An Abſtract of a Treatiſe of the Calculus Humanus in anſwer to ſeveral Queries propoſed by Sir John Hoſkins; by the Learned and Ingenious Fred. Slare M. D. and fellow of the Royal Society.

IT is generally obſerved by thoſe that have been ſubject to the *Stone* of the *Bladder*, that pains in the *Kidnies* were antecedent, which intimates the foundation was firſt laid there, and afterwards by the *Ureters* and a *Guſt* of *Urine* conveyed into the *Bladder*. The manner of its growth in the *Bladder* is obvious, the *Urine* (by ſome called *Lotium*) being too highly ſatiated or impregnated with a ponderous matter (which we here deſign to examine) precipitates the ſame at certain times upon the mention'd *Baſis* and alſo on the inward *Superficies* or *Coat* of the *Bladder*, which upon a Relaxation of their diſtended *Fibræ*, do ſoe ſtrictly embrace that præternatural ſubſtance it finds there, as to overlay it or cloath it with what ever Sediment ſubſided there. That the *Urine* only at ſome *Intervals* is diſpoſed to let fall this matter, ſeems probable from this obſervation that the *Concrete* conſiſts of ſeveral *Spherical Superficies*, or round Incruſtations, which like ſo many diſtinct *Shells* may be parted from each other. Moreover theſe Incruſtations are obſerved to be very unequal, ſome much thicker then the other: An argument that the *Urine* continued much longer diſpoſed to depoſe this *Calculous*

lous matter at one time than at another: or elſe that it was much more ſatiated or abounded with this ponderous *Præcipitate* at one time than at another, and ſo laid it over with thicker *Cruſt* in as ſhort a time.

If we might be allowed briefly to examine the cauſes that have been aſſigned to the *Production* of this *Concrete*; I think we cannot well grant *heat* in the *Kidneys* to be a probable efficient Cauſe; a much more *Intenſe Heat* than is poſſible to be found here, being neceſſary to make *Bricks*, or bake *Sand* and *Earth* into *Stone*. Nor is it neceſſary to derive the material Cauſe from ſuch a ſlimy and roapy or mucilaginous Indiſpoſition of the humours, that may perhaps coagulate and harden into a *Stone*. Such a *viſcous Urine* being leſs apt to precipitate this gritty matter than more thin and limpid *Urine*. For I have found in more than one, where the *Urine* has often been ſo roapy and ſtringy that it would draw out into threads upon the application of a ſtick; but yet we never diſcovered ſymptoms of the *Stone* in the *Kidneys* or *Bladder* of ſuch Perſons. Nor do I believe that an *Acid* meeting with ſome *Alkalies* may be reaſonably concluded to conſtitute this ſo firm and ſolid a *Concrete*. Which does not at all hold good in our *Analyſis*, nor does it ſeem reaſonable, that *Acids* ſhould make this *Connection*, ſince nothing that I know of but *Acids* will make the leaſt *Solution*. Now if *Acids* make the firſt *Bond* of *Union*, we may expect from them rather that they ſhould ſtrengthen and confirm than ſhatter this *Confederacy* in pieces.

Nor can I charge any putrifying morbid *Ferment* in the *Kidnies* with ſuch a *Coagulating power* as will anſwer for the *Product*. This *Hypotheſis* of *Helmont* being very precarious, and ſeems grounded on one uncertain Inſtance, of a Perſon that upon eating *Aſparagus*, from that

that time contracted the *Stone* in the *Kidnies*, which Plant he much diſcommends as well as the *Raphani*, upon the ſcore of their ill ſent, for diſpoſing the *Kidneys* to putrefaction, and ſo to breed the *Stone*. Much might be ſaid to invalidate this *Hypotheſis*: but the common and innocent uſe of theſe *Plants* will ſecure us againſt this prejudice, upon which *Obſervation* his *Hypotheſis* ſeems wholly to depend.

We may alſo except againſt the Experiment of *Coagulation*, upon the mixtures of high rectified *Spirits* of *Urine* and *Wine*, which if warily managed will make a *Coagulum* with ſuch expedition as ſeems very ſtrange and ſurprizing: for this *Concretion* will eaſily be diſſolved by water. In like manner if either of the *Spirits* be very *phlegmatic*, there will follow no *Coagulation*. In ſo much that the humours of the *human Body* contain too much *water* in them to admit ſuch an Effect, even in thoſe *Conſtitutions* that have uſed themſelves to very highly rectified *Spirits*. Moreover *Horſes Doggs* and other *Animals* that drink no *wine* are not free from this *gretty Cementation*. Nor could I ever diſcover any drop of *vinous Spirits* afforded upon our Diſtillation of this matter. I would not be thought here to excuſe theſe *Ardent Spirits* from doing miſchief to the *human body*, but doe believe that they are apt enough to make ill *Secretions* and ſome *Concretions* of the humors, (tho' of an other ſort) I mean ſuch as are viſible enough in the *faces of Great drinkers* and the like. Nor is this diſagreeable to our *experiments*, where tho' the diluted and weakened *Spirits* will not convene into a firm harden'd body, yet ſome leſſer and ſofter *Concretions* will Subſide to the bottom of the *Glaſs*.

We may alſo queſtion the *Hypotheſis* of the *Production* of the *Stone* by *Petrefaction*. Stones are ſuch fixt bodys that they yield nothing upon *Diſtillation* except a ſmall

Quantity

Quantity of inſipid water chance to riſe, nor will they *Exhale* very much in an open fire, whereas we can *volatilize* ſix parts of eight of our *Calculous matter*: and obtaine *Salts* and *oyls*.

But to paſs on: The *chymiſts*, who of all men ſuppoſe their *Opinions* the leaſt ſubject to uncertainty, being grounded on *experiments*. They deſcribe the *Concretions* of the body, and particularly this morbid one by calling them *Tartareous*: who conclude they have ſufficiently accounted for the nature of a body, if they can but call it *Tartar*, which muſt be acknowledged to conſiſt of *Acid*, and *fixt Salts*, called *Alcalizat*, and of ſome *Tarra damnata*; tho' it be very little in proportion to the other *Salts*.

If we compare ſuch *Analyſes* of the *Calculus* which we have often made, with the aforeſaid *Tartar*, we may then infer what little reaſon there is to *Eclipſe* its *nature* by that *denomination*. We Diſtilled an ounce of *Calculus Humanus*, that was recently cutt out of a body, which afforded about two *drams* of a brown *Spirit*, nearer to that of *Harts-horn* than *Urine*. We put the *Caput mortuum* upon the *Cupel* and reduced it to near a *dram*, the reſt burning and ſmoaking away.

Another time we diſtilled in a naked fire a *Stone* that weighed two ounces, the *Vapor* came over upon a good ſtreſs of fire, and ſetled in the form of *Salt* without any *liquor*, of which we preſerved only a *dram*, it appeared very *brown* and taſted *bitter*, as the *fetid oil* of *Harts-horn* and other *Empyreumatical Oils* doe. We examined by boyling and evaporating water from the *Caput mortuum*, whether it held any fixt Salt, but found none. The *Caput mortuum* weighed one ounce and ſix drams, ſo that it loſt only two drams in the *Diſtillation*; that is only two drams came over the *Helme*. We proceeded farther and placed this *Caput mortuum* upon a *Teſt* in an open fire, where

where it burnt away to two *Drams*, 44 *Grains*: this we alſo boyled in water to ſee what ſalt it held, it ſcarce afforded a taſt of Salt, ſcarce ſurmounting that we uſually find in the like Quantity of common water.

The *Chymiſts* do generally paſs by one material Circumſtance in their *fiery Tryal*: rarely enquiring after that conſiderable part evaporated in the open fire which in our preſent *Experiment* proves much the greater proportion of the Body. There being an ounce and three drams of our two ounces evaporated, of which we have no account, I endeavoured to ſave ſome of it, (tho I concluded it impoſſible to preſerve very much) by placing a taper Chimney or Tunnel to receive the *Smoak* as the fire and a pair of Bellows raiſed it, which ſo far ſucceeded that I catched above two drams of this *fuliginous Subſtance*, and ſome drops of a water of a fetid ſaline Taſt.

To make many experiments with this *Product* it requires a greater Quantity of water then *Lithotomiſts* will eaſily furniſh us with. The ſmoak of our common fires gives us a *Sublimat*, whoſe *chymical Principles* are no leſs conſiderable than the bodys from whence they aſcend. For I lately found them not only to contain *volatile Salts*, *Oyles*, and *Phlegm* with other things, but even a *Salt* ſo near to common *Sea Salt* that it ſhot into *Cubic* Figures: much like to that we lately exhibited here in our *Analyſis* of *Urine*. But ſeeing it was then objected that that *Salt* might probably be nothing elſe but the common *culinary Salt* we conſtantly take in with our *Food*, I have ſince diſtill'd the *Urine* of *Horſes*, that were fed with Hay and Oates, and have obtained the ſame ſort of *Salt*. Both of theſe *Experiments* confirm Dr. *Grew's* diſcovery of *marine Salt* in ſeveral *Plants*: which I am apt to think was *Antecedent* there, to its expoſition in the open *Air*, for ſeveral reaſons too large to be here mention'd: having been guilty of a ſmall digreſſion already.

If we now compare this concrete with *Tartar*, we find

the one a *vegetable Salt* wholly *diſſolvable* in *water*: the other ſo ſtubborn, that ſeveral very corroſive *Menſtruums*, that will eaſily diſſolve *Iron* and *Copper* and *Silver* and almoſt any thing, will not make any Impreſſion here. The one affords a little *volatile Salt*, which is *Alcalizat*, and no *fixt Salt*. The other gives no *volatile Salt*, and a very large proportion of *fixt*. The one affords much more *earthy Subſtance* call'd *Terra Damnata* than the *Hoofes* or *Horns* of *Animals*, *&c.* and the other leaves us ſcarce any. One abounds with an *acid Salt*, which is ſenſible to the palate, and very manifeſt in the *Spirit* of *Tartar*, but in the other we could diſcover none upon the narroweſt ſearch. This leads us to the *Examen* of *Tachenius* his *Experiment*: which is this.

He puts a whole *Stone* of the *Bladder* into a Retort, and diſtils over a liquor, which he acknowledges to be *urinous*; this done; he pours back the liquor upon the body from whence it was diſtill'd, which he ſays reduces this *Caput mortuum* after a ſhort infuſion to its former ſolidity. From whence he concludes ſome *occult Acid* mixt with this *Alkali*, muſt needs cauſe the hardening ſo friable a body, which, without it, will be apt to crumble into duſt like the *Subterraneal Carkaßes* of *Rome*, that molder away upon the leaſt touch.

A great fondneſs for the *Hypotheſis*; made the *Operator* very careleſs in his Examination. For the *Caput mortuum* he ſuppoſes ſo very pulveriſable, I could never find ſo, but after *Diſtillation* it remained almoſt as hard as formerly, and this is certain that upon the Reaffuſion of the *Spirit*, it grew rather ſofter than harder. But if we reflect upon what has been ſaid and experimented before, it will prove unneceſſary to argue further againſt *Tachenius*. Hence we may infer that 'tis very dangerous to give the ſame *names* to things that are very oppoſite in their *Natures*: by this means men are very apt to be led into Errors. Thus the notion of preſuming this matter

ter *Tartareous*, has put men upon uſing *Medicines* to deſtroy *tartareous Concretions*, as well as avoid many things that ſeem to have *Tartar* in them: and yet at the ſame time perhaps it may be as inoffenſive as ſome of thoſe *Medicines* that are ſubſtituted; at leaſt, as *Spirit* of *Salt* or common *Salt* commended by *Helmont*. In like manner the notion of *Petrification* which ſeems, from whence the Stone derives its Name, may be no leſs erroneous, there being no agreement or *Analogy* in their *Natures* whether we conſider them *Synthetically* or *Analytically*. If we conſider *Stones in compoſito*, there is a particular *Weight* or *Gravity* belonging to their *Bulk* in which they *ſpecifically* agree. Several ſorts I have weigh'd according to the *Hydroſtatical Laws*, I find them agree in being twice as heavy as their Bulk of water, and about a fourth part more. This I found true in *Wood*, *Bone*, and *Shells*, when petrified, and even *water* it ſelf, and ſome other *Bodies* tho never ſo light in their former ſtate, as ſoon as they have obtained the form of *ſtone* they all become of the mention'd weight or very near it. But this which is called the *Stone* of the *Bladder* is much lighter, and ſeveral of them agree in being only as heavy as their Bulk of water and a 4*th* part more. This yields to none but the moſt *potent Acids* and particularly to *Nitrous* ones alone; the other is diſſolved by almoſt any ſlight *Corroſive*. The one in our *Analyſis* affords various conſtituent parts, and the other upon *Diſtillation* only a drop or two of inſipid water, the reſt remaining fixt. But we need not inſiſt upon the difference which is ſo obvious.

Since 'tis much eaſier to quarrel at other's *Hypotheſes* than to invent better, in order to the giving ſome account of the *Cauſe* of this *Nonnatural Concrete*, I would lay down ſome Conſiderations.

This *Concrete* may herhaps owe its *Origine* to a very ſoft and thin *fluid*, more remotely to the *chyle* ſtrained through the *Guts*, and yet nearer the matter to the *Blood* it ſelf, but

neareſt and immediatly to the *Serum* of the *Blood* which ſeems to be its proper *Vehicle*.

We ſhall be the leſs ſurprized to derive ſuch firm and ſolid *Productions* from *fluids*, when we conſider that there are particles floating in the *Blood* always diſpoſed to be converted either into *Griſtles*, or to make up the ſolid *Skull*, *Nailes*, *Bones*, *&c.* and that even the *Teeth* whoſe Texture is very firm, are made and ſupplyed out of the ſoft *fluids* of the Body.

Even ſome of theſe ſolid parts of the Body may by a *Diſeaſe* of the *Blood* be abraded and abſorbed by the common *Fluid*, and *precipitated* by their own weight upon the *Pelvis*; or elſe ſtick in the *Tubules* of the *Kidnies*, and ſo choak them up, and by degrees extend them to a *Rupture*, or grind them to pieces by a conſtant impulſe of this *gritty ſubſtance*, which may at laſt convert the greateſt part of the *Kidnies* into this firm *Concrete*.

Moreover without any reſpect had to theſe ſolid abraſions, the *Blood* it ſelf (of which the *Serum* is a great part and with which it is intimately mixt) conſiſts of *heterogeneous Particles*, of ſo various forms, ſizes and ſhapes, which ſeems neceſſary for their accommodating themſelves to all *parts*, that even theſe deſign'd to conſtitute the ſolid parts, may ſuffer ſuch irregular changes in the Body, which may unfit them to paſs the *emulgent Vein*, and ſo to continue their *Circulation*. In ſo much that the continued *Impulſe* of this matter by the *Artery* may make very conſiderable *Aggregates* or *Concretions* in the *Kidneys*.

And not only ſo but without either reſpect to *Vein* or *Artery*, the *ſerous* or watery part of the *Blood*, which we ſaid before was the *Vehicle* of the *Stone*, may have imbibed ſuch heterogeneous groſs and ponderous Particles, as may whilſt in *circulation*, fluctuate and mix well enough together, but may very eaſily ſeparate upon the leaſt *Stagnation*. Thus *Water* and *Oyl* unite only by *contact*, and

that

that by a violent Concuſſion and agitation of their parts, which as ſoon part as the force is ta' en off. The various mixtures in a *Torrent* ſeem to make up one homogeneous *Fluid*, but if ſome part of this Fluid happen to fall into a Pit, or ſtagnate in a quiet place, we ſhall find it clear it ſelf of *Sand*, *Mud* and other *differing parts*. So great a difference there is betwixt the *humors* during their motion and agitation through *Veins* and *Arteries*, and when they are in the quiet Paſſages of the *Kidneys*, or the more quiet ſtate in the *Bladder*; as there is betwixt a *Torrent* and a *Well*: the firſt may hurry along with it ſuch groſs and ponderous parts, which eaſily ſubſide in the other.

That the Nature of this Concrete ſeems rather referrable to *Bone* than to any other conſiſtent or fluid part of the Body, I concluded by comparing *chymical* Products which I only very briefly relate.

Having cleared the *Bone* of *Marrow* and *Fat* by boyling it in water, I diſtil'ed it and obtained about two drams and an half from an ounce of *Bone* of a volatile liquor impregnated with *Salt*, that ſmelt very much like that I have mention'd, which was very differing from Spirit of *Urine*; and nearer that of *Harts-horn*: I found the *caput mortuum*, as to weight, very conſonant; and alſo could extract no manner of *ſalt* from it. For which reaſon *Refiners* make their *Cupels* of *calcined Bones*, they being forced to dulcify (which they call waſhing out the *ſalts* of) other *Aſhes* before they can make *Cupels* of them. Laſt of all it herein alſo agrees with the *calculus Humanus*, vulgarly ſo termed, that few *Acids* will diſſolve it, excepting thoſe that are *nitrous*, nor do theſe work on it very vigorouſly.

Herein they muſt be al'ow'd to differ in their *ſpecific Gravity*, the Calculus not having ſo cloſe and compact a Texture as the *Bones* have. For *Bones* I have found twice as heavy as their Bulk of water.

An

An Index of ſome Experiments made in this ſhort Treatiſe.

SEveral *Stones* of the *Bladder* and *Kidnies* were diſtill'd, all afforded *volatile urinous Salts*; which *Ferment* upon any *Acids*. *Bones* were diſtill'd and found to be of agreeable *Principles*.

Petrifi'd Water affords only freſh and clear water upon diſtillation.

Calculi examined *Hydroſtatically*, were found in proportion to their Bulk of water as 5 to 4.

We weigh'd *Flint*, *Cryſtal*, *petrifi'd Water*, *Welch Diamonds*, *petrifi'd Wood* in water, and found them all very near of a *ſpecific Gravity* and almoſt as heavy again as our *calculous* matter.

We weigh'd *Bones Hydroſtatically* and found them twice as heavy as their Bulk of water.

Bones not eaſily wrought on by common *Acids*, only by *nitrous* ones and that without *Ebullition*.

Various unſuccesful attempts made to diſſolve the *Callus*, by *acid* and *Acrimonious Menſtruums*, ſome were *Vegetable* and ſome *Mineral*, as *Spirit* of *Salt*, of *Vinegar*, of *Venus*, *Oyl* of *Vitriol*, *&c.* alſo with *Alkaliſat acria*, as *Sal Fraxini* (which corrodes Glaſs) *Lapis Infernali*, but none would touch it except *nitrous*.

The Coagulation of *Spirit* of *Wine* has no place here

Expe-

Experiments to be made Relating to the Therapeutic *Part.*

TO diſcover innocent *Menſtruums* that may diſſolve the *Stone.*

To examine the Condition of the *Urine* ſometimes before a *Paroxiſm* both as to its *ſpecific Gravity* and *Contents.*

And alſo during the *Paroxiſm* to regard the painful water ſometimes tranſmitted.

To enquire into the *Nature* of *nephritic Medicines.*

To examine *Lython thripticks*, ſo as to exclude thoſe from that *Claſs* and *Character*, which have no relative Vertue that way: and to leſſen the *Catalogue* of thoſe miſtaken *ſpecifics.*

To enquire into the *Nature* of the *Hop*, which is ſo much and perhaps innocently condemned for its aptneſs to generate the *Stone.*

To explain the manner of the *Operations* of ſome *Medicines*, which tho they are not *Lython thripticks* yet may be good *Nephriticks.*