

A Conjecture concerning the Bladders of Air that are found in Fishes, communicated by A. I; and illustrated by an Experiment suggested by the Honorable Robert Boyle.

REflecting on that Question, Whether Liquids gravitate upon Bodies immersed or not? I came to a Resolution in my own thoughts, that they do gravitate; and one of the greatest instances that did occur to me was, that a bubble of Air, rising from the bottom, does dilate it self all the way to the top; which is caused by the lessening of the weight or pressure of the incumbent water, the nearer it is to the top. Upon consideration of that instance, the following conjecture presented its self to my thoughts; That fishes by reason of the bladder of Air that is within them can sustain or keep themselves in any depth of water. For the Air in that bladder is like the bubble, more or less compressed, according to the depth the fish swims at, and takes up more or less space; and consequently the body of the fish, part of whose bulk this bladder is, is greater or less according to the several depths, and yet retains the same weight. The Rule *de insidentibus humido*, is, that a Body that is heavier than so much water as is equal in quantity to the bulk of it, will sink; a Body that is lighter, will swim; a Body of equal weight, will rest in any part of the water.

Now by this Rule, if the fish in the middle Region of the water be of equal weight to the water that is commensurate to the bulk of it, the fish will rest there without any tendency upwards or downwards: And if the fish be deeper in the water, the bulk of the fish becoming less by the compression of the bladder, and yet retaining the same weight, it will sink and rest at the bottom: And on the other side, if the fish be higher than that middle Region, the Air dilating its self, and the *bulk* of the fish consequently increasing, but not the *weight*, the fish will rise upwards, and rest at the top of the water.

Perhaps the fish by some action can emit Air out of this bladder, and afterwards out of its body, and also, when there is not enough, take in Air and convey it to this bladder; and then it will not be wondred, that there should be alwayes a fit proportion

on of Air in the Bodies of all fishes, to serve their use, according to the depth of water they are bred and live in: Perhaps by some Muscle the fish can contract this bladder beyond the pressure of the weight of water: Perhaps the fish can by its sides or some other defence keep off the pressure of the water, and give the Air leave to dilate itself. In these cases the fish will be helped in all intermediate distances, and may rise or sink from any Region of the water without moving one Fin.

It were worth observing, what fishes want bladders, and if the bladders of several fishes are not of different shapes or bigness, and how they are in Sea-fishes that live in great depths, and whether any amphibious creatures have them, or any thing analogous; as the Lungs may be, or other Cavities. By an inquiry into these and other particulars this conjecture may be either fortified or refuted.

So far this Conjecture: In reference to which, when it was propounded to the Honourable *Robert Boyle*, he, reflecting upon the manner how a Fish comes to rise or sink in water, soon bethought himself of an Experiment probably to determine, Whether a Fish makes those motions by contracting or expanding himself? The Experiment by him suggested was; To take a Bolthead with a wide neck, and having fill'd it almost full with water, to put into it some live fish of a convenient size, that is, the biggest that can be got in, as a Roch, Perch, or the like; and then to draw out the neck of the Bolthead as slender as you can; and to fill that also almost with water: Whereupon the fish lying at a certain depth in the water of the Glass, if upon his sinking you perceive the water at the slender top does subside, you may infer, he contracts himself, and if, upon his rising, the water be also raised, you may conclude, he dilates himself.