



Philosophical Transactions

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II. *An Account of the Honourable Robert Boyle's way of examining Waters as to Freshness and Saltness.*

To be Subjoyn'd as an Appendix to his lately Printed Letter about Sweetned Sea-Water, Octob. 30. 1683.

HAVING, since the Publication of the foregoing Letter, been commanded by the King, to show His Majesty an Experiment of the way herein mention'd, to examine the Freshness and Saltness of Waters; I did in His Presence, (and that of his Royal Highness, his Grace the Duke of *Grafton*, and several Persons of Quality) make tryal of it, both upon some Water prepar'd according to the Patentees way, and upon two or three Natural Waters, that were order'd to be brought. In all which Tryals, (in some whereof his Majesty, for greater certainty, was pleas'd to employ His own Hands) the Success was such, as mov'd him to vouchsafe the Experiment the Honour of his special Approbation, and to give me an encouraging Permission to communicate it, as a thing that may prove not unuseful to the Publick. This I think fit to mention, not only to procure to my way of trying Waters, the high Advantage of a Royal, and, (on Philosophical Accounts) Illustrious Patronage; but that, if this Method be found as beneficial as I wish it may, Men may know to whom they ought to acknowledge the early Publication of it. This is all my Hast allows me to premise, to the Account I am going to deliver, of the way of trying Waters hitherto spoken of: which Account I shall set down, as I drew it up to be dispatch'd to a Friend *, in case I should have his Majesty's permission to impart it to him.

I.

N.B. This Paper was deposited with the Secretaries of the Royal Society, *An. 1683.* sealed up and opened since the Authors Death.

* Which should have been to the worthy Doctor *John Beal*, to whom the Letter this Paper refers to was written; but to the Authors Grief, and the great loss of the Commonwealth of Learning, he died before this Paper was written.

H

My

II. My way of examining the Freshness and Saltness of Waters, *tho'* (because it is wont to be surprizing the first time one sees it try'd, and has had the luck to be much talk'd of in many good Companies) 'tis thought to be an Invention very difficult, to be either found out or practis'd, is *yet* really no such mysterious thing as Men imagine it. And for my part, I hope it will be found much more considerable for its use, than I think it is for the degree of Skill and Sagacity, that was necessary to devise it. For when I remembred and consider'd, that (as I have found by various Trials) divers Metalline, and other Mineral Solutions could be readily precipitated, not only by the Spirit of Salt, but by crude Salt, whether dry or dissolv'd in Water, 'twas no very difficult matter for me to think, that by a heedful application of the Precipitating Quality of common Salt, one might discover whether any Particles of it, (at least in a number any way considerable) lay conceal'd in a distill'd Water, or any other propos'd to be examin'd.

III. To find whether I was not mistaken in this Conjecture, as also because it is very convenient to be as little as one can confin'd to one Material, I employ'd several Drugs, and those not all prepar'd by one *Menstruum*, to make the intended Discovery. And, tho' two or three of my other Trials had Successes, that I dislike'd not when I made them, yet that which at length I pitch'd upon as the most certain, and which therefore I meant, when I had the Honour to be sent for by his Majesty about the Patentees Water, was that which I think may be best understood, as well as recommended, by this short Narrative.

IV. I took some common Water distill'd in Glass Vessels, that it might leave its Corporeal Salt, if it had any, behind it, and put into a Thousand Grains of it, one Grain of dry common Salt: Into a convenient quantity, for Example, two or three Spoonfuls, of this thus impregnated

nated Liquor, I let fall a fit proportion, for instance Four or Five drops, of a *very strong* and well filtrated Solution of well-refined Silver, dissolv'd in clean *Aqua Fortis*; [for a shift, common or Sterling Silver will serve the turn:] And I made the Experiment succeed with Spirit of Nitre, instead of *Aqua fortis*, upon which there immediately appear'd a whitish Cloud, which tho' but slowly, descended to the bottom, and settled there in a white Precipitate.

N. B.

This Experiment having been several times, for the main of it, reiterated with Success, I thought fit to keep constant to the way of Probation I made use of in it, (and which Trials had recommended to me for between 20 and 30 Years) tho' (by reason of some things that *Hast* forbids me to mention) I pitch'd upon this way without at all denying, that Men of Sagacity, especially if well vers'd in Chymical Operations, may upon the same ground that I went upon, find some other and cheaper ways, tho' scarce any more nice and certain, of compassing the same end.

V.

After what has been hitherto said, I presume I may seasonably proceed, to subjoyn the four ensuing Advertisements.

VI.

And *First*, I shall give notice, that, to make the Experiment rather severely, than at all favourably, there was usually taken somewhat more than a thousand parts of Water to one of Salt.

Next, I observ'd, that having let fall a few drops of our Metalline Solution, into the Liquor obtain'd from Sea water by the Patentees way of Sweetning it, there did not presently ensue any white Cloud or precipitate, much less such an one as had been newly afforded by the Water, that was impregnated with less than a thousandth part of Salt. And if after some time there *happen'd* to appear (for 'tis not absolute necessary it should) a little Cloudiness in this Factitious Liquor, it was both slower produced,

VII.

* VIII. And perhaps It may be proper, that I here observe (what is not wont to be taken notice of) That divers Solutions of Mineral Bodies may be Precipitated by *Dilution*; that is, (to explain this Expression) when the Solution has time enough allow'd to diffuse it self, through a great quantity of Water, the Saline Parts are thereby so diluted and weakened, that they are no longer able to sustain the Mineral Corpuscles, they kept swimming before, but make with them, and the Water, a confus'd and subsiding Mixture, usually of a whitish colour. This may appear when the Butter of Antimony, being put into common Water, is thereby quickly and plentifully precipitated in the form of that white Powder, that Chymists (not over-de'ervedly) call *Mercurius Vitæ*. To which I may add, that I have also produc'd a Powder of that colour, by pouring into common Water a strong Solution of Tin Glass made in *Aqua Fortis*. And by the same way we have precipitated the Tincture for Solutions of the finer Parts) of Jalap, Benjamin, true Labdanum, Antimonial Sulphur, and divers other Bodies made in Vinous Spirits. If it were not for this Power, that Water has to weaken most Solutions of Bodies, I could have employ'd instead of that Silver, either Quick-silver dissolv'd in *Aqua fortis*, or Lead crude or calcin'd, in the same Liquor, or (which is more convenient) in strong Spirit of Vinegar; since these, and some others, are found to be precipitable by Salt Water into whitish Powders. But *tho'* a very heedful Observer may for a Shift, make use of these Metalline Solutions, to guess at the Quality of Water, as to Freshness and Saltness; yet the Precipitation that is made by *Dilution*, is not difficult to be distinguish'd, from that which is perform'd by a true and proper *Precipitant*, (as in our case by the common Salt, that is harbour'd in the Pores of the Water) both by the *quickness* of the Eff. & the *copiousness* of the white Substance produc'd, and on both those accounts is very much inferiour to it; as may evidently appear in the very different Effects that our Solution of

— had upon the Parentees Water, or upon well distill'd common Water, compar'd with those it had upon Water impregnated with a

thousandth part of Silk, and upon divers common undistilled Waters. This Advertisement I have plac'd in the Margent, as not thinking it fit either to omit it, or by inserting it in the Body of the Writing, to give too great an Interruption to the Series of my Discourse.

duc'd, and much less, than that which appear'd in the impregnated Water *.

IX. Thirdly, The Usefulness of this Experiment is not to be estimated only by the *Examen* it helps us to make of dulcify'd Sea-water, but much more by the Estimate, that by its means may be made of natural Fresh Waters, whether of Springs, Rivers, Clouds, Lakes, Wells, &c. For it being generally granted, that those Waters, *cæteris paribus*, are the best, as well for the Wholsomeness, as divers Oeconomical Uses, as Washing, Brewing, &c. that are free from Saltness, which is an adventitious, and in most cases, a hurtful Quality in Waters; by our way of examining these Liquors, a heedful Eye may in a trice discover, whether there be any latent Saltness in them, (as most Waters imbibe from the Soil they have travell'd, or do stagnate in) and may enable one, especially by the help of a little Practice, to give a near guess, how much one Water is fresher than another, as I have purposely try'd with

pleasure in differing Waters, that were ordinarily drunk, even by considerable Persons. And if once you have attentively mark'd, what change Four or Five drops, for instance, of our discovering Liquor, will make in two or three, or some other small determinate number of Spoonfuls, (or rather of half Ounces) of Water; 'twill not be difficult for a heedful Observer, keeping the same proportion between the two Liquors, to make a near Estimate, *whether* any Natural Water propos'd to him, have a greater, an equal, or a lesser degree of Freshness or Saltiness, than that Water that he has chosen for his Standard; and *how much*, in case there be a difference, the propos'd Liquor is less or more free from Saltiness than the other.

And that (to add this upon the by) such a difference in a Liquor of such frequent inward Use as Water (which is the *Basis* of Beer, Ale, Mead, and some other common Drinks) may have considerable Effects upon Humane Bodies in reference to Health, may be probably argued from the differing Effects that Waters more or less impregnated with Salt, have upon divers other Bodies. Since most Pump-Waters, for instance, will not boil Peas and Beef, and some other Aliments, near so well as Spring Water or Rain Water; which are usually softer, and more free from the Saltiness we speak of. 'Tis commonly known to Barbers and Laundresses, that the same Pump-Water will not so well and uniformly, or without little Curdlings, dissolve Wash-balls and Soap, as Rain-Water, and some running Waters usually will: Nay, when I was curious of tempering Steel, I remember 'twas confess'd by the skillfullest Artists I made use of, that some Tools, (as Gravers, &c.) made of that hardest of Metals, would receive a differing Temper if they were quench'd in Pump Water, from that which the like Extinction in Spring Water, or River Water, would give them. But how to make our Estimate of the Freshness or Saltiness of Water come *nearest* the Truth, is a Problem,

X.

Problem, of which I have now neither time nor conveniency enough to deliver my Thoughts. And by what has been said, I hope it does already seem sufficiently probable, that the way above propos'd may prove of good use, both to Navigators, that are often necessitated to Water in unknown places. and to others that only, or frequently drink that Liquor, without having any better way than the Taste, (which is but an incompetent one) to estimate its Freshness and Saltness by*.

* XI. I might add on this occasion, That, whereas Experience has inform'd several Persons who have consult'd it, that divers Medecinal Waters, that are presum'd to owe their Vertues to the participation either of Metalline, or of other Mineral Bodies, do upon trial appear to leave sometimes little, and sometimes nothing behind them, except a kind of common Salt; our Precipitant may much assist Men to discover, *whether* a mineral Water propos'd to be examin'd, do, or do not contain, such a Salt; and if it do, *whether* it contain it copiously or no. This I have try'd upon more than one of our English mineral Waters, and thereby found in a trice, that one that is reputed of another nature, contain'd pretty store of Saline matter; and that another (which is still, for ought I have learn'd, of an unexamin'd and unknown Nature) is impregnated with a surprizing Plenty of Salcish Substance. But how and with what Cautions, our Precipitant may be the most usefully employ'd, about the Examen of medicinal and other mineral Waters, belongs not to this place, (but to || another Paper.) Upon which account I forbear to declare the use I have sometimes made of our Precipitant, in examining the fresh Urine of Men, the *Serum* of Humane Blood, and other Bodies belonging to what the Chymists call the *Animal Kingdom*.

|| *About the Examen of Mineral Waters.*

Salt, being disperfed through two thousand, and another time

XII. Fourthly, (and Lastly) tho' both in my Letter to Dr. *I. B.* and in this present Postscript, I did not for certain Reasons ascribe to our Method of examining Waters, a greater Nicety than to be able to discover one part of Salt in a thousand of Water, that Proportion being great enough to recommend it, and express'd by a round number easie to be retain'd in ones Memory: Yet I would not have it thought but that, if it were requisite, our Method may make more nice Discoveries. For, having sometimes for Curiosities sake, put one Grain of Salt into no less than Fifteen Hundred of distilled Water, we could manifestly, (tho' not quite so conspicuously as before) make it appear by our way, that even this so lightly impregnated Liquor was not devoid of Salt, but had more of that in it, than some of the Patentees Water that I kept by me had; nay, I once found, that a Grain of dry

time that being dissolved in three Thousand times its Weight of the same kind of Liquor, so inconsiderable a proportion of Salt was plainly discoverable by our Precipitant.

But here Philosophical Candour forbids me to conceal an Objection that I made to my self, though it be the chief, if not the only considerable Scruple that occur'd to me, about our way of examining Waters. For I foresaw that it may be objected, that, whereas the Experiments hitherto mentioned have been try'd only upon Waters impregnated with gross or corporeal Sea-Salt, this perhaps may not hinder, but that they may be imbued with the Spirits of Marine Salt, which by reason of their activity, may be as unhealthful to the Drinker, as the grosser Salt it self. But tho' to this Surmise I might answer, that a very small Proportion of Spirit of Salt, may in many cases make the Water season'd with it, rather Medicinal than unwholsom; yet I shall answer more directly to the Objection, by saying, that to manifest it's not being well grounded, I took above a thousand Grains of distill'd Water, and, instead of corporeal Salt, put to it one single drop of *moderately strong* Spirit of Salt, (for I had *much stronger* by me, that I purposely declin'd to employ) and having shak'd it into the Water, I let fall into a Portion of this unequally compos'd Mixture, some drops of our Solution of Silver, which presently began to precipitate in a whitish Form; insomuch that, for ought appear'd to the Eye, this Trial succeeded better, than if the Water had been impregnated with but a thousandth part of Corporeal Salt. The like Experiment was made with the Patentees Water instead of the other. And to pursue this Trial a great way further, I had the Curiosity to diffuse one drop of Spirit of Salt into two thousand Grains of distill'd Rain Water; and upon letting fall some drops of our Precipitant into it, I found that the Success well answer'd my Expectation. And then,

to urge the Trial yet further, I added as much of the same distill'd Rain Water, as by a modest Conjecture made it amount to at least half as much more. So that one Grain of Spirit of Salt had a manifest Operation, tho' not quite so conspicuous as the former, upon above three thousand Grains of Water, whose Immunity from common Salt we try'd apart;) and possibly, if the Vial could have contain'd more, and would not have been, when fill'd, too heavy for our tender Ballance, the Discolouration of the Mixture would have been discernable, tho' but one Grain of Spirit of Salt had been put upon Four, or even Five Thousand Grains of Water. And that a drop of the Saline Spirit we made use of, did not equal in weight a grain of dry Salt; I found by this, that having let fall into a counterpois'd piece of Glass, ten drops of that Spirit, I found them to want near half a Grain of nine Grains weight; which way of estimating I chose, as less subject to any considerable Error, than that of weighing a single Drop by it self.

XIV.

The like Trial I made by substituting above a thousand Grains of Rain Water, in the room of the like quantity of distill'd Water. And these two Experiments I the rather mention, because they do not only show how free the Patentees Water was from Spiritous, as well as from Corporal Sea-Salt; but also manifest that, whereas it is the Opinion of some Sea-men, and of a Person, for whom I have a profound respect, that Water ought to have a little saltishness to preserve it; if this be really a desirable Quality in our Artificial Water, it may in a trice be supply'd with as much Saltness, whether Corporal or Spirituous, as shall be requir'd, and consequently as will bring it to be equal in that quality to the common Water of Rivers, or of Springs. And perhaps 'twill not be impertinent to add on this occasion, that in some places, especially lying in hot Climates, it may sometimes be of good use to know, whether on the ac-
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count of the Sun's Heat, or that of the Subterranean Regions of the Earth, the Rain-Water is impregnated with Volatile (not Acid) Spirits, like those that are distill'd from Urine, and which I have for Curiosities sake, obtain'd from a Mineral Body, native Sal-armoniac ; upon which account I made a Trial, that inform'd me, that if Five or Six drops of strong Spirit of Urine (whose drops I observ'd to be but small) were shaken into a thousand Grains at least of distill'd or Rain Water, impregnated with but one of Salt, our Precipitant would make a Discovery of some Saltiness in the Liquor. And it were neither to be admir'd nor censur'd, if the Patentees Water should sometimes show a Change, when our Precipitant is plentifully put or long kept in it, especially that Change being a more light one, than that I came from speaking of. Since, for ought I have yet observed, not only such undistill'd Waters as are generally allow'd to be freely potable, but even those that Nature her self distils, are not always quite devoid of Saltness. For I have found Rain-Water that I caus'd to be carefully sav'd, after the House-tops had newly been well wash'd with former Rain, to grow a little troubled, if any store of our Precipitant were kept for some competent time in it. And being gently distill'd off, it left a residue, which with a little of our Solution afforded a far more suddenly made and copious Precipitate, than had been produc'd with the like quality even of Pump-Water it self. And, *tho'* I have met with Rain-Water that was more free from Salt than any Spring or River-water that I remember, I have examin'd; yet, having for Curiosities sake made Trial of Snow-Water, (which if the Weather had been somewhat milder, would have been Rain) this Liquor, I say, which is thought to afford the lightest Water of all natural ones, I manifestly found by our way of examining it, not to be devoid of Saltness.

XV.

But to return to the Trial we made with the Spirit of Salt, these Experiments may not a little confirm the Freshness of the Patentees Water. And whereas some have either really suspected, or invidiously pretended, that even a moderate Action of the Fire upon Water, will make it brackish and putrifie : As I see no substantial grounds of this Surmise, so it appears by the foregoing Trials, that really the Patentees Water is not brackish, but is more free from Saltness, than most of the Waters Men do without scruple drink : And if it were true, that this Water should not keep quite so long as others, yet that were no more than is objected (how truly I now enquire not) to the Generality of distill'd Waters : And that this we speak of, may keep sweet longer than is necessary in a Ship, that can from time to time, within a few days supply it self with fresh out of the Sea, may be gather'd from these two things. The *First* is, That to satisfy my self, whether closeness would make the prepar'd Water soon putrefy, (as seem'd obvious to be surmis'd) or at least afford Dregs, I caus'd a Pint, or a Pound of it, to be hermetically sealed in a Vial, whereof I left by guess about a third part empty, and having above six Weeks after held this Vessel against the Light, I found the Water to be clear and limpid ; tho' I did not judg it had deposited so much as the tenth part of a Grain of Feculency. And having open'd the Seal, and taken out a little of the Liquor, I did not find it alter'd, either as to Smell or Taste. The *Second* of the two things that were to be mention'd, is, That I have kept the Bottle of prepar'd Water mentioned in my Letter to Dr. *Beal*, in the same unstopt Vessel ever since *March*, that is so long, that 'tis now near eight Months old, and yet it continues sweet and well condition'd. And, if that which is called Crudity in Water does consist, (as probably it often times does) in certain gross Particles that are mingled with the purely aqueous ones, it is likely,

likely, that the Action of the Fire may divide and dissipate theſe into Minuter Particles, and thereby deſtroy the Texture that makes them hurtful; and by cauſing innumerable tumblings and rovings among the more earthy Particles, give them opportunity to make little Coalitions, whoſe weight precipitating them to the bottom, frees the pure Water from them.

And becauſe 'tis but too probable, that the unwholſomneſs of divers Waters proceed, not only, or perhaps not ſo much, from bare Crudity, as from a great quantity of groſſer Particles, that are not eaſie to be rais'd, becauſe of their being combin'd with fixt and earthy ones, that ſwim up and down in the Water they impregnate, as Silver or Mercury does in a Solution made with *Aqua fortis*, or rather as the Particles of Salt do in Pump-water, and many other common Waters: On this account I ſay, the Patentees Invention may very much correct ſuch Waters, ſince by their way of ſweetning thoſe Liquors, the truly Aqueous Parts are not only freed from the Saline ones, but from the Mineral, and other groſs and hurtful Corpuſcles that may have lain conceal'd in the Liquor. As may be argued from hence, that having purpoſely in the gentle Fire of a digeſtive Furnace, ſlowly diſtill'd off a Pound of the Patentees Water, it left us in the Cucurbit ſo light and thin a Feculency, that the bottom of the Glaſs ſeem'd to be rather fullied than cover'd by it; and I did not judge that the whole Feculency, if we could have got it out, would have amounted to ſo much as two Grains.

But to return, after this ſhort, and I hope not impertinent Digreſſion, to what I was lately ſaying, of the Virtue of the Fire, to correct the Crudity of Waters; I ſhall proceed, and ſay, that perhaps 'twas upon ſome ſuch Reaſons, (to which others might be added, if I could in few Words confirm Paradoxical ones) that the laſt Great Duke of *Tuſcany* when he drank Water, (for it was not,

XVI.

XVII.

as I perceive some have misunderstood, his only Drink) prefer'd for wholsomness that which was distill'd to that which was not ; and if herein that Learned Prince, and those of the same Opinion, were not mistaken, it will highly recommend the usefulness of the Patentees Invention to Mankind: For I shall on this occasion observe, that there are multitudes of Waters that are not considerably brackish to the Taste, that yet, by reason of some unheeded Saltness, as in most Pump-waters, are more frequently, by reason of Crudity, are not only unfit, or (at best) less fit, for divers Oeconomical Uses, as Washing, Boyling of some Meats, &c. but are very unwholsome; sometime to a degree, that makes them mischievous to whole Communities, and perhaps Nations. Of this 'twere to be wish'd, that it were harder to give Instances. I remember I have seen a notable one, in those high and unsightly Tumors about the Throat, which are observ'd by Travellers to be exceeding common, among those that inhabit the lower Tracts of Ground that lie between the *Rhætian*, *Helvetian*, and some other neighbouring Mountains; which monstrous Swellings are generally imputed to the Snow Waters that flow from the Mountains, and make the usual Drink of the meaner sort of People; whence 'tis observ'd, that Persons of better condition, who drink Wine more than Water, are either not at all, or far less troubled with these disfiguring *Goitres*, (as they call them.) But much more notable instances to our present purpose are afforded me by that Great, (and yet living) Traveller *Monsieur Tavernier* (Baron of *Aubonne*) who speaking of a Nation of *Cafres* or *Negroes*, that comes sometimes to trade with the *Portuguez* from a remote part of *Africk*, informs us, *That the Water of their Country is very bad, which is* (says he) *the reason that their Thighs do swell, and it is a wonder to see any one of them free.* Nay, which is far more, where he speaks of the *African* Kingdom

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or Empire) of *Monomotapa*, he has this memorable Passage, *The Natives never live long, by reason of the badness of the Waters in the Country. For at the Age of Twenty Five they begin to be Dropsical, so that 'tis a great wonder if any among them live above Forty Years.*

What *Monsieur Tavernier* delivers being taken for granted, it seems very probable, that these People may be much reliev'd, and be brought to live as long as other Nations, if they had so compendious a way as that of the Patentees, to provide themselves plentifully with Waters, whose Crudity is corrected, its grosser and heavier parts separated, and its brackishness destroy'd by the Fire, as its Action is regulated and help'd by their Invention.

XVIII.

The Experiment mention'd in this Paper was try'd at a meeting of the *Royal Society*, Feb. 17. 169 $\frac{1}{2}$. by Dr. *Slone*, with a Success answerable to the Assertions of the *Honourable Author*, and that a drop or two of Spirit of Salt mixed with common Water, would be by the same Method discovered.

At another meeting of the said Society on the 2d of *March* following, Dr. *Hooke* read a Lecture concerning another Method of his own for the discovering the smallest quantity of Salt contained in Water, from a Principle of *Hydrostaticks*; and after his Discourse thereof, he produc'd the *Apparatus* which he had prepared to exhibit the same before the Persons then present; and it was there shewn, that the Instrument he apply'd to that Scrutiny did very evidently discover the Mixture of a 2000th part of Salt added to common Water, and would easily have detected half that quantity of Salt added to an equal quantity of Water, as was judged by those that observed the Success thereof.

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The Method of doing which Operation was by means of a large Poise of Glafs, somewhat of the shape of a Bolt-head, the Ball of which was about 3 Inches Diameter, but the Stem or Neck thereof was not above half a Line, or a twenty fourth part of an Inch; this was so poised by Red Lead put into it, as to make it but a little heavier than fair, or fresh Water. Then this Poise was suspended by the small Stem to the end of a slender Beam, which was very tender, and being not over-charged with weight, would turn with a small part of a Grain. This Beam was hung on a steady Frame, and the Poise hanging at one end of the same, cover'd with the Water to a certain Mark or Division made on the small Neck, it was so counterpoised by some small Weights put into the opposite Scale of the Ballance. Then (the weight of the Water contained in the Cistern or Vessel into which the Poise was immersed being first known) a 2000th part of it's weight was taken of common Salt weighed out, and put into the whole 2000 parts of the Water, which by being stirred soon dissolved. Then the Poise suspended as before, was viewed and examined by many then present, and they manifestly saw that near half an inch more of the Neck emerged out of the Water so seasoned, than did before the 2000th part of Salt was dissolved therein. This was only one use of this Method of discovering very small Alterations in the Constitutions of Bodies, the same Author having long since, namely, *October 25. 1677.* shewn to the same Society a Method of discovering divers Alterations much more curious, namely, to the 176000th part of it's weight.

This Description will be more easily apprehended by the first Figure, where *A* signifies the Beam, *B* the Ball of the Poise, *CC* the Neck, *D* the Mark to which it sunk
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in Fresh Water, *E E* the Cistern or Vessel containing the Water, *F* the Scale wherein the Weights to counterpoise it were put.

III. *Three Queries relating to Shells proposed by Mr. Samuel Dale, and answered by Dr. Martyn Lister. R.S.S.*

The Queries.

There are three things among *Shells*, in which I would be glad of Dr. *Lister's* Assistance, which if you can procure, will be a great Favour, and desire it may be done as soon as possible.

1. *What is the Entalia of the Shops ? by what Authors described ? under what Names ? and how they differ from the Dentalia ?*

2. *Of what Shell is the Blatta Byzantina the Operculum ?*

3. *There are divers sorts of Purpuræ among Authors, which is that of the Shops ? Likewise which sort of Buccina and Umbilici Marini ought to be used in the Shops ?*

The Answer to the Three Queries, by Dr. Lister.

1. As to the *Entalia*, I do not remember to have seen any thing in the Shops under that Name. The Descriptions of the *Dentalia* in *Scroder* are very faulty, and both those and the *Entalia* by him should seem to be the Two *Species* of *Dentalia*, which are by me figured. The *Dentalium* being that which is commonly and in Plenty found about the Island of *Garnsey*, and elsewhere.

