MICROGRAPHIA:

OR SOME

Physiological Descriptions

OF

MINUTE BODIES

MADE BY

MAGNIFYING GLASSES.

WITH

OBSERVATIONS and INQUIRIES thereupon.

By *R. HOOKE*, Fellow of the ROYAL SOCIETY.

Non possis oculo quantum contendere Linceus,
Non tamen idcirco contemnas Lippus inungi. Horat. Ep. lib. 1.

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Obſerv. XVII. *Of* Petrify'd wood, *and other* Petrify'd bodies.

OF this ſort of ſubſtance, I obſerv'd ſeveral pieces of very differing kinds, both for their outward ſhape, colour, grain, *texture*, hardneſs, *&c.* ſome being brown and reddiſh; others gray, like a Hone; others black, and Flint-like: ſome ſoft, like a Slate or Whetſtone, others as hard as a Flint, and as brittle. That which I more particular examin'd, was a piece about the bigneſs of a mans hand, which ſeem'd to have been a part of ſome large tree, that by rottenneſs had been broken off from it before it began to be *petrify'd*.

And indeed, all that I have yet ſeen, ſeem to have been rotten Wood before the petrifaction was begun: and not long ſince, examining and viewing a huge great *Oak*, that ſeem'd with meer age to be rotten as it ſtood, I was very much confirm'd in this opinion; for I found, that the grain, colour, and ſhape of the Wood, was exactly like this *petrify'd* ſubſtance; and with a *Microſcope*, I found, that all thoſe *Microſcopical* pores, which in ſappy or firm and ſound Wood are fill'd with the natural or innate juices of thoſe Vegetables, in this they were all empty, like thoſe of *Vegetables charr'd*; but with this difference, that they ſeem'd much larger then I have ſeen any in *Char-coals*; nay, even then thoſe of Coals made of great blocks of Timber, which are commonly call'd *Old-coals*.

The reaſon of which difference may probably be, that the charring of Vegetables, being an operation quickly perform'd, and whileſt the Wood is ſappy, the more ſolid parts may more eaſily ſhrink together, and contract the pores or *interſtitia* between them, then in the rotten Wood, where that natural juice ſeems onely to be waſh'd away by *adventitious* or unnatural moiſture; and ſo though the natural juice be waſted from between the firm parts, yet thoſe parts are kept aſunder by the *adventitious* moyſtures, and ſo by degrees ſettled in thoſe poſtures.

And this I likewiſe found in the *petrify'd* Wood, that the pores were ſomewat bigger then thoſe of *Charcoal*, each pore being neer upon half as bigg again, but they did not bear that diſproportion which is expreſt in the tenth *Scheme*, between the ſmall ſpecks or pores in the firſt Figure (which repreſenteth the pores of Coal or Wood charr'd) and the black ſpots of the ſecond Figure (which repreſent the like *Microſcopical pores* in the *petrify'd* Wood) for theſe laſt were drawn by a *Microſcope* that magnify'd the object above ſix times more in Diameter then the *Microſcope* by which thoſe pores of Coal were obſerv'd.

Now, though they were a little bigger, yet did they keep the exact figure and order of the pores of Coals and of rotten Wood, which laſt alſo were much of the ſame size.

The other Obſervations on this *petrify'd* ſubſtance, that a while ſince, by the appointment of the *Royal Society*, I made, and preſented to them an account of, were theſe that follow, which had the honour done them

by the moſt accompliſh'd Mr. *Evelin*, my highly honour'd friend, to be inſerted and publiſhed among thoſe excellent Obſervations wherewith his *Sylva* is repleniſh'd, and would therefore have been here omitted, had not the Figure of them, as they appear'd through the *Microſcope* been before that engraven.

This *Petrify'd* ſubſtance reſembled Wood, in that

Firſt, all the parts of it ſeem'd not at all *diſlocated*, or alter'd from their natural Poſition, whil'ſt they were Wood, but the whole piece retain'd the exact ſhape of Wood, having many of the conſpicuous pores of wood ſtill remaining pores, and ſhewing a manifeſt difference viſible enough between the grain of the Wood and that of the bark, eſpecially when any ſide of it was cut ſmooth and polite; for then it appear'd to have a very lovely grain, like that of ſome curious cloſe Wood.

Next (it reſembled Wood) in that all the ſmaller and (if I may ſo call thoſe which are onely viſible with a good magnifying Glaſs) *Microſcopical* pores of it appear (both when the ſubſtance is cut and poliſh'd *tranſverſly* and *parallel* to the pores of it) perfectly like the *Microſcopical* pores of ſeveral kinds of Wood, eſpecially like and equal to thoſe of ſeveral ſorts of rotten Wood which I have ſince obſerv'd, retaining both the ſhape, poſition and magnitude of ſuch pores. It was differing from Wood:

Firſt, in *weight*, being to common water as $3\frac{1}{4}$ to 1. whereas there are few of our *Engliſh* Woods, that when very dry are found to be full as heavie as water.

Secondly, in *hardneſs*, being very neer as hard as a Flint; and in ſome places of it alſo reſembling the grain of a Flint: and, like it, it would very readily cut Glaſs, and would not without difficulty, eſpecially in ſome parts of it, be ſcratch'd by a black hard Flint: It would alſo as readily ſtrike fire againſt a Steel, or againſt a Flint, as any common Flint.

Thirdly, in the *cloſeneſs* of it, for though all the *Microſcopical* pores of this *petrify'd* ſubſtance were very conſpicuous in one poſition, yet by altering that poſition of the poliſh'd ſurface to the light, it was alſo manifeſt, that thoſe pores appear'd darker then the reſt of the body, onely becauſe they were fill'd up with a more duſkie ſubſtance, and not becauſe they were hollow.

Fourthly, in its *incombuſtibleneſs*, in that it would not burn in the fire; nay, though I kept it a good while red-hot in the flame of a Lamp, made very *intenſe* by the blaſt of a ſmall Pipe, and a large Charcoal, yet it ſeem'd not at all to have diminiſh'd its extenſion; but only I found it to have chang'd its colour, and to appear of a more dark and duſkie brown colour; nor could I perceive that thoſe parts which ſeem'd to have been Wood at firſt, were any thing waſted, but the parts appear'd as ſolid and cloſe as before. It was further obſervable alſo, that as it did not conſume like Wood, ſo neither did it crack and flie like a Flint, or ſuch like hard Stone, nor was it long before it appear'd red-hot.

Fifthly, in its *diſſolubleneſs*; for putting ſome drops of diſtill'd *Vinegar* upon the Stone, I found it preſently to yield very many Bubbles, juſt like thoſe which may be obſerv'd in ſpirit of *Vinegar* when it corrodes *corals*, though

though perhaps many of thoſe ſmall Bubbles might proceed from ſome ſmall parcels of Air which were driven out of the pores of th *petrify'd* ſubſtance by the inſinuating liquid *menſtruum*.

Sixthly, in its *rigidneſs* and *friability*, being not at all flexible but brittle like a Flint, inſomuch that I could with one knock of a Hammer break off a piece of it, and with a few more, reduce that into a pretty fine powder.

Seventhly, it ſeem'd alſo very differing from Wood to the *touch*, *feeling* more cold then Wood uſually does, and much like other cloſe ſtones and Minerals.

The Reaſons of all which *Phænomena* ſeem to be,

That this *petrify'd* Wood having lain in ſome place where it was well ſoak'd with *petrifying* water (that is, ſuch a water as is well *impregnated* with ſtony and earthy particles) did by degrees ſeparate, either by ſtraining and *filtration*, or perhaps, by *precipitation*, *coheſion* or *coagulation*, abundance of ſtony particles from the permeating water, which ſtony particles, being by means of the fluid *vehicle* convey'd, not onely into the *Microſcopical* pores, and ſo perfectly ſtoping them up, but alſo into the pores or *interſtitia*, which may, perhaps, be even in the texture or *Schematiſme* of that part of the Wood, which, through the *Microſcope*, appears moſt ſolid, do thereby ſo augment the weight of the Wood, as to make it above three times heavier then water, and perhaps, ſix times as heavie as it was when Wood.

Next, they thereby ſo lock up and fetter the parts of the Wood, that the fire cannot eaſily make them flie away, but the action of the fire upon them is onely able to *Char* thoſe parts, as it were, like a piece of Wood, if it be clos'd very faſt up in Clay, and kept a good while red-hot in the fire, will by the heat of the fire be charr'd and not conſum'd, which may, perhaps, alſo be ſomewhat of the cauſe, why the *petrify'd* ſubſtance appear'd of a dark brown colour after it had been burnt.

By this *intruſion* of the *petrifying* particles, this ſubſtance alſo becomes hard and *friable*; for the ſmaller pores of the Wood being perfectly wedg'd, and ſtuft up with thoſe ſtony particles, the ſmall parts of the Wood have no places or pores into which they may ſlide upon bending, and conſequently little or no flexion or yielding at all can be caus'd in ſuch a ſubſtance.

The remaining particles likewiſe of the Wood among the ſtony particles, may keep them from cracking and flying when put into the fire, as they are very apt to do in a Flint.

Nor is Wood the onely ſubſtance that may by this kind of *tranſmutation* be chang'd into ſtone; for I my ſelf have ſeen and examin'd very many kinds of ſubſtances, and among very credible Authours, we may meet with Hiſtories of ſuch *Metamorphoſes* wrought almoſt on all kind of ſubſtances, both *Vegetable* and *Animal*, which Hiſtories, it is not my buſineſs at preſent, either to relate, or *epitomiſe*, but only to ſet down ſome Obſervation I lately made on ſeveral kind of *petrify'd* Shels, found about *Keinſham*, which lies within four or five miles of *Briſtol*, which are commonly call'd *Serpentine-ſtones*. Exami-

Examining ſeveral of theſe very curiouſly figur'd bodies (which are commonly thought to be Stones form'd by ſome extraordinary *Plaſtick virtue latent* in the Earth it ſelf) I took notice of theſe particulars:

Firſt, that theſe figured bodies, or ſtones, were of very differing ſubſtances, as to hardneſs: ſome of Clay, ſome Marle, ſome ſoft Stone, almoſt of the hardneſs of thoſe ſoft ſtones which Maſons call Fire-ſtone, others as hard as Portland ſtone, others as hard as Marble, and ſome as hard a a Flint or Cryſtal.

Next, they were of very differing ſubſtances as to tranſparency and colour; ſome white, ſome almoſt black, ſome brown, ſome Metalline, or like Marchaſites; ſome tranſparent like white Marble, others like flaw'd Cryſtal, ſome gray, ſome of divers colours; ſome radiated like theſe long *petrify'd drops*, which are commonly found at the *Peak*, and in other *ſubterraneous caverns*, which have a kind of pith in the middle.

Thirdly, that they were very different as to the manner of their outward figuration; for ſome of them ſeem'd to have been the ſubſtance that had fill'd the Shell of ſome kind of Shel-fiſh; others, to have been the ſubſtance that had contain'd or enwrapp'd one of theſe Shels, on both which, the perfect impreſſion either of the inſide or outſide of ſuch Shells ſeem'd to be left, but for the moſt part, thoſe impreſſions ſeem'd to be made by an imperfect or broken Shell, the great end or mouth of the Shell being always wanting, and oftentimes the little end, and ſometimes half, and in ſome there were impreſſions, juſt as if there had been holes broken in the figurating, imprinting or moulding Shell; ſome of them ſeem'd to be made by ſuch a Shell very much bruſed or flaw'd, inſomuch that one would verily have thought that very figur'd ſtone had been broken or bruſed whilſt a gelly, as 'twere, and ſo hardned, but within in the grain of the ſtone, there appear'd not the leaſt ſign of any ſuch bruſe or breaking, but onely on the very uttermoſt ſuperficies.

Fourthly, they were very different, as to their outward covering, ſome having the perfect Shell, both in figure, colour, and ſubſtance, ſticking on upon its ſurface, and adhering to it, but might very eaſily be ſeparated from it, and like other common *Cockle* or *Scolop-ſhels*, which ſome of them moſt accurately reſembled, were very diſſoluble in common *Vinegar*, others of them, eſpecially thoſe *Serpentine*, or *Helical ſtones* were cover'd or retained the ſhining or Pearl-colour'd ſubſtance of the inſide of a Shel, which ſubſtance, on ſome parts of them, was exceeding thin, and might very eaſily be rubbed off; on other parts it was pretty thick, and retained a white coat, or flaky ſubſtance on the top, juſt like the outſides of ſuch Shells; ſome of them had very large pieces of the Shell very plainly ſticking on to them, which were eaſily to be broken or flaked off by degrees: they likewiſe, ſome of them retain'd all along the ſurface of them very pretty kind of *futures*, ſuch as are obſerv'd in the ſkulls of ſeveral kinds of living creatures, which *futures* were moſt curiouſly ſhap'd in the manner of leaves, and every one of them in the ſame Shell, exactly one like another, which I was able to diſcover plainly enough with my naked eye, but more perfectly and diſtinctly with my *Microſcope*; all

theſe

theſe *ſutures*, by breaking ſome of theſe ſtones, I found to be the *termini*, or boundings of certain *diaphragms*, or partitions, which ſeem'd to divide the cavity of the Shell into a multitude of very proportionate and regular *cells* or *caverns*, theſe *Diaphragms*, in many of them, I found very perfect and compleat, of a very diſtinct ſubſtance from that which fill'd the cavities, and exactly of the ſame kind with that which covered the outſide, being for the moſt part whitiſh, or *mother-of-pearl* colour'd.

As for the cavities between thoſe *Diaphragms*, I found ſome of them fill'd with Marle, and others with ſeveral kinds of ſtones, others, for the moſt part hollow, onely the whole cavity was uſually covered over with a kind of *tartarous petrify'd* ſubſtance, which ſtuck about the ſides, and was there ſhot into very curious regular Figures, juſt as *Tartar*, or other diſſolv'd Salts are obſerv'd to ſtick and *cryſtallize* about the ſides of the containing Veſſels; or like thoſe little *Diamants* which I before obſerved to have covered the vaulted cavity of a Flint; others had theſe cavities all lin'd with a kind of *metalline* or *marchaſite-like* ſubſtance, which with a *Microſcope* I could as plainly ſee moſt curiouſly and regularly figured, as I had done thoſe in a Flint.

From all which, and ſeveral other particulars which I obſerv'd, I cannot but think, that all theſe, and moſt other kinds of ſtony bodies which are found thus ſtrangely figured, do owe their formation and figuration, not to any kind of *Plaſtick virtue* inherent in the earth, but to the Shells of certain Shel-fiſhes, which, either by ſome Deluge, Inundation, Earthquake, or ſome ſuch other means, came to be thrown to that place, and there to be fill'd with ſome kind of Mudd or Clay, or *petrifying* Water, or ſome other ſubſtance, which in tract of time has been ſettled together and hardned in thoſe ſhelly moulds into thoſe ſhaped ſubſtances we now find them; that the great and thin end of theſe Shells by that Earthquake, or what ever other extraordinay cauſe it was that brought them thither, was broken off; and that many others were otherwiſe broken, bruiſed and disfigured; that theſe Shells which are thus *ſpirallied* and ſeparated with *Diaphragmes*, were ſome kind of *Nautili* or *Porcelane ſhells*; and that others were ſhells of *Cockles*, *Muſcles*, *Periwincles*, *Scolops*, &c. of various ſorts; that theſe Shells in many, from the particular nature of the containing or enclos'd Earth, or ſome other cauſe, have in tract of time rotted and mouldred away, and onely left their impreſſions, both on the containing and contained ſubſtances; and ſo left them pretty looſe one within another, ſo that they may be eaſily ſeparated by a knock or two of a Hammer. That others of theſe Shells, according to the nature of the ſubſtances adjacent to them, have, by a long continuance in that poſture, been *petrify'd* and turn'd into the nature of ſtone, juſt as I even now obſerv'd ſeveral ſorts of Wood to be. That oftentimes the Shell may be found with one kind of ſubſtance within, and quite another without, having, perhaps, been fill'd in one place, and afterwards tranſlated to another, which I have very frequently obſerv'd in *Cockle*, *Muſcle*, *Periwincle*, and other ſhells, which I have found by the Sea ſide. Nay, further, that ſome parts of the ſame Shell may be fill'd in one place, and

ſome

ſome other caverns in another, and others in a third, or a fourth, or a fifth place, for ſo many differing ſubſtances have I found in one of theſe *petrify'd* Shells, and perhaps all theſe differing from the encompaſſing earth or ſtone; the means how all which varieties may be caus'd, I think, will not be difficult to conceive, to any one that has taken notice of thoſe Shells, which are commonly found on the Sea ſhore: And he that ſhall throughly examine ſeveral kinds of ſuch curiouſly form'd ſtones, will (I am very apt to think) find reaſon to ſuppoſe their generation or formation to be aſcribable to ſome ſuch accidents as I have mention'd, and not to any *Plaſtick virtue*: For it ſeems to me quite contrary to the infinite prudence of Nature, which is obſervable in all its works and productions, to deſign every thing to a determinate end, and for the attaining of that end, makes uſe of ſuch ways as are (as farr as the knowledge of man has yet been able to reach) altogether conſonant, and moſt agreeable to man's reaſon, and of no way or means that does contradict, or is contrary to humane Ratiocination; whence it has a long time been a general obſervation and *maxime*, that *Nature does nothing in vain*; It ſeems, I ſay, contrary to that great Wiſdom of Nature, that theſe prettily ſhap'd bodies ſhould have all thoſe curious Figures and contrivances (which many of them are adorn'd and contriv'd with) generated or wrought by a *Plaſtick virtue*, for no higher end, then onely to exhibite ſuch a form; which he that ſhall throughly conſider all the circumſtances of ſuch kind of Figur'd bodies, will, I think, have great reaſon to believe, though, I confeſs, one cannot preſently be able to find out what Nature's deſigns are. It were therefore very deſirable, that a good collection of ſuch kind of figur'd ſtones were collected; and as many particulars, circumſtances, and informations collected with them as could be obtained, that from ſuch a Hiſtory of Obſervations well rang'd, examin'd and digeſted, the true original or production of all thoſe kinds of ſtones might be perfectly and ſurely known; ſuch as are *Thunder-ſtones*, *Lapides Stellares*, *Lapides Judaici*, and multitudes of other, whereof mention is made in *Aldrovandus Wormius*, and other Writers of Minerals.

Obſerv. XVIII. *Of the* Schematiſme *or* Texture *of* Cork, *and of the Cells and Pores of ſome other ſuch frothy Bodies.*

I Took a good clear piece of Cork, and with a Pen-knife ſharpen'd as keen as a Razor, I cut a piece of it off, and thereby left the ſurface of it exceeding ſmooth, then examining it very diligently with a *Microſcope*, me thought I could perceive it to appear a little porous; but I could not ſo plainly diſtinguiſh them, as to be ſure that they were pores, much leſs what Figure they were of: But judging from the lightneſs and yielding quality of the Cork, that certainly the texture could not be ſo curious,

curious, but that poſſibly, if I could uſe ſome further diligence, I might find it to be diſcernable with a *Microſcope*, I with the ſame ſharp Penknife, cut off from the former ſmooth ſurface an exceeding thin piece of it, and placing it on a black object Plate, becauſe it was it ſelf a white body, and caſting the light on it with a deep *plano-convex Glaſs*, I could exceeding plainly perceive it to be all perforated and porous, much like a Honey-comb, but that the pores of it were not regular; yet it was not unlike a Honey-comb in theſe particulars.

Firſt, in that it had a very little ſolid ſubſtance, in compariſon of the empty cavity that was contain'd between, as does more manifeſtly appear by the Figure A and B of the XI. *Scheme*, for the *Interſtitia*, or walls (as I may ſo call them) or partitions of thoſe pores were neer as thin in proportion to their pores, as thoſe thin films of Wax in a Honey-comb (which encloſe and conſtitute the *ſexangular cells*) are to theirs.

Next, in that theſe pores, or cells, were not very deep, but conſiſted of a great many little Boxes, ſeparated out of one continued long pore, by certain *Diaphragms*, as is viſible by the Figure B, which repreſents a ſight of thoſe pores ſplit the long-ways.

I no ſooner diſcern'd theſe (which were indeed the firſt *microſcopical* pores I ever ſaw, and perhaps, that were ever ſeen, for I had not met with any Writer or Perſon, that had made any mention of them before this) but me thought I had with the diſcovery of them, preſently hinted to me the true and intelligible reaſon of all the *Phænomena* of Cork; As,

Firſt, if I enquir'd why it was ſo exceeding light a body? my *Microſcope* could preſently inform me that here was the ſame reaſon evident that there is found for the lightneſs of froth, an empty Honey-comb, Wool, a Spunge, a Pumice-ſtone, or the like; namely, a very ſmall quantity of a ſolid body, extended into exceeding large dimenſions.

Next, it ſeem'd nothing more difficult to give an intelligible reaſon, why Cork is a body ſo very unapt to ſuck and drink in Water, and conſequently preſerves it ſelf, floating on the top of Water, though left on it never ſo long: and why it is able to ſtop and hold air in a Bottle, though it be there very much condens'd and conſequently preſſes very ſtrongly to get a paſſage out, without ſuffering the leaſt bubble to paſs through its ſubſtance. For, as to the firſt, ſince our *Microſcope* informs us that the ſubſtance of Cork is altogether fill'd with Air, and that that Air is perfectly encloſed in little Boxes or Cells diſtinct from one another. It ſeems very plain, why neither the Water, nor any other Air can eaſily inſinuate it ſelf into them, ſince there is already within them an *intus exiſtens*, and conſequently, why the pieces of Cork become ſo good floats for Nets, and ſtopples for Viols, or other cloſe Veſſels.

And thirdly, if we enquire why Cork has ſuch a ſpringineſs and ſwelling nature when compreſs'd? and how it comes to ſuffer ſo great a compreſſion, or ſeeming penetration of dimenſions, ſo as to be made a ſubſtance as heavie again and more, bulk for bulk, as it was before compreſſion, and yet ſuffer'd to return, is found to extend it ſelf again into the ſame ſpace? Our *Microſcope* will eaſily inform us, that the whole maſs

conſiſts of an infinite company of ſmall Boxes or Bladders of Air, which is a ſubſtance of a ſpringy nature, and that will ſuffer a conſiderable condenſation (as I have ſeveral times found by divers trials, by which I have moſt evidently condens'd it into leſs then a twentieth part of its uſual dimenſions neer the Earth, and that with no other ſtrength then that of my hands without any kind of forcing Engine, ſuch as Racks, Leavers, Wheels, Pullies, or the like, but this onely by and by) and beſides, it ſeems very probable that thoſe very films or ſides of the pores, have in them a ſpringing quality, as almoſt all other kind of Vegetable ſubſtances have, ſo as to help to reſtore themſelves to their former poſition.

And could we ſo eaſily and certainly diſcover the *Schematiſme* and *Texture* even of theſe films, and of ſeveral other bodies, as we can theſe of Cork; there ſeems no probable reaſon to the contrary, but that we might as readily render the true reaſon of all their *Phænomena*; as namely, what were the cauſe of the ſpringineſs, and toughneſs of ſome, both as to their flexibility and reſtitution. What, of the friability or brittleneſs of ſome others, and the like; but till ſuch time as our *Microſcope*, or ſome other means, enable us to diſcover the true *Schematiſm* and *Texture* of all kinds of bodies, we muſt grope, as it were, in the dark, and onely gheſs at the true reaſons of things by ſimilitudes and compariſons.

But, to return to our Obſervation. I told ſeveral lines of theſe pores, and found that there were uſually about threeſcore of theſe ſmall Cells placed end-ways in the eighteenth part of an Inch in length, whence I concluded there muſt be neer eleven hundred of them, or ſomewhat more then a thouſand in the length of an Inch, and therefore in a ſquare Inch above a Million, or 1166400. and in a Cubick Inch, above twelve hundred Millions, or 12597 12000. a thing almoſt incredible, did not our *Microſcope* aſſure us of it by ocular demonſtration; nay, did it not diſcover to us the pores of a body, which were they *diaphragm'd*, like thoſe of Cork, would afford us in one Cubick Inch, more then ten times as many little Cells, as is evident in ſeveral charr'd Vegetables; ſo prodigiouſly curious are the works of Nature, that even theſe conſpicuous pores of bodies, which ſeem to be the channels or pipes through which the *Succus nutritius*, or natural juices of Vegetables are convey'd, and ſeem to correſpond to the veins, arteries and other Veſſels in ſenſible creatures, that theſe pores I ſay, which ſeem to be the Veſſels of nutrition to the vaſteſt body in the World, are yet ſo exceeding ſmall, that the *Atoms* which *Epicurus* fancy'd would go neer to prove too bigg to enter them, much more to conſtitute a fluid body in them. And how infinitely ſmaller then muſt be the Veſſels of a Mite, or the pores of one of thoſe little Vegetables I have diſcovered to grow on the back-ſide of a Roſe-leaf, and ſhall anon more fully deſcribe, whoſe bulk is many millions of times leſs then the bulk of the ſmall ſhrub it grows on; and even that ſhrub, many millions of times leſs in bulk then ſeveral trees (that have heretofore grown in *England*, and are this day flouriſhing in other hotter Climates, as we are very credibly inform'd) if at leaſt the pores of this ſmall Vegetable ſhould keep any ſuch proportion to the body of it, as we have found theſe pores

of

Schem: XI.

Fig: 1.

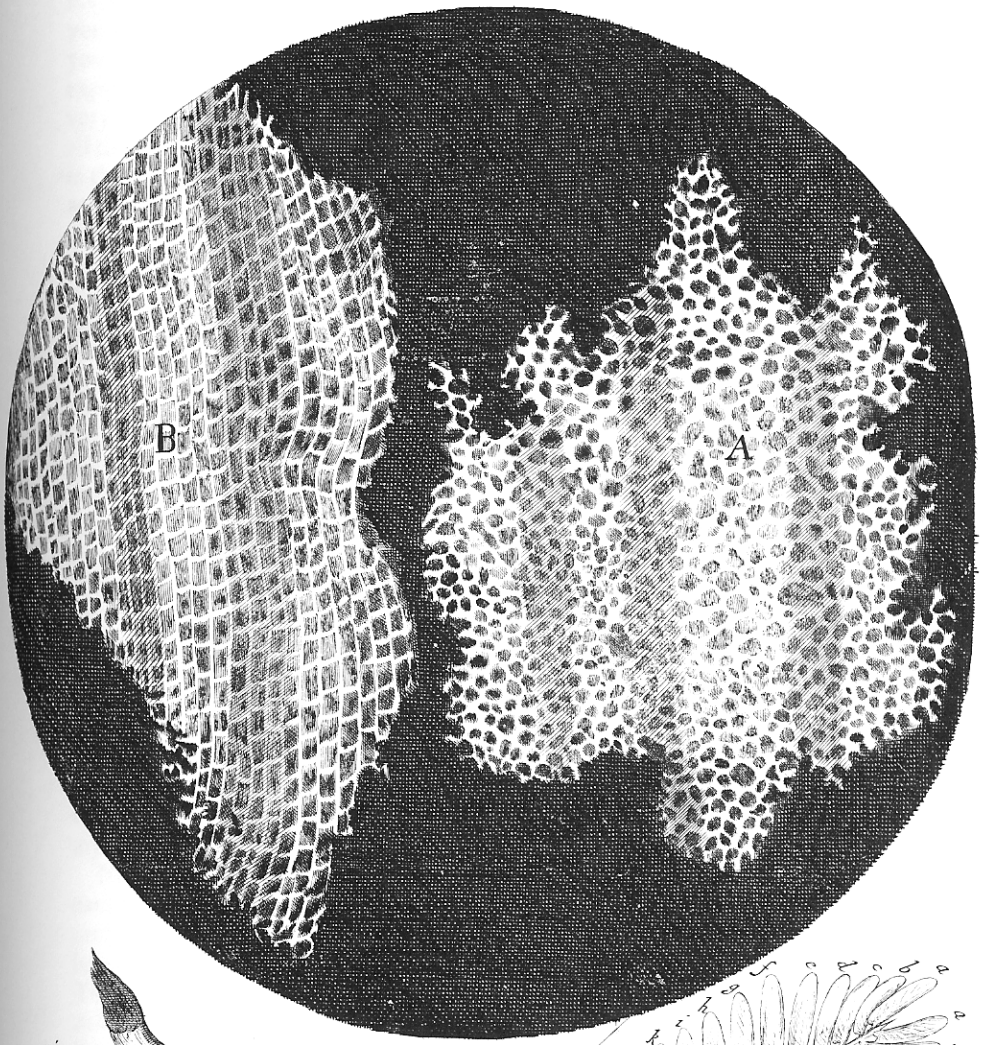
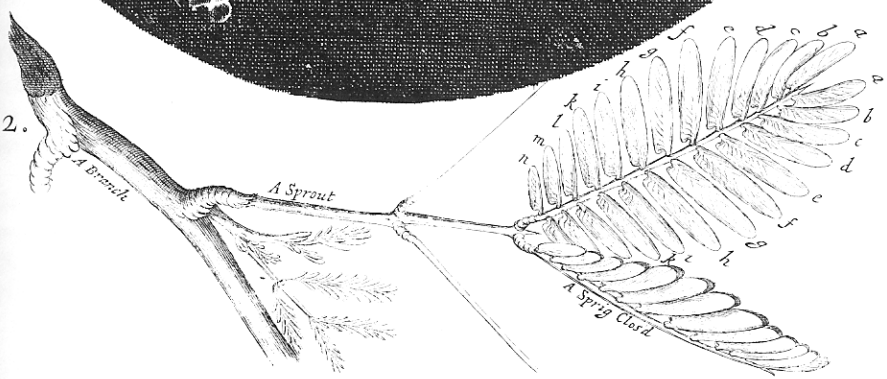


Fig: 2.



of other Vegetables to do to their bulk. But of theſe pores I have ſaid more elſewhere.

To proceed then, Cork ſeems to be by the tranſverſe conſtitution of the pores, a kind of *Fungus* or Muſhrome, for the pores lie like ſo many Rays tending from the center, or pith of the tree, outwards; ſo that if you cut off a piece from a board of Cork tranſverſly, to the flat of it, you will, as it were, ſplit the pores, and they will appear juſt as they are expreſs'd in the Figure B of the XI. *Scheme*. But if you ſhave off a very thin piece from this board, parallel to the plain of it, you will cut all the pores tranſverſly, and they will appear almoſt as they are expreſs'd in the Figure A, ſave onely the ſolid *Interſtitia* will not appear ſo thick as they are there repreſented.

So that Cork ſeems to ſuck its nouriſhment from the ſubjacent bark of the Tree immediately, and to be a kind of excreſcence, or a ſubſtance diſtinct from the ſubſtances of the entire Tree, ſomething *analogus* to the Muſhrome, or Moſs on other Trees, or to the hairs on Animals. And having enquir'd into the Hiſtory of Cork, I find it reckoned as an excreſcency of the bark of a certain Tree, which is diſtinct from the two barks that lie within it, which are common alſo to other trees; That 'tis ſome time before the Cork that covers the young and tender ſprouts comes to be diſcernable; That it cracks, flaws, and cleaves into many great chaps, the bark underneath remaining entire; That it may be ſeparated and remov'd from the Tree, and yet the two under-barks (ſuch as are alſo common to that with other Trees) not at all injur'd, but rather helped and freed from an external injury. Thus *Jonſtonus* in *Dendrologia*, ſpeaking *de Subere*, ſays, *Arbor eſt procera, Lignum eſt robuſtum, dempto cortice in aquis non fluitat, Cortice in orbem detracto juvatur, craſceſcens enim præſtringit & ſtrangulat, intra triennium iterum repletur: Caudex ubi adoleſcit craſſus, cortex ſuperior denſus carnoſus, duos digitos craſſus, ſcaber, rimoſus, & qui niſi detrahatur debiſcit, alioque ſubnaſcente expellitur, interior qui ſubeſt novellus ita rubet ut arbor minio picta videatur.* Which Hiſtories, if well conſider'd, and the tree, ſubſtance, and manner of growing, if well examin'd, would, I am very apt to believe, much confirm this my conjecture about the origination of Cork.

Nor is this kind of Texture peculiar to Cork onely; for upon examination with my *Microſcope*, I have found that the pith of an Elder, or almoſt any other Tree, the inner pulp or pith of the Cany hollow ſtalks of ſeveral other Vegetables: as of Fennel, Carrets, Daucus, Bur-docks, Teaſels, Fearn, ſome kinds of Reeds, *&c.* have much ſuch a kind of *Schematiſme*, as I have lately ſhewn that of Cork, ſave onely that here the pores are rang'd the long-ways, or the ſame ways with the length of the Cane, whereas in Cork they are tranſverſe.

The pith alſo that fills that part of the ſtalk of a Feather that is above the Quil, has much ſuch a kind of texture, ſave onely that which way ſoever I ſet this light ſubſtance, the pores ſeem'd to be cut tranſverſly; ſo that I gheſs this pith which fills the Feather, not to conſiſt of abundance of long pores ſeparated with Diaphragms, as Cork does, but to be a kind

of ſolid or hardned froth, or a *congeries* of very ſmall bubbles conſolidated in that form into a pretty ſtiff as well as tough concrete, and that each Cavern, Bubble, or Cell, is diſtinctly ſeparate from any of the reſt, without any kind of hole in the encompaſſing films, ſo that I could no more blow through a piece of this kinde of ſubſtance, then I could through a piece of Cork, or the ſound pith of an Elder.

But though I could not with my *Microſcope*, nor with my breath, nor any other way I have yet try'd, diſcover a paſſage out of one of thoſe cavities into another, yet I cannot thence conclude, that therefore there are none ſuch, by which the *Succus nutritius*, or appropriate juices of Vegetables, may paſs through them; for, in ſeveral of thoſe Vegetables, whil'ſt green, I have with my *Microſcope*, plainly enough diſcover'd theſe Cells or Poles fill'd with juices, and by degrees ſweating them out: as I have alſo obſerved in green Wood all thoſe long *Microſcopical* pores which appear in Charcoal perfectly empty of any thing but Air.

Now, though I have with great diligence endeavoured to find whether there be any ſuch thing in thoſe *Microſcopical* pores of Wood or Piths, as the *Valves* in the heart, veins, and other paſſages of Animals, that open and give paſſage to the contain'd fluid juices one way, and ſhut themſelves, and impede the paſſage of ſuch liquors back again, yet have I not hitherto been able to ſay any thing poſitive in it; though, me thinks, it ſeems very probable, that Nature has in theſe paſſages, as well as in thoſe of Animal bodies, very many appropriated Inſtruments and contrivances, whereby to bring her deſigns and end to paſs, which 'tis not improbable, but that ſome diligent Obſerver, if help'd with better *Microſcopes*, may in time detect.

And that this may be ſo, ſeems with great probability to be argued from the ſtrange *Phænomena* of ſenſitive Plants, wherein Nature ſeems to perform ſeveral Animal actions with the ſame *Schematiſm* or *Organization* that is common to all Vegetables, as may appear by ſome no leſs inſtructive then curious Obſervations that were made by divers Eminent Members of the *Royal Society* on ſome of theſe kind of Plants, whereof an account was delivered in to them by the moſt Ingenious and Excellent *Phyſician*, Doctor *Clark*, which, having that liberty granted me by that moſt Illuſtrious Society, I have hereunto adjoyn'd.

Obſervations on the Humble *and* Senſible Plants *in* Mr. Chiffin's *Garden in Saint* James's *Park, made* Auguſt *the* 9th, 1661. *Preſent, the* Lord *Brouncker*, Sr. *Robert Moray*, Dr. *Wilkins*, Mr. *Evelin*, Dr. *Henſhaw, and* Dr. *Clark*.

There are four Plants, two of which are little ſhrub Plants, with a little ſhort ſtock, about an Inch above the ground, from whence are ſpread ſeveral ſticky branches, round, ſtreight, and ſmooth.