II. *A Propoſal to bring ſmall paſſable* Stones ſoon *and with* Eaſe *out of the Bladder: By the Reverend* Stephen Hales, *D. D.*

Read Octob. 31. 1746. *here printed with Alterations.*

BEING preſent, *February* 4. 1744-5. when the late Right Honourable the Earl of *Orford* (after having taken for two Months Dr. *Jurin's Lixivium*) voided at once eleven pretty large nearly cubical Fragments of larger Stones, which were involved in coagulated Blood and Urine; and, a few Hours after, fifteen more at once, in the ſame manner; in all thirty two that Day; ſome of which were as large as were poſſibly paſſable; it hence immediately occurred to my Thoughts, that all paſſable Stones which have lately fallen from the Kidneys into the Bladder, or which have broken off from larger ones, might readily and eaſily be brought out thence, by conveying into the empty Bladder, by a *Catheter*, ſome very mucilaginous Subſtance, ſuch as Syrup of Marſh-mallows, or a Solution of Gum Arabic, or Barley-water. Such Subſtances would bring the Stones away ſoon, and with great Eaſe to the Patient; and thereby not only prevent much teazing Pain, by fruitleſly endeavouring to bring them away with the weak Force of thin Urine, but alſo effectually to ſecure the Patient from the Danger of their growing too big to come away, by long continuing in the Bladder.

And what ſtrongly evinces the Reaſonableneſs of this Propoſal, is, that, on opening the Bladder of his Lordſhip, there were no Stones found remaining, except

except two ſmall Grains, which were involved in the Folds in the Neck of the Bladder.

If, on Trial, any Stones ſhall be found too big to paſs off, the Patient is but where he was before; and if any ſhall be of ſuch a Size as to enter the *Urethra* but Part of the Way, they may be puſhed back, or cut out, according as their Situation ſhall happen to be.

And further to evince the Reaſonableneſs of this Propoſal, I made the following Experiments; *viz.* In order to ſhew the comparative Force, with which Fluids of different Degrees of Denſity and Tenacity will impel Stones, I took a glaſs Tube, which was an Inch in Diameter within, and fourteen and half Inches deep; and, having fill'd it full of Urine, I put into it a nearly cubical Piece of a large Stone, taken out of a human Bladder, which weigh'd ſeven and half Grains; and, ſtanding by a Clock whoſe *Pendulum* beat Seconds, I found, by repeated Trials, that the Stone was a Second and a Quarter in deſcending through the fourteen and half Inches Depth of Urine.

The Experiment being tried with the ſame Stone in Oil of Olives, it was five and three Quarters Seconds in deſcending: So that the Reſiſtance of the Oil to the falling Stone was 4.6, that is, more than four times greater than the Reſiſtance of the Urine; and, conſequently, the impelling Force of Oil to propel a Stone in paſſing thro' a narrow Tube, would be proportionably ſo much greater than that of Urine, were their Velocities equal.

When an Ounce of Gum-Arabic was diſſolved in half a Pint of Water, the Stone deſcended in

two

two Seconds; with two Ounces, in three Seconds; with three Ounces, in four Seconds.

In a Decoction of warm Barley-water, which was ſo thick as to be a tender Jelly when cold, the Stone was forty-five Seconds in deſcending, that is, thirty-five times ſlower than in Urine; and, conſequently, the impelling Force of Urine is thirty-five times leſs than that of this Mucilage, in caſe their Velocities were equal.

This Mucilage was, as I gueſs, of a due Conſiſtence for the Purpoſe; for it was about the Thickneſs of Lord *Orford*'s coagulated Blood and Urine. Equal Quantities of Blood and Urine will continue a thick *Coagulum* for many Weeks, without any Separation.

But as the Velocity, with which ſuch mucilaginous Subſtances paſs thro' ſmall Tubes, is conſiderably leſs than the Velocity with which Urine will paſs; ſuppoſing the Forces with which they are impelled to be equal; it was requiſite to determine thoſe different Velocities by Experiments: And, in order to it, I put half a Pint of the ſame blood-warm Decoction of Barley into a glaſs Veſſel, where its Depth was near eight Inches, and therefore its mean Depth near four Inches. It run out at the Bottom in about fifty Seconds thro' a glaſs Tube, whoſe Bore was $\frac{1}{7}$th Inch Diameter; its Length two Inches: And, on repeating the ſame Experiment twice, as the Decoction grew cooler and cooler, it was about eighty and then ninety Seconds in running out; whereas a like Quantity of Urine ran out thro' the ſame Tube in eighteen Seconds.

Now, ſuppoſing the Velocities, at a *Medium*, thro' the *Urethra*, to be as ſeventy-two to eighteen, then the Velocity of the Urine will be three Fourths greater

greater than that of the Mucilage of Barley. Taking therefore three Fourths from Thirty-ſix, the Force of the Mucilage, the Remainder nine is the Force with which the Mucilage will impel the Stone; and, conſequently, the impelling Force of the Mucilage, in the Neck of the Bladder and in the *Urethra*, will be nine times greater than that of Urine; beſides the Advantage of greater Slipperineſs which it gives to the *Urethra*.

III. *An Account of ſome Experiments, lately made in* Holland, *upon the Fragility of unannealed* glaſs Veſſels; *communicated to the* Preſident.

Read Oct. 31. 1745. THE following Paper contains the Account of ſeveral Experiments of an odd Nature, that have lately been tried both in *Italy* and in *Holland*, upon ſome unannealed glaſs Phials; that is to ſay, ſuch as have been expoſed to the Air as ſoon as blown, without paſſing through the Operation that is commonly called Annealing.

The exceſſive Fragility of theſe Sorts of Glaſſes muſt have been obſerved, as long as the Art of making Glaſs has been in Uſe: it having been found, that almoſt all the Veſſels that were made of ſuch Glaſs were entirely uſeleſs upon that Account; as being ſubject to break and fly, almoſt conſtantly, of themſelves, and that even frequently before they were well cold.

It was therefore to remedy this Inconveniency that the Practice of Nealing or Annealing them was de-