ſecretion is evident; ſince no pus was ever obſerved in the urine either before, or after the introduction of the catheter. How this extraordinary caſe comes to be ſo particularly circumſtanced ſeems worthy of conſideration. If the ſingularity of it ſhall merit any regard from your Lordſhip, and the gentlemen of the Society, it will give the higheſt ſatisfaction to,

my Lord,

Your Lordſhip's

All Souls College,
Nov. 24th, 1762.

moſt obedient and

moſt humble ſervant,

Daniel Lyſons.

CIII. *Experiments to prove that Water is not incompreſſible*; *by* John Canton, *M. A. and F. R. S.*

Read Dec. 16, 1762.

HAVING procured a ſmall glaſs tube of about two feet in length, with a ball at one end of it of an inch and a quarter in diameter; I filled the ball and part of the tube with mercury; and keeping it with a Fahrenheit's Thermometer, in water which was frequently ſtirred, it was brought exactly to the heat of 50 degrees; and the place where the mercury ſtood in the tube, which was about $6\frac{1}{2}$ inches above the ball, was carefully

fully marked. I then raiſed the Mercury, by heat, to the top of the tube, and ſealed the tube hermetically; and when the mercury was brought to the ſame degree of heat as before, it ſtood in the tube $\frac{32}{100}$ of an inch higher than the mark.

The ſame ball, and part of the tube being filled with water exhauſted of air, inſtead of the mercury; and the place where the Water ſtood in the tube when it came to reſt in the heat of 50 degrees, being marked, which was about 6 inches above the ball; the water was then raiſed by heat till it filled the tube; which being ſealed again, and the water brought to the heat of 50 degrees as before, it ſtood in the tube $\frac{43}{100}$ of an inch above the mark.

Now the weight of the atmoſphere (or about 73 pounds avoirdupois) preſſing on the outſide of the ball and not on the inſide, will ſqueeze it into leſs compaſs. * And by this compreſſion of the ball, the mercury and the water will be equally raiſed in the tube: but the water is found, by the experiments above related, to riſe $\frac{11}{100}$ of an inch more than the mercury; and therefore the water muſt expand, ſo much, more than the mercury, by removing the weight of the atmoſphere.

In order to determine how much water is compreſſed by this, or a greater weight, I took a glaſs ball of about an inch and $\frac{6}{10}$ in diameter which was joined to a cylindrical tube of 4 inches and $\frac{2}{10}$ in length, and in diameter about $\frac{1}{100}$ of an inch; and

* See an account of experiments made with glaſs balls by Mr. Hooke, (afterwards Doctor Hooke,) in Doctor Birch's hiſtory of the Royal Society, Vol. 1. page 127.

by weighing the quantity of mercury that exactly filled the ball, and alſo the quantity that filled the whole length of the tube; I found that the mercury in $\frac{23}{100}$ of an inch of the tube, was the 1000ooth part of that contained in the ball; and with the edge of a file, I divided the tube accordingly.

This being done, I filled the ball and part of the tube with water exhauſted of air; and left the tube open, that the ball, whether in rarefied or condenſed air, might always be equally preſſed within and without, and therefore not altered in its dimenſions. Now by placing this ball and tube under the receiver of an air-pump, I could ſee the degree of expanſion of the water, anſwering to any degree of rarefaction of the air; and by putting it into a glaſs receiver of a condenſing engine, I could ſee the degree of compreſſion of the water, anſwering to any degree of condenſation of the air. But great care muſt be taken in making theſe experiments, that the heat of the glaſs ball be not altered, either by the coming on of moiſture, or it's going off by evaporation; which may eaſily be prevented by keeping the ball under water, or by uſing oil only, in working the pump and condenſer.

In this manner, I have found by repeated trials, when the heat of the air has been about 50 degrees, and the mercury at a mean height in the Barometer, that the water will expand and riſe in the tube, by removing the weight of the atmoſphere, 4 diviſions and $\frac{6}{10}$; or one part in 21740; and will be as much compreſſed under the weight of an additional atmoſphere. Therefore the compreſſion of water by twice the

the weight of the atmoſphere, is one part in 10870 of it's whole bulk.*

The famous Florentine experiment, which ſo many Philoſophical writers have mentioned as a proof of the incompreſſibility of water, will not, when carefully conſidered, appear ſufficient for that purpoſe: for in forcing any part of the water contained in a hollow globe of gold through its pores by preſſure, the figure of the gold muſt be altered; and conſequently, the internal ſpace containing the water, diminiſhed; but it was impoſſible for the gentlemen of the academy *del Cimento* to determine, that the water which was forced into the pores and through the gold, was exactly equal to the diminution of the internal ſpace by the preſſure.

* If the compreſſibility of the water was owing to *any air* that it might ſtill be ſuppoſed to contain, it is evident that *more air* muſt make it *more compreſſible*; I therefore let into the ball a bubble of air that meaſured near $\frac{6}{10}$ of an inch in diameter, which the water abſorbed in about four days; but I found upon trial that the water was not more compreſſed, by twice the weight of the atmoſphere, than before.

The compreſſion of the glaſs in this experiment, by the equal and contrary forces acting within and without the ball, is not ſenſible: for the compreſſion of water in two balls, appears to be exactly the ſame, when the glaſs of one is more than twice the thickneſs of the glaſs of the other. And the weight of an atmoſphere, which I found would compreſs mercury in one of theſe balls but $\frac{1}{3}$ part of a diviſion of the tube, compreſſes water in the ſame ball 4 diviſions and $\frac{6}{10}$.