filthy scabs; as well as by that Feverish disposition they are always inclined to; which argues a great disparity between the parts of their blood,) is thereby stopp in its course, and detained in them; where the grossness of its parts, and their incumbrance figures will
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of the broken particles remaining between them, will corrode, and eat holes in the new head of the Tooth, and so it comes out already perished: which to prevent, the first Teeth must be drawn out as soon as they appear any thing loose.

Moreover, it happens sometimes, that the new head of the Tooth is nourished, and increases so fast, that being obstructed by the too great connexion of the old one, to the adjacent parts, from advancing in its right course; it turns aside, and makes its way through either the inside, or outside of the Gums; and so it grows biassing, and out of rank. This defect is remedied by drawing out the superfluous Tooth, and the use of some convenient means to bring the new Tooth into its place; which is very easy to do, if undertaken at first, but otherwise a great deal more difficult; and especially if the two next Teeth are approached so near one another, that it cannot be contained between them, without being leftened, or the others put further off from each other.

Note. That in drawing out the old, or fucking Tooth, a great care is to be taken not to hurt the new one, lying under it.

S E C T. VII.

Of the Acceleration of the Teeth.

The five first of the foregoing Sections have been imploy’d about mens Teeth, and the sixth about those of Children; but this seventh and last Section of
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of our Discourse shall respect both men and children; for it will not only teach how to hasten the growth of Children's second Teeth, when it happens to be delayed, or retarded too long; but also how to accelerate the coming out of those in Men, that are called Teeth of Wisdom. Which, without the help of Art, hardly ever appear before almost half of our life is already past away: And when the time of our growth is over: during which, we have the greatest occasion for them. But because the bare saying or affirming of any thing without proofs, or some reasons to render it probable, has no force to persuade any man of its truth, nor to make him sensible of what utility it is of: We will elucidate the matter in hand, by an example drawn from the motion of Seeds sown in the Earth. Now the quick or slow germinating of Seeds after they have been sown, depends upon their being buried shallow, or deep in the ground; the lightness or heaviness of the Earth, and its good or ill manuring, and the proportion of humidity that dilutes it; as well as the heat or coldness of the season: the several proportions of either of which accidents, alter and vary the progress of the Seed, according to their prevalency in respect of each other.

For in a well prepar'd Soil, being cherished by the warmth of the Sun, and duly diluted with water, the Seed will bud a great deal sooner; the lightsome Earth easily yielding to the expansion of the Semen, when it imbues that Sucess Nutritious, which Transfoating through the coats of the Seed, and impregnating its Paren-

Parenchyma, causes by its fermentation therein, a gentle shake, and a vital motion in the Radicle, and Planc; (as the Learned Doctor Grew calls the Seminal Root, and Trunk of a Plant in Embryo) whereby they are impowered to Extrace themselves out of their Integuments; and Parenchyma; and begin to vegetate, and grow like a Plant.

But the Seed being buried deep in a cold, cloggy earth; will, by the stubborn Cohesion, and lumpishness of the said earth, be kept from dilating it self; and consequently from receiving those particles that are altogether necessary for its viuiifying, and augmenting. From whence it follows, that its growth (if not helped by Art) will be check'd, and obstructed till the heat of the Sun has opened the ground, and let its particles in such motion as they ought to be, to enter the Seed, and provoke the earth upwards.

So likewise Childrens Gums, being yet tender, shallow, and loose, and withal prepar'd, as we have taught heretofore in its place, their first Teeth come out and grow very early; as also do their second, if in shedding of the first, their heads only come off; for the others do grow up fo soon, that the Gums have hardly any time to close up again. But if the sticking Teeth do shed root and all, the matter out of which the next (which I call Novel Teeth) are to be made, will not only be a considerable time in diffusing it self into the requisite form, but when the first lineaments are drawn, and Nature has accomplished her first work, the Gums will be re-united together; and grown
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To the efficacy of this new strength of the Blood upon the arrival of Nature to its highest Period, may be attributed the causes of those alterations that usually happen in mens bodies about that time: many looking pale, and being troubled with divers infirmities till then, of which they are afterwards delivered. But leaving off Digreffions, let us return to our Subject.

We have already observed, that the Novel-Teeth in Children, and Dentes Sapientes in Men, could not arrive to their perfection, nor therefore become serviceable to us without a long time, and a great Effort of Nature. It remains now, that (purportant to our design, as we have declar'd it at the beginning of this Section) we endeavor to find out some means, whereby we may remedy those defects; in facilitating Nature's work, and rendering those tardy Teeth above-mentioned, serviceable to us as soon as we can. And as I find none more proper and expeditious, than the Raisalition, and Dilatation of the Gums, so that they may lose their greatest stubbornness, and become more yielding to the Teeth: I conclude that all the difficulty lies in knowing how such an effect can be produced; which (after a due consideration) I think may be performed after this manner.

In the first place, there is need of an Instrument made of Gold, or Silver, about a foot long, as big as a Tobacco-pipe, and like a Syringe; being fo bored, that a perfectly Cylindrical embolus, or fucker, may fill exactly nine inches of its cavity, the rest being made a good deal...
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...deal smaller, and bow'd like the Blowing-pipe of Watch-makers; which ought to end into an head resembling the cup of an Acorn; and so contriv'd, that it may embrace the Gums exactly. Your Instrument being ready, if you have a mind to perform the Operation, you must in the next place (concerning the Dentes Superiores) tie all the Teeth together, (which may be done without any trouble) so that the two foremost of them may draw the last of all towards the fore-part of the mouth. By this the included Teeth will be freed from being compressed between the others, and the extremity of the Jaw-bone. And then the Gums being prepar'd by Emollients, and relaxing things, apply the end of your Syringe close upon the Gums, under which the imperfect Tooth lies; and then draw the Embolus, and the top of the Gums will follow, and rise within the little Acorn-cup-like end of the Pipe, as the flesh usually doth under Cupping-Glasses. Keep it a while so, and then take away the Syringe; and sacrifice that part of the Gums that was drawn within the Pipe, in several places; reiterating the same Operation twice a day, for about a fortnight, omitting only the Scarification, which is to be used the first time only. By this means it appears probable to me, that the Gums yielding, the force of the Blood will compel the fibres or minute parts of the imperfect Tooth, to advance according to their natural order, and situation; and so cause the said Tooth to grow.

As to the Novel Teeth, you shall follow the same method, and use the same means in facilitating their coming.

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coming out, that you have done to the others; omitting only the tying of the Teeth, which would be superfluous here.

Note, that every thing is not capable of the same perfection, and that as there is no rule without some exception; so when I have averted such and such things to be improvable to such a degree, it is to be understood for the most part, and in general; not denying but that it may happen otherwise in some particular cases: but I shall always deal candidly with every body, never undertaking any thing but what I shall be able to do according to agreement. And if any one will be pleased to come to my Chamber, he may have my Advice (concerning any thing that belongs to my Profession) gratis at any time.

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TO THE

READERS.

GENTLEMEN,

Although I have offered nothing in this Paper, but what is according to my own Experience, and the best of my knowledge; yet I will not say but that I have been deficient in many things, and have committed a great many Errors in the management of my Subject; but if you consider that I am the first (as far as I know) that ever wrote any thing of this nature; and withal, what is to be expected from one in my Circumstances, I hope you will be the more ready to excuse my faults. However, if what I have done be acceptable to you, I intend in a second Impression of this small Treatise, to Correct, Illustrate, and augment it, to its full proportion. In the mean while I would advise you, to make use of what is here presented you, by

Your very Humble Servant,

CHARLES ALLEN.

Printed in the Year 1686.

A

Physical Discourse

WHEREIN

The Reasons of the Beating of the PULSE, or Pullation of the Arteries; Together with those of the Circulation of the Blood, are Mechanically Explained: Which was never done before.

The Beating of the Pulse being one of those Phenomena, that deserve mans consideration the best, it has excited the most Learned in all Ages to search out what might be the cause of it.

The best Physicians and greatest Philosophers of former times, being ignorant of the Circulation of the Blood, did ascribe it to their occult qualities, and unknown powers.

Galen, an Eminent Physician, searching the natural cause of the Beating of the Pulse, thought upon the making of that famous Experiment of his; by which, having put a Quill into an Artery, and tied the Artery upon it, he found that the said Artery ceased from beating betwixt the ligature and the extremity, that it continued still beating betwixt the same ligature and the heart: And then seeing also, that the Artery being
A Physical Discourse concerning the Beating of the Pulsæ.

But the said Phystrian alluding against this, that if one takes an Artery without Quill, or any Incision, and ties its sides to close together, that there be left a far smaller passage for the Blood in that place, than in the Quill; the Artery will nevertheless continue still to beat on both sides of the ligature, as it did before:

(contrary to which would necessarily follow, if it were so, that the straitness of the passage of the Blood did occasion the loss of the Pulsæ) Carus was here forced to recede somewhat from his former Sentiment, and to confess, that the motion of the Arteries depends partly upon the free continuation of their coats: which totally overthrows his opinion. For, the power of the said continuation be what it will; supposing, as the Philosopher did, that its action may be stopt by the compresion of the sides of the Artery: It is certain, that altho' the Quill in the Artery were of equal, or, if you will, greater capacity than the Artery; yet if the said Artery were tied upon it, the Pulsæ would, notwithstanding all that, cease below the ligature. But Carus said, that such a Quill as that we were speaking of just now, being in an Artery either tied, or untied; wou'd never hinder any part of the Artery from beating: And therefore, &c.

Doctor Lower says, after many Disquisitions on this Subject, that the knowledge of those things was left to God alone.

Doctor Willis ascribes the Beating of the Pulsæ to the contraction of the circular Fibres of the muscular coat of the Artery: But it is absurd to think so; for it is impossible...
The Beating of the Pulse.

It is impossible to imagine that those Fibres could contract themselves of their own accord; neither does the Doctor give any reason for what he says. Besides, he is inconsistent with himself, when he ascribes the same motions to the circular Fibres of the muscular coat of the veins; which are notwithstanding wholly destitute of any Pulsation, &c.

All which considering, and how these and other great men had (through the difficulty of the thing, and not out of any insufficiency in them) fallen into so gross and so erroneous opinions concerning the Point in Question; I concluded, that it was as good as impossible ever to solve the difficulty. Yet, recollecting my self, and seeing that the said Effect must have a cause, whatever it be, which probably cannot reside anywhere else, but either in the Heart, Blood, or coats of the Artery; or finally, in them all together; I made a resolution to examine carefully each one of these things separately, as possibly containing alone the cause sought after; and then all together, as being possibly Coadjutors in the production of the known Effect. And after as exact an Inquiry into the matter as I am capable of, my Reasons (which would be too tedious to tell you now) persuade me, that all the Mystery consists in the three following things.

The First is, the Structure of the Artery; which is made up of four Coats. (We shall examine in another place how they are generated at first.) The First of them, which contains the Blood immediately, seems to be nervous, and made of strait Fibres; which take their Origin from the heart; or rather are a continuation of those that immediately invest the cavity of the heart. As soon as they are arriv'd at the orifice of the heart, they rank themselves by one another, forming a certain Cartilaginous Ring; from the circumference of which, they run almost parallel along the Artery; but yet with such an inclination towards one another, that going from the heart to the extreme parts, they form a kind of Cone; (for that we may render our Discourse more intelligible; we shall consider here one of the trunks of the great Artery, (suppose the ascending one,) as a continued right Conical Pipe, abstracting from all its divisions and branches; to every one of which may easily be apply'd, what we are going to say of one of them,) a little below the Apex of which, those Fibres unite themselves together, and do compose a little tendinous Ring, called Anastomoses: to which is affixed the extremity of the Nervous Cord; which vein we shall suppose here to be a single conical Channel, or pipe, dilated, as we have taken the Artery to be. Within this Anastomoses there is a little Valve to disposed, that it permits the Blood to pass from the Artery into the vein, but hinders it from returning back again from the vein into the Artery. Between every one of those Nervous Fibres, there is a thin Membrane that joins them together (as the skin in a Goose's foot ties its toes to one another,) which permits the said Fibres to open, and go further from one another, when the Artery is dilated, and which do continually increase in breadth, as they go from the Anastomoses to...
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The base of the Artery: so that they become conspicuous near the heart, that Doctor Willis took them for some large fleshy Fibres; to which he assigned the faculty of shortening the Artery, in order to promote the circulation of the Blood. The second coat is the Muscular, and the third the Glandulous: but the consideration of these middle coats, being not necessary to our present purpose, we shall speak of them another time. As to the fourth, or outmost Coat, it is that which we have most need to take notice of here; as being the principal instrument of the Syphole and Diaphole of the Artery. This Coat is made up of two orders, or ranks of spiral Fibres, which proceed from the oblique Fibres of the heart, from whence they go twisting and winding themselves about the body of the Artery, as joy does about Trees; some running upon it from the left to the right, and the others from the right to the left; interlacing thus one another obliquely, as they go from the heart to the anastomosis; whereby they form a sort of Net, or Sieve-like-woof upon the outside of the Artery. At their coming out of the heart, they are knitted together by a cartilaginous substance, that encompasses the root of the Artery round about, as an iron-ring does the end of a handle: from the circumference of which cartilaginous Ring, they run Helix-wise upon the superficies of the artery; at the extremity of which, being arrived, they inflect themselves into the tendinous small ring, or anastomosis. These spiral Fibres are tied so loosely on the body of the artery, and so lightly between themselves, at the places where they intersect one another, that they may run very easily to and fro upon the artery.

The second thing conducive to the production of those several turns of Syphole's and Diaphole's of the artery, is, that the blood contains a certain subtil matter, or vital spirit, which can move it, and pass between its parts very easily. And in fine, that the blood coming out of the heart (where it acquires an extreme agitation) into the arteria magna, expands it self with great violence, and strongly dilaTes that part of the said artery that lies contiguous to the heart, (forcing in the same time the blood to advance from the heart towards the extremity,) whereby the spiral Fibres being necessarily drawn towards the dilating place, do compress the artery round about all along, & to squeeze the subtil matter, from between the parts of the compressed blood, into that which is not; forcing it thus to pass from the extremity towards the heart, which makes the ebbling of syphole of the artery. And then the spiral Fibres having been extended violently, and on a sudden, upon the dilatation of the artery, do (by the Edaphic faculty of some of their parts) come back again, and reconstitute themselves into their former situation, and state; forcing thereby the subtil matter to fly through the blood, from the dilated place of the great artery, towards the extremity of the capillary ones, &c. which makes the flowing or Diaphole of the Artery.
We have already supposed the Artery to be of a right Conical figure; let us further, for greater evidence, imagine it to be mentally divided into four parts of equal capacity: so that as much as the first shall exceed the second in breadth, the second will exceed the first in length, &c. Let besides, the places of the supposed divisions be marked with several letters, as A, B, C, and let A, denote the first division (proceeding from the heart to the extremity;) B, the second; and C, the third: let us also mark the Bafis of the Cylindrical artery, which is inerfed into the basis of the heart, by X; and its capillary end infirfed into the circumference of the annular analfonofis, by Y.

And now, suppose that a certain portion of blood, as a dram for example, paffes out of the heart into the aorta, where it fwell, and dilates it felf very considerably, (by reafon of a very intense degree of heat,) it acquires in the ventricles of the heart; and of its being mixed therein with a certain leaven, or fermentative juice, (it being the residue of that portion of blood, that had paft immediately before through the heart,) which neccifarily causes a great commotion and strife amongst its parts; it must follow according to true Philosophy, that the faid portion of blood coming out of the heart, does in the fame time thrust the blood already in the artery, forwards, and dilates that part of the artery that lies contiguous to the heart.

It thurfs the blood, I fay, towards the extremity; becaufe that it muft occupy a space in the artery equal to its natural bulk, neither greater nor smaller; by reafon that a like quantity of the blood to that, that comes out of the heart into the artery, is pored out of the vein into the heart; fo that there is only room left in the vein to admit juft as much blood, as comes out of the heart at each Diafole. And if we suppose the space X A, to contain a dram of blood, (whether more, or lefs, makes no matter here) as we have alfo supposed, that the fame quantity comes out of the heart at every Diafole, (or Syfole, as some would have it) it is an invincible truth, that this blood coming out of the heart, must exaftly occupy the space X A; and that therefore, it thurfs in the fame time, the blood that occupied it before, into the space A B; that in A B, into the space B C; that in the space B C, into the space C Y; and that in C Y, into the capillary end of the vein, &c. And alfo (according to our Hypothesis) the passage from the artery into the vein be much smaller, than that of the heart into the artery; yet if the motion of the blood through the analfonofis, is to the motion of the blood at the orifice of the heart, as the orifice of the heart is to the analfonofis; that is, as X is to Y, (as it may cally be fo, alfo it is naturally otherwise: the rest of the analfonofis, from which we have abftracted here, being together at leaft as capacious, as the orifice of the heart,) it is plain, that a dram of blood will as soon pafs from the artery into the vein, as another from the heart into the artery, et hoc.
And as the blood coming out of the heart into the great artery, cannot possibly occupy a greater space, than such as is adequate to its volume in a condened state; and that nevertheless it dilates itself, it must necessarily extend and dilate X A, the part of the artery that contains it, as much beyond its natural tone, or reach, as the rarefaction of the blood increases its volume; which cannot come to pass, but these two things must necessarily follow. First, that when the blood dilates itself, it leaves some intervals between its parts; which intervals (because there is no vacuum in nature) must in the same time be filled up with some other fluid matter: (which ought to be thinner than the blood; for otherwise it could not pass between its parts.) And as this substil matter can't come from the heart, because that then it's empty; and that besides its office is shut close by its three valves; it can neither come through the coats of the artery, by reason of their thicknefs, and close texture; neither is there any such matter about them. It remains then only, that it must come from the blood contained in the artery.

Secondly, that the fibres must be drawn towards the dilated place, and the rest of the artery made as much narrower than ordinary, as X A, becomes wider than it used to be. Whereby the artery being compressed round about, the vital spirit is squeezed from between the compressed parts of the blood, and forced to advance towards the dilated place; in such manner, that as much of the spirit, as is necessary to fill up the spaces left between the parts of the dilated blood, is sent thither from between the parts of that, which is compressed; the remnant of the spirit being equally distributed through the rest of the artery, so that if every one of the four parts, or divisions of the artery, contains a certain quantity of vital spirit, distinguished into three parts, and that three of those parts, do pass from A B into X A, two of them will in the same instant pass from B C, into A B; and one from C Y, into B C; in which action conflits the ebbing, or fall of the artery. And as a rope, or (more sensibly, a gat-firing) which is fixed to any place, being pulled with a jerk, will draw back again him that drew it at first; so likewise the fibres being extended violently, and on a sudden, upon the dilatation of the artery, do come back again instantaneously, (by reason that some of the parts of each fibre, being strongly thrust towards its middle, and somewhat bent from its circumference towards its centre, do presently spring back again, extending themselves according to the breadth of the fibre; whereby the said fibre is necessarily as much shortened, as it had been stretched before) and reftitute themselves into their former situation & tone; (which they are facilitated to do by the exertion of that extraordinary agitation of the blood; which it communicates in an instant to the yielding sides of the artery,) forcing thereby three parts of the vital spirit, or substil matter, to pass from X A, to A B; and the two parts, that were already in A B, to pass into B C; from whence another will pass into C Y, &c. which
which makes the flowing, or Diafole of the artery.

I foresee an Objection, that some may make against what we have said, that that portion of the blood, that comes out of the heart in its Diafole, is dilated, and yet occupies no more of the artery, than if it were condensed; only that part of the artery which contains it, is a little more extended than the rest: for, they will say, this supposes, that both the artery and the vein are always full of blood; being certain, that if the blood, in coming out of the heart into the great artery, did fill there any empty space, where it might expand it self freely, it would start forwards into it, and then it would not dilate the artery, nor by consequence draw the spiral Fibres; and therefore there would neither be Syphole nor Diafole in the artery: But it is most certain, they will continue, that men have sometimes more, and sometimes less blood in their bodies, and that if a man has, for example, fifteen ounces of blood drawn, it will follow; that there being a vacuity in the Sanguiducts, till the same quantity of blood be regenerated anew, the Beating of the Pulse must also cease till then; which being contradicted by daily experience, they will conclude, that the motion of the spiral Fibres, with whatever else we have taught concerning the Beating of the Pulse, is altogether chimerical. To which I answer in few words, that for the Beating of the Pulse, and Circulation of the Blood, it matters not at all, whether or no, the artery and vein be quite full of blood; since that as the blood decreases in them, the muscles of the limbs, and other adjacent parts, do proportionably compress them round about; so that their internal superficies touches the blood continually every way; which has the same effect, as if the artery and vein were exactly full of blood: for the blood coming out of the heart, and finding as much difficulty in lifting up the adjacent parts, as to drive on the blood of the artery and vein, when they are full on't; it's forced to keep the same order and method in that case, as it does in this, concerning its dilatation and place in the artery.

Now, these being the true and genuine reasons of the Diafole, and Syphole of the arteries, it's very easy thereby to explain all the Phenomena relating to Gal's experiment. For the Quill being put into the artery, and left there without being tied, the artery will nevertheless beat still above and below the Quill, as it did before; because that the spiral Fibres can still play to and fro from one end of the artery to the other, without impediment. But if you bind the sides of the artery upon the Quill, the motion of the same spiral Fibres will be intercepted by the ligature; so that it must necessarily follow, (by the foregoing reasons,) that the artery being not alternatively compressed, and dilated betwixt the said ligature, and the extremity, the Pulse must also cease in that part of the said artery, &c.

Many things may easily be explained by this Doctrine, the impossible to be interpreted any otherwise, which therefore become as many proofs of its verity: as namely, the difference which is between the arterial and venous parts of the body; the increase and decrease of heat in bodies; the operation of the bowels; and the action of the muscles; and the like.
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risil and venal blood. For (having demonstrated above, that when the blood advances in the great artery from the heart towards the anastomosis, and from thence into the vein, the vital spirit goes in the very same time from the anastomosis towards the heart; whereby the said spirit is necessarily kept within the artery,) it is certain, that this disparity proceeds from the want of spirit in the venal to keep its parts in agitation; which abounding in the arterial, keeps it in a continual effervescency, &c. I could add many other things to authorize what we have said concerning the Beating of the Pulse, and Circulation of the Blood; but I hope this will suffice to rational men, and such as are of a Mechanical Genius. As for those that attribute all things to final causes, and have recourse upon every occasion, to the designs and intentions of Nature; (as when they say, that the Eye-brows are made to hinder the Sweat from falling into the eyes, &c.) if, notwithstanding all that we can do, they remain still insensible to our reasons, it matters not much; and, in my opinion, such persons had a great deal better study Astrology; or, if they are big with devotion, go and comment upon Job, or Paraphrase some Psalms, than meddle with Physical matters.

FINIS.

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A Physical Discourse concerning the Beating of the Pulse, and Circulation of the Blood
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