

THE WORKS OF
ROBERT BOYLE

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The Origin of Forms and Qualities
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THE
ORIGINE
OF
FORMES and QUALITIES,

(According to the *Corpuscular Philosophy*,)
Illustrated by *Considerations* and
EXPERIMENTS,

(Written formerly by way of *Notes* upon an
Essay about NITRE)

By the Honorable
ROBERT BOYLE,
Fellow of the *Royal Society*.

*Audendum est, & Veritas investiganda; quam etiamsi
non assequamur, omnino tamen propiùs, quàm nunc sumus,
ad eam perveniemus. Galen.*

CONSIDERATIONS,
AND
EXPERIMENTS
touching
the Origine of Qualities, and Forms.
The Theoricall Part.

That before I descend to Particulars, I may (*Pyrophilus*) furnish you with some General Apprehension of the Doctrine (or rather the *Hypothesis*;) which is to be Collated *with*, and to be either Confirmed, or Disproved by, the Historicall Truths, that will be deliver'd concerning Particular Qualities, (& Forms;) I will assume the person of a Corpuscularian, / and here, at the Entrance, give you (in a general way) a brief Account of the *Hypothesis* it selfe, as it concerne the Origine of Qualities (and Forms:)^a and for Distinctions sake, I shall comprize it in the Eight following Particulars, which, that the whole Scheme may be the better Comprehended, and as it were Survey'd under one Prospect, I shall do little more then Barely propose *Them*, that either seem evident enough by their owne Light, or may without Præjudice have diverse of their Proofes reserv'd for proper places in the following part of this Treatise: and though there be some *Other* Particulars, to which the Importance of the Subjects, and the Greatnesse of the (almost Universall) Prejudices, that lye against them, will oblige mee Immediately to annexe (for the seasonable Clearing, and Justifying of them)^b some Annotations: yet that they may, as Little as I can, Obscure the Cohærence of the whole Discourse, as / much of them as conveniently may be, shall be included in [] Parentheses.^c

I. I agree with the generality of Philosophers so far, as to allow, that there is one Catholick or Universal Matter common to all Bodies, by which I mean a Substance extended, divisible and impenetrable.

II. But because this Matter being in its own Nature but one, the diversity we see in Bodies must necessarily arise from somewhat else, then the Matter they consist of. And since we see not, how there could be any change in

^a In Lat. followed by 'tibi ós én túπω exhibebo, eamque totam', 'I shall display the whole work to you, as in a summary'.

^b Lat. lacks '(for the seasonable Clearing, and Justifying of them)'.

^c In fact, Boyle failed to adopt this convention.

Matter, if all its (actual or designable) parts were perpetually at rest among themselves, it will follow, that to discriminate the Catholick Matter into variety^a of Natural Bodies, it must have Motion in some or all its designable Parts: and that Motion must have various tendencies, that which is in this part of the Matter tending one way, and that which is in that part tending another; / as we plainly see in the Universe or general Mass of Matter there is really a great quantity of Motion, and that variously determin'd, and that yet diverse portions of Matter are at rest.

That there is Local Motion in many parts of Matter is manifest to sense, but how Matter came by this Motion was of Old, and is still hotly disputed of: for the antient Corpuscularian Philosophers, (whose doctrine in most other points, though not in all, we are the most inclinable to,) not acknowledging an Author of the Universe, were thereby reduc'd to make Motion congenite to Matter, and consequently coëval with it; but since Local Motion, or an Endeavour at it, is not included in the nature of Matter, which is as much Matter, when it rests, as when it moves; and since we see, that the same portion of Matter may from Motion be reduc'd to Rest, and after it hath continu'd at Rest, as long as other Bodies doe not put it out / of that state, may by external Agents be set a moving again; I, who am not wont to think a man the worse Naturalist for not being an Atheist, shall not scruple to say with an Eminent Philosopher of Old, whom I find to have propos'd among the Greeks that Opinion (for the main) that the Excellent *Des Cartes* hath revived amongst Us, That the Origine of Motion in Matter is from God;^b and not onely so, but that thinking it very unfit to be believ'd, that Matter barely put into Motion, and then left to it self, should Casually constitute this beautiful and orderly World: I think also further, that the wise Author of Things did by establishing the laws of Motion among Bodies, and by guiding the first Motions of the small parts of Matter, bring them to convene after the manner requisite to compose the World, and especially did contrive those curious and elaborate Engines, the bodies of living Creatures, / endowing most of them with a power of propagating their Species. But though these things are my Perswasions, yet because they are not necessary to be suppos'd here, where I doe not pretend to deliver any compleat Discourse of the Principles of Natural Philosophy, but onely to touch upon such Notions, as are requisite to explicate the Origine of Qualities and Forms, I shall pass on to what remains, as soon as I have taken notice, that *Local Motion seems to be indeed the Principl amongst Second Causes, and the Grand Agent of all that happens in Nature*: For though Bulk, Figure, Rest, Situation, and Texture do concur to the *Phænomena* of Nature, yet in comparison of Motion they seem to be in many Cases, Effects, and in many others, little better then *Conditions, or Requisites, or Causes sine quibus non*, which modifie the operation,

^a Lat. has 'diversarum familiarum', 'diverse families'.

^b Evidently a reference to Anaxagoras (c. 500-428 BC), whom Boyle viewed favourably for insisting that a mind was necessary to explain motion in sluggish matter. Descartes speaks most explicitly about God's role in originating motion in *Principia philosophiæ* (1644), ii. 36, and in *L'Esprit de Monsieur de Malebranche* (1654), ch. 7.

that one part of Matter by vertue of its Motion hath upon another: / as in a Watch, the number, the figure, and coaptation of the Wheels and other parts is requisite to the shewing the hour, and doing the other things that may be perform'd by the Watch; but till these parts be actually put into Motion, all their other affections remaine inefficacious: and so in a Key, though if^f it were too big, or too little, or if its Shape were incongruous to that of the cavity of the Lock, it would be unfit to be us'd as a Key, though it were put into Motion; yet let its bigness and figure be never so fit, unless actual Motion intervene, it will never lock or unlock any thing, as without the like actual Motion, neither a Knife nor Razor will actually cut, how much soever their shape & other Qualities may fit them to do so. And so Brimstone, what disposition of Parts soever it have to be turn'd into Flame, would never be kindled, unless some actual fire, or other parcel of vehemently and variously agitated / Matter should put the Sulphureous Corpuscles into a very brisk motion.

III. These two grand and most Catholick Principles of Bodies, Matter, and Motion, being thus establish'd, it will follow both, that Matter must be actually divided into Parts, that being the genuine Effect of variously determin'd Motion, and that each of the primitive Fragments, or other distinct and entire Masses of Matter must have two Attributes, its own Magnitude, or rather *Size*,^b and its own *Figure* or *Shape*. And since Experience shews us (especially that which is afforded us by Chymical Operations, in many of which Matter is divided into Parts, too small to be singly sensible,) that this division of Matter is frequently made into insensible Corpuscles or Particles, we may conclude, that the minutest fragments, as well as the biggest Masses of the Universal Matter are likewise endowed each with its peculiar Bulk and / Shape. For being a finite Body, its Dimensions must be terminated and measurable: and though it may change its Figure, yet for the same reason it must necessarily have *some Figure* or other. So that now we have found out, and must admit three Essential Properties of each entire or undivided, though insensible part of Matter, namely, *Magnitude*, (by which I mean not quantity in general, but a determin'd quantity, which we in English oftentimes call the *Size* of a bodie,)^c *Shape*, and either *Motion* or *Rest*, (for betwixt them two there is no mean:) the two first of which may be called *inseparable Accidents* of each distinct part of Matter: *inseparable*, because being extended, and yet finite, it is Physically impossible, that it should be devoid of some Bulk or other, and som determinate Shape or other; and yet *Accidents*, because that whether or no the Shape can by Physical Agents be alter'd or the Body subdivided, / yet mentally both the one and the other may be done, the whole essence of Matter remaining undestroy'd.

^a Lacking in 2nd edition.

^b Lat. has 'quam anglicè dicimus SSize [sic]', 'which in English we call Size', and lacks 'or Shape'.

^c Lat. has 'quam anglicè, ut nuper admonitum est (the SSize [sic] of a Body) appellamus, i.e. exactam & peculiarem': 'which in English, as was recently stated, we call the size of a body, that is its precise and specific size'.

Whether these Accidents may not conveniently enough be call'd the Moods or primary affections of Bodies, to distinguish them from those lesse^a simple qualities, (as Colours, Tastes, and Odours,) that belong to Bodies upon their account, or whether with the Epicureans they may not be called the Con-juncts of the smallest parts of Matter, I shall not now stay to consider, but one thing the Modern Schools are wont to teach concerning Accidents, which^b is too repugnant to our present Doctrine, to be in this place quite omitted, namely that there are in Natural Bodies store of *real Qualities*, and other *real Accidents*, which not onely are no Moods of Matter, but are real Entities distinct from it, and according to the doctrine of many modern Schoolmen may *exist separate* from all / Matter whatsoever. To clear this point a little, we must take notice, that *Accident* is among Logicians and Philosophers us'd in two several senses, for sometimes it is oppos'd to the 4th Prædicable, (*Property*), and is then defin'd, "that which may be present or absent, without the destruction of the subject"; as a Man may be sick or well, and a Wall white or not white,^c and yet the one be still a Man, the other a Wall; and this is call'd in the Schools *Accidens prædicabile*, to distinguish it from what they call *Accidens prædicamentale*, which is oppos'd to Substance: for when things are divided by Logicians into 10 Prædicaments, or highest genus'es of things, Substance making one of them, all the nine other are of Accidents. And as Substance is commonly defin'd to be a thing that subsists of it self, and is the subject of Accidents, (or more plainly, a real Entity or thing, that needs not any (*created*) Being, that it may exist:) / so an Accident is said commonly to be *id cuius esse est inesse*,^d and therefore *Aristotle*, who usually calls Substances simply *ὄντα*,^e Entities, most commonly calls Accidents *ὄντος ὄντα*, Entities of Entities. These needing the existence of some substance or other, in which they may be, as in their subject of Inhæ-sion. And because Logicians make it the discriminating note of Substance, and Accident, that the former is a thing that cannot be in another, as in its subject of Inhæ-sion, tis requisite to know, that according to them, That is said to *Be in a Subject*, which hath these three conditions; That however it (1) *be in another thing*, (2) *is not in it as a part*, and (3) *cannot exist separately* from the thing or subject, wherein it is: as a white Wall is the subject of Inhæ-sion of the Whiteness we see in it, which self-same whiteness, though it be not in the wall as a part of it, yet cannot the self-same whiteness according to our Logicians / exist any where out of the wall, though many other Bodies may have the like degree of whiteness. This premis'd, twill not be hard to discover the falsity of the lately mentioned Scholastick opinion touching real Qualities and Accidents, their doctrine about which does, I confess, appear to me to be either unintelligible, or manifestly contradictious: for speaking in a Physical sense, if they will

^a Lacking in Lat.

^b Lacking in 2nd edition.

^c Lat. has 'nigrum', 'black', or 'dark'. In the previous line, the closing quotation marks are accidentally omitted in the original.

^d 'That whose being is in being'.

^e Lat. has 'ἄλλοσ ὄντα'.

not allow these Accidents to be Modes of Matter, but Entities really distinct from it, and in some cases separable from all Matter, they make them indeed Accidents in name, but represent them under such a notion as belongs only to Substances; the nature of a Substance consisting in this, That it can subsist of it selfe, without being in any thing else, as in a subject of *Inhætion*: so that to tell us, that a Quality, or other Accident may subsist without a subject, is indeed, whatever they please to call it,^a to allow it the / true Nature of Substance, nor will their Groundlesse Distinctions do any more then keep them from seeming to contradict themselves in words, whilst Unprepossess'd persons see that they do it in effect. Nor could I ever find it intelligibly made out, what these real Qualities may be, that they deny to be either Matter or modes of Matter, or immaterial Substances. When a Bowl runs along or lies still, that *Motion* or *Rest*, or *Globous figure* of the Bowl, is not *Nothing*, and yet it^b is not any *part* of the Bowl; whose whole Substance would remain, though it wanted which you please of these Accidents: and to make them *real* and *physical* Entities, (for we have not here to do either with *Logical* or *Metaphysical* ones) is, as if, because we may consider the same Man sitting, standing, running, thirsty, hungrie, wearie, &c. we should make each of these a distinct Entitie, as we do give some of them (as hunger, weariness, &c.) / distinct names. Whereas the subject of all these Qualities is but the same Man as he is considered with Circumstances, that make him appear different in one case from what he appears in another: And it may be very useful to our present Scope to observe, that not onely diversity of *Names*, but even diversity of *Definitions*, doth not alwaies infer a diversity of *Physical Entities* in the Subject, whereunto they are attributed. For it happens in many of the Physical Attributes of a Body, as in those Other cases, wherein a Man that is a Father, a Husband, a Master, a Prince, &c. may have a Peculiar Definition (such as the Nature of the thing will bear) belong unto him in each of these Capacities, and yet the Man in himself considered is but the same Man, who in respect of differing Capacities or Relations to other things is call'd by differing Names, and describ'd by various Definitions, which yet (as I was / saying) conclude not so many real and distinct Entities in the person so variously denominated.

An

EXCURSION

about the Relative Nature of Physical Qualities.

But because I take this Notion to be of no Small Importance towards the Avoiding of the Grand Mistake, that hath hitherto obtain'd about the Nature of Qualities, it will be worth while to Illustrate it a little farther. We may consider then, that when *Tubal-Cain*,^c or whoever else were the Smith, that Invented *Locks* and *Keys*, had made his first Lock, (for we may Reasonably

^a In Lat. followed by 'æquè absurdam mihi videatur', 'which seems equally absurd to me'.

^b Lacking in 2nd edition.

^c In the Biblical tradition the first metalworker, 'an instructor of every artificer in brass and iron', Genesis 4, 22.