

of a Minute or two may be allowed, arising from the Indistinctness of the *Penumbra*.

II. *A Continuation of the Experiments on Substances resisting Putrefaction; by John Pringle M. D. F. R. S.*

Read Nov. 1. 1750. **H**AVING in my last Paper in the preceding Number of these *Transactions*, p. 480, &c. just mentioned the comparative Force of a few Salts, and other Substances resisting Putrefaction, I shall now lay before the *Society* a more particular Account of those Experiments, with some others, since made, on that Subject.

1. Three Pieces of the Lean of fresh Beef, each weighing two Drachms, were put separately into wide-mouth'd Phials. Two Ounces of Cistern-Water were added to each; in one were dissolved 30 Grains of Sea-Salt; in another 60; but the third contained nothing but Flesh and Water. These Bottles were little more than half-full; and, being corked, were placed in a Lamp-Furnace, regulated by a Thermometer, and kept about the Degree of human Heat.

About ten or twelve Hours after, the Contents of the Phial without Salt had a faint Smell; and in three or four Hours more were putrid*. In an
Hour

* It is to be observed, that these Pieces were all intire; but when they are beat to the Consistence of a Pap, with the same Quantity of Water, the Putrefaction then begins in less than half the Time mentioned here.

X x x 2

Hour or two longer the Flesh with the least Salt was tainted; but that which had most, remained sweet above 30 Hours after Infusion. This Experiment was often repeated with the same Result, making Allowance for Variations of the Degree of Heat.

The Use of this Experiment was for making Standards, whereby to judge of the septic or antiseptic Strength of Bodies. Thus, if Water with any Ingredient preserved Flesh better than without it, or better than with the Additions of the Salt, that Ingredient might be said to resist Putrefaction more than Water alone, or with 30 or 60 Grains of Sea-Salt. But if, on the other hand, Water, with any Addition, promoted Corruption more than when pure, the Substance added was to be reckoned a Septic, or Hastener of Putrefaction.

The following Experiments were therefore all made in the same Degree of Heat with the Quantity of Flesh, Water, and Air, as above specified; together with such septic or antiseptic Substances, as shall be afterwards mention'd, and were all compared with the Standards. But whereas the least Quantity of Salt preserved Flesh little longer than plain Water, I shall always compare the several antiseptic Bodies with the greatest Quantity of Salt; so that whenever any Substance is said to oppose Putrefaction more than the Standard, I mean, more than 60 Grains of Sea-Salt.

2. I began with examining other Salts, and compared them in the same Quantity with the Standard; which being of all the weakest, I shall suppose it equal to Unity, and express the proportional Strength of the rest in higher Numbers in the following Table.

A Table of the comparative Powers of Salts in resisting Putrefaction.

Sea-Salt	. . . . .	1
<i>Sal Gemmæ</i>	. . . . .	1+
Tartar vitriolated	. . . . .	2
<i>Spiritus Mindereri</i>	. . . . .	2
<i>Tartarus solubilis</i>	. . . . .	2
<i>Sal diureticus</i>	. . . . .	2+
Crude <i>Sal Ammoniac.</i>	. . . . .	3
Saline Mixture	. . . . .	3
Nitre	. . . . .	4+
Salt of Hartshorn	. . . . .	4+
Salt of Wormwood	. . . . .	4+
Borax	. . . . .	12+
Salt of Amber	. . . . .	20+
Alum	. . . . .	30+

In this Table I have mark'd the Proportions by integral Numbers; it being hard, and perhaps unnecessary, to bring this Matter to more Exactness; only to some I have added the Sign +, to shew, that those Salts are stronger than the Number in the Table by some Fraction; unless in the three last, where the same Sign imports that the Salt may be stronger by some Units †. The Tartar vitriolated
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† Five Grains of Borax was the smallest Quantity compared with Sea-Salt; but holding out so much longer, I suspect three Grains would have been sufficient; in which Case the Force of this Salt was to be estimated at 20: A singular Instance of the Strength of

is rated at 2; tho' more than 30 Grains of it was taken to equal the Standard: But perceiving all of it was not dissolved, an Allowance was made accordingly. On the other hand, as Part of the Hart's-horn flies off, its real Force must be greater than what appears by the Table. The Salt of Amber is likewise volatile; and as three Grains of it were found more preservative than 60 Grains of Sea-Salt; it may therefore be much more than 20 times stronger. This is indeed an acid Salt; but as the acid Part of it is inconsiderable, this high antiseptic Power must be owing to some other Principle. The *Spiritus Mindereri* was made of common Vinegar and Salt of Hartshorn; the saline Mixture of Salt of Wormwood saturated with Lemon-juice. The alkaline Part in either of these Mixtures with Water only would have resisted with a Power of 4 +; so that the Acid added render'd these Salts less antiseptic; *viz.* the *Spiritus Mindereri* by a Half, and the saline Mixture by a third Part: Which was a Circumstance very unexpected.

3. Next I proceeded to try Resins and Gums, and began with Myrrh. As Part of this Substance dissolves in Water, eight Grains were made into an Emulsion; but most of it subsiding, I could not reckon on a Solution of more than one or two Grains; which nevertheless preserving the Flesh longer than the Standard, we may account the soluble
Part

Salt not acid. One Grain of Alum was weaker than 60 Grains of Sea-Salt; but two Grains were stronger. The Power therefore of Alum lies between 30 and 60; but, as I could judge by the Experiment, nearer the first Number.

Part of Myrrh perhaps about 30 times stronger than Sea-Salt.

Aloes, *Afa fetida*, and the *Terra Japonica*, dissolved in the same manner as Myrrh, like it subsided, and with the same antiseptic Force. But Gum ammoniac and *Sagapenum* shewed little of this Virtue. Whether it was that they opposed Putrefaction less, or that all the antiseptic Principle fell with the grosser Parts to the Bottom. Three Grains of Opium dissolved in Water did not subside, and resisted Putrefaction better than the Salt. But I observed that more Air than usual was generated, and the Flesh became tenderer than with any of the stronger Antiseptics.

Of all the resinous Substances Camphire resisted most: Two Grains dissolved in one Drop of Spirit of Wine, five Grains of Sugar, and two Ounces of Water exceeded the Standard: Tho', during the Infusion, most of the Camphire flew off, swam a-top, or stuck to the Phial. Suppose only the Half lost, the Remainder is at least 60 times stronger than Salt; but if, as I imagine, the Water suspended not above a tenth Part, then Camphire will be 300 times more antiseptic than Sea-Salt. That nothing might be ascribed to the minute Portion of the Spirit, used in this Experiment, I made another Solution of Camphire in a Drop or two of Oil, and found this Mixture less perfect, but still beyond the Standard.

4. I made strong Infusions of Camomile-flowers, and of *Virginian* Snake-root; and finding them both greatly beyond the Standard, I gradually lessened the Quantity of these Materials, till I found five Grains of either impart a Virtue to Water superior

to 60 Grains of Salt. Now as we cannot suppose these weak Infusions contained half a Grain of the embalming Part of these Vegetables, it follows, that this must be at least 120 times more antiseptic than common Salt.

I also made a strong Decoction of the Bark, and infused a Piece of Flesh in two Ounces of it strained; which Flesh never corrupted, tho' it remained two or three Days in the Furnace, after the Standard was putrid. In this time the Decoction became gradually limpid, whilst the grosser Parts subsided: By which it appears, that a most minute Portion of the Bark intimately mixed with Water (perhaps less than of the Snake root, or Camomile-flowers) is possessed of a very extraordinary antiseptic Force.

Besides these, Pepper, Ginger, Saffron, Contrayerva-root, and Galls, in the Quantity of 5 Grains each, as also 10 Grains of dried Sage, of Rhubarb, and the Root of wild Valerian *, separately infused, exceeded 60 Grains of Salt. Mint, Angelica, Groundivy, Senna, Green Tea, red Roses, common Wormwood, Mustard, and Horse-radish, were likewise infused, but in larger Quantities, and proved more antiseptic than the Standard. And as none of these can be supposed to yield in the Water above a Grain or two of the embalming Principle, we may look upon them all as very powerful Resisters of Putrefaction. Farther, I made a Trial with a Decoction
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* Tho' the Experiment was only made with ten Grains of the Powder of this Root, yet, considering how long that Quantity resisted Putrefaction, we may reckon the Valerian among the strongest Antiseptics.

of white Poppy-heads, and another with the expressed Juice of Lettuce, and found them both above the Standard.

By these Specimens we may now see how extensive Antiseptics are; since, besides Salts, fermented Spirits, Spices and Acids, commonly known to have this Property, many Resins, Astringents, and Refrigerants, are of the Number; and even those Plants called Anti-acids, and supposed Hasteners of Putrefaction; of which Class Horse-radish is particularly antiseptic. And indeed after these Trials, I expected to find all dissolvable Substances endowed with some Degree of this Quality; till, upon further Experiments, I perceived some made no Resistance, and others promoted Corruption. But before I enter upon that Part of my Subject, it will be proper to relate some other Experiments more nearly connected with the preceding.

5. Having seen how much more antiseptic these Infusions were than Sea-Salt, I then tried whether Plants would part with this Virtue without Infusion. For this Purpose, having three small and thin Slices of the Lean of Beef, I rubbed one with the Powder of the Bark, another with Snake-root, and a third with Camomile-flowers. It was in the Heat of Summer, yet, after keeping these Pieces for several Days, I found the Flesh with the Bark but little tainted, and the other two quite sweet. The Substance of all the three was firm; particularly that with the Camomile, which was so hard and dry, that it seemed incorruptible. Why the Bark had not altogether the same Effect, was probably owing to its close Texture.

6. I have also made some Attempts towards the sweetening of corrupted Flesh, by means of mild Substances; because distill'd Spirits, or strong Acids, the only things known to answer this Intention, were of too acrid and irritating a Nature to be thoroughly useful, when this Correction was most wanted, As for Salts, besides their Acrimony, it is well known, that Meat once tainted will not take Salt.

A Piece of Flesh weighing two Drachms, which in a former Experiment had become putrid, and was therefore very tender, spongy, and specifically lighter than Water, was thrown into a few Ounces of the Infusion of Camomile-flowers, after expressing the Air, to make it sink in the Fluid: The Infusion was renewed twice or thrice in as many Days; when, perceiving the *Fætor* gone, I put the Flesh into a clean Bottle, with a fresh Infusion; and this I kept all the Summer, and have it still by me, quite sweet, and of a firm Texture*. In like manner I have been able to sweeten several small Pieces of putrid Flesh, by repeated Affusions of a strong Decoction of the Bark; and I constantly observed, that not only the corrupted Smell was removed, but a Firmness restored to the Fibres.

Now, since the Bark parted with so much of its Virtue in Water, it was natural to think it would still yield more in the Body, when open'd by the *Saliva* and Bile; and therefore it was by this anti-septic

* This Piece has been kept a Twelvemonth in the same Liquor, and is still firm and uncorrupted.

septic Virtue it chiefly operated. From this Principle we might account for its Success in Gangrenes, and in the low State of malignant Fevers, when the Humours are so evidently putrid. And for Intermittents, in which the Bark is most specific, were we to judge of their Nature, from Circumstances attending them in Climates and Seasons most liable to the Distemper, we should assign Putrefaction as a principal Cause. They are the great Endemic of all marshy Countries, and rage most after hot Summers, with a close and moist State of Air. They begin at the End of Summer, and continue thro' Autumn; being at the worst, when the Atmosphere is most loaded with the *Effluvia* of stagnating Water, render'd more putrid by Vegetables and animal Substances that rot in it. At such times all Meats are quickly tainted; and Dysenteries, with other putrid Distempers, coincide with these Fevers. The Heats dispose the Humours to Acrimony; the putrid *Effluvia* are a Ferment; and the Fogs and Dews, so common to those Climates, stop Perspiration, and bring on a Fever. The more these Causes prevail, the easier it is to trace this Putrefaction of Humours. The *Nausea*, Thirst, bitter Taste of the Mouth, and frequent Evacuations of putrid Bile, are common Symptoms and Arguments for what is advanced. We shall add, that in moist Countries, in bad Seasons, the Intermittents not only begin with Symptoms of a putrid Fever, but, if unduly managed, easily change into a putrid and malignant Form, with livid Spots and Blotches, and Mortification of the Bowels. But, as a thorough Discussion of this Question might carry us too far from our present

Subject, and be unseasonable here, I shall refer it to its proper Place, and only remark, that whatever Medicines (besides Evacuations and the Bark) have been found useful in the Cure of Intermittents, they are, so far as I know, all highly antiseptic; such are; Myrrh, Camphire, Camomile-flowers, Wormwood, Tincture of Roses, Alum with Nutmeg, vitriolic or strong vegetable Acids with Aromatics.

Thus far I have only related my Experiments upon Flesh, or the fibrous Parts of Animals; I should next proceed to shew, what Effects Antiseptics have upon the Humours; for, tho' from Analogy we may conclude, that whatever retards the Corruption of the Solids, or recovers them after they are tainted, will act similarly upon the Fluids; yet, as this does not certainly follow, I judged it necessary to make new Trials; which, with some Experiments on the Promoters of Putrefaction, the reverse of the former, shall be offer'd to the *Society* at another Meeting.

N. B. *These Experiments are continued in this Transaction, p. 550.*

III. *A Letter from Mr. Joseph Platt to Mr. Peter Collinson F. R. S. concerning a flat Spheroidal Stone having Lines regularly crossing it.*

Dear Sir,

Manchester, Dec. 9, 1749.

Read Nov. 8.
1750.

A LITTLE while since a Man brought me a Stone, which he found at *Ardwick*, 7 Feet deep, near this Town, in driving a Slough through some Gret stone. It is what I call