BENJAMIN FRANKLIN

EXPERIMENTS AND OBSERVATIONS ON ELECTRICITY MADE AT PHILADELPHIA IN AMERICA

Benjamin Franklin

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The PREFACE.

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It may be necessary to acquaint the reader, that the following observations and experiments were not drawn up with a view to their being made publick, but were communicated at different times, and most of them in letters wrote on various topicks, as matters only of private amusement.

But some persons to whom they were read, and who had themselves been conversant in electrical disquisitions, were of opinion, they contain'd so many curious and interesting particulars relative to this affair, that it would be doing a kind of injustice to the publick, to confine them solely to the limits of a private acquaintance.

The Editor was therefore prevailed upon to commit such extracts of letters, and other detach'd pieces as were in his hands to the press, without waiting for the ingenious author's permission so to do; and this was done with the less hesitation, as it was apprehended the author's engagements in other affairs, would scarce afford him leisure to give the publick his reflections and experiments on the subject, finish'd with that care and precision, of which the treatise before us shews he is alike studious and capable. He was only apprized of the step that had been thus taken, while the first sheets were in the press, and time enough for him to transmit some farther remarks, together with a few corrections and additions, which are placed at the end, and may be consulted in the perusal.

The experiments which our author relates are most of them peculiar to himself; they are conducted with judgment, and the inferences from them plain and conclusive; though sometimes proposed under the terms of suppositions and conjectures.

And indeed the scene he opens, strikes us with a pleasing astonishment, whilst he conducts us by a train of facts and judicious reflections, to a probable cause of those phænomena, which are at once the most awful, and, hitherto, accounted for with the least verisimilitude.

He exhibits to our consideration, an invisible, subtile matter, disseminated through all nature in various proportions, equally unobserved, and, whilst all those bodies to which it peculiarly adheres are alike charged with it, inoffensive.

He shews, however, that if an unequal distribution is by any means brought about; if there is a coacervation in one part of space, a less proportion, vacuity, or want, in another; by the near approach of a body capable of conducting the coacervated part to the emptier space, it becomes perhaps the most formidable and irresistible agent in the universe. Animals are in an Instant struck breathless, bodies almost impervious by any force yet known, are perforated, and metals fused by it, in a moment.

From the similar effects of lightening and electricity our author has been led to make some propable conjectures on the cause of the former; and at the same time, to propose some rational experiments in order to secure ourselves, and those things on which its force is often directed, from its pernicious effects; a circumstance of no small importance to the publick, and therefore worthy of the utmost attention.

It has, indeed, been of late the fashion to ascribe every grand or unusual operation of nature, such as lightening and earthquakes, to electricity; not, as one would imagine, from the manner of reasoning on these occasions, that the authors of these schemes have, discovered any connection betwixt the cause and effect, or saw in what manner they were related; but, as it would seem, merely because they were unacquainted with any other agent, of which it could not positively be said the connection was impossible.

But of these, and many other interesting circumstances, the reader will be more satisfactorily informed in the following letters, to which he is therefore referred by

The EDITOR.

LETTER I.

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FROM
Mr Benj. Franklin, in *Philadelphia*.
TO
Mr Peter Collinson, F.R.S. *London*.
July 28, 1747.

SIR,

THE necessary trouble of copying long letters, which perhaps when they come to your hands may contain nothing new, or worth your reading (so quick is the progress made with you in Electricity) half discourages me from writing any more on that subject. Yet I cannot forbear adding a few observations on M. *Muschenbroek*'s wonderful bottle.

1. The non-electric contain'd in the bottle differs when electrised from a non-electric electrised out of the bottle, in

this: that the electrical fire of the latter is accumulated *on its surface*, and forms an electrical atmosphere round it of considerable extent: but the electrical fire is crouded *into the substance* of the former, the glass confining it.

2. At the same time that the wire and top of the bottle, &c. is electrised *positively* or *plus*, the bottom of the bottle is electrised *negatively* or *minus*, in exact proportion: *i. e.* whatever quantity of electrical fire is thrown in at top, an equal quantity goes out of the bottom. To understand this, suppose the common quantity of Electricity in each part of the bottle, before the operation begins, is equal to 20; and at every stroke of the tube, suppose a quantity equal to 1 is thrown in; then, after the first stroke, the quantity contain'd in the wire and upper part of the bottle will be 21, in the bottom 19. After the second, the upper part will have 22, the lower 18, and so on 'till after 20 strokes, the upper part will have a quantity of electrical fire equal to 40, the lower part none: and then the operation ends: for no more can be thrown into the upper part, when no more can be driven out of the lower part. If you attempt to throw more in, it is spued back thro' the wire, or flies out in loud cracks thro' the sides of the bottle.

3. The equilibrium cannot be restored in the bottle by *inward* communication or contact of the parts; but it must be done by a communication formed *without* the bottle, between the top and bottom, by some non-electric, touching both at the same time; in which case it is restored with a violence and quickness inexpressible: or, touching each alternately, in which case the equilibrium is restored by degrees.

4. As no more electrical fire can be thrown into the top of the bottle, when all is driven out of the bottom, so in a bottle not yet electrised, none can be thrown into the top, when