

A disquisition about the final causes of natural things; wherein it is inquir'd, whether, and (if at all) with what cautions, a naturalist should admit them? / By the Honourable Robert Boyle, Esq; To which are subjoyn'd, by way of appendix, some uncommon observations about vitiated sight. By the same author.

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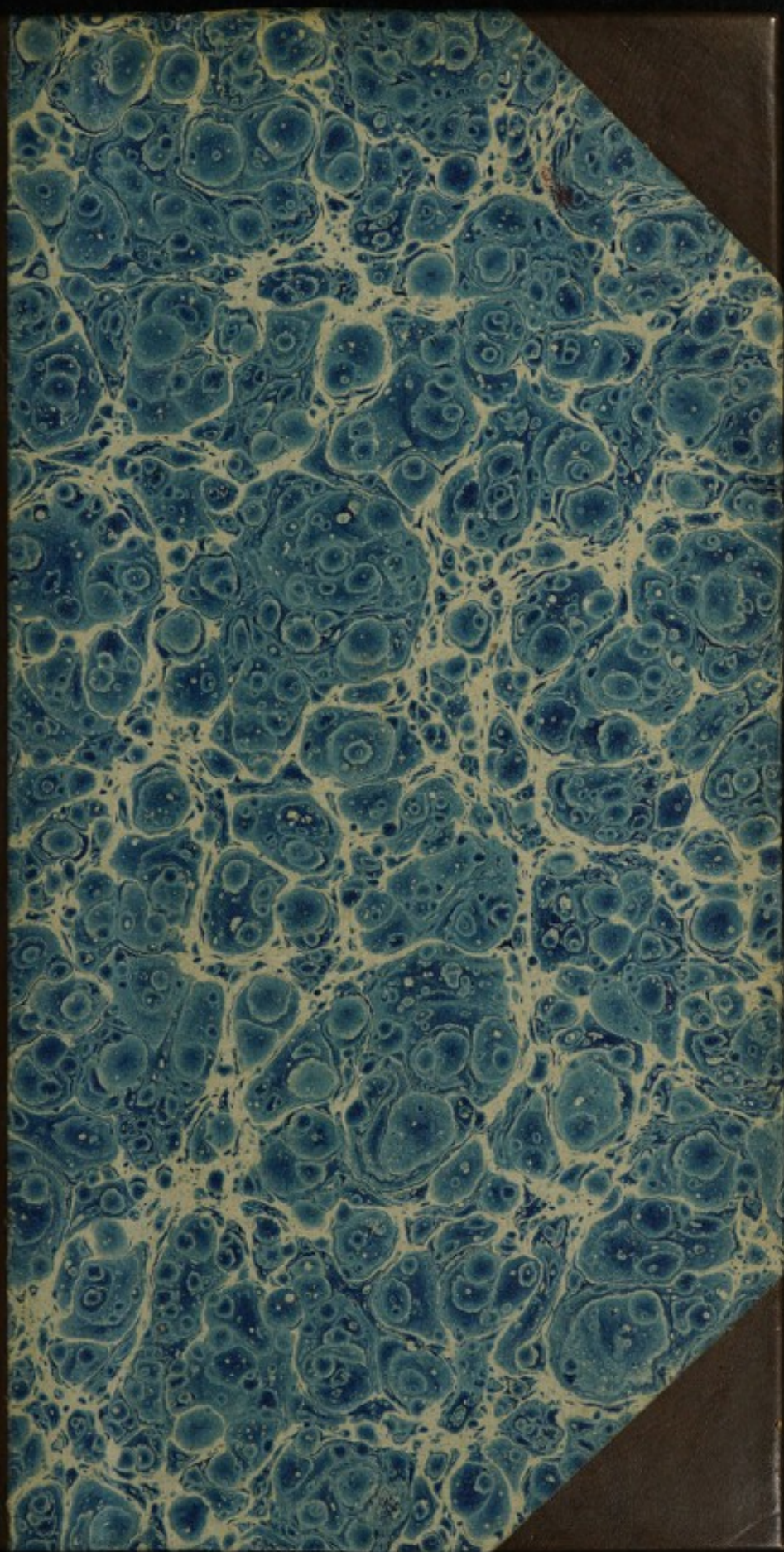
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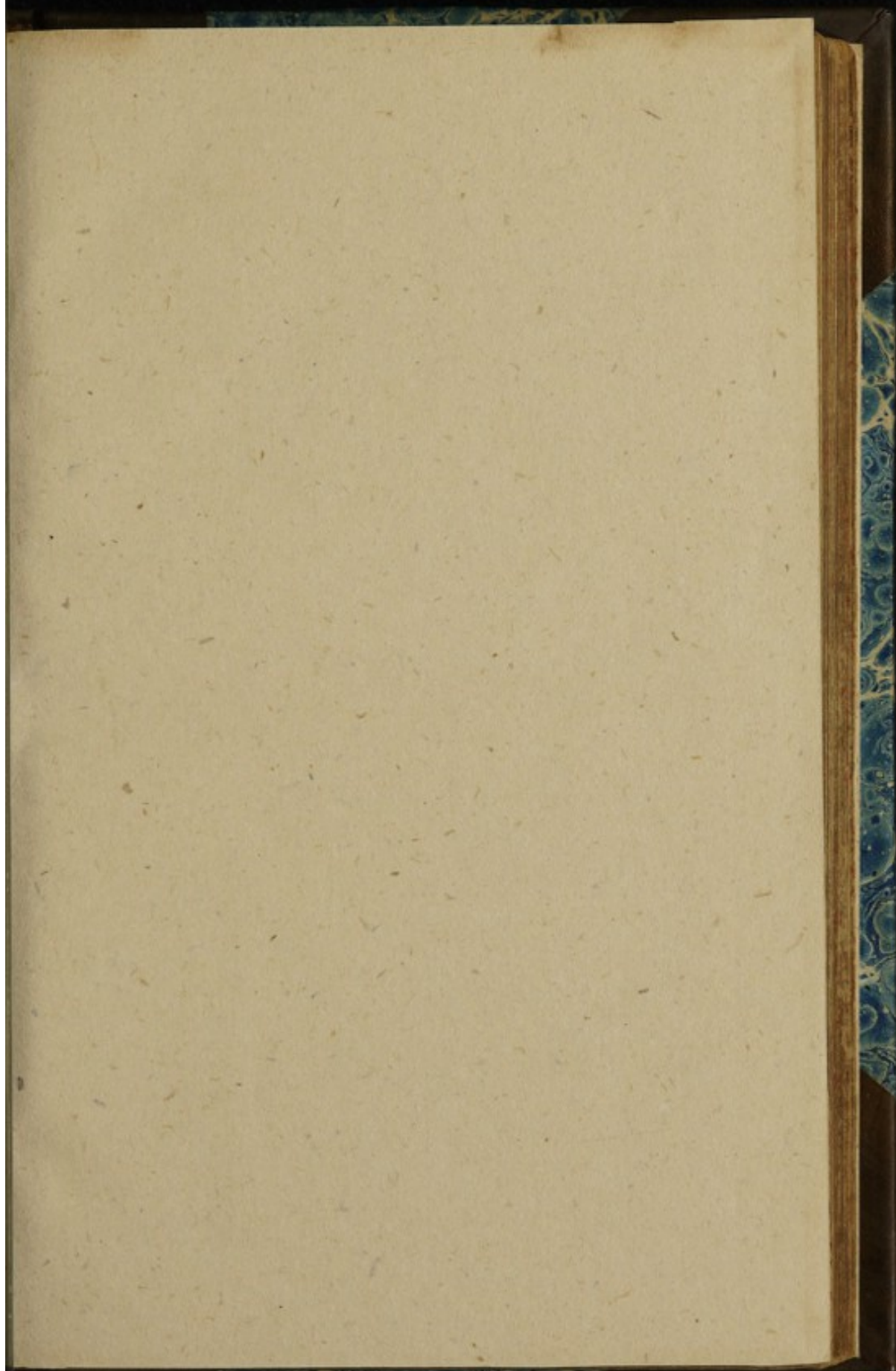
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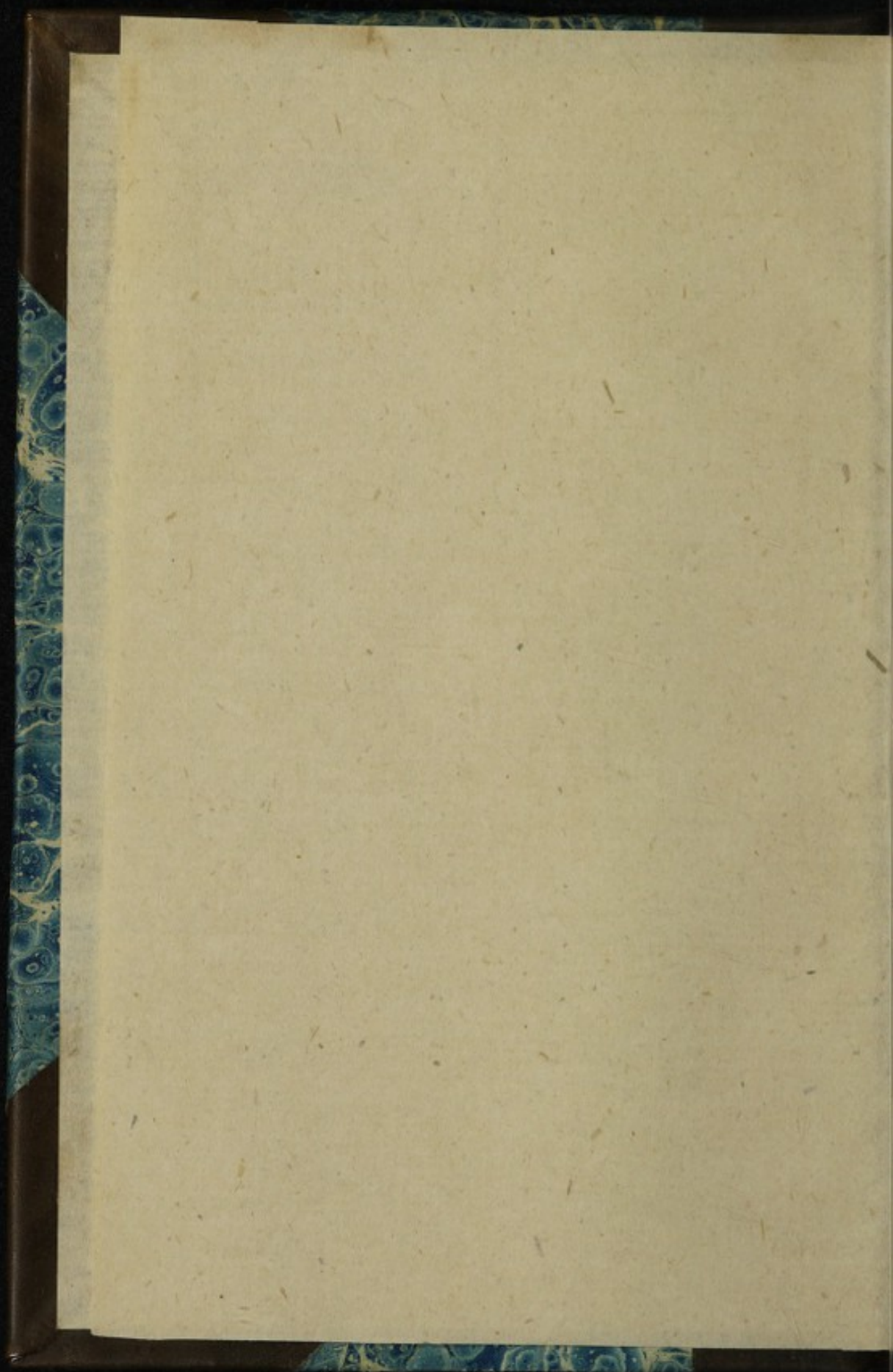


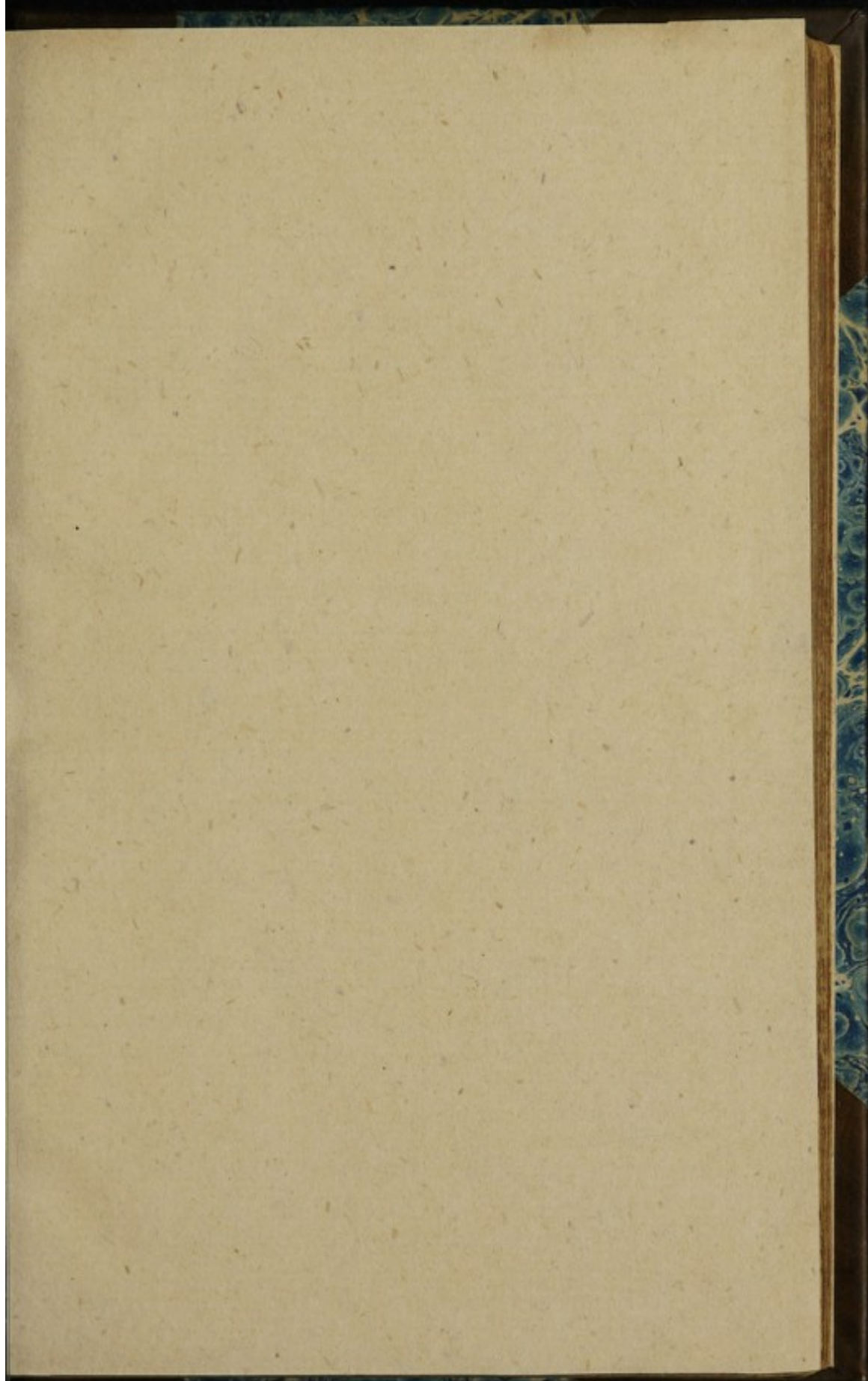


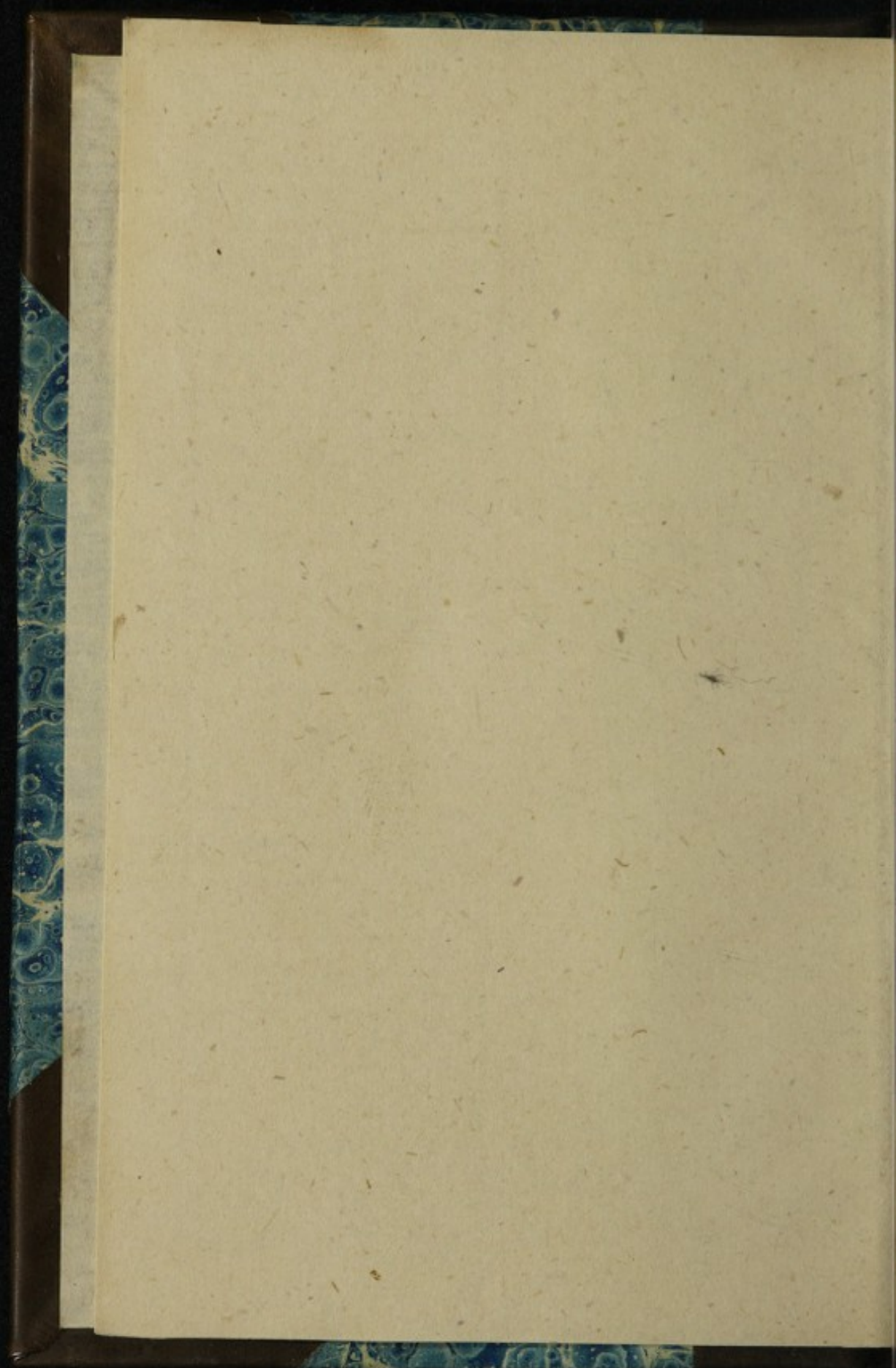


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RESOLUTION

OF THE

NATIONAL ANTHROPOLOGICAL ARCHIVES

APPENDIX

OF THE

VIETIATED STORY



A
DISQUISITION
ABOUT THE
Final Causes
OF
NATURAL THINGS:

Wherein it is Inquir'd,
Whether, And (if at all) With what
Cautions, a Naturalist should admit Them?

By the Honourable *Robert Boyle*, Esq;

To which are Subjoyn'd, by way of

APPENDIX

SOME

9 *Uncommon Observations*
ABOUT

VITIATED SIGHT.

By the same *AUTHOR*.

L O N D O N :

Printed by *H. C.* for *John Taylor*, at the
Ship in *St. Paul's Church-Yard*, 1688.

L. Stephens.
1720.

DISQUISITION

ABOUT THE

Final Causes

OF

NATURAL THINGS

Wherein it is inquired,

Whether, And (if not all) Which, of the
Causes, Natural, should admit them?

By the Honorable Robert Boyle,

To which are Subjoyn'd

APPENDIX

SOME

Observations

ABOUT

VITiated SIGHT

By the same Author.

LONDON.

Printed by H. C. for Robert Taylor, at the
Shop in St. Pauls Church-yard, 1683.



THE
PREFACE.

There are not many Subjects in the whole compass of Natural Philosophy, that better deserve to be Inquired into by Christian Philosophizers, than That which is Discours'd of in the following Essay. For Certainly it becomes such Men to have Curiosity enough to Try at least, Whether it can be Discover'd, that there are any Knowable *Final Causes*, to

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be Consider'd in the
Works of Nature. Since,
if we neglect this Inquiry,
we live in danger of being
Ungrateful, in Overlook-
ing those Uses of Things,
that may give us Just
Cause of Admiring and
Thanking the Author of
them, and of Losing the
Benefits, relating as well
to Philosophy as Piety,
that the Knowledge of
them may afford us. And
if there be no such Things,
we are more than in dan-
ger to Mispend our Labor
and Industry, in fruitless
Searching

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Searching for such Things
as are not to be Found.
And an Inquiry of this kind
is now the more Seasonable,
because two of the Chief
Sects of the modern Philo-
sophizers, do both of them,
though upon differing
Grounds, deny that the
Naturalist ought at all to
trouble or busie himself a-
bout *Final Causes*. For *Epi-
curus*, * and most of his Fol-
lowers (for I except some
few late ones, especially the
Learned *Gassendus*) Banish

* Illud in his rebus vitium vehementer inest, Eju-
gere illorumque Errorem præmeditemus, Lunina qui fa-
ciunt Oculorum clara Creatâ Prospicere ut possemus —
Lucr. de rer. nat. lib. IV. sect. 824.

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the Consideration of the Ends of Things ; because the World being, according to them , made by Chance, no Ends of any Thing can be suppos'd to have been intended. And on the contrary, * *Monfieur Des Cartes*, and most of his Followers, suppose all the Ends of God in Things Corporeal to be so Sublime, that 'twere Presumption in Man to think his Reason

* *Ita denique nullas unquam rationes circa res naturales, a fine, quem Deus aut Natura in iis faciendis sibi proposuit, desumemus ; qui non tantum nobis debemus arrogare ut ejus consiliorum participes esse putemus : Cartesius Princip. Philosop. Parte prima Artic. 28.*

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can extend to Discover
them. So that, according
to these Opposite Sects, 'tis
either Impertinent for Us
to Seek after *Final Causes*,
or Presumptuous to think
We may Find Them.
Wherefore, I hope I shall
be Excus'd, if, having been
engag'd by some Sollicita-
tions, (wherewith 'tis need-
less to trouble the Reader,)
I did not Decline to Try,
what the Bare, but Atten-
tive, Consideration of the
Subject would Suggest to
My Own Thoughts. And,
tho' 'twas easie to Foresee,

A 4 that

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by this means my Friend
might miss of receiving
in my Essay, divers things
that occur'd not to Me;
yet I consider'd on the other
side, that such *things* would,
notwithstanding my Si-
lence, be found in the Au-
thors that deliver'd them :
and 'twas very possible, that
by the Course I took, I
might light upon some
Thoughts, that I should
have miss'd, if I had prepos-
sess'd my Mind with the
Opinions of Others; which
I was the less Tempted to
do, because an easie prospect
of

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of my Theme suffic'd to let me see, I was like to have the *Epicureans* and *Cartesians* for my Aderfaries, not my Assistants. And for the School-Philosophers; the very Slight Account that their Master *Aristotle* gives of One of my Four Questions, (for of the rest, as far as I remember, He says little or nothing,) gave me small hopes of being Aided by Them; especially since in This, as in many Other Questions, they proceed upon Grounds that I cannot Assent to. Ana-
tomists

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tomists indeed, and some Physicians, have done very laudably upon the Uses of the Parts of the Human Body ; which I take this Occasion to Declare, that it may not be Suspected, that I do in the least Undervalue their happy Industry, because I Transcribe not Passages out of their Books : The Reasons of which Omission are, not only, That I had not any one Book of Anatomy at hand, when I was Writing ; but, That the Uses of the Parts of Man's Body related

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but to a small Part of my Discourse : to make which more Comprehensive, I took in the Consideration of more General Questions, besides that which was controverted between *Aristotle* and the Ancienter Philosophers, who disputed how Bodies, that were devoid of Knowledg, could Act for Ends.

Those that Relish no Books in Natural Philosophy but such as abound in Experiments, are seasonably Advertis'd, that I do not Invite Them to Read this
Trea-

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Treatise; wherein I thought it much more Suitable to the Nature of my Subject and Design, to declare the Works of God, than of Men; and consequently to Deliver rather Observations, than Artificial Experiments. And even of the Former of these, tho' perhaps most Readers may find in the ensuing Discourse Several that they have not met with in Classic Authors, yet I shall freely acknowledge, that, upon the Review I made of what I writ, I find, tho' too Late
to

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to Repair the Omission,
that I have left several
Things unmentioned, that
would have been very per-
tinent to my Subject;
which may, I hope, be
more easily Excus'd, be-
cause, the Body of the fol-
lowing Disquisition having
been Written many years
ago, and Thrown by upon
the Death of the * Gentle-
man that Press'd me for it;
I could not then take no-
tice of those many Disco-
veries in Anatomy, and o-

* Mr. Henry Oldenburgh, Secretary of
the Royal Society.

ther

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ther Parts of Physiology, that have since been happily made. But perhaps some will think, I may have more need to Excuse the Largeness of Some Parts of the following Treatise, compar'd with the Others. And I should rather Grant than Answer the Objection, if I could not Alledge, that the Contagious Boldness of some Baptiz'd *Epicureans*, Engag'd me to dwell much longer on the Third Proposition of the Fourth Section, than I at first Intended. And on the other hand,

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hand, the *Cartesian* Opinion having of late made it Requisite to Handle the formerly Difficult Question, about the Consideration of *Final Causes*, after a New Manner; I thought it Unfit, Lightly to Pass over the Paradox Maintain'd by so Great a Man; and Judg'd it Expedient in Some Places (what I could not do without Enlarging) to Propose Thoughts adjusted to to the Present State of Things in this Affair: in the Management of which, I have had so much more
Regard

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Regard to some Other Things, than to the Symmetry of the Parts whereof this Tract consists, that I will not say, That *I fear*, I have in It but *Thrown together* Materials for a Just Discourse on my Subject; since to *Do so* was the Main Thing I Intended. And if the Materials be Good and Solid, they will easily, in so Learned an Age as This, find an Architect, that will Dispose them in a more Artful Way, than I was either at Leisure or Sollicitous to do.

A N

(1)

AN
ESSAY,
INQUIRING

Whether and How a Naturalist should Consider Final Causes.

To my very Learned Friend Mr. F. O.

S I R,

THough in a Book or two of mine, that you have already been pleas'd to peruse, there are some passages, whence you may easily enough gather, what I thought about your Questions;
B yet

yet because the Subject is of great moment, as well as difficulty, and you may suspect I have alter'd my opinion, I shall, without referring you to writings, which perhaps neither you nor I have at hand, set down succinctly, but yet as if I had said nothing of any of them before, my present thoughts about these Four Questions.

I. Whether, generally or indefinitely speaking, there be any Final Causes of things Corporeal, knowable by Naturalists?

II. Whether, if the first Question be resolv'd in the Affirmative, we may consider Final Causes in all sorts of Bodies, or only in some peculiarly qualified ones?

III. Whether, or in what sense, the Acting for Ends may be ascrib'd to an Unintelligent, and even Inanimate Body?

IV. And

IV. And lastly, How far, and with what Cautions, Arguments may be fram'd upon the supposition of Final Causes ?

S E C T. I.

TO begin with the first Question; Those that would exclude Final Causes from the consideration of the Naturalist, are wont to do it (for ought I have observ'd) upon one of these two Accounts : *Either*, that with *Epicurus* they think the world was the Production of Atoms and Chance, without any intervention of a Deity ; and that consequently 'tis improper and in vain to seek for Final Causes in the effects of Chance : *Or*, that they judge with *Des Cartes*, that God being an Omniscient Agent, 'tis rash and presumptuous for men to

B 2 think,

think, that they know, or can investigate, what Ends he propos'd to himself in his Actings about his Creatures. The Ground on which the *Epicureans* have rejected Final Causes, has been disallow'd by the Philosophers of almost all other Sects; and some have written sufficient Confutations of it, which therefore I shall here forbear to insist on; though somethings I shall upon occasion observe, that may help, if not suffice, to discredit so unreasonable an Opinion. But the *Cartesian* Argument has been so prevalent among many Learned and Ingenious men, that it will be worth while (if it be but to excite better Pens) to spend some time in the Consideration of it.

Perhaps one thing that alienated that excellent Philosopher, from allowing the Consideration of *Final* Causes in Physicks, was, that the School-Philosophers, and many other Learned men, are wont to pro-

propose it too unwarily, as if there were no Creature in the world that was not solely, or at least chiefly, design'd for the Service or Benefit of *Man*: Infomuch that I remember I have seen a Body of Divinity, publish'd by a famous Writer, wherein, to prove the opinion he favours, of those that would have the world annihilated after the day of Judgement, he urgeth this Argument; That since the World was made for the sake of Man in his travelling Condition (*homini viatoris causa,*) when once Man is possess'd of his Everlasting State of Happiness or Misery, there will be no further use of the World. The opinion, that gives rise to such presumptuous and unwarrantable Expressions, did, as I guess by his objection, more *choque Des Cartes*, than I wonder that it should displease him. But the indiscretion of men ought not to prejudice Truth; which must not be cast away, with the un-

warrantable Conceits that some men have pinn'd upon it.

Wherefore, since I cannot entirely close, either with the opinion of the *Epicureans*, or of the *Cartesians*, I shall leave each party to maintain its own opinion, and proceed to propose mine: For the clearing of which, and indeed of the Disquisition of *Final Causes*, I shall beg leave to premise a Distinction, which, though novel, I shall venture to employ, because it comprises and distinguishes some things, which I think, ought neither to be overlook'd nor confounded.

I conceive then, that when we speak of the Ends which Nature, or rather the Author of Nature, is said to have in things Corporeal, One of these four things may be signify'd, or, if you like that expression better, the End design'd by Nature may be fourfold:

First,

First, there may be some grand and General Ends of the whole World, such as the Exercising and Displaying the Creators immense Power and admirable Wisdom, the Communication of his Goodness, and the Admiration and Thanks due to him from his Intelligent Creatures, for these his divine Excellencies, whose Productions manifest his Glory. And these Ends, because they regard the Creation of the whole Universe, I call the *Universal Ends* of God or Nature.

Secondly, in a somewhat more restrain'd sense, there may be Ends design'd in the number, fabrick, placing, and wayes of moving the great Masses of Matter, that, for their Bulks or Qualities, are considerable parts of the World ; since 'tis very probable, that these bodies, such as the Sun, Moon, and fixed Stars, and the Terraqueous Globe, and perhaps each of its two chief

parts, the Earth and the Sea, were so fram'd and plac'd, as not only to be capable of persevering in their own present state, but also as was most conducive to the Universal Ends of the Creation, and the good of the whole World, whereof they are notable parts. Upon which account these Ends, may, for distinctions sake, be call'd *Cosmical* or *Systematical*, as regarding the Symmetry of the great System of the world.

There is a *Third* sort of Ends, that do more peculiarly concern the Parts of Animals (and probably Plants too) which are those, that the particular parts of Animals are destinated to, and for the welfare of the whole Animal himself, as he is an entire and distinct System of organiz'd parts, destinated to preserve himself and propagate his *Species*, upon such a Theatre (as the Land, Water or Air) as his Structure and Circumstances determine

termine him to act his part on. And these Ends, to discriminate them from others, may be call'd *Animal* Ends.

Fourthly, and lastly, there is another sort of Ends, which, because they relate particularly to Man, may, for brevity's sake, be call'd *Human* Ends, which are those that are aim'd at by Nature, where she is said to frame Animals and Vegetables, and other of her productions, for the use of Man. And these Ends themselves may be distinguish'd into *Mental*, that relate to His Mind, and *Corporeal*, that relate to His Body, not only as He is an Animal fram'd like other Animals, for his own Preservation, and the propagation of his Species (Mankind;) but also as He is fram'd for Dominion over other Animals and works of Nature, and fitted to make them subservient to the Destinations, that one may suppose to have been made of
of

of them to His service and benefit.

This Distinction of *Final Causes*, which I hope will not prove altogether useless, being premis'd; I shall begin my intended Discourse, by owning a dissent from both the opposite Opinions; *Theirs*, that, with the vulgar of Learned Men, will take no notice of Final Causes but those we have stiled *Human* ones; and *theirs*, that (as they think, with *Descartes*) reject Final Causes altogether; since, tho' I judge it erroneous to say in the strictest sense, that every thing in the Visible World, was made for the Use of Man; yet I think 'tis more erroneous to deny, that any thing was made for ends Investigable by Man.

'Tis a known Principle of the *Cartesian* Philosophy, That there is always just the same quantity of Motion in the World at one time, that there is at another: Of which
After-

Assertion this Reason is given ;
 That there is no Cause, why God,
 who is Immutable, should at the
 beginning of things, when he first
 put Matter into Motion, have gi-
 ven it such a quantity of Motion,
 as would need to be afterwards
 augmented or lessen'd. But I see
 not, how by this Negative way
 of Arguing, those that imploy it,
 do not (implicitly at least) take
 upon them to judge of the Ends,
 that God may have propos'd to
 himself in Natural things. For,
 without a Supposition, that they
 know what God design'd in set-
 ting Matter a-moving, 'tis hard
 for them to shew, that His Design
 could not be such, as might be best
 accomplish'd by sometimes adding
 to, and sometimes taking from, the
 Quantity of Motion he communi-
 cated to Matter at first. And I
 think it may be worth consider-
 ing, Whether by this Doctrine of
 theirs, the *Cartesians* do not more
 take upon them than other Philo-
 sophers

sophers, to judge of God's Designs. For, if a Man be known to be very Wise, and have various ways of compassing his several Ends, He that, seeing some of those ways have a direct tendency to some Rational End, shall conclude That End to be one of those that is intended, does thereby less presume, and express more respect to that Wise Man, than he that should conclude, that those cannot be his Ends, and that He can have no other Design knowable by us, except a certain General one nam'd by the Assertor. And indeed, it seems more easie to know, that this or that particular thing, for which an Engine is proper, may be *among others*, intended by the Artificer, tho' never so Skilful, than to know Negatively, that he can have no other than such or such an End.

And how will a *Cartesian* assure me, that among the many Ends,
that

that he grants that God may have propos'd to himself in the Production of his Mundane Creatures; one may not be, That We, whom he has vouchsaf'd to make Intelligent Beings, and capable of Admiring and Praising him, should find just cause to do so, for the Wisdom and Goodness he has display'd in the World? which Attributes we could not well discern or celebrate, unless we knew as well, that the Creatures were *made* for such Uses, as that they are exceedingly well *fitted* for them. I know God's Immutability is alledged, to prove that the Quantity of Motion is never vary'd: But to me 'tis not evident, why God's having particular Ends, tho' some of them seem to require a Change in his way of Acting in Natural Things, must be more inconsistent with his Immutability, than his Causing many things to be brought to pass, which tho' *abæterno* he decreed to do, are yet not actually done, unless in process

process of Time. And particularly it seems not clear, why God may not as well be Immutable, tho' he should sometimes vary the Quantity of Motion that he has put into the World, as He is, tho', according to the Opinion of most of the *Cartesians* themselves, he does daily create multitudes of Rational Souls, to unite them to Human Bodies: Especially considering, that these newly created substances, are, according to *Descartes*, endow'd with a power, to determine and regulate the motions of the Spirits and the *Conari-*
on; which are things clearly Corporeal, I say not this, as if I absolutely rejected the *Cartesian* Doctrine, about the continuance of the same Quantity of Motion in the whole Mass of Matter. For, whether or no it be a Truth; I think 'tis no unuseful nor improbable *Hypothesis*: And I have not so much argued *against it*, as upon the *Grounds*, on which they argue *for it*.
Where

Wherefore, to come now to the thing it self, whereas Monsieur *Des-Cartes* objects, that 'tis a Presumption for Man, to pretend to be able to investigate the Ends, that the Omniscient God propos'd to himself in the making of his Creatures; I consider by way of Answer, That there are two very differing ways, wherein a Man may pretend to know the Ends of God in his visible Works: For, he may either pretend to know only *some* of God's Ends, in some of his Works; or, he may pretend to know *all* his Ends. He that arrogates to himself, to discover God's Ends in this *latter* sense, will scarce be excus'd from a high Presumption, and no less a Folly, from the reason lately intimated in the *Cartesian* Objection. But to pretend to know God's Ends in the *former* sense, is not a *Presumption*, but rather, to take notice of them is a *Duty*. For, there are some things in Nature so curiously contrived,
and

and so exquisitely fitted for certain Operations and Uses, that it seems little less than Blindness in Him, that acknowledges with the *Cartesians* a most wise Author of things, not to conclude, that, tho' they *may* have been design'd for *other*, and perhaps higher Uses; yet they *were* design'd for *this* Use. As he that sees the Admirable Fabric of the Coats, Humors, and Muscles of the Eyes, and how excellently all the parts are adapted to the making up of an Organ of Vision, can scarce forbear to believe, that the Author of Nature intended It should serve the Animal, to which it belongs, to See with. The *Epicureans* indeed, that believe the World to have been produc'd but by the casual concurrence of Atoms, without the intervention of any Intelligent Being, may have a kind of excuse, whereof other Philosophers are destitute, that acknowledge a Deity, if not also a Providence. For the very Supposition,
for

for instance, that a mans Eyes were made by Chance, argues, that they need have no relation to a designing Agent ; and the use that a man makes of them , may be either casual too, or at least may be an effect of *His* knowledge, not of *Nature's*. But when, upon the Anatomical Dissection, and the Optical Consideration, of a Human Eye, we see 'tis as exquisitely fitted to be an organ of Sight, as the best Artificer in the world could have fram'd a little Engine, purposely and mainly design'd for the use of seeing ; 'tis very harsh and incongruous to say, that an Artificer , who is too intelligent either to do things by chance, or to make a curious piece of workmanship without knowing what uses 'tis fit for, should not design it for an use to which 'tis most fit.

'Tis not to be deny'd that he may have more uses for it than one, and perhaps such uses as we cannot divine ; but this hinders not, but that,

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among

among its several uses, this, to which we see it so admirably adapted, should be thought one. And I see not, how it does magnifie Gods wisdom, or express our Veneration of it, to exclude out of the number of his Ends in framing Human Eyes, that most obvious and ready use which we are sure is made of them, and which they could not be better fitted for. This may perhaps be not unfitly illustrated by the following Comparison, whereof the application were superfluous: Suppose that a Country Man, being in a clear day brought into the Garden of some famous Mathematician, should see there, one of those curious Gnomonick Instruments, that show at once, the *place* of the *Sun* in the *Zodiack*, his *Declination* from the *Aequator*, the *Day* of the *Month*, the *Length* of the *Day*, &c. It would indeed be presumption in him, being unacquainted both with the Mathematical Disciplines, and the
several

several Intentions of the Artist, to pretend or think himself able, to discover all the Ends, for which so Curious and Elaborate a Piece was framed. But when he sees it furnished with a Stile, with Hourly Lines and Numbers, and in short, with all the Requisites of a *Sun Dial*, and manifestly perceives the Shadow to mark from time to time, the Hour of the Day; 'twould be no more a Presumption than an Error in him to conclude, that (whatever other Uses the Instrument is fit, or was design'd for) it is a *Sun-Dial*, that was meant to shew the Hour of the Day.

And here I shall demand of those, that will not allow us to think, that any Natural Things are directed to Ends knowable by Men; whether, if the Divine Author of them had really design'd them for such Ends, the things themselves are not so Fram'd and

directed, as in that case they should be? And whether the Fabrick and Management of Natural Things, do really countenance or contradict our Supposition?

For my part, after what has been already discours'd, I scruple not to confess, that I see not why it should be reputed a Disparagement to the Wisdom of any Agent whatsoever, to think, that his Productions were design'd for such *Ends*, among others, as they are excellently fram'd and fitted for; unless it did appear, that those *Ends* were unworthy to be Design'd by the Wise Agent. But that cannot be justly said in our present Case; since 'tis not injurious to the Divine Author of things, to believe that *some* of the *Ends*, to which he destinated divers of his Corporeal Works, were; To exert and communicate His Exuberant Goodness, and to receive from his intelligent Creatures, such
as

as Men, an ardent Love, a high Admiration, and an obsequious Gratitude, for having display'd so much Wisdom and Beneficence, in exquisitely qualifying his Works to be wonderfully serviceable to one another, and a great number of them to be particularly subservient to the Necessities and Utilities of Man.

And indeed I can by no means assent to that Assertion of *Mr. Descartes*, That it cannot be said, that some of Gods Ends (in his Corporeal Works) are more manifest than others; but that all of them lie equally hid in the Abyss of the Divine Wis-

Nec fingi potest, aliquos Dei Fines, magis quam alios, in propatulo esse; omnes enim in imperscrutabili ejus sapientiæ Abyssis sunt eodem modo reconditi. Resp. Quart. ad Object. Gassendi.

dom: since there are many of his Creatures, some of whose Uses are so manifest and obvious, that the generality of Mankind, both

Philosophers and Plebeians, have in all Ages, and almost in all Countries, taken Notice of, and Acknowledg'd them. And as to what he adds, (by which he seems to intimate the motive that led him to make the foremention'd Assertion,) That in Physicks, all things ought to be made out by certain and solid Reasons; to this I answer, *First*, That I see not why the admitting, that the Author of Things design'd some of his Works for these or those Uses, amongst others, may not consist with the Physical Accounts of making of those things; as a Man may give a Mechanical Reason of the Structure of every Wheel and other part of a Watch, and of their way of acting upon one another when they are rightly put together, and in short, of the Contrivance and *Phænomena* of the little Machine; tho' he suppose, that the Artificer design'd it to show the hours of the day, and tho' he have

have that intended use in his Eye, whilst he Explicates the Fabrick and Operations of the Watch. I answer, *Secondly*, That I readily admit, that in Physicks we should indeed ground all things upon as solid Reasons as may be had; But I see no necessity, that those Reasons should be always precisely Physical: Especially if we be treating, not of any particular *Phænomenon*, that is produc'd according to the course of Nature establish'd in the *World*, already constituted as *this* of ours is: but of the first and general Causes of the *World* it self; from which Causes, I see not why the Final Causes, or Uses, that appear manifestly enough to have been design'd, should be excluded. And to me 'tis not very material, whether or no, in Physicks or any other Discipline, a thing be prov'd by the peculiar Principles of that Science or Discipline; provided it be firmly proved by the common

grounds of Reason. And on this occasion let me observe, that the Fundamental Tenents of Mr. *Descartes's* own Philosophy, are not by himself prov'd by Arguments strictly Physical; but either by Metaphysical ones, or the more Catholick Dictates of Reason, or the particular testimonies of Experience. For when, for instance, he truly ascribes to God, all the Motion that is found in Matter; and consequently, all the variety of *Phænomena* that occur in the World; he proves not by an Argument precisely Physical, that God, who is an Immaterial Agent, is the efficient cause of Motion in Matter; but only by this, That since Motion does not belong to the Essence and nature of Matter, Matter must owe the Motion it has to some other Being: And then 'tis most agreeable to common Reason, to infer, that, since Matter cannot move it self, but it must be mov'd by some other Being, that

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Being must be Immaterial, since otherwise some Matter must be able to move it self contrary to the *Hypothesis*. And when *Des-Cartes* goes to demonstrate, that there is always in the Universe, the self-same quantity of Motion, (that is, just as much at any one time, as at any other) and consequently, that as much motion as one Body communicates to another, it looses it self; he proves it, by the Immutability of God, which is not a Physical Argument strictly so call'd, but rather a Metaphysical One; as he formerly prov'd, God's being the Cause of all Motion in Matter, not by Principles peculiar to Physicks, but by the common grounds of Reason.

Tho' Monsieur Des-Cartes does, as I have formerly shown, speak very Dogmatically and Universally, against

C'est une chose qui de soy est manifeste, que nous ne pouvons connoître les fins de Dieu, si luy mesme ne nous les revele. Et encore

Mens

qu'il soit vray en Morale, en egard à nous autres hommes, que toutes choses ont esté faites pour la gloire de Dieu, à cause que les hommes sont obligez de louer Dieu pour tous ses ouvrages; & qu'on puisse aussi dire, que le soleil a esté fait pour nous éclairer, pour ce que nous expérimentons que le soleil en effet nous éclaire: ce seroit toutes fois une chose puerile & absurde, d'affirmer en Metaphysique, que Dieu, à la façon d'un homme superbe, n'auroit point eu d'autre fin en bastissant le Monde, que celle d'estre loué par les hommes; & qu'il n'auroit créé le soleil, qui est plusieurs fois plus grand que la Terre, à autre dessein que d'éclairer l'homme, qui n'en occupe qu'une tres-petite partie.

Mens endeavouring or pretending to know any Final Causes in Natural things; for which Reason I have, as well as the generality of his other Readers, and even his Disciples, look'd upon the Sense of those positive Expressions as containing his Opinion; yet, since I writ the foregoing part of this Treatise, I lighted on a Passage of his, wherein he seems to speak more cautiously or reservedly, opposing His Reasoning to Their

Opi-

Opinion who teach, that God hath no other End in making the World, but that of being prais'd by Men. But in that short Discourse whereof this Passage is a part, there are two or three other things wherein I cannot Acquiesce. As first, that 'tis Self-evident, that we cannot know the Ends of God, unless he Himself reveal them to us; (he must mean in a Supernatural way, if he will not speak impertinently:) For what he says to be evident of it self, is not at all so, to the generality of Mankind, and even of Philosophers; and therefore I think, it ought not to be barely proneunc'd, but (if it can be) should be prov'd. And next, he does not show how we are oblig'd to praise God for his Works, if He had no intention to have us do so, or that we should discover any of the Ends for which He made them. If a judicious Man should see a great Book, written in some Indian Language, which he
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is utterly a Stranger to, and should know nothing of it, but that 'twas made by a very Intelligent Physician: He might indeed conclude, that the Work was not made by chance, but would have no means to be convinc'd by the Inspection of the Book it self, that it was compos'd with great Skill and Kindness, and deserv'd his Praise and Thanks: Since he could not know any of the particular Ends, to which the several Chapters of it were destinated, nor consequently discover how skilfully they were fitted to reach such Ends. What *Des-Cartes* says, that 'tis childish and absurd to think, that God had created the Sun, which is many times bigger than the Earth, only to afford Light to Man, who is but a very small part of It, is somewhat invidiously propos'd; there being few able Writers, that confine the Utility of the Sun directly to the affording Light to Man; and the littleness of his Bulk,

Bulk, ought not to make it thought absurd, that God may have had an especial Eye to his Welfare, in framing that bright Globe ; since not only, for ought appears to us, that most excellent Engine of Mans Body, is a more admirable thing than the Sun, but the rational and immortal Soul that resides in it, is incomparably more noble than a thousand Masses of brute Matter, and that not so much as Organiz'd, can be justly reputed, (as will be hereafter more fully declared.) And since in this very Discourse, the accute Author of it confesses, that we may know the ends of God's Corporeal Works, if He reveal them to us ; a Christian Philosopher may be allow'd, to think the Sun was made, among other purposes, to enlighten the Earth, and for the use of Man, since the Scripture teaches us, that not only the Sun and Moon, but the Stars of the Firmament, which *Des-Cartes* not improbably thinks to be
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so many Suns, were made to give
Light to the Earth, and were divi-
ded to all the Nati-
Deut. 4. 19. ons that inhabit it.

Perhaps it were not
rash to add, that I see not why
the Belief, that a Man may know
some of God's Ends in things
Corporeal, should more derogate
from our Veneration of his
Wisdom, than to think we
know some of his Ends in other
Matters, of which the Scrip-
ture furnishes us with a mul-
titude of Instances, as (particu-
larly) that of *Job* sacrificing for
his Friends; and the declar'd Uses
of the *Urim* and *Thumim*: Since
God may, if He pleases, declare
Truths to Men, and instruct them,
by his Creatures and his Actions,
as well as by his Words: As when
He taught *Noah* by the Rain-bow,
and *Jonah* by a Gourd and a
Worm, and regulated the Incamp-
ment of the *Israelites*, by the gui-
dance of a Cloudd, and a fiery
Pillar.

Pillar. Lastly, whereas Monsieur *Des-Cartes* objects, that those he dissents from, talk as if they look'd upon God as a proud Man, who design'd his Works only to be prais'd for them; I know not, whether in this place he speaks so cautiously and reverently of God, as he ought; and elsewhere is wont to do. For as Humility, tho' it be a Vertue in Men, is extreamly remote from being any of Gods Perfections, so That may be pride in a Man, who is but a Creature, imperfect, dependent, and hath nothing that he has not receiv'd; which would be none at all in God, who is incapable of Vice, and who may, if he please, justly propose to himself His own Glory for one of his Ends, and both require and delight to be prais'd by Men for his Works; since he is most worthy of all praise, and 'tis their duty and *reasonable service*, which he is graciously pleas'd to approve of, to pay it Him.

'Tis

'Tis not without trouble, that I find my self oblig'd by the exigency of my design, so much to oppose, in several places of this present Discourse, some Sentiments of *Mr. Des-Cartes*, for whom otherwise I have a great esteem, and from whom I am not forward to dissent. And this I the rather declare to you, because I am not at all of Their mind, that think *Mr. Des-Cartes* a favourer of Atheism, which, to my apprehension, would subvert the very foundation of those Tenents of Mechanical Philosophy, that are particularly his. But judging that his Doctrine (at least as it is understood by several of his Followers, as well as his Adversaries;) about the rejection of Final Causes from the consideration of Naturalists, tends much to weaken, (as is elsewhere noted) if not quite to deprive us of, one of the best and most successful Arguments, to convince Men, that there
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is a God, and that they ought to Admire, Praise, and Thank him : I think it my duty *to* prefer an important truth, before my respect to any Man, how eminent soever, that opposes it ; and *to* consider more the Glory of the great Author of Nature, than the Reputation of any one of Her Interpreters.

And to strengthen what I have been saying, give me leave to mind you more expressly here, of what I have elsewhere Intimated, *viz.* That the excellent Contrivance of the great System of the World, and especially the curious Fabrick of the Bodies of Animals, and the Uses of their Sensories, and other parts, have been the great Motives, that in all Ages and Nations induc'd Philosophers to acknowledge a Deity, as the Author of these admirable Structures ; and that the Noblest and most Intelligent Praises, that have been paid

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Him

Him by the Priests of Nature, have been occasion'd and indited by the Transcending Admiration; which the attentive Contemplation of the Fabrick of the Universe and of the curious Structures of Living Creatures, justly produc'd in them. And therefore it seems injurious to God, as well as unwarrantable in it self, to banish from Natural Philosophy, the Consideration of Final Causes; from which chiefly, if not only, I cannot but think (tho' some Learned Men do otherwise) that God must reap the Honour that is due to those glorious Attributes, his Wisdom, and his Goodness. And I confess, I somewhat wonder, that the *Cartesians*, who have generally, and some of them skilfully, maintain'd the Existence of a Deity, should endeavour to make Men throw away an Argument, which the Experience of all Ages shews to have been the most Successful, (and in some Cases the only prevalent one) to establish

establiſh among Philoſophers the Belief and Veneration of God. I know the *Carteſians* ſay, That their Maſter has demonſtrated the Exiſtence of a God, by the *Innate Idea* that Men have of a Being infinitely perfect; who left it upon the mind of Man, as the mark of an *Artiſt impreſt upon his Work*: And alſo that they aſcribe to God, the having made Matter out of nothing, and alone put it into Motion; which ſufficiently argue the Immenſity of his Power. But, *tho'* I would by no means weaken the Argument, drawn from the *Inbred Notion* of God, ſince I know, that divers Learned Men have Acquieſc'd in it; yet, on the other ſide, I ſee not, why we may not reaſonably think, that God, who, as themſelves confeſs, has been pleas'd to take care, Men ſhould acknowledge Him, may alſo have provided for the ſecuring of a Truth of ſo great Conſequence, by ſtamping Characters, or lea-

ving Impresses, that Men may know his Wisdom and Goodness by, as well *without*, upon the *World*, as *within*, upon the *Mind*. The bare Speculation of the Fabrick of the World, without considering any part of it as destinated to certain (or determinate) Uses, may still leave Men unconvinc'd, that there is any Intelligent, Wise, and Provident Author and Disposer of Things: Since we see generally the Aristotelians (before some of them were better Instructed by the Christian Religion) did, notwithstanding the Extent, Symmetry, and Beauty of the World, believe it to have been Eternal. And tho' They, whatever their Master thought, did not believe it to have been Created by God; yet, because they asserted that Animals, Plants, &c. act for Ends, they were oblig'd to acknowledge a Provident and Powerful Being, that maintain'd and govern'd the Universe, which they call'd *Nature*:
Tho'

Tho' they too often dangerously mistook, by sometimes confounding this Being with God himself; and at other times, speaking of it as Co-ordinate with him, as in that famous Axiom of *Aristotle*, *Deus & Natura nihil faciunt frustra*. I acknowledge therefore, that, as I set a just value upon the *Cartesian* Proof of God's Existence, so I see no reason, why we should disfurnish our selves of any other strong Argument to prove so noble and important a Truth; especially, since the *Cartesian* way of considering the World, is very proper indeed to shew the Greatness of God's Power, but not, like the way I plead for, to manifest that of his Wisdom and Beneficence. For, whereas a *Cartesian* does but shew, that God is admirably Wise, upon the supposition of his Existence; in our way, the same thing is manifested by the Effect of a Wisdom, as well as Power, that cannot reasonably be ascribed to

any other, than a most intelligent and potent Being: So that by This way, Men may be brought, upon the same account, both to *acknowledge* God, to *admire* Him, and to *thank* Him.

SECT.

 S E C T. II.

TO give you now my thoughts of the *second Question, viz. Whether we may consider Final Causes in all sorts of Bodies, or only in some peculiarly Qualify'd Ones.* I must divide Natural Bodies into *Animate* and *Inanimate*. The former of which Terms, I here take in the larger sense of those, who under it comprehend, not only Animals, but Vegetables; tho' I shall not disdainfully reject the Opinion of those Learned Men, that are unwilling to allow Plants a soul or life, at least as properly so call'd, as that which is confessedly granted to Animals.

Of the *Inanimate* Bodies of the Universe, the Noblest, and those
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which on this occasion deserve chiefly to be considered, are the Sun, Planets, and other Cœlestial Bodies. For, when Men saw those vast and luminous Globes, and especially the *Sun*, move so constantly, and so regularly, about the Earth, and diffuse on it Light and Heat; and by their various Revolutions produce day and night, Summer and Winter, and the Vicissitudes of Seasons, that are so opportune for the Inhabitants of the Earth: The observers, I say, of all this concluded, both that these Motions were guided by some Divine Being, and that they were design'd for the benefit of Man. Whether this be a demonstrative *Collection*, I shall not now debate; but I see not, why it may not have thus much of Probability in it; that in case a Man shall think, that the Fabrick of the Cœlestial parts of the World, was the curious Production of an Intelligent and Divine Agent, the regular *Phænomena* of

of the Heavens will not contradict him; since there is nothing in that Fabrick that misbecomes a Divine Author; and the Motions and Operations of the Sun and Stars are not such, but that they will allow us to think, that, among other purposes, they were made to illuminate the Terrestrial Globe, and bring Heat and other Benefits to the Inhabitants of it: So that the Contemplation of the Heavens, which so manifestly declare
 Psal. 19. 1. *the Glory of God*, may justly excite Men, both to admire his Power and Wisdom in them, and to return him Thanks and Praises, for the great Benefits that accrue to us by them.

But now, on the other side, it may be said, that in bodies *Inanimate*, whether the portions of Matter they consist of be greater or lesser, the Contrivance is very rarely so Exquisite, but that the various Motions and Occursions of the parts
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of Matter may be, without much Improbability, suspected to be capable, after many Essays, to cast one another into divers of those Circumvolutions of Matter, that, I remember, *Epicurus* calls *ὑποστροφῆς* and *Des-Cartes Vortices*; which being once made, may continue very long, by the means express'd by *Cartesius*, or by some other as probable Ones. But, without allowing this *Hypothesis* to be more than not very improbable, when I consider, what Causes there may be to fear, that we are not yet sufficiently acquainted with the true System of the World, and are not usually sensible enough, how small a part We, and the Terrestrial Globe we inhabit, make of the Universe; I am apt to fear too, that Men are wont, with greater Confidence than Evidence, to assign the Systematical Ends and Uses of the Cœlestial Bodies, and to conclude them to be made and moved, only for the service of the
Earth

Earth and its Inhabitants. And *tho'*, even as a meer Naturalist, I will not deny, that, as *Man* actually receives Benefits by the establish'd order and motion of the Stars, so one of the several Uses intended by the Author of Nature in them, may particularly respect Men; yet I am apt to think, that by what we hitherto know, 'twill not be easie to be prov'd, that some, at least, of the Cœlestial Bodies and Motions, may not be intended more for other purposes, than to cast their Beams, or shed their Influences (supposing they have some) upon the Earth. And at least, I cannot but think, that the Situations of the Cœlestial Bodies, do not afford by far so clear and cogent Arguments, of the Wisdom and Design of the Author of the World, as do the bodies of Animals and Plants. And for my part I am apt to think, there is more of admirable Contrivance in a *Mans Muscles*, than in (what we

we yet know of) the *Celestial Orbs*; and that the Eye of a Fly is, (at least as far as appears to us,) a more curious piece of Workmanship, than the Body of the Sun.

As for other *Inanimate Bodies*, as *Stones, Metals &c.*, whose matter seems not organiz'd; tho' there be no absurdity to think, that they also were made for distinct particular purposes, if not also for Human Uses; yet most of them are of such easy and unelaborate contextures, that it seems not absurd to think, that various occurrences and justlings of the parts of the Universal matter, may at one time or other have *produc'd* them; since we see in some Chymical Sublimations, and Christallizations of Mineral and Mettalline Solutions, and some other *Phenomena*; where the motions appear not to be Particularly guided and directed by an Intelligent Cause, that Bodies of as various Contextures, as those are wont to be, may be *produc'd*;

duc'd ; of which I have elsewhere given some Instances.

If it be objected, that if we allow Chance, or any thing else, without the particular Guidance of a wise and All-disposing Cause, to make a finely shap'd Stone, or a metalline substance, growing, as I have some times seen *silver* to do, in the form of a Plant ; it ought not to be denyed, that Chance may also make Vegetables and Animals : I can by no means allow the consequence. There are some effects, that are so easy, and so ready, to be produc'd, that they do not infer any knowledge or intention in their Causes ; but there are others, that require such a number and concourse of conspiring Causes, and such a continued *series* of motions or operations, that 'tis utterly improbable, they should be produced without the superintendency of a Rational Agent, Wise and Powerfull enough to range and dispose the several intervening

intervening Agent's and Instruments,
 after the manner requisite to the
 production of such a remote effect.
 And therefore it will not follow,
 that if Chance could produce a
 slight contexture in a few parts of
 matter ; we may safely conclude it
 able to produce so exquisit and ad-
 mirable a Contrivance, as that of
 the Body of an Animal. What then,
 if sometimes in sawing pieces of va-
 riegated Marble, men happen, tho'
 rarely, to meet with the Delineati-
 ons or Pictures (some of which
 I have beheld with pleasure) of
 Towns, Woods, and Men? For,
 besides that the pleasingness and ra-
 rity of such spectacles inclines the
 Imagination to favour them, and
 supply their defects ; would any
 wise man therefore conclude, that
 a real Town or wood, much less
 numbers of men, should be made
 by such a fortuitous concurrence of
 matter? What comparison is there,
 betwixt the workmanship that
 seems to be expressed in a few ir-
 regular

regular Lines, drawn upon a plane *superficies*, and perhaps two or three Colours luckily plac'd; and the great multitude of Nerves, Veins, Arteries, Ligaments, Tendons, Membranes, Bones Glands, &c. that are required to the compleating of a human Body; of which *numerous* parts (for the Bones alone are reckon'd to amount to three hundred) *every one* must have it's determinate size, figure, consistence, situation, connexion, &c. and *many or all* of them together, must conspire to such and such determinate Functions or uses? And indeed, tho' I keep by me some curious ones, yet I never saw any Inanimate production of *Nature*, or, as they speak, of *Chance*, whose contrivance was comparable to that of the meanest Limb of the despicablest Animal: and there is incomparably more Art express'd in the structure of a Doggs foot, then in that of the famous Clock at *Strasburg*.

And,

And, tho' the Paw of a Dog will be confess'd, to be of a structure far Inferior to that of the Hand of a man : yet even This ; however Aristotle prettily styles it the *Instrument of Instruments*, is a less considerable Instance to my present purpose, than another Instance, which therefore, since my intended brevity permits me not to consider *many*, I shall pitch upon, as that which I shall almost only insist on, in the following part of this Tract. And this Instance is afforded me by the Eye. For Tho' the parts that concurr to make up that admirable Organ of vision, are very numerous, yet how little any of them could have been spar'd or alter'd, unless for the worse, may appear by that great Number of Diseases, that have been observ'd in that little part of the Body. Since each of those Diseases consist in this, that some of the Coats, Humors, or other parts of the Eye, is brought into a State differing from that whereto Nature

Nature had design'd it, and where-
 into she had put it. 'Twould be
 tedious so much as to enumerate the
 several distempers of the Eye,
 whereunto Physitians have given
 particular Names; wherefore I
 shall only mention two or three
 things, wherein one would scarce
 imagine, that a small recess from
 the natural state could bring any
considerable, or perhaps *sensible*, in-
 convenience. That which we call
 the *Pupil*, is not (you know) a
 substantial part of the Eye, but on-
 ly a hole of the *Uvea*: which aper-
 ture is almost perpetually changing
 it's bigness, according to the differ-
 ing degrees of Light, that the Eye
 chances from time to time to be ex-
 pos'd to. And therefore one would
 not think, but that, whilst this hole
 remains open, it performs well e-
 nough it's part; which is, to give
 admission to the Incident beams of
 Light, whether direct or reflected.
 And yet I lately saw and discours'd
 with a woman, who after a Feaver,

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was

was not able to debate the Pupils of her eyes as formerly ; and tho' they were so very little narrower then ordinary, that I should scarce have taken more notice that 'twas at all so, if she had not told me of it, yet she complain'd she had thereby almost lost her sight, seeing Objects in certain Lights but very dimly and imperfectly. And tho' the Præternatural constriction of the Pupil be not a frequent distemper, yet tis not so rare, but that Physitians have given it a place among the Stated diseases of the eye. And on the other side tho' it appear by what hath been newly related, that a competent wideness of the Pupil is requisite to clear and distinct Vision, yet if it's wideness exceed due Limits, there is produced that distemper that is call'd *Dilatatio pupille* ; which is worse then the former, because it oftentimes deprives the Patient almost totally of his sight. And, *tho'* it may seem but a slight circumstance, that the transparent

parent coats of the eye should be devoid of colour, and of as little moment, that the *cornea* should be very smooth, provided it be transparent: yet when either of these circumstances is wanting, the sight may be much vitiated; as we see that in the Yellow-Jaundies, when 'tis come to a high degree, the adventitious Tincture wherewith the Eye is Imbued, makes men think they see a yellowness in many objects, to which that colour does not belong. And I know an Ingenious Gentleman, who, having had a small *pustula* excited and broken upon the *Cornea*, tho' the eye have been long whole; yet a very little Inequality or depression that still remains upon the Surface of the Transparent *Cornea*, does so affect him, that tho' he can read well in a Room, yet when he comes into the open fields or the streets, he for a pretty while (as himself has particularly complain'd to me) thinks many of the Objects he looks on ve-

ry Glareing, and fees many others, as men do stones at the bottom of a Brook or running water ; which I impute to the want of Uniformity in the refraction of those reflected beams of Light, that fall upon the *Cornea*, whose surface is not so smooth and equal as it should be.

To give some further Proof, that the Eye was made with design, I shall here take notice of an observation or two, that do not occur in the dissection of a human Eye, and therefore are not wont to be mentioned by Anatomists.

NB. —

I have observed in Frogs, (as I presume some others also may have done) that, besides those parts of the Eye which they have in common with Men, Dogs, Cats, and the most part of other Animals, They have a peculiar, whether membrane, or Cartilage, or both, which ordinarily is not perceived ; wherewith they can at pleasure cover the Eye, without too much hindering the sight, because this membrane is

is as well Transparent as strong ; so that it may pass for a kind of moveable *Cornea*, and (if I may so call it) a kind of false-scabord to the Eye. In furnishing frogs with this strong Membrane, the providence of Nature seems to be conspicuous : For they being Amphibious Animals, design'd to pass their lives in watery places, which for the most part abound with Sedges, and other plants endowed with sharp Edges or points ; and the progressive motion of this Animal being to be made, not by *walking*, but by *leaping* ; if his Eyes were not provided of such a sheath as I have been mentioning, he must either shut his Eyes, and so leap *blindly*, and by consequence *dangerously*, or, by leaving them open, must run a venture to have the *Cornea* cut, prickt, or otherwise offended, by the edges or points of the Plants, or what may fall from them upon the Animals Eye : whereas this Membrane, as was

said, is like a kind of Spectacle that covers the Eye without taking away the sight ; and as soon as the need of imploying it is past, the Animal at pleasure withdraws it into a little Cell, where it Rests out of the way, till there be occasion to use it again. This you may see, if you apply the point of a pin, or a Pen, or any such sharp thing, to the Eye of a frog, whilst you hold his head steady : for to screen his Eye, he will presently cover it (at least for the greatest part) with this Membrane, which when the danger is over he will again withdraw. And, because many if not most sorts of Birds, are wont or destinated to fly, (as more would do if not kept tame) among the Branches of Trees and Bushes ; least the Prickles, Twigs, Leaves, or other parts should wound or offend their Eye. Nature hath given them likewise such another kind of horny Membrane, as we have been mentioning in frogs.

'Tis

'Tis known that Men, and the generality of Four-footed Beasts, and of Birds, have several Muscles belonging to their Eyes; by the help of which Muscles, they can turn them this way, or that way, at pleasure; and so can obvert the Organ of Sense to the Object, whether it be placed on the right hand or the left, or above or beneath the Eye. But, Nature having not given that Mobility to the Eyes of Flys, (the reason whereof I shall not now stay to consider) she hath in recompence furnish'd them with a multitude of little *protuberant* parts, finely rang'd upon the convex of their large and Protuberant Eyes: So that by means of the number of these little Studs (if I may so call them) many beams of Light that rebound from Objects placed on either hand, or above, or beneath, the level of the Eye, fall conveniently enough upon that Organ, to make the Objects they come from, visible to the Animal.

— *B.*

Which you will the more easily believe, if you contemplate (as I have often done with great pleasure) even the Eye of an ordinary Flesh-Fly, (for Bees and other greater Insects have immoveable Eyes too, but I find them not so pretty) in a good Microscope and a clear Day. For you may reckon some hundreds of these little round Protuberances, curiously rang'd on the Convexity of a single Eye.

But perhaps some, whose partiality for *Chance* makes them willing to ascribe the structures of Animals rather to That, then to a designing Cause; will make them draw an Objection, fit to be here obviated, against our Doctrine, from what we have observ'd of the difference between Human and other Eyes: Since they will pretend that all Organs of Sight ought to be conform'd to those of Men, as those that are the best and most perfect. 'Tis true, that Man being

ing justly reputed the most perfect of Animals, it is not strange that he should (as Men generally do) presume, that His Eyes and other parts of his Body, are the best contriv'd of any that are to be found in Nature. But yet I think we cannot from hence safely conclude, that all Eyes, which in other Animals are of Structures differing from those of Man, are for that reason defective. For I consider, *First*, That the admirable Wisdom display'd by the Author of Things, in fitting the Eyes and other Organical parts of Animals, for the Uses that seem manifestly to have been design'd in their Fabrick, and for the respective Functions we actually see them exercise, may justly persuade us, that the things whose Reasons or Uses we do not alike discern, are yet most wisely constituted: Such an Author as God, having too much knowledge to do any thing unskilfully; and We having too much presumption,

if

if we think He can have in the framing of his Creatures, no Ends that are beyond our Discovery. And, *Secondly*, We may represent, that the Eye is not to be consider'd abstractedly as an Instrument of Vision, but as an Instrument belonging to an Animal of this or that kind; and who is ordinarily to make use of it in such and such Circumstances. And therefore I think it ought not at all to Disparage, but rather highly Recommend, the Wisdom and Providence of the great Author of Things; that he has furnish'd various Species of Animals, with Organs of Sight that are very differinglly fram'd and plac'd: Since this diversity nobly manifests his great Providence, and (if I may so call it) Forecast; that has admirably suited the Eyes of the differing kinds of Animals, both to the rest of their Bodies, and (which I here mainly consider) to those parts of the great Theatre of the World,
on

on which He designs that they shall live and act. Thus though divers Beasts, as Horses, Oxen, and some others, have their Eyes furnish'd with a seventh Muscle, besides the six they have in common with Men; we must not conclude, either that the Organs of Vision are Imperfect in Men, or that those of these Beasts have something superfluous. For Horses, &c. being to feed for the most part on grass and herbs of the Field, and, that they may the better chuse their Food, being oblig'd to make their Eyes look very long downwards; the seventh Muscle does excellently serve them to do so, without that weariness, which if they were not furnish'd with it, that durably constrain'd Pasture would be sure to give them; whereas Man who has no such necessity of looking assiduouſly downwards, would be but incumber'd by a seventh Muscle.

On

On the other side, the defectiveness observable in the Eyes of some Animals, in comparison of those of Man, may be ascrib'd to the thriftiness (if I may so speak) of *Nature*, that, on most occasions, declines doing that which is not necessary to the particular Ends, She aims at in the Fabrick of a Part. Thus *Moles* being design'd to live for the most part under Ground, the Eyes which *Nature* hath given them, are so little, in proportion to their Bodies, that 'tis commonly believ'd, and even by some Learned Men maintain'd, they have none at all. But tho' by

AN — Anatomy, I, as well as some others that have try'd, have found the Contrary; yet their Eyes are very differing from those of other Four-footed Beasts. Which is not to be wonder'd at; considering, that the design of *Nature* was, that *Moles* should live under Ground, where a Sight was needless and useless; and where greater Eyes would be more

more expos'd to danger : And their Sight, as dim as 'tis, is sufficient to make them perceive that they are no longer under Ground, (at least so as they are wont to be) which seems to be the most necessary use they have of Light and Eyes.

Zoographers observe, That the *Camelion* has a very uncommon structure of his visive Organs ; since, to omit lesser, tho' not inconsiderable, peculiarities, his Eyes often move independantly from one another ; so that, for Instance, he may look directly forward with the right Eye, and with the other at the same time, directly backwards towards his Tail ; or may turn the Pupil of the former straight upwards, whilst he looks downwards with the other. Which peculiar power seems to have been granted him by Providence, that, being a very low Animal, and destinated to live for the most part in Trees
and

-NB

and Busses, and there chiefly feed on Flys; He may perceive them, which way soever they chance to come within the reach of his long Tongue, by suddenly darting out of which, he catches his nimble Prey.

NB.

Whereas it may be observ'd, that many or most, if not all, meer Fishes have the Chrystalline Humours of their Eyes, almost spherical as to Sense, and consequently far more round than that Humour is wont to be found in Man, and other Terrestrial Animals. This difference of Figure, tho' it would be inconvenient in Us, does very well accommodate Fishes; since they living in the Water, which as a thicker *Medium*, does much more refract the Beams of Light, than the Air through which they pass to our Eyes; 'twas fit, that the Chrystalline Humour of Fishes should be very Globous, that by the help of their Figure, the Beams already refra.

refracted by the Water, should be yet so much refracted and made Convergent, as to Paint the Images so near, as upon the bottom of the Eye.

One that being Curious, had more Opportunity than I have, to survey and reflect on the various Structures of the Organs of Vision in differing Animals, may, if I mistake not, be able to find by comparing them with the other parts of the same Animal, and the Scene he is design'd to act on, and the uses he is to make of his Eyes in his most ordinary Circumstances; such a Person, I say, may be able to offer a probable Reason of several differences in those Organs, that, if commonly taken notice of, would seem to the Censorious to be aberrations of Nature, or defects: To which purpose I remember, that an ingenious Cultivator of Opticks, gives this Reason, of what both he and I, have taken notice

NB —

notice of (tho' it be usually overlook'd) about the Figure of the Pupil ; namely, that, tho' it be oblong in Horses, Oxen, and divers other Quadrupeds, as well as in Cats, yet in the former kinds of Animals, the Pupil lies transversely from the right side of the Eye to the left, but in Cats its situation is perpendicular ; whereof he ingeniously guesses the Reason may be, that Horses and Oxen, being usually to find their Food growing on the Ground, they can more conveniently receive the Images of the laterally neighbouring Grass, &c. by having their Pupils transversely plac'd ; whereas Cats, being to live chiefly upon Rats and Mice, which are *Animals* that usually climb up or run down Walls, and other steep Places ; the commodiousest situation of their Pupil for readily discovering and following these Objects, was to be Perpendicular. But 'tis time we proceed in our Discourse.

Other

Other Instances to the same purpose with this are elsewhere deliver'd : and therefore I shall now, to strengthen the Apology for Divine providence, take notice, that the differing structures and Situations of the Eyes in several Animals, are very fit to shew the fecundity of the Divine Authors Skill, (if I may so speak,) in being able to frame so great a Variety of exquisite Instruments of Vision . And indeed, if I may presume to guess at any of Gods Ends that are not manifest, (for some others of his Ends seem Conspicuous ;) I should think, that this delightful and wonderful Variety that we may observe, not only in Animals themselves consider'd as entire Systemes, but in those parts of them that appear destined for the same Function, as particularly that of Seeing, was design'd, at least among other Ends, to display the multiplicity of the great Creators Wisdom, and Shew his intelligent Creatures, that his Skill

is not confin'd to one sort of Living Engines; nor in the parts of the same kind, (as Eyes, Ears, Teeth, &c.) to the same Contrivances: but is able to make for the same use, a multitude of surprising Organs or Instruments, tho' not perhaps all equally Perfect, (since to do so, we may think he must make no Animals but Men,) yet all of them curious and exquisite in their kinds, and in order to their differing Ends. To be able to frame both Clocks, and Watches, and Ships, and Rockets, and Granadoes, and Pumps, and Mills, &c. argues and manifests a far greater Skill in an Artificer, than he could display in making but one of those sorts of Engines, how artificially soever he contriv'd it. And the same superiority of knowledge would be display'd, by contriving Engines of the same kind, or for the same purposes after very differing manners. As Weights indeed are of great use and necessity in the famous Clock of *Strasburg*; and therefore

therefore it recommends the Inventors of Watches, not only that they can make Clocks of a very little and easily portable Bulk, which the *Strasburg* Machine is not, but can make a Clock without weights, and by means of a Spring perform their Office. And thus, tho' to fly, it seems absolutely necessary that an Animal should be furnisht with Feathers; the Wise Creator hath shewn that he is not confin'd to make use of them for that purpose: since a Flying Fish is able to move a great way in the Air; and the Indies have lately furnisht us with a sort of flying Squirrels (whereof I saw one alive at *White-Hall*.) — *NB*

And tho' the flight of these is not long, yet there is another kind of Animals without Feathers that can fly long enough, namely the Batt; tho' some of these, as I have seen, be little less than Hens: and I have been assur'd by a credible Eye-witness, that in the kingdom of *Golconda*, He had seen much bigger. — *NB.*

But *tho'* this consideration may suffice to justify the Wisdom of the Creator, who being an Agent most Free, as well as most Wise; Men ought not to find fault, if he think fit to Recommend his Wisdom by displaying it in very different manners: *yet* this is not all that may be said on this occasion. For there are many Cases, and perhaps far more than we imagine, wherein the peculiar, and in some regards less perfect, fabrick or situation of an Eye or other Organical part, may be more convenient than the correspondent Organ of Man, to attain the Ends for which was given to an Animal that was to act upon such a Theatre, and live by such Provision. Besides that an Organical part may, in some Animals, be intended for more uses than in others, and therefore may require a differing structure; as in Moles, the Feet are otherwise fram'd or situated than in other Quadrupeds; because the chief use they were to make of
 them

them was to walk upon the Ground, but to Dig themselves ways Under Ground. The provident *δυναμικὸς* wisely suiting the Fabrick of the Parts, to the Uses that were to be made of them: as a mechanist employs another Contrivance of his Wheels, Pinions, &c. when he is to grind corn with a Mill that is to be driven by Water, than when he is to do the same thing by a Mill that is to be mov'd by the Wind. And the Camelion has a Tongue, both pecurliarily shap'd, and of a length disproportionate to that of his Body, because he was to take his Prey, by shooting out (if I may so speak) his Tongue at the Flies he was to live upon, and could not often approach them very near without frightening them away. And in many Cases in which this Reflection does not so properly take place, we may observe, that there is a wonderful Compensation made, for that which seems a defect in the parts of an Animal of this or that particular *spe-*

cies, compar'd with the correspondent ones of a Man, or an Animal of some other *species*.

Thus Birds, that (except the Bat and one or two more) want Teeth to chew their food, are not only furnish'd with hard Bills to break it; and Birds of prey, as Hawks, &c. with crooked ones to tear it; but, which is more considerable, have Crops to prepare and soften it, and very strong Muscular Stomachs to digest and grind it: In which work they are usually help'd by gravel and little stones that they are led by Instinct to swallow, and which are often found (and sometimes in amazing numbers,) in their Stomachs where they may prove a vicarious kind of Teeth.

I shall hereafter have occasion to say somewhat more against Their Opinion, that find fault with those Animated Structures that we think to be Productions of the Divine Wisdom, under pretence that the
Parts

Parts of some living Creatures are not so curious and Symmetrical, as not to have been casually producible. But in the mean time, I shall here note, for those that ascribe so much to *Chance*; that *Chance* is really no natural Cause or Agent, but a Creature of Man's Intellect. For the things that are done in the Corporeal World, are really done by the parts of the Universal Matter, acting and suffering according to the Laws of Motion, establish'd by the Author of Nature. But we Men, looking upon some of these parts as directed in their Motions by God, or at least by Nature, and dispos'd to the attainment of certain Ends; if by the intervention of other Causes, that we are not aware of, an Effect be produc'd very differing from that which we suppos'd was intended; we say, that such an Effect was produc'd by *Chance*. So that *Chance* is indeed but a Notion of *Ours*, and such a thing as a School-

man might call an *Extrinfecal Denomination*, and fignifies but this ; that *in our apprehensions*, the Physical Causes of an Effect, did not Intend the Production of what they nevertheless produc'd. And therefore I wonder not, that the Philosophers that preceded *Aristotle*, should not treat of Chance, among Natural Causes ; As we may learn from *Aristotle* himself ; who is more just to Them in Suspecting they own'd not such a Cause, than in Taxing them of an Omission for not having Treated of it.

And on this occasion, I shall only add, before I proceed, that whereas some of the most curiously shap'd kind of Stones, as the *Astroites*, have embolden'd many of the Favourers of *Epicurus*, to bring them into Competition with these Animals, or Parts of Animals, from their likeness to which, they have receiv'd their Names ; it is fit to be consider'd, *First*, that
some

some Learned Men have of late made it very probable, that some of the curiouſeſt ſorts of theſe Stones were once really the Animals whoſe ſhapes they bear, or thoſe Parts of Animals which they reſemble; which Animal ſubſtances were afterwards turned into Stones, by the ſupervening of ſome Petreſcent Matter, or Petrifying Cauſe; of which *Metamorphoſis* I have met with, and do elſewhere mention, more Inſtances than are fit to be ſo much as named in this place. Secondly, *Though* ſome of thoſe ſorts of Stones were the Production of the Mineral Kingdom; (for I will not be Dogmatical in this Point) yet, beſides that it would not clearly follow, that they owe their ſhapes to Chance, ſince there is no abſurdity to admit *Seminal* Principles in ſome more elaborate ſorts of Foffiles; I think it would be very injurious to make theſe Productions vye with the Animals, to which they are Compared.

For

For the Resemblance of Shapes, wherein alone they and the Animals Agree, being but the Outward Figure, is but a Superficial thing, and not worthy to be mention'd, in comparison of that wherein they differ: The rude and slight Contexture of the best shap'd Stones, being incomparably inferior to the Internal contrivance of an Animal; which must consist of a multitude of Parts, of such a Figure, Bulk, Texture, Situation, &c. as cannot but be obvious to any that have seen Dissections skilfully made. And 'tis not only in the Stable and Quiescent parts, that this great Internal Difference between Stones, and the Animals they resemble, is to be found; but there is in a Living Animal a greater difference, than any of the Knives of Anatomists can shew us in a Dead one betwixt a Stone, tho' never so curiously Figur'd, and an Animal. For there are, I know not how many, Liquors, Spirits, Digestions, Secretions, Coagulations,

tions, and Motions of the whole Body, and of the Limbs and other parts, which are lodged and perform'd in a Living Body, and not in a *Cadaver*; and are perchance far more admirable, even than the structure of the stable and quiescent Parts themselves. So that, tho' a Stone, outwardly very like a Shell-fish, were made by Chance; yet from thence to Conclude, that Chance may make a real Living Shell-fish, would be to argue worse than he that should contend, that, because even an unskilful Smith may make a hollow piece of Metal, like a Watch Case, tho' he can fill it but with filings of Iron, or some other rude Stuff, he must be able to make a Watch; there being less difference betwixt the skill express'd in making the Case of a Watch, and the Movement, than in making a Body like a Shell, and the Internal parts of a real Fish: Or to say, that, because Putrefaction and Winds, have sometimes
made

made Trees hollow, and blown them down into the Water, where they swim like Boats, therefore the like Causes may make a Galley built and contriv'd, as well within as without, according to the Laws of Naval Architecture, and furnish'd with Mariners to Row it, Steer it, and, in a word, to excite and guide all its Motions to the best Advantage, for the Preservation and various Uses of the Vessel. In short, if *Chance* sometimes does some strange things, 'tis in reference to what *She her self*, but not to what *Nature*, uses to perform.

And now, to give you the Summary of my Thoughts, about the *Second Question*; 1. I think, that from the Ends and Uses of the Parts of *Living Bodies*, the Naturalist may draw Arguments, provided he do it with due Cautions, of which I shall speak under the fourth Question. 2. That the *Inanimate Bodies* here below, that pro-

proceed not from Seminal Principles, have but a more parable Texture, (if I may so speak) as Earths, Liquors, Flints, Pebbles, and will not easily warrant Ratiocinations, drawn from their supposed Ends.

3. I think, the Cœlestial Bodies do abundantly declare God's Power and Greatness, by the Immensity of their Bulk, and (if the Earth stand still) the Celerity of their Motions, and also argue his Wisdom and general Providence as to them; because He has for so many Ages, kept so many vast *Vortices*, or other Masses of Matter, in scarce conceivably rapid Motions, without destroying one another, or loosing their Regularity. And I see no Absurdity in supposing, that, among other Uses of the Sun, and of the Stars, the Service of Man might be intended; but yet I doubt, whether, from the bare Contemplation of the Heavens and their Motions, it may be cogently inferr'd, at least so strongly as Final

nal Causes, may be from the structure of Animals, that either the sole, or the chief, End of them all, is to enlighten the Earth, and bring Benefits to the Creatures that live upon it.

In what has been hitherto said on our *Second* Question, 'tis plain, that I suppose the Naturalist to discourse meerly upon Physical Grounds. But if the Revelations, contain'd in the *Holy Scriptures*, be admitted, we may rationally believe More, and speak less Hæsitantly, of the Ends of God, than bare Philosophy will warrant us to do. For, if God is pleased to declare to us any thing concerning His Intentions, in the making of his Creatures, we ought to believe it; tho' the Consideration of the things themselves, did not give us the least suspicion of it; which yet in our case they do. And therefore a late Ingenious Author did causelessly reflect upon me, for having
men-

mention'd the Enlightning of the Earth, and the Service of Men, among the Ends of God, which he thought undiscoverable by us. For whether or no we can discover them by meer Reason, as divers of the Heathen Philosophers thought they did; yet sure we may know Those that God is pleas'd to Reveal to us: And the Persons, I argu'd with, were apparently such as admitted the Authority of the Scriptures; which expressly teach us, that God made *the two* Gen. 1. 16. *great Luminaries*, (for so I should render the Hebrew words *אֶת־שְׁנֵי הַמְּאֹרֹת הַגְּדֹלִים*) *the greater for the rule of the Day, and the lesser for the rule of the Night*. And that *He made the Stars also*, and set them in the Firmament, or rather *Expansum* of the Heaven, to give *Light upon the Earth*. And a little above, among the Uses of the Luminaries these are reckon'd, *to divide the Day*

ver. 14.

from

*from the Night, and to be for Signs,
 and for Seasons, and for Days and
 Tears. And in another place, the
 Prophet Moses dehorting the Isra-
 elites from Worshipping the Sun,
 the Moon, and the Stars, tells them,
 that the Lord, had im-
 Deut. 4. 19. parted them unto all na-
 tions under the whole Hea-
 ven. And therefore those Carte-
 sians, that being Divines, Admit
 the Authority of Holy Scripture;
 should not reject the Consideration
 of such Final Causes, as *Revelation*
 discovers to us; since 'tis certainly
 no presumption to think we know
 Gods Ends, when he himself ac-
 quaints us with them; nor to be-
 lieve that the Sun, tho' it be gene-
 rally esteem'd to be a nobler Body
 than the Terrestrial Globe, was
 made, among other Purposes, to
 give Light to its Inhabitants. 'Tis
 recorded in the Book of
 Gen. 1. 26, 27, *Genesis*, the Design of
 28. God in making man,
 was, that *men should Subdue the
 Earth**

Earth (as vast a Globe as 'tis) and have dominion over the Fish of the Sea, and over the Fowle of the Air, and over the Cattle, and over all the Earth, and (to speak Summarily) over every living thing that

moveth upon the Earth. And Gen 9. 23.

the same Book informs us,

that after the Deluge, God deliver'd all Terrestrial Beasts, and Fowle, and Fishes, and every moving thing that lives, into the hands of Men; and intended that they should

eat Animals, as before the Gen. 1. 29.

Flood, He had appointed

them all the sorts of wholesome Vegetables for their Food. And since

God was pleased to appoint that men should live on these Creatures,

it cannot be absurd to say, that, a-

mong other Purposes to which he

destinated the Sun, His Shining

upon the Earth was one; since with-

out His Light and Heat, men could

not provide for, or enjoy them-

selves; and neither those Plants

that Men and Cattell must live upon,

G

could

*If we would
appear that
God changes
his mind, &
alters his
plans, like
a vascularity
human being*

*What a
mixture of
travails &
absurdity*

could grow and ripen; nor (con-
sequently) those Animals that were
to be their principal Food, and serve
them for many other uses, could be
sustain'd and provided for. Many
other Texts that show, how much
God was pleas'd to intend mans wel-
fare, and Dominion over many of his
Fellow-creatures, might be here al-
ledg'd. But I shall content my self
to mention, what the Kingly Prophet
says in the 8th Psalm,
Psal. 8. 56. where speaking of Man
to his Maker, he says;
*Thou hast made him, a little lower than
the Angels, and hast crown'd him with
Glory and Honour. Thou mad'st him
to have dominion over the works of
thine hands, and hast put all things un-
der his Feet.* Indeed if in Man we
consider only that Visible Part, his
Body; the smallness of it may make
it thought improbable, that Portions
of the Universe incomparably great-
er than He, should be at all intended
to be serviceable to Him. But Chri-
stians ought not to think this incre-
dible,

dible, if they consider Man, as he chiefly consists of a Rational Mind; which proceeds immediately from God, and is capable of knowing him, loving him, and being Eternally happy with him. They that despise Man consider'd in this capacity, do very little know the worth of a Rational Soul; and estimate things like Masons, and not like Jewellers, who justly value a Diamond no bigger than a Bean, more than a whole Quarry of ordinary Stones. And particularly to those Undervaluers of their own *Species* that are Divines; it may be represented, that God, who will not be deny'd to be the best Judge in this case, as in all others; was pleas'd to consider Men so much, as to give David cause to admire it in the words lately cited; and not only to endow them with his Image at their first Creation, but when they had criminally lost and forfeited it, he vouchsaf'd to Redeem them by no less than the Sufferings and Death of his own Son; who is in-

comparably more excellent than the whole World. And 'tis not incredible that God should have intended, that many of his other works should be serviceable to Man; since by Miraculous Operations he hath sometimes Suspended the Laws of Nature, and sometimes Over rul'd them, upon the account of Man: as may appear by *Noah's* Flood; by the passage of the *Israelites* on dry Land through the Red Sea, and the River of *Jordan*; by the standing still of the Sun and Moon (or the Terrestrial Globe) at *Joshua's* command; by the efficacy of the burning Fiery Furnace, on *Daniel's* three Companions; and (to be short) by the stupendous Eclipse of the Sun at the full Moon, at the Crucifixion of the *Messias*. To which I might add, that the chief part of Mankind, namely the Children of God, will by their most bountiful Remunerator, be thought fit to inhabit the *New World* (for that by an Hebraism is meant by the *new Heavens and the new Earth* St.

St. *Peter* speaks of) which shall succeed the Renovation and Refinement of the Present World by the last Fire, that will not only Dissolve, but, if I may so speak, Transfigure it.

2 *Pet.* 3. 10,
11, 12, 13.

And we shall the less scruple to admit that such vast and bright Bodies as the Sun and Moon, may be design'd (among other things) to be serviceable to Men; if we consider, that 'tis so far from being a constant Rule, That a Thing more excellent cannot (by a wise Agent) be employ'd for the good of one that is less so; that not only the first Angel whose Apparition we read of in the Scripture, was sent to relieve

Gen. 16. 9.
&c.

Hagar, a Slave wandering in a Wilderness; another had regard to the life of a Sooth-sayers Ass; and many others (and sometimes Companies of them) were employ'd on Earth to do good Offi-

Numb. 22. 23.
Gen. 32. 1, 2.
2 Kings 6. 17.

ces to particular persons : but of all
the Angels in general ; the Excel-
lent Epistle to the He-

brews informs us, That
they are *Ministring Spi-
rits, sent forth to Minister unto them
who shall be Heirs of Salvation.*

SECT.

S E C T. III.

TO handle the *Third Question*, † It will be necessary for us to clear the grand Difficulty that has, ever since *Aristotles* time, and even before that, Perplex'd those that allow in Natural Philosophy, the Consideration of *Final Causes*. The Difficulty is obvious enough: For, much the greater part of Bodies being void of Knowledge, and most of them (as all *Inanimate Bodies*) of Life it self, it seems not conceivable, how they should act constantly for Ends, they are not capable of pre-designing; and appositely imploy Means

† viz. Whether, and in what sense, the Acting for Ends may be ascribed to an Unintelligent, and even Inanimate Body?

that they have no Knowledge
wherewith to make choice of.

Aristotle, who expressly teaches,
that Nature does nothing in vain,
and rightly judg'd, that the Acti-
ons of Natural A-
gents tended to cer-
tain Ends, takes no-
tice of this Difficul-
ty ; but seems rather
to Shift it off than

*vid. Aristot. De
Caelo, lib. II. c. 5.
& eund. De Gen.
& Interitu lib II.
cap. 10.*

Resolve it ; The Solution he frames
regarding so peculiarly the Words
wherein he has express'd the Ob-
jection, that I much doubt, whe-
ther it would signifie much to clear
the same Difficulty propos'd in
other Terms. And to me he seems
to speak so darkly, not only in his
Translators *Latine*, but in his own
Greek, that, if he have given a
good Solution of the Difficulty, I
must ingenuously confess my Dull-
ness, in not being able to under-
stand it.

But,

But, to consider the Difficulty it self, there are two Accounts, on which the Actions of natural Agents may be said to tend to a certain End: *One*, when the Agent has a Knowledge of that End, and acts with an Intention to obtain it; as, when a man shoots an Arrow to hit a mark: The *Other* is, when the Action of the Proximate Agent, is indeed so directed as it ought to be to obtain an End, and yet that End is neither Known nor Intended by the Proximate Agent, but by a Remoter Agent that is Intelligent. In the *former* of these Senses, I cannot admit that (not now to Examine whether any Living, but not Rational, Works of Nature May) any Inanimate Bodies Can, act for an End; for, to do so, presupposes, that the Agent both Knows the End he is to attain, and Purposes to attain it; which are things whereof Inanimate Bodies are incapable. And to fancy with some

some, that they may have a Knowledge *ſui generis* (as they ſpeak,) which, tho' confin'd to the actions proper to this or that particular kind of Body, is yet ſufficient to determine to thoſe Actions; is *to* offend againſt that rational and receiv'd Rule of Philoſophizing, *Entia non ſunt multiplicanda ſine neceſſitate*, and *to* introduce a ſort of Knowledge, which I fear the Propoſers do not well conceive; or at leaſt, I am ſure I do not.

It remains then, that I embrace the *ſecond* Senſe, in which we formerly ſaid, that Natural things may be ſaid to work for an End; tho' indeed in this Caſe, we muſt ſpeak ſomewhat improperly: For, by him that Conſiders, the Action will be oftentimes more juſtly attributed to the Intelligent, but Remoter, than to the Immediate, Agent, which is but, as it were, the Inſtrument of the other. But how this is poſſible to be done, appears difficult to be explain'd.

plain'd. To me it seems, it may be thus conceiv'd : The most Wise and Powerful Author of Nature, whose peircing sight is able to penetrate the whole Universe, & survey all the parts of it at once, did at the Beginning of Things, Frame things Corporeal into such a System, and Settled among them such Laws of Motion, as he judg'd futable to the Ends he propos'd to Himself, in making the World. And *as* by vertue of his vast and boundless Intellect that he at first imploy'd, he was able not only to See the Present State of things he had made, but to Foresee all the Effects, that particular Bodies so and so qualify'd, and acting according to the Laws of Motion by him establish'd, could in such and such circumstances, have on one another : So by the same Omniscient Power, he was able to contrive the whole Fabrick, and all the parts of it, in such manner, that, whilst his general Concourse maintain'd the Order of Nature, each
part

Part of this great Engine, the *World*, should without either Intention or Knowledge, as regularly and constantly Act towards the attainment of the respective Ends which he design'd them for, as if themselves really understood, and industriously prosecuted, those Ends. Just as in a well made Clock, the Spring, the Wheels, the Ballance, and the other parts, *tho'* each of them Act according to the Impulses it receives, and the Determination that is given it, by the other pieces of the Engine, without knowing what the Neighbouring Parts, or what themselves do; *yet* their Tendencies are so Determin'd, and sometimes Overrul'd, and their Motions so Quickn'd, by the structure of the Clock, that they would not move more conveniently, nor better perform the Functions of a Clock, if they *knew* that they were to make the *Index* truly mark the Hours, and *intended* to make it do so. 'Tis true, that 'tis not easie to conceive how One A-

Agent should, by so simplean Instrument as *Local motion*, be able to Direct a Multitude of Agents, as numerous as the Bodies that make up a World, to Act as regularly, as if each of them Acted upon its own particular Design, and yet all of them Conspir'd to obey the Laws of Nature. But if we consider, that 'tis to God, that is an Omniscient and Almighty Agent, that this Great Work is ascrib'd, we shall not think it incredible; especially if we consider, that, whereas 'tis manifest enough, that a Multitude of Bodies Act, as we have suppos'd; if we will not ascribe the Direction and Superintendence of the Motions, that are manifestly fitted for the attainment of Ends, unto God, we must do it to Nature; which will not Lessen but Increase the Difficulty: And when I have seen, as sometimes I have with pleasure, a great Engine, wherein the Works of I know not how many Trades, and a great many other Motions, were performed

ed by little Puppets, that manag'd the Tools of the Artificers; and all these were set a work by one Spring, which communicated Motions that were regulated and determined by the particular structure of the little Statues and other Bodies: when, I say, I consider such things as these, I cannot think it impossible that the Divine and Great *Διευκρινεως* as both Philosophers and sacred Writers have styl'd the Worlds Creator; should be able by the Motions and Structures of Matter, to set a work very many Partial and Subordinate Engines. For 'twill not, I hope, be deny'd, that the Multitude of These does not any thing near so much surpass the number of Those, which I saw in the hand of an illiterate Tradesman, as the Narrow Knowledge of that Artificer is surpass'd by the Boundless Understanding of an Omniscient Artist. And 'tis more, in the making so many and so various Bodys act according to their par-

particular Designations, & yet all of them Conspire to the General Ends of the Universe, that Gods Wisdom, and (if I may so speak) his Skill is display'd, *than* barely in the making Bodies Act Appositely for Ends to themselves Unknown. For, if Moving Bodies be duly display'd, and have a sufficient connection, 'tis not difficult to Direct a few of them to the attainment of an End propos'd by an Understanding Agent, tho' Unknown to the Immediate Agents: As anciently among the Jewish Husband-men, (and at this day in some parts of the East) the Ox, that intended no such matter, did by Treading the Corn as well Separate the Grain from the Straw, as our Plowmen do, when they thresh it purposely to make that Separation: And a Horse or an Ass in a Mill, may as well by his going round Grind the Corn, as the Miller himself could do.

Nor

Nor is this Doctrine inconsistent with the beleif of any True *Miracle*; for, it supposes the Ordinary and Settled Course of Nature to be maintain'd, without at all denying, that the most Free and Powerful Author of Nature is able, whenever he thinks fit, to Suspend, Alter, or Contradict those Laws of Motion, which He alone at first Establish'd, and which need His perpetual Concourse to be Upheld.

The Laws of Method would oblige me to conclude here this Section, and pass on to another: But in regard that all I thought my self oblig'd to say about it, leaves it so very short, as to be very Disproportionate in Bulk to the other Sections of this Discourse; I will crave leave to lengthen it in this place, with Something, which, tho' it may be judg'd to belong more properly to Another, will not perhaps be thought to be impertinent Here;
and

and much less to be useleſs to the
deſign of this Diſcourſe.

Here then you may pleaſe to take
notice, that in all that I have diſ-
cours'd in the ſecond Section, or
may elſewhere have occaſion to ſay,
againſt the receiv'd Opinion, *that*
the whole material World was made
for Man; I would not be under-
ſtood to ſpeak either too dogmati-
cally, or too excluſively: my de-
ſign being to deliver, what I thought
might probably be repreſented, to
take off the Prejudice, that Men are
generally prepoſſeſs'd with in their
own favour. For, *tho'* the Argu-
ments I alledge Againſt the vulgar
Opinion, ſeem as yet to me more
probable than thoſe I have hitherto
met with For it, eſpecially as it re-
lates to the vaſt Cæleſtial Region
of the World; *yet* I am *not only* wil-
ling to grant, that, among the Ends
deſign'd by the Authour of Nature
in *ſeveral* of his Works, eſpecially
Plants, Animals and Metals, the
H Utility

Utility of men may be one, and perhaps one of the principal : *but* I am not averſe from thinking, that Humane Ends, (or Uſes that relate to Men,) may have been deſign'd by God in ſeveral Creatures, whoſe *Humane Uſes* Men are not yet aware of : And that he may have intended, that of ſeveral of his Creatures, whereof Men do already know, and make *ſome* Uſes, they ſhall hereafter diſcover *other* Utilities, and perhaps *nobler* Ones.

Thoſe that reflect on the Providence of God, whiſt they repreſent what they call *Nature* as a Step-mother to *Man*, whom She brings Naked, Toothleſs, and Helpleſs into the World ; whiſt She furniſhes the new Born *Fætuſ's* of Brutes with Wooll or other Clothing, and both with a Power to Walk and Seek their Food, and (as to many of them) with Teeth to Eat it : Thoſe men, I ſay, have been long ago anſwer'd by the Eloquent
Lactan-

Lactantius, and other Champions of Providence. And therefore I shall only add this, that God *by* giving Man *Necessity* and *Reason*, has effectually Excited him, and richly Furnisht Him with Ability, to procure for himself far greater Accommodations and Advantages, than those Beasts come into the world with; and *by* vouchsafing him that Noble Faculty of Understanding, He has put it in his Power to convert to his own use those very Things, for which Profane Wits would have the Condition of Beasts preferable to His. For Man, by his Reason imploying skilfully such Admirable Instruments as his Hands, is able to Master and Apply to his own Uses, *the* fierceness of several Wild Beasts, as Leopards (which the Persians Hunt with,) *the* vast strength of Elephants, *the* huge bulk of Whales, *the* Sagacity of Spaniels, Hounds, and Setters, *the* Swiftnes of Grey-Hounds, *the* Suttlety of Tumblers, and *the* Furs of Beavers,

Martins, &c. To omit a Multitude of others, which God, by the single Gift of Reason to Man, has enabled him to master and make use of to his own advantage. And tho' at first he be helpless enough, and unable to exercise his Dominion over inferiour Creatures; yet God has sufficiently provided for Him, by giving his Parents whilst he needs them, that ~~say~~ Natural affection for Him, which engages them to take care of him, till he be in a condition to take care of himself; and become qualify'd to obtain such knowledge and Industry, as may make him Possessor of the advantages, whereof his Indulgent and Bountiful Creatour made him capable.

Those Moderns that think it ridiculous to Imagine, that, in framing such Vast Bodies as the Earth, and some of the Cælestial Globes, their Creatour should have any Regard to so small a Part of the Earth as Man, and design'd that They
should

should be some way or other serviceable to him, look upon Things rather as *Surveyers*, who consider mainly their Extent, than as *Philosophers*, that Estimate them by their Intrinsic Value. For tho' it be true, that Man consider'd barely as an *Animal*, is a Creature little enough to be Contemptible; yet as He is endow'd with a *Soul* Immaterial, Rational, and Immortal, he is a Creature much more Noble and Excellent than the whole Terraqueous Globe, or a much vaster Masse of Corporeal Substance that is Stupid and Inanimate. For the Rational *Soul* is capable of Understanding and Willing, (which are higher Faculties than meer *Matter* can reach to) and which is more, of Knowing, Serving and Enjoying God. And Man being the only Visible Creature, that is capable to Understand the Wisdom, Power, and Beneficence of God in the Creation, and in many ways to Subdue a great Variety of the other Creatures, and Apply them to his

Uses : it ought not to seem strange, that the Wise Author of the Universe, that made all things so as to bring Glory to himself, should have a more especial regard to so Noble a Piece of his Workmanship, than to any, that being meerly Corporeal, can neither Understand his Wisdom and his Power, nor Render him thanks nor Praises for the Manifold and admirable Effects of them. And that Littleness that is alledged to make Man a Contemptible Creature, is so far from being a Disparagement to that Noble part of him, the *Soul*, which makes him a Man, that is, a *Rational Creature*; that its Excellency consists in being less than the Minuteest Body; Since not having Extension, it is not Divisible; which is the Prerogative of Substances, which, for that reason, are Immaterial and Immortal.

This mention of the Human Mind leads me to a further Reflexion, which is, That many parts of the Material

Material World, whereof Man has not been known to make any advantage, in the Capacity of a meer *Animal*, may yet be highly useful to him, as he is a *Rational Creature*, that is, Capable, by Contemplating the great and Admirable Works of God, to Raise his Mind to the acknowledgment of the Divine Architects Power, Wisdom, and Beneficence, and thereby Find produc'd in him due Sentiments of Veneration, Gratitude and Love. And These may be safely reckon'd among those Ends or Uses, which in the first Section we have Styl'd *Human Ones*; Since some of the Heathen Philosophers themselves call'd the World a *Temple*, and one of the more Philosophical Fathers of the Church loftily Styles it, παιδιδύτειον τῆς θεογνωσίας, καὶ ψυχῶν λογικῶν διδασκαλεῖον.

And indeed we find, that the Psalmist alone may furnish us with divers Instances to our present purpose. For *Psal. xix. 1, 2, 3.* not only He teaches us

H 4

that

that *the Heavens declare the Glory of God*, and that in a Language, that, notwithstanding what happen'd at *Babel*, reaches to all the Nations of the World; but He imployes the Contemplation of Gods Visible Works, to excite in himself and others true Sentiments, both of Devotion and of particular Vertues.

Thus the Consideration
Ps. CXXXIX. 14. of his having been *wonderfully form'd* in his

Mothers Womb, moves Him to Revere and Celebrate the admirable Skill of the Opificer. Elsewhere

*Psal. civ. thorough-
out especially v. 24.*

the Consideration of the Regular Vicissitudes observable in the course of Nature, invite him to Admire and Extoll the Providence of God. And when in another place, He beholds

those Vast Bodies and
Psa. viij. 3. 4. Shining Ones, that compose and adorn the Cœlestial part of the World, he justly falls into Sentiments of great Hu-

Humility and deserved Gratitude.

And as to This Use, the Distance; and Vastness of the fixt Starrs, the Immenfity of the Heavens, and the Regular Motion of the Superiour Planets, (fupposing they can bring Man no other advantage) may do him good Service; fince they afford him Rational and Solid Grounds to believe, admire, adore, and obey the Deity. For by thus Spiritualizing (if I may fo fpeak) the Corporal worksof God, there may accrew to the Pious Soul, Ufes far more valuable than they can afford the Body; fince they will Perfectionate the Mind here, and Continue to be advantageous to it, when the Body will not need the World, and the World it felf, as to its prefent Conftitution, fhall be deftroy'd.

But to proceed from this Use of the World, which is Theological, to a Humane Use, that is more Physical,

fical, as relating to the present welfare of Man, as he is an *Animal*, as well as a *Rational Creature*: I shall represent That, as a Nation is oftentimes, in the account of Providence, consider'd as one Man, notwithstanding Its various dispersions, and perhaps long continuance; as the Israelitish People, during many Ages, notwithstanding its Divisions and Captivities, was address'd to and treated, by the Prophets and Apostles commission'd by God, as one Person, nam'd *Israel*, whom God sometimes in the Scripture is pleas'd to call his *Son*: so perhaps it will not be absurd to conceive, that Mankind it self may in some regards, or as to some purposes, be lookt upon by its Author as one Man, who, by Successive Improvements of his knowledge, may from time to time be enabled to make New and considerable Uses of the things, that the Wise and bountiful Providence of his Maker had fram'd, with a Foresight

Exod. 4. 22.

Hos. 11. 1.

fight that he would, and with Intention that he might, make them advantagious to him. And therefore it cannot safely be concluded That every thing whose Usefulness to Man is not yet obvious, nay, That every thing that seems hurtful to him, can never be made beneficial to him. For we see that *Opium* was for many ages look'd on only as a Poyson, but now is imploy'd as a Noble Remedy, (as indeed it is, if skilfully prepar'd & Judiciously exhibited) in many Violent, and oftentimes Dangerous, Distempers. *Vipers* are Venemous Animals; but yet their Flesh is a main Ingredient of that famous Antidote *Treacle*; and being in great part Dissolv'd in Tract of Time in good Spanish Wine, I have try'd it with Surprizing Success, in an uncommon and very difficult Case. Scorpions also afford, by bare Infusion, an Oyl that not only Cures their own Stings, but is very available in several Distempers. And I remember, that a learned

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ed Professor of *Padua*, having Cured the Widow of a Sovereigne Prince of a Fit of the Stone, answer'd me some few Days after, that the chief Remedy he Imploy'd and Rely'd on, was a Preparation (which he intimated to Consist mainly in a light kind of Calcination) of Scorpions, which, somewhat to my Wonder, he made his Patient take inwardly. And, tho' the Roots of *Mandioca* be reckon'd among Poysons, when the Juice is in them, of which I elsewhere relate a Notable Instance; yet, when the Juice is Press'd out, and the Firm part reduc'd to Meal, it affords the *Cassava*, which is the Common Bread of a great Part of the *Americans*: and I did not scruple to Eat of it here in *England*. Nay the Poysonous Juice it self, in Divers places of the West Indies, is even by the unskilful Inhabitants turn'd into an Ordinary, and by them beloved Drink. But enough of this sort of Instances; I shall be more Brief in those of another Kind, where-

whereof the first is afforded by the Loadstone, which, tho' for many Ages admir'd by Greeks and Romans, for what is Commonly call'd its Attractive Vertue, had not its Directive Vertue known, at least any thing Vulgarly, in these parts of the World, till within less than four Ages; Since when, of what Vast Use this Stone has prov'd to Mankind, the discovery of the *West-Indies*, and of the Way of Sailing by the Cape of good *Hope* to the *East-Indies*, sufficiently declares. I will say nothing of the Uses of the Silk Worm, and the Sugar-Cane, which were little taken Notice of for many Ages, even by the Civiliz'd and Luxurious Greeks and Romans; but now, together with the lately discover'd *Cocheneal*, which is but an Insect, and far less than the Silk Worm, make a good part of the Trade of *Europe*, and furnishes the Tables of the Delicate with Sweet meats, and the Courts of Princes with many of their Finest Ornaments.

But

But not to insist on such things as these, but to proceed.

It deserves also to be consider'd on this occasion, That many Things that are not thought Useful to Men, because we see not that they directly bring in many Immediate Advantages, may yet be of great Use to them, as they Minister to, or are Necessary for, other things that are very serviceable to them. As the excessive Rains that cause the overflowings of Rivers in divers parts of *Africk*, and some other Countries, tho' they seem rather Destructive than profitable, do yet, by their seasonable Inundations, make *Egypt* and some other Countries exceeding Fertile, that without them would be very Barren: and among Us, those Clouds that do us no Immediate Service, do oftentimes, by Watering our Fields and Gardens in Summer, and by Manuring them, as 'twere, in Winter, do Nourish those Trees, Grass, Corn, Herbs, and
other

other Plants, whereof some Serve immediately for Aliments to Man, and others are necessary for the nourishment of Sheep, Oxen, Deer, and other Beasts that Men usually feed upon.

Not only Plants, and Animals, and Stones, and Metals, and such other smaller Bodies as are within Mans reach, are capable of being made use of by Him ; but to advance a Step farther, to far greater Masses of Matter, and even some of those remote Cælestial Globes, which he is thought able only to Contemplate ; One of those Ends, to which the Indulgent Creatour destinated them, may be To be serviceable to Man.

To say nothing of the advantage that skilful Seamen make of the Ebbing and Flowing of that vast Collection of Waters, the *Ocean* ; The Declination of the *Mariners Needle*, and the Variation of it, which probably depends upon the Motions

tions or changes of some Vast Internal Portion of the Terraqueous Globe, is found to be of great Use by Experienc'd Pilots and Navigators, in their Voyages through those Vast Seas they use to pass, between *Europe* and the *East-Indies*; as I learnt by particular Enquiry, from Eminent Persons, that have more than once Sail'd upon those *Seas*. The *Moon*, to omit her Light, serves Men, not only to make Moon-Dials by, and to foretell regularly the Times and Quantities of the Various Ebbings and Flowings of the *Sea*, the knowledge of which is very Beneficial, if not necessary, to Mariners, but serves Mathematicians for Divers other Purposes. The *Sun*, not to mention his ordinary Light and Heat, and the necessity of them to the Plants and Animals that afford Man Food and Medicines, and to the Production of many other Effects; whereon his Welfare depends, do inable him, by Concave and convex Glasses, to burn

burn with Cœlestial Beams, without the help of Culinary Fire ; and enable the Gnomonist *to* make Accurate Dials, to know exactly how the Time passes ; the Cosmographer, *to* make very useful Discoveries of the Elevation of the Pole, and Latitudes of Places ; and the heedful Observer of his Rising and Setting, *to* discover what Artists call his *Amplitude*, which is of good use to Astronomers, and more to Navigators, by helping them to estimate, among other things, the Variation of the Compass, (from true North and South Points.) And the Conjunction or Opposition of the Sun and Moon in Ecclipses, tho' it be a frightful thing to the Superstitious Vulgar, yet to Knowing Men, that can Skilfully apply them, these Ecclipses are of great Use, and such as common Heads would never have Imagin'd ; Since not only They may, on divers occasions, help to settle Chronology, and rectify the Mistakes of Historians,

rians, that writ many Ages ago ; but, which is, tho' a less Wonder, yet of greater Utility, They are, as things yet stand, necessary to define with competent Certainty, the Longitude of Places or Points assign'd on the Terraqueous Globe ; which is a thing of very great moment, not only to Geography, but to the most useful and important Art of Navigation. And lastly, at how stupendious a distance soever the Fixt Stars are plac'd, yet their remoteness cannot hinder the Industry of Man, from making even These Serviceable to his Uses ; Since, if we should admit those determinate Cœlestial Influences that are little less than the Idols of Astrologers, they would enable us to predict the Changes of Weather, the Fertility and Dearth, the Sickliness, or Healthiness, of any propos'd Season ; and, not to lay any stress upon so Controverted a Science, 'tis plain that Skilful Navigators can make use of any of the fixt Stars,

to

to know by any of them, what Hour 'tis of the Night: And 'tis more known, that Fishermen and Pilots didgenerally for many Ages, till within thefour last Centuries, make very great use of the Pole-Star, and other of the Northern fixt Ones, to guide them, when nothing else could, in the perilous Courses of their Navigations.

I have seen, and been Master of a Telescope, made in the form of a Walking-Staff, so that it was fitted to serve for several purposes; whereof tho' one was very different from the other, yet all of them were in the *Idea* of the Artificer, and intended by him. The like may be said of a Concave Metalline Burning-Glass; which, *tho'* it is imploy'd *to* magnify the Pictures of Objects, *to* cast their Images into the Air, and *to* Concenter the Sun-beams to a *Focus*, in which they will burn several Bodies; yet These and many other things, which, tho' they seem to have little Affinity

with these, are perform'd by a Metalline Concave, were beforehand destinated by the Artist, who foresaw and intended, that in such various Junctures of Circumstances, it should produce all those determinate Effects.

And indeed, if we consider Gods Omniscience and Providence, and how Indulgent a *Creator* he has been to *Man*; it may well seem reasonable to think, that *as* God foresaw that Men *might* make very various and profitable Uses of divers of his other Creatures, by the help of that Prerogative of Reason, which he had vouchsaf'd them; *So* he design'd that Men *should* reap the Advantages he had made many of his other Works capable of affording them. And I confess, I think this Reflection may justly serve to Recommend the Doctrine about Final Causes that we embrace, to Philosophers that are truly pious: Since it furnishes them with just Arguments

ments for Gratitude to the Author of so many good things, as the Corporeal World, by being contemplated or possess'd, affords them. For to look upon the World, as vast and curious a Work as it is, only as a vast and curious piece of Workmanship; may indeed give a Man a great *Idea* of the Power and Skill of the Divine Architect: But will rather exact his Wonder, than his Gratitude. And therefore the Ancient Aristotelians, who look'd upon the World as Eternal and Self-existent in a Condition like its present System; did not use to Thank *God* for the Benefits they receiv'd from things Corporeal: Tho' some of them thought themselves Oblig'd to thank *Nature*; which they look'd upon as acting with Design, and proposing to her Self for Ends, the Welfare of the Universe, and of Men. To illustrate this with something, whose Application is Obvious. If a Traveller being in some Ill-inha-

bited Eastern Country, should come to a large and fair Building, such as One of the most Stately of those they call *Caravanzeras*; tho' He would esteem, and be delighted with the Magnificence of the Structure, and the Commodiousness of the Apartments; yet supposing it to have been Erected but for the Honour or the Pleasure of the Founder, He would *Commend* so stately a Fabrick, without *thanking* him for it. But if he were Satisfied that this Commodious Building was design'd by the Founder, as a Receptacle for Passengers, who were freely to have the Use of the many Conveniencies the Apartments afforded; he would then think himself oblig'd, not only to Praise the Magnificence, but with Gratitude to acknowledge the Bounty, and the Philanthropy of so Munificent a Benefactor,

SECT.

SECT. IV.

IT remains now, that we discourse a while of the *Fourth* and last Question, propos'd at the beginning of this Tract; which was, *With what Cautions Final Causes are to be Consider'd by the Naturalist?*

But the Cases whereto this Question may relate, are so many and so differing, that, what I shall endeavour upon so diffus'd and difficult a Subject, will be rather to point you out some Sea-Marks, that may direct you to shun those latent Rocks, against which divers Learned Men have dash'd; than to present you with a Mariners Compass, and a Sea-Card, that may constantly guide you in the Courses of your

Navigation, through so unfrequented a Sea,

And, to make way for what I am to offer by a Distinction, the want of which seems to have contributed to the Obscurity of my Subject; I shall observe to you, that there are two ways of Reasoning from the Final Causes of Natural Things, that ought not to be Confounded. For, Sometimes from the Uses of things Men draw Arguments that relate to the Author of Nature, and the General Ends he is suppos'd to have intended in things Corporeal: As, when from the manifest Usefulness of the Eyes, and all its parts, to the Function of Seeing, Men infer, that at the Beginning of Things the Eye was fram'd by a very Intelligent Being, that had a particular care, that Animals, especially Men, should be furnish'd with the fittest Organ of so necessary a Sense as that of Sight. And Sometimes also, upon the

the supposed Ends of things Men Ground Arguments, both Affirmative and Negative, about the peculiar Nature of the Things themselves; and Conclude, that This Affection of a Natural Body or Part ought to be granted, or That to be denyed, because by This, and not by That, or by This more than by That, the End design'd by Nature may be best and most conveniently attain'd. This latter sort of Arguments I am wont to call purely or simply, *Physical* Ones; and those of the former sorts may, for distinctions sake, be styl'd *Physico-Theological* Ones; or (if we will with *Verulamius* refer Final Causes to the Metaphysicks,) by a somewhat shorter name, *Metaphysical* Ones.

What has been premised about these Two Ways of Arguing, allows me to proceed to what I shall venture, tho' not without much diffi-

diffidence, to offer you, concerning our Grand Question about; which I shall refer my present Thoughts to the Five ensuing Propositions.

PROP.

PROP. I.

AS to the Generality of Celestial Bodys, it seems not safe to propound Arguments of their Nature, from the supposition of particular Ends, at least of the Human ones, design'd by the Author of Nature in framing them.

I will not only Allow you, but Encourage you, to take a Rise from the Contemplation of the Celestial Part of the World, and the Shining Globes that Adorn it, and especially the *Sun* and *Moon*; To Admire the Stupendious Power and Wisdom of Him that was able to frame such Immense Bodys, and, notwithstanding their Vast Bulk, and (if the Earth stand still) scarce conceivable

able Rapidity, keep them for so many Ages, so Constant, both to the Lines and Paces of their Motion, without jostling or interfering with one another. And I shall most willingly joyn with you, in returning Thanks and Praises to the Divine Providence and Goodness, for having so plac'd the *Sun* and *Moon*, and determin'd the former (or the Earth) to move in *such Lines*, under that Oblique Circle Astronomers call the *Ecliptick*, that there needs Skill in Cosmography to be able to Apprehend, how useful these Situations and Motions are, for the Good of Men and other Animals; and how disadvantageous it would have been to the Inhabitants of the Earth, if the Luminaries had been otherwise plac'd or moved than they are. But for all this, I dare not imitate Their Boldness, that not only affirm, that the *Sun* and *Moon*, and all the *Stars*, and other Celestial Bodys, were made solely for the use of Man; but Presume

to

to ground Arguments, to evince such a System of the World to be True, and such another Erroneous, because the Former is, as they think, better fitted to the Conveniency of Mankind, or the other less suited to that End, or perhaps altogether Useless or unnecessary to it: As when they Argue, that the *Sun* and other vast Globes of Light, ought to be in perpetual Motion to Shine upon the Earth; because, as They fancy, 'tis more convenient for Man, that those Distant Bodys, than that the *Earth*, which is His Habitation, should be kept in Motion. But, considering things as meer Naturalists, it seems not very likely, that a most Wise Agent should have Made such vast Bodys, as the Sun and the fixt Stars, especially if we suppose them to Move with that Inconceivable Rapidity that Vulgar Astronomers Do and Must assign them; Only or Chiefly to Illuminate a little Globe, that without *Hyperbole* is but a Physical Point,

in

in comparifon of the Immenfe Spaces
 compris'd under the Name of *Hea-
 ven*; whose Lights might as well
 Illuminate the Earth, if They were
 a thoufand times Leffer than they
 are, provided they were plac'd at a
 proportionably Leſs Diſtance from It.
 And 'twill be very hard to Affign,
what conſiderable Uſe the Terres-
 trial Globe or its Inhabitants Derive,
 from that Multitude of Celeſtial
 Globes that make the *Milky Way*;
 ſince each of thoſe Stars is ſo far
 from being ſingly able to Inlighten
 the Earth, that *Ariſtotle*, and the
 generality of Philoſophers for many
 Ages, (therein follow'd by divers
 of the Peripatetick Schools at this
 day) took the whole Aggregate
 of them for a *Meteor*. And *what*
 Light, or other known Advantage,
 can the Earth or its Inhabitants De-
 rive from thoſe many Fixt Stars that
 the Teſcope only can diſcover,
 (and which for that reaſon I ſome-
 times call *Teſcopical* Stars) among
 the fix or ſeven Conſpicuous Ones
 of

of the *Pleiades*, or among those that the Naked Eye can see in the *Belt* or *Girdle* of *Orion*? which (Constellations) I scarce ever look upon, through a good Telescope, without Wonder.

I foresee, it may be said, that These and other the like Celestial Bodys may be at least Thus far Useful to Man, as to Discover to him, and give him a Rise to Admire and Praise, the Greatness and Power of the Divine Maker: And if this be said, I shall not quarrel with the Allegation, but readily grant, that, tho' perhaps his Wisdom shines as bright to Us Men, in the Structure of a Glowworm, as in the Disposition of the unseen Stars that make up the *Galaxy*; yet the Immensity of his Power could not perhaps be so well declar'd by less Vast Productions of it. But still these Arguments are not purely *Physical*, but of that sort that I call *Physico-Theological*, whose Inferences Relate to the General Intendments of God in the Uni-

Universe, which I therefore Style
Cosmical Ends ; but do not reach to
 Prove any thing about the determi-
 nate Nature of particular Bodys.
 And since the Utmost that Philosophy
 teaches us, is, that in general the
 Good of Man was One of the Ends
 design'd by God, in so framing the
 World as we see it is fram'd : There
 may be other Ends design'd by the
 same Omniscient Author of Na-
 ture, of those Telescopical and o-
 ther Small or Remote Stars, whose
 Uses to Us are doubtful or incon-
 siderable ; towards the attainment
 of which Ends, those Celestial Bo-
 dies and Motions may be admira-
 bly contriv'd and directed. And,
 We not being able by meer Rea-
 son to Investigate what those Ends
 are, tho' we have not near so much
 Reason to assure us that there *may*
not be such Ends, as the Infiniteness
 of God's Wisdom gives us to think
 there *may be* ; 'tis Presumptuous for
 Us to Judge of the System of the
 World, and of the Destinations of
 fixt

Fixt Stars so Remote, that, tho' they be probably like so many Suns, We cannot so much, as Discern them without good Telescopes, By That Systtms Greater or Lesser Advantageousness to Us: Especially, since tho' it were certain that, among other Uses, God intended they should be in some sort Serviceable to Us, yet he has no way declared to us, in what Capacity, or to what Degree, they shall be Useful to Us. And therefore if they be so in any Measure (as for example Mentally,) they are So, for what we know, as much as He design'd they should be: and That it self being an unmerited Favor, deserves our humble Thanks. And it seems very likely, that God did not design to all the parts of the Earth it self, Equal, and consequently not the Greatest, Advantages by the present Systeme of the Universe; since the Countries Inhabited by the *Sa- moids* and *Novazemblans*, and other Nations that live very near the

Arctick Pole, want many Conveniencies and Advantages enjoy'd by the Inhabitants of the *Temperate Zones*, that lye nearer the Way in which the Sun moves.

But, tho' *bare Philosophy* does not favour the Bold Opinion I dare not assent to; yet I know, 'twill be pretended, that *Revelation* does. And I readily confess, *that* the Terraqueous Globe, and its Productions, (among which perhaps the Atmosphere may be reckoned) and especially the Plants and Animals 'tis furnish'd with, do by the *Scripture* appear to have been design'd for the Use and Benefit of Man, who has therefore a Right to Imploy as many of them, as he is able to Subdue: and *that* the two Luminaries themselves, the

Sun and Moon, were appointed by God to give Light upon the Earth, and be useful to all the Nations that Inhabit it: And *that* therefore the Kingly Prophet had reason to exclaim,

claim, *How manifold are thy works O Lord! How wisely hast thou made them all!* *Psal. 104. 24.*

when in the precedent and subsequent words, he applys this to the Terraqueous Globe, and its Inhabitants. And He might justly say, as he elsewhere did, *That the Heavens declare the Glory of God, and the Firmament sheweth his handy Work.* But

these General Declarations, *Psal. 19. 1.* tho' they be just Motives of our Wonder and Thankfulness; yet I fear they are not good Topicks to draw such Physical Conclusions from, in particular Cases, as some Learned Men adventure to do. For I do not remember, that 'tis any where declar'd in the *Scripture*, that the Service of Man was the Only, or perhaps so much as the Chief, Use of all the Celestial Lights, and other Bodys of that Immense Part of the World. And This Single Consideration ought to oblige us, to be very wary

in making Ascriptions to our selves, as if the Great System of the World were to be estimated by Our Conveniencies. And if it be said, that Things meerly Corporeal *have not*, and Man alone *has*, a Rational faculty, whereby to Refer the great & wonderful Works of God to the Glory of their Maker ; I shall take the Liberty to answer, that, tho this has been Affirm'd by Many, if not also Assented to by All, yet I have not found it prov'd by Any. And I somewhat wonder, that Divines should on this Occasion overlook that passage in the 38th. Chapter of *Job*, which they generally interpret of the Angels. For the Question, which God there puts to *Job*, may be justly applied to *Adam* himself ;

Job. 38. 5. *Where wast thou when I*
4. 7. *laid the Foundations of the*
Earth? Declare if thou hast under-
standing. When the Morning Starrs
sang together and all the Sons of God
shouted for joy. And indeed, if
We

We even may presume to Conjecture of such things, it seems to me reasonable to think, that God created the Angels before the Material World, that He might have Intelligent Beings to pay him the just Tribute of Praises, for so Admirable a Spectacle as That of the *Rising World*, or rather the Beginning and Progress of the Creation. However by the words last Cited out of the Book of *Job*, it appears, that before Man was made (for that he was not till the 6th. day) God wanted not Intelligent Spectators and Applauders of his Corporeal Works. And since the *Angels* are a Nobler Order of Intellectual Creatures than *Men*, and are not Unconcern'd Spectators of the Works of God: How do we know, but that *in* the Systeme of That Part of Heaven, of which we need Telescopes to Know that there is such a thing *in rerum Natura*; and *in* the Plants, Animals, or other furniture, what ever it be, of

those Particular, and to Our naked Eyes Invisible, Stars, that serve Us men barely for Declarations of their Makers Power; such Intelligent Spirits as Angels may discern as Wise Destinations, and as Admirable Contrivances, as Those, which at the forming of the Earth and its Furniture, invited their devout Hymns and Acclamations? And in this Case, God will not loose any thing of the Glory due to the Divine Attributes, display'd in the Fabrick of the Celestial part of the World, tho the fixt Stars, should be neither Only nor Principally design'd for the Service of Men.

To what has been hitherto said, to let you see the Reasonableness of my *first* Caution, which represents the Making Particular and meerly Physical Inferences from the supposed Destinations of Celestial Bodies, as a thing Unsafe, I shall now add in the *Second* place;

That

That 'tis yet more unsafe, to ground Arguments of the Nature of particular Bodies that are Inanimate in the Sublunary World, upon the Uses we think they were design'd for.

This will not appear an unreasonable Caution if we consider, How little we know of the Particular Purposes of Nature in those Bodies here below, which not being Organical, like those of Animals and Plants, cannot by the Curiousness of their Structure disclose to us the Particular Ends to which they were ordained. And as for their Motions, since they are extremely far from being so Constant and Regular as those of the Celestial Bodies, the Caution we gave about drawing Arguments from the System of the *Heavens*, will not, sure, be thought unfit to take place when we speak of the *Clays, Chalks, and Stones*, and the like Terrestrial Bodies, whose Tex-

tures are, comparatively to those of Living Creatures, very Simple, and Slight, and feldom more Curious than may be made by Art, by Dissolving Stones and Metals in Chymical Menstruums, and afterwards Chrystallizing the Solutions; of which I elfewhere give Examples. Tis true, that, tho' *Revelation* speaks rather of Gods having destinated Animals and Vegetables, than Inanimate Bodyes, to the Service of Men; yet there is no absurdity to conceive, that generally speaking, That may be one of the Ends design'd by the Author of Nature, in making Metals, Stones, and those other Inanimate parts of the Terrestrial Globe that Man is able to master and make use of. But whereas in this Globe the Surface is distant from the Center, above three thousand and five hundred Miles; and I do not find that either Mens Spades or their Plumming Lines have

*See the Tract
of the Origine
and Vertues of
Gems.*

have reach'd above one Mile of that great number ; Nor is it very likely, that Human Industry will ever make its way down to the Thousandth part of that vast Depth : it seems very improbable, that the remaining Internal part of the Earth, that is above seven thousand Miles thick, and may, for ought we know, contain great varieties of Fossils and other Creatures, should be made Chiefly or Only for the service of Men, from whose sight they lye hid in a deeper Well than that of *Democritus* ; and who do not so much as know what kind of Bodies they are. And *tho'* it will not hence follow, that the Terraqueous Globe was made by Chance, no more than that any of the other Planets was so ; because the Admirable Structure of Plants and Animals evinces the Existence and Providence of a most Wise and Powerful Author of things, who may justly be suppos'd to have made nothing in Vain, even among the Inanimate portions of
our

our Globe, whose Animated portions are so wisely and exquisitely framed: yet, that *those* Inanimate Bodies were made for determinate Ends, is more easy to be deduc'd from the knowledge we have by other *Mediums*, that they are the Productions of a Wise and Provident Author, than by the Contemplation of these Inanimate Bodies themselves. And perhaps it may be worth Inquiry, whether some things may not be made, even by a wise Agent, not out of a Primary Intention, but as Productions that will naturally follow upon the Establishment and Preservation of those grand Laws and Rules of Motion, that were most fit to be settled among Things Corporeal. And 'tis very possible, that according to that *Cosmical* Establishment (if I may so call it,) many parts of the Terrestrial Globe should be so plac'd or dispos'd of, as not to be serviceable to Men; because the whole Aggregate, or Globulous Mass, could
not

not otherwise be so well suited to the General Destinations of the Universe, which, if otherwise Contriv'd would perhaps have been less serviceable than now it is to Man himself. To Countenance which Consideration, I shall observe, that, tho the Eclipses of the Sun and Moon be usually Unwelcom, and if Astrologers may be credited, often very Prejudicial to Multitudes of Men; yet the great

Former of all things, or Forzer raccol
Jer. x. 16. &
L. 1. 12.

as the Original will bear it, *of the whole,* did not think fit to alter the Tracts or Lines of Motion, that he assigned the Luminaries, to avoid the Ecclipses that must yearly ensue upon their Moveing in such Lines. Whence we may also learn, that some *Phænomena* may not belong to the Primary Intention of Nature, but are only the necessary Consequences and Effects, of the Primitive Constitution of the World, and the Catholick Laws of Motion.

And

And if it be here demanded, what the Ends are, for which the Deep and hidden parts of the Terraqueous Globe, and the Telescopical Stars of the *Firmament*, were made ; if they were not made for the Use of Man : I shall frankly answer, that I cannot tell : And I know not but such an Answer may be more expressive of the profound Reverence we owe the great Author of Nature, than Their Opinion is, that would have all these made for the Use of Man : since, To say that we know not why some Part of a Work is made by an Artist, whom other parts proclaim to be most Wise and Skillful, does both Acknowledge our own Ignorance, and leave it highly probable that such Pieces of Work are suited to Purposes worthy of Him, and suitable to Them ; and seems therefore a safer and more respectful Opinion, than to suppose Him to have made such things for a Particular

lar End, which we cannot make out to be in any considerable measure worthy of *his* Wisdom, and attainable by *them*.

PROP.

PROP. II.

IN the Bodies of Animals 'tis oftentimes allowable for a Naturalist, from the manifest and apposite Uses of the Parts, to Collect some of the Particular Ends to which Nature, destinated them. And in some cases we may, from the known Natures as well as from the Structure, of the Parts, ground probable Conjectures (both Affirmative and Negative) about the Particular Offices of the parts,

To obviate mistakes, you may please to take notice, both That in this Proposition, I speak only of those Ends and Uses of the Parts of an Animal, that relate to the Welfare and Propagation of the Animal it self, and which therefore I formerly

ly call'd *Animals Ends*: and yet that I do not thereby deny any Declaration that is made in the H. Scriptures, That God design'd that the Entire Animals, as well as their Parts, should be in several ways serviceable to Man. And haveing premis'd this to explain my meaning in the Proposition, I shall now consider distinctly the two parts whereof it consists.

And 1. There is no Part of Nature known to us, wherein the Consideration of *Final Causes* may so justly take place, as in the Structure of the Bodies of Animals. And I confess, that when I assist at a well-administer'd Anatomy, I do so wonder at the admirable Contrivance of a Humane Body, that I cannot but somewhat wonder, that there should be found among Philosophers, men that can ascribe it to blind Chance. The *Stoick*, that in *Cicero* asked an *Epicurean*, why Chance did not make Palaces and other Buildings, seems not to me to have made an impertinent

tinent Question. For the commodiousest Houses Mens Bodies dwell in, are far less curious Structures, than the Mansions their Souls reside in: which you will not think a groundless Paradox, if you consider, that, whereas even in a Palace, the Materials being Wood, Stone, Brick, Mortar, Glass, and four or five Metals, are but Few in comparison of the Parts of differing Textures, as Bones, Nerves, Ligaments, Membranes, Muscles, Veins, Arteries, Gistels, Glandules, Jellys, Humours, &c; and their Disposition is exceeding Slight, in comparison of the curious and elaborate Contrivance of the numerous Parts, both solid and fluid, of the Human Body: whereof tho' the Stable Parts alone have been reckon'd to amount to some Hundreds; yet in Every One of these parts, the Bulk, Figure, Consistence, Texture, Situation, Connexion and Aptness for motion, is the most Commodious that can be devised; and All of them are wonder-

wonderfully Symmetrical, both to, one another and the whole Body; To divers of whose Motions, as Leaping, Running Speaking, Swimming, Sneezing &c. a great Number of them conspire. And this Number of Parts is so artificially contrived and pack'd together, that tho' in a Body where no room is lost, many Parts do at the same time exercise very differing Motions, yet each of them moves freely, and does not at all Hinder another, but rather they Promote each others Motions.

I will not suffer Indignation to transport me so far as to wish, That those that deny the Usefulness of all the Parts of their Bodys may fall Sick, or receive some Wound, to be thereby at once Convinc'd and Punish'd: But I will venture to say, that Diseases or Hurts alone may shew, how excellently all the Parts of our Bodys are Contriv'd in order to our Welfare. For, if so much as a Finger be made Bigger by Tumors,

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mors,

mors, or Displac'd by being put out of Joynt, or kept in a Wrong Posture by Contractions, or have its Continuity violated by Cutting, or its Tone chang'd by Strains or Contusions, or its Sense or Motion taken away by the Palsey, or its Membranes fretted by Sharp Humors, or its Motions Disorder'd by the Cramp or Convulsions; In any of these Cases we quickly find, how Commodiously the Parts Affected were Framed or Dispos'd, when any Disease or Hurt gives them a Preternatural Constitution; that is, changes that Figure, Connexion, Tone, &c, which, according to the Institution of Nature, whilst the Body is in full Health, does belong to it.

The Eye (to single out again that Part for an Instance) is *so* little fitted for almost any other Use in the Body, and is *so* exquisitely adapted for the Use of Seeing, and That Use is *so* necessary for the welfare

fare of the Animal, *that* it may well be doubted, whether any Considering Man can really think, that It was not destinated to that Use. The six or seven Muscles that move the whole Bulbe of the Eye, upwards, downwards, to the right Hand, to the left, and to various oblique Positions; and the several Coats and Humors that make up the Sensory, Have not only their Bigness, Shape, Consistence, Situation and Connexion admirably Adapted to that End; but the Transparency of the *Cornea* and the Humors, the Opacity of the *Uvea*, and the Semi-opacity of the *Retina*, and the several Motions of the Parts of the Eye, being requisite to Receive, Transmit, Refract, and Dispose the Visive Beams that come from the Object, after the manner requisite to make the Liveliest Picture of it in the Bottom of the Eye, Do no less concur to Compleat this matchless Organ of Vision: which is so rarely Contrived in order to That Use, and

comparatively so little to any Other, that there is no more Rashness to say, that an Eye, than that a Telescope, was made for an Instrument to See with; that is, to Discover the Colours, Magnitudes, Shapes and Motions of Distant Objects. And in that admirable Perforation of the *Uvea*, which we call the *Pupil*, Nature has much outdone Art. For whereas We are fain to apply to the Object-Glasses of *Telescopes*, Opaque Bodys with several Circular Apertures, that Some may let in less Light, and Others more, according as the Objects are more or less Bright or Inlighten'd; That part of the *Uvea* that hangs in the Aqueous Humor, is an Aperture, as the Artists call it, that Narrows and Opens it self in a trice, according to the exigency of the Objects we look on; Which if they be so constituted or plac'd, that they Reflect but a Dim Light, the Curtain is presently drawn Open, and the *Pupil* circularly Widen'd, to let in the more Beams

Beams of Light ; and the Contrary happens, as often as the Object, being too Luminous or Illustrated, would offend the Organ, or disturb the Sight, if the Contraction of the *Pupil* did not shut out some of Its Beams. But for the Uses of the several parts of the Eye, I shall refer you to the Industrious Jesuit *Scheiner's Oculus*, and *Des Cartes* his excellent *Dioptricks* ; where you will easily perceive, that, in Framing the Eye, Nature did not only act with Design, but with so much Skill in Opticks, that a more than ordinary insight into that Science, is necessary to Understand the Wisdom of the Contrivances ; and perhaps no degree of Skill in it, would enable a man to Alter them for the better. 'Twere tedious to mention the Other Parts of the Body, that manifestly appear to have been pre-ordain'd to certain Uses. The Books of Anatomists are full of Passages applicable to this purpose ; of which I shall say in general, that,

tho' what they deliver suffices to shew, That all the Parts of the Body are the Effects of an Intelligent Cause: yet, unless their Descriptions and Reflexions be improv'd by Men vers'd in Mathematicks and Mechanicks, and, I shall venture to add, in Chymistry too; we shall but imperfectly understand, how Intelligent that Cause is, or how much Wisdom it has display'd, in the Structure of a Human Body and each of its parts.

*Illud in his rebus
vitium vehementer
inesse Effugere, illo-
rumq; errorem pre-
peditemur, Lumi-
na qui faciunt O-
culorum clara crea-
ta Prospicere ut pos-
simus, Lucret. de
Nat. l. iv.*

*Nihil ideo quoni-
am natum est in
Corpore ut uti
possemus, sed quod
natum est, id pro-
creat Usus, Ibid.*

I know 'tis object-
ed by the *Epicure-
ans*, that the Parts of
Animals were first
made, and their U-
ses afterwards found
out by mens Sagaci-
ty. But this is a So-
phistical Objection.
For, *first*, as to many
of the Inner parts, as,
the Heart, Liver,
Spleen, Kidneys, &c,
They

They perform their Functions without so much as Our Knowledge of their Structure, or perhaps their Situation; so far are they from being applyed to such Uses by Our Sagacity. And as for the Limbs and other Parts, which we can Move at pleasure; 'tis true, that they cannot be actually Employed to the respective Uses, till they be actually Form'd; but That hinders not but that in their Formation they were therefore so Formed, that they may be in due time fit for such Uses. And therefore we see, that the Chick is furnished with compleat Eyes, and with Wings and Feathers, before he be Hatch'd; tho' whilst he is yet inclos'd in the Egg, he can not make use of them to See or Flye. And why was it, do the *Epicureans* think, that Nature provided a whole Set of *Temporary* Parts for Pregnant Females, and Animals in the Womb, which, when they are come into a freer state, partly fall away of themselves, and partly

turn to a Ligament, fitted no longer for the former, but for a more seasonable Use? And 'tis to be noted, that the Production of these Umbilical Vessels, and the *Placenta* or Analogous Body in the Womb to which they are fasten'd, is of no Necessity nor Use to the Female before Conception; and thereby those Temporary Parts appear to have bin Design'd by Nature, not so much for the Personal Preservation of the Female as for the Propagation of the *Species*: Which Destination not coming to be accomplished, till a Woman, for instance, has attain'd to a competent Age, appears to have been preordain'd by the Author of Mankind for the Continuation of It.

And *tho'* it be true, that the Sagacity of men may have found out some Uses of some Parts of their Bodys, that cannot be made appear to have been Primarily Intended by the Author of Nature; yet That is no good Argument, that *those* Uses were not Intended, which either are made
With-

Within us, or do, as it were obtrude themselves Upon Us. And as for other Uses, the Prescience and Goodness of God are such, that it ought not to appear incredible, That He that gave man both the Limbs of his Body, and the Rational Endowments of his Mind, and that he made many Parts, as the Eyes and the Ears, Double, that One may supply the want of the Other ; Did both Foresee what Uses men might, according to their Sagacitys and Emergencies, make of these Parts, and so Contrive the Parts that they should be applicable to such Uses. Suppose, a Wise man should send his Son to Travel, and among other things give him a Pocket-Dyal with a Magnetic Needle ; and this Traveller having lost his way in some wild Plain, or being at Sea in a Vessel, whose Compass was broken or spoyl'd by a Storm, or some other Mischance : If, I say, in this case tho' the Traveller Ordinarily Employed his Dyal only to find the Hour of the Day,

Day, He shall now Imploy it to Guide his Course, or Steer the Vessel, by the help of the Needles pointing Northward; tho' this would be an Effect of His own Sagacity, yet his Father being a Wise and Experienced Man, may reasonably enough be suppos'd to have Foreseen, that his Son might have need of knowing the Northern and Southern Points of the Horizon. And accordingly may have given him a Dial furnish'd with a Magnetic Needle, rather than an Ordinary Gnomonic Dial. And so a Man that has taught another to Paint Landships, when he gives him a Pencil and a Pallet furnish'd with Colours, to draw a Particular Prospect, is not to be suppos'd to have Design'd, that he should not Imploy them to any other purpose, if Urgent Circumstances made it requisite for him to do so.

Having insisted longer than I intended upon the *former* part of my
Propo-

Proposition, I now proceed to the *latter*; namely, That in some cases we may from the known Ends of Nature, as well as from the Structure of the Parts, ground Probable Conjectures, both Affirmative and Negative, about the particular Offices of the Parts. Which I could not seasonably doe before, because the Arguments, that were founded on the Uses of the Parts of Animals, suppose, not only that those Parts were destinated to Particular Uses knowable by Us, but that the several Parts of the Body were Contrived as Wisely and Commodiously as Men are able to Devise, in order to the Ends of Nature; which is always to be understood to have United in her Designs, the Uses of the Parts, and the Welfare of the Whole.

And indeed if we consider, how admirable a Fitness there is in the Parts of the Human Body, for instance, to those Particular Ends we can discover them to have been Pre-design'd

design'd for ; it seems allowable to Conjecture, that such a Part was not Primarily Design'd to such an Use, because it is, on the account of its Structure or otherwise, less Fitted for it, than the constant Wisdom of Nature seems to require ; especially if there be any Other Parts, by which That Office may be more commodiously perform'd. And on the other side, it may be a Probable Ground, tho' not altogether so Probable as the former, to Conclude that such a Part was Destinated to such an Use, if the Use it self appear to be necessary, and the Part better fitted for it than any Other is.

Thus, tho' Anatomical and Optical Writers, as well as the Schools, did for many ages unanimously conclude, the *Crystalline Humor* to be the Principal Seat of Vision ; yet the industrious *Scheiner*, in his useful Tract intituled *Oculus*, does Justly enough reject that receiv'd Opinion,
by

by shewing, that it Suits not with the Skill and Providence of Nature, to make that Part the Seat (or chief Organ) of Vision, for which it wants divers requisite Qualifications, especially most of these being to be found in the *Retina*. And I remember that when I asked our famous *Harvey*, in the only Discourse I had with him, (which was but a while before he dyed) What were the things that induc'd him to think of a *Circulation of the Blood* ? He answer'd me, that when he took notice that the Valves in the Veins of so many several Parts of the Body, were so Plac'd that they gave free passage to the Blood Towards the Heart, but oppos'd the passage of the Venal Blood the Contrary way : He was invited to imagine, that so Provident a Cause as Nature had not so Plac'd so many Valves without Design : and no Design seem'd more probable, than That, since the Blood could not well, because of the interposing Valves, be Sent by the Veins to the Limbs; it should

should be Sent through the Arteries, and Return through the Veins, whose Valves did not oppose its course that way.

Thus, whereas former Anatomists and Physicians generally believed the Nutrition of the Parts by the Venal Blood, the more Recent Writers are wont to teach, that the Parts are nourish'd by the Blood in its passage through the Arteries. Not that they Think, the Blood that runs through the Veins altogether unfit to Irrigate the Parts with that Vital Liquor; but that they Judge the Veins to be less fit than the Arteries, into which the Blood comes immediately from the left Ventricle of the Heart, Agitated and Spirituous, and with a brisk Impulse, which forces out the *Particles* of the *Blood*, at those *Pores* of the *Arteries* that they find Congruous to their Shape and Size, and which answer to the several Parts that are to be nourished by Corpuscles so Qualified. 'Twere
not

not Difficult, if 'twere Necessary, to accumulate Instances to the same purposes with those already mentioned; there being nothing more frequent in the Books of Anatomists, and those that treat of the Physiological and Pathological parts of Physick, than to draw Arguments, as well Affirmative as Negative, about the Use of the Parts of the Body, from their Fitness or Unfitness, or their greater or lesser Fitness, to attain such Ends as are suppos'd to have been Design'd by Nature. And indeed these Argumentations occur so frequently, that I think there is less need of my Increasing them, than of my Proceeding to give you a Caution about them, which I shall do in the following Proposition.

PROP.

PROP. III.

I*T is Rational, from the Manifest Fitness of some things to Cosmical or Animal Ends or Uses, to Infer that they were Fram'd or Ordain'd in reference thereunto, by an Intelligent and Designing Agent.*

Divers things have Incidentally been said in this Paper, especially in the first Section of it, and others may hereafter be Occasionally added, that may justly be imploy'd against that part of the *Epicurean Hypothesis*, which Ascribes the Origine of Things to *Chance*, and Rejects the Interest of a *Deity*, and the Designing of Ends, in the Production and Management of Natural things. But because I observe, not without grief, that of late years too many, other-

otherwise perhaps Ingenious Men, have with the Innocent Opinions of *Epicurus*, embrac'd those Irreligious ones, wherein (as I was saying) the Deity and Providence are quite Excluded from having any Influence upon the Motions of Matter, all whose Productions are refer'd to the Casual Concourse of Atoms : For this Reason, I say, I thought it a part of my Duty, as well to the most Wise Author of Things, as to Their Excellent Contrivance, and Mutual Subserviency, to say Something, tho' but briefly, yet distinctly and expressly, to shew, That, at least in the Structure and Nature of Animals, there are Things that argue a far Higher and Nobler Principle, than is Blind *Chance*. But, that I may do what I here intend, with as much brevity as I can, I will do little more than name some Particulars, that I have not observed to be so usually reflected on, to the Purpose for which I mention them. And I shall Confirm these Considerations

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rations but with One Instance, and That too, taken from a Sort of Parts that are as little Elaborate, and therefore seem to be as little Fit for my Purpose, as almost any in the Humane Body.

I will not now inculcate what has been delivered, and may be farther said, of that Exquisite Structure of the Bodies of Dead Animals, that is discoverable by the Knives of Anatomists; (tho' I shall not Scrupulously forbear to touch lightly on a few things of that kind, that are requisite to my Purpose :) My present Design being, to set down very briefly a few Arguments, to Strengthen the Proposition lately delivered.

First then, I observe, That there seems to have been Care taken, that the Body of an Animal should be furnished, not only with all things that are Ordinarily Necessary and Convenient, but with some

some Superabundant Provision for Casualties. Thus, *tho'* a Man may Live very well, and Propagate his Kind, (as many do,) *tho'* he have but One Eye; yet Nature is wont to furnish Men with Two Eyes, that, if One be Destroyed or Diseased, the Other may suffice for Vision. And *so*, if One Ear grow Deaf, a Man may be Conversed with, by the help of the Other that remains Sound. In short, Nature has furnished Men with Double Parts of the same Kind, where that Duplicity may be highly Useful, and can be permitted without Incongruity to the rest of the Body. And this is the more Considerable, because in Other Parts Nature appears to Husband things, so, as to Shun doing things Superfluous: As within the Skull, some Vessels that would in other Parts of the Body have Double Coats like other Arteries, are much Thinner, almost like Veins; the Thickness of the Skull being ordinarily a sufficient

—NB.

Fence to them from External Injuries.

Another Argument, That divers Things that Nature does about Animals, are done with Design, may be taken from what Anatomists Observe of Those Parts of the Womb or the *Fætus*, that are to be found but at Certain Times, at which there is Need of them, and not at Others, when they would be Useless. Thus, when a Woman is with Child, the *Vasa Umbilicalia* are produc'd, to be Channels either for the Blood or Alimental Juice and Spirits, that then ought to pass between the Womb and the *Fætus*; which is to be Nourished, either only or chiefly, by the Liquors derived to It through those Vessels, assisted by the *Placenta*, that Supply to it the want of Eating with the Mouth, which the Unborn Infant either does not at all, or does but very imperfectly, employ to Feed himself. And though, as long as he continues Im-

Imprison'd in the *Womb-state*, these *Temporary Parts*, (if I may so call them) continue with him ; yet, as soon as he comes abroad into the World, these Umbilical Vessels, particularly the Two Arteries and the Vein, together with the Membranes they are wrapt up in, and Those (commonly call'd the *Chorion* and the *Amnios*,) that Involve the *Fætus*, are Thrown off, as Unnecessary to the Born Infant's New State ; and when It has quitted the Womb, are Expell'd after it, whence they are call'd the *After-birth* ; there remaining only that Part of the Umbilical Vessels that lies within the Child's *Abdomen*, between the Navel and the Liver, where its Use is Considerable, tho' New ; it Serving no more to convey Blood, or an Alimantal Liquor, to and fro, but Degenerating into a Ligament.

To the same Purpose with *this* Contrivance, we may mention that *other*, wherein Nature employs the

N3

Foramen Ovale, that gives Passage to the Blood from the Right Ventricle of the Heart to the Left ; that the Circulation of It may be maintain'd, tho' It cannot in the *Embryo*, as it does in a Born Child, pass through the Vessels of the Lungs from One of the Ventricles to the Other. For this *Formen Ovale* being but (if I may so call it) an *Expedient* that Nature Employs, as long as that which is Intended to be an *Infant*, remains an *Embryo*; this Temporary Conformation is Obliterated, when the Child Breathing the free Air, is in a Condition to make the Blood Circulate through the Pulmonick Vessels, according to the Primary Intention of Nature. From which and the like Instances we may infer, That these Temporary Parts were Fram'd by a Fore-casting, as well as a Designing, Agent, who Intended they should Serve for such a Turn, and then be laid Aside ; it being utterly Improbable, that an Undesigning Agent should

should so Appositely and Exquisitely Frame Scaffolds for the future Buildings, if he did not before-hand Destinate both the One and the Other, to concur to the same ultimate Effect.

Another Argument for our present purpose may be drawn, from the Consideration of those things that in Animals are commonly call'd *Instincts*; whereof Some more directly regard the Welfare of the Individuals they belong to, Others the Propagation of their *Species*; and Some again respect both. The Writers of Voyages, and those that professedly deliver Natural History, recount strange, and scarce credible, Instances, of the Instincts observable in certain Animals. But we need not lay the stress of our Argument upon dubious, or suspected Relations; since what I have met with in Authors of good Authority, or receiv'd from the mouths of Travelers of good Credit, may serve my

present turn ; especially if it be allow'd, (as I see not why it may not be,) to take the word *Instinct* in a latitude, so as to comprise those Un-taught Shifts and Methods, that are made use of by some Animals, *to* shun or escape Dangers, or *to* provide for their future Necessities, or *to* catch their Preys.

Divers Strange Things are deliver'd, not only by Poets, but by more Credible Writers, about the wonderful Sagacity and Government of Bees, in point not only of Oeconomy, but of Politicks too. But tho' I shall not build any thing upon the Authorities that I my self Suspect, yet, having had the Curiosity to keep for a good while in my Closet a Transparent Hive, whence there was a free passage into a neighbouring Garden ; and having thereby had the opportunity to make frequent Observations of the Actions of these little Animals, and particularly to see them at work about
making

making their Combs, and filling them with Honey : I confess I discover'd some things that I did not believe before, and was induc'd to look upon them as very fit Instances, of Creatures endow'd with natural Instincts and Providence. For 'twere hard for a Mathematician, in contriving so many Cells, as They make in the *Area* of one of their Combs, to husband so little space more Skilfully, than They are wont to do. And not only They Carefully and Seasonably lay up their Honey, to serve them all the Winter, but Curiously close up the particular Cells with Covers of Wax, that keep the included Liquor from Spilling, and from External Injuries. I do not here mention the Prognostication of Weathers, that may be made in the morning by Their keeping within their Hives, or flying early abroad to furnish themselves with Wax or Honey, or by their unexpected Return before a Storm unforeseen by Men ; because I suspect

pect that these things may not be so much the Effects of Instincts, as of a Tenderness and Quickness of Sense, such as may be seen in a good Weather-glass, and found in divers Wounded and Crazy Persons, that are affected with such Beginnings of the Changes of the Air, as are not yet perceiv'd by other men. But among the Peculiarities to be observ'd in the Conduct of Bees, I cannot but take notice, that after a Fight, I have, not without some wonder, seen them take up the Dead that lay on the Ground, and fly away with them to I know not what distance from their Hive.

B. —

Another obvious Instance of the Instinct that Nature has given even to some despicable Insects, may be taken from Ants, to whom *Solomon* sends the Sluggard to School, to learn the Providence of making Seasonable Provision for the Future. For 'tis known, that these little Creatures do in the Summer Hoard
up

up Grains of Corn against the Winter. And their Sagacity is the more Considerable, if it be true, what divers learned Persons affirm, that they eat or bite off the *Germens* of the Grains of Corn they lay up, least the Moisture of the Earth expos'd to the Rains, should make it Sprout. But whatever become of this Tradition, these Insects do some other Actions, resembling Sagacity and Industry, that are not so contemptible as their Bulk, tho' I must not stay to mention them particularly in this Place.

The Untaught Skill of Spiders, in Weaving their Curious Webs, that are so Fitly Contrived, both to Catch their Flying Prey, and give them immediate Notice of its being Caught, is a Thing, which, if it were not Familiar, would be look'd upon as Admirable. And this Skill is not, as Some Imagine, an Effect of Imitation of their Parents: For if the Eggs be taken away and enclos'd

clos'd in a Glass, when they come to be Hatch'd by the Heat of the Sun, the little Creature will Immediately fall to Spinning in the Glass itself, as was related to me, by an Eminent Mathematician that made the Experiment. And I saw the less reason to Distrust it, because, having by an External Heat Hatch'd many Eggs of Silk-worms, in a Place where there had not been any of a long time before, nor probably ever till then, yet the Worms produc'd by these Eggs, did in Autumn, of their own accord, Climb up to those convenient Places I had prepar'd for Them, and there Weave those Curious Oval Prisons in which they enclose themselves, and which are Unrevel'd into Silk, of whose extreme Fineness or Slenderness I have elsewhere given an Account.

Nor is the provident Industry of Animals confin'd to Insects, of whom the Poet, (if his words be taken

taken in a Popular Sence,) truly
faith;

*Ingentes Animos angusto in Pe-
ctore versant.*

Since 'tis to be found in divers of
the Greater Animals, particularly
in Beavers; of whom *tho'* Some
things that are recounted by Au-
thors and Travellers, are but Fabu-
lous; yet what has been related to
me by Sober and Judicious Persons,
that were either Born or Liv'd in
New England, where these Animals
abounding, they had the Opportu-
nity to observe Them; is sufficient
to Confirm such Relations, as may
give One just Cause of Wonder.
For these Credible Persons affirm'd,
That the Beavers with their sharp
Teeth, (whose Shape and Strength
I have Admir'd,) Cut pieces of
Wood so as to make them Fit for
their Purpose: *That* by Associating
their Labours, they lay these toge-
ther so as to Build themselves Strong
Winter-

N3 —

Winter-houses, in which there is sometimes a kind of Second Story, for the Inhabitants to retire to, when the Water chanches to Overflow : *That* for These Houses, they chuse a very Convenient Situation, just by some River, or other Water, that can furnish Them with Fish : And, *That* the Overture or Hole that belongs to each of these Houses, is plac'd just by the Water, that they may immediately Flounce into It, and so Save themselves when their Houses are Attaqu'd. And to Facilitate their Swimming away, and the Catching of their Prey in the Waters, Nature has furnish'd them, as I have Observ'd with pleasure in a Live Beaver, with two Feet not made like Those of *Dogs*, or *Cats*, or like their Own two Other Feet, but furnish'd with broad Membranes betwixt the Toes, like the Feet of *Geese*, *Ducks*, and other Aquatick Animals, that are to use them as Oars, to Thrust away the Water,

Water, and Facilitate their Motions upon It, and in It.

'Twere easie to accumulate Instances of the Sagacity and Industry of Animals, for their own *Preservation*: But 'tis more easie to find Notable Ones, among those Actions that concern the *Propagation* of their *Species*.

The various Arts employ'd by Animals of differing Kinds about the Materials, the Construction, and the Situation of their Nests, is usually Remarkable, and sometimes Wonderful. Of this Skill, we have divers Eminent Instances, some of which I have been delighted to See, but have not time to Recount. Yet One there is, whose Oddness will not suffer me to pretermit it. For in a Country that abounds with Apes and Monkeys, that are very Greedy of Birds Eggs, and oftentimes Climb Trees to come at Them; there is a Sort
of



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Museum at
Ox.

of Birds, whose Eggs they peculiarly affect, that do as it were Hang their Nests at or near the end of some long Flexible Branch or Wand, that grows Over the Water ; by which means their Insidious Enemies, who do not Swim, cannot come at them Underneath ; and by reason of the Yielding of the Flexible Branch or Twigs whereto the Nest is fastened, they are Frighted from venturing to pass on, for want of a Firm Support.

The Structure of the Nests of Wasps, which they often make under Ground to Secure them, I have observ'd to be very Curious and Artificial, especially when the Young Ones are Form'd in the little Cells, where they lye Hid and Shelter'd till they are ready to Fly away.

I might here multiply Examples of this Kind, but I think it fitter to proceed, by telling you, That the
Instincts

Instincts that Nature has Implanted in Animals to Preserve themselves, tho' they would seem Admirable if they were less Familiar, are much Inferiour to That Providence that She has furnish'd Animals with, for the Propagation of their *Species*.

There are diverse Notable Things to be met with in the Nests of several Birds, both as to their Materials, their Structure, and the very Situations of the Places pitch'd upon to Build them in. I have seen some Nests, especially *Indian* Ones, which would make a Man Wonder, how the Birds that Built them, should seek and find such Odd, and yet, all Circumstances consider'd, Commodious Materials to Build with. Of which we have an Eminent Instance in the Nests of certain *Eastern* Birds, whose Names I remember not, that make their Nests of a White Substance, (which has been Presented me by some of our *East-India* Merchants,) that looks almost
N like

like *Icthyocolla*, in the Shops commonly call'd *Isinglass*, and is Dissoluble in Liquors, and so very well Tasted, that it makes the chief Sawce that they use in the *Southern* Parts of *India* at their Feasts. The Structure also of the Nests of divers Birds, both as to their Figure, their Capacity suitable to the Bulk of the Builders, and the Accommodations they are furnish'd with for Warmth and Softness, may deserve to be Applauded by Mathematicians themselves: especially if it be consider'd, that these little Untaught Architects had no Tools to make their Curious Buildings with, save their Beaks and their Feet. And yet much more of Providence and Foresight appears in the Situation of the Places, that some Birds make Choice of to Build their Nests in: As may be observ'd, not only in the Pendulous Nests of Swallows, and the Crafty Hidden Ones of some *European* Birds, but very conspicuously in the Hanging and
Moveable

Moveable Nests, that we lately mention'd to be so Oddly plac'd by some Birds, to secure their Eggs from Apes and Monkeys ; and by the Situation of the well Tasted Nests I was newly speaking of, which are to be found only upon high and steep Rocks , and are so fastned to those Concave Parts of them that look downwards, and, for the most part, hang directly over the Sea , *that* there is no getting Them without much Trouble and Danger, by the help of Boats and Poles : Upon which Account, as well as That of their Delicioufness, they are very Dear in the *East Indies* themselves. The like Care to Contrive their Nests Advantageously, and make them in Secure Places, is taken by divers Insects themselves, as may be observ'd in the Subterranean Nests of the Wasps formerly mentioned, and in the Eggs of Snails, which I have sometimes found Hid under Ground, and had the Curiosity to Hatch in Glasses furnish'd

with the same Earth they were found in.

If I should here reckon up and display the several Effects, and consequently Arguments, of the Wonderful Providence, that the most Wise Author of Nature exercises about the Propagation of Animals, *by* distinguishing them into Male and Female: *By* furnishing both Sexes with Mutual Appetites and Organs, exquisitely adapted to the Increase of their Kind: *By* the admirable Formation of the *Fœtus* in the Womb, without the Females Knowledge How it is perform'd: *By* the strange Subtilties and Courage that Several of them, either Oviparous or Viviparous, have, to Hide and Defend their Young: *By* the full Provision that is made for the Nourishment of the *Fœtus*, and the Welfare of the Female after She has brought It forth: And *by* divers other Ways that I must not now stay to specify. If, I say, I should

should venture to do this, I might indeed, much enrich and adorn my Argument, but should make this Discourse too much exceed the Limits that my Design, and small Stock either of Ability or Leisure, would allow. And therefore, instead of pursuing a Speculation, that would lead me a great deal too far, I shall look back upon the Intimation I gave not long since, that even those Meaner Parts of Animals which seem to have been Fram'd with the least Care or Contrivance, are yet not Unworthy of their Author.

For Proof of which, I shall now observe, That *tho'* the Teeth be some of the least Elaborate Parts of the Humane Body; *yet* even These afford more Observations applicable to our present Purpose, than my Intended Brevity will permit me to take Notice of. And therefore I shall only, and that little more than transiently, consider a few of Them

here ; and some of the Others elsewhere, on those particular Occasions, on which it will be more Proper to bring them in.

I. And First, 'Tis considerable, That whereas, when a Man is come to his full Stature, all the Other Bones of the Body cease to Grow, the Teeth continue to Grow in Length, during a Man's whole Life.

AB. —

This Growth of the Teeth appears, not only by their Continuing so many Years of the Same Length, but by the Unsightly Length of One Tooth, when That which was opposite to It in the other Jaw happening to Fall out or be Pulld out, the Tooth we speak of has liberty, to Grow into the Gap made by the Removal of the Other. Of this Difference in point of Growth betwixt the Teeth and other Bones, What Reason can be so probably given, as, That 'tis design'd to repair the Waste that is daily made of the
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Substance of the Teeth, by the frequent Attritions that are made, between the upper and lower Tyre, in Mastication ?

II. Whereas the Other Bones of the Body (some few Small Ones excepted) are Invested with a very thin and sensible Membrane, which, for its close adhesion to the Bone, is by Anatomists call'd the *Periosteum* : That Part of each Tooth which is not cover'd by the Gums, has none of this Membrane, which would be subject to frequent and very painful Compressions and Lacerations. — *Ab.*

III. To enable the Teeth to Break, and make Comminutions of the more Solid kind of Aliments, Nature has providently Fram'd them of a Closer and Harder Substance, than almost any other Bones of the whole Body ; tho' these be so Numerous, that Anatomists reckon above Three Hundred of them. And I have met with Relations in

Authors of good Credit, That Some Men's Teeth have been so Hard, as, when struck with another Fit Body, to produce Sparks of Fire.

IV. That These Bones, whose Use (to Prepare Aliments for Nutrition) is so Great, and almost Necessary, may themselves be continually Fed and Cherish'd, tho' they Grow in Other Bones; the All-wise Author of Things has admirably Contriv'd an Unseen Cavity in each side of the Jaw bone, in which Greater Channel are lodg'd an Artery, a Vein, and a Nerve, which thorough Lesser Cavities, or as it were Gutters, send their Twigs to each particular Tooth; which by These little Vessels that reach to It, receives a continual Supply of Nourishment and Strength.

V. In regard that Babes are, according to Nature's Institution, to Feed for a considerable time on Milk, for which there is no need of Teeth,
and

and which would also Hurt the Nipples of Her that gives them Suck : Nature forbears for many Months to produce Teeth in Humane Infants : whereas the *Fætus*'s of divers Brute Animals, that are oftentimes reduc'd Early to seek out Aliments that are not Fluid, nor very Soft, are Born with Teeth already Form'd in their Jaws.

VI. The Bony Substance appointed for the Comminution of Aliments, ought not for several Reasons, (which for Brevity's sake I here omit,) to be in either Jaw Entire, or all of one Piece : And therefore Nature has providently made for that Use, a competent Number of distinct Bones in either Jaw. And, because Men may often have Occasion, to feed upon very differing Sorts of Aliments, and usually the Same Aliment may require Differing Preparations in the Mouth, to Facilitate the Digestion of It in the Stomach : Na-
ture

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ture has provided Men with Two Rows or Sets of Teeth, equal for the most part in Number, (each Jaw in Men usually having Sixteen, and in Women Fourteen or Fifteen,) and answering to each other, but yet of differing Shapes, for differing Uses. For Some, as the Fore-teeth, are Broader, and with a kind of Edge, to Cut the more Yielding Sort of Aliments; whence these Teeth are called *Incisorii*. Others are Stronger, and more fitly Shap'd to Tear the more Tough and Resisting Sort of Aliments: These are They that by the Vulgar are in *English* call'd *Eye-Teeth*, and which, for their Resemblance to Those of Dogs, are by Anatomists call'd *Canini*. And then there is a Third Sort, whose principal Office is to Grind the Aliments that are Cut or Torn by the Others; and for this Purpose they are made much Broader, and somewhat Flattish, but yet with their Upper Surfaces Uneven and Rugged, that by their
Knobs

Knobs and little Cavities, they may the better Retain, Grind and Commix the Aliments, that are to be Chew'd by Them : And for this Reason they are call'd *Molares*.

VII. And because the Operations to be perform'd by the Teeth, oftentimes require a considerable Firmness and Strength, *partly* in the Teeth themselves, and *partly* in the Instruments that Move the Jaw wherein the Lower Set of them is fix'd : Nature *has* provided the Lower Jaw, (which alone is Moveable, unless, as Some affirm, in *Crocodiles*,) with Strong Muscles, to make it bear forcibly against the Upper Jaw : And *has* not only Plac'd each Tooth in a distinct Cavity of the Jaw bone, as it were in a Close, Strong, and Deep Socket, but *has* furnish'd the several Sorts of Teeth with Hold-fasts, suitable to the Stress, that, by reason of their Differing Offices, they are to be put to. And therefore, whereas
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the Other Teeth (the Cutters and the Dog-teeth) have usually but One Root, (which in these last nam'd is wont to be very Long ;) the Grinders, that on many Occasions are employed to Crack Nuts, Bones, or Other Hard Bodies, before they can be Ground ; are furnish'd with Three Roots, and oftentimes with Four, in the Upper Jaw, whose Substance is somewhat Softer, and whose Grinders Serve as so many little Anvils, for Those of the Lower to Strike or Press against. On which Account, as hath been already Intimated, the Lower Jaw, (for the Other belongs to the Immoveable Part of the Skull,) is furnish'd with a strong Muscle on either side, capable of Moving It, and consequently the Teeth in It, with great Force against the Upper Jaw.

If some Favourer of *Epicurus's* Doctrine shall here Object, that, *tho'* Man indeed be Advantagiously furnish'd with Teeth, *yet* there are many

many Other Animals, and even Quadrupeds, whereof some have not near so Many Teeth as Man, nor so Commodiously Shap'd and Plac'd as His; and Others are not furnish'd with any Teeth at all: And that likewise there are many Other Animals, that have some of their Other Parts less Convenient in their Kind, or otherwise are not near so well provided for, as they would be, if they were not rather Casual Productions, than those of an Intelligent and Designing Opificer: If These things, I say, be Objected, I must own myself of a very differing Opinion from the Objector. And I think I could add much about the *Final Causes* of Things Corporeal, as the Consideration of them leads to a high Veneration of their Divine Author, and as it tends to manifest, that, when His Providence is Deny'd or Condemn'd, 'tis for want of Its having been sufficiently Understood, and duely Consider'd. But, besides that this Third Proposition

ought

ought to be but One Part of our Discourse of *Final Causes* ; I have in great Part prevented myself already, by what I have formerly said, to Obviate or Answer some Exceptions, relating to the Eyes of Man, and Differing Animals. For Most of the Considerations, if not All, that have been Alledg'd on the Occasion of those Organs of Sight, may well be, *Mutatis Mutandis*, applied to the Varieties that are to be found in the Teeth, and other Parts, of differing Kinds of Animals. For I may justly represent, That the Reason why This or That Organical Part of This or That *Species* of Living Creatures, has not such a Structure, or is not so Plac'd, as We might think most convenient, may often be, That in this Case it would be less proper for Other Ends, of more Importance to the Welfare of the Animal, than such a Fabrick and Situation of the Part as We Prefer, would be. And there are also many Cases, wherein the Thing
that

that We make bold to think Wanting or Amiss, is provided for by Other Contrivances in the Same Animal ; by which Provision, the Part under Consideration is made more Serviceable and Symmetrical to the rest of the Body : And so, performing Other Offices beside the Main, is, upon the whole Matter, more Useful to the Animal, than Otherwise it would be.

'Tis known that Oxen and Sheep, and many Other Ruminating Beasts, are not furnish'd with near so many Teeth as Men are, and as are to be found in *Dogs, Cats, Horses,* and many other Quadrupeds. But for the Paucity of Teeth Amends is made, in most of those Animals, *partly*, by the Power and Instinct They have to Chew the Cud, and thereby make a Second Attrition of their already much Softned Aliments ; and *partly*, by the Successive Cavities or Stomachs, (distinguish'd by the Names of *Primus, Venter, Reti-*

— NB.

Reticulum, Omasus and Abomasus,) through which the Aliment is Transmitted, and more and more Elaborated, to make it Fit for further Uses. The Mouths (especially the Inward Parts of them,) of the *Beaver*, the *Tortoise*, the *Bee*, the Humming Bird that Feeds on Flowers, whose Exudations with his long little Bill He Sucks like the *Bee* : These, I say, and many Other Animals, (to omit the Elephant himself,) have their Mouth, and their Ways of Preparing their Aliments for the Stomach, very Different from what is observ'd in Men, and yet very Convenient for them respectively, all Circumstances consider'd.

These and the like, whether Compensations or Expedients, are in many Animals such, that there is no Cause to tax the Author of Nature, for not having given Some Animals, all the same Parts that Others are furnish'd with : But rather the
 Thrifty

Thrifty Providence, (if I may so speak,) and Designing Wisdom of God, in the Contrivance of his Visible Works, may be as well discover'd *by* the seeming Omission of This or That Part, that is Useful to Other Animals, but is not Necessary to Those wherein it is not found, as, *by* Granting Those Parts to the Animals, to whose Compleatness or Welfare they are Necessary, or highly Conducive. On which account 'tis not to be thought Strange, that He has not to Men, as to Frogs, and many sorts of Birds, given such Tough, Transparent, and Moveable Membranes, as these Animals are provided of to Cover their Eyes, from Harms that Those of Men are not usually expos'd to. And 'tis not an Omission, not to have given Girls Swelling Breasts, before they are capable of Generation, more than 'tis, not to continue to them, after their being grown Mothers, the *Placenta Uterina*, when they are not with Child.

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Though *Batts* be look'd upon as a Contemptible sort of Creatures, yet I think they may afford Us no Contemptible Argument to Our present Purpose. For in this Heteroclite Animal, you may discern the Fœcundity of the Divine Artificers Skill, which has in this Form'd an Animal that Flies like Birds, and yet is not only Unfurnish'd with Feathers, but is of a Fabrick quite differing from that of Other Birds. And in this little Animal We may also observe, *both* the Compensation that is made for Parts, that seem either Deficient, or less Advantag'd than Those of the same Denomination in Other Birds: *and* the Regard, which the Divine Artist appears to have to the Symmetry of Parts, in His Animated Works, and to their Fitness for the Places they are to Live in or Frequent. For the *Batt*, being to act sometimes like a Bird, that Flies freely to and fro in the Air, and on some Occasions like a Terrestrial Animal

Animal, such as is that little Quadruped a *Mouse* ; ought to be furnish'd with Parts suitable to such Differing Destinations. And therefore, to fit him to Answer the First of These, the want of Feathers in the Wings is supply'd by a broad Membranous Expansion, and a kind of Toes furnish'd with Articulations, that make up the Wings : And, because this Animal was to be able, like Other Birds, to forbear Settling on the Ground, otherwise than his Occasions requir'd : Each of his Wings is furnish'd with a strong Crook, like the Claw of a Bird's Foot, by the Help of which he can fasten himself to Trees, Walls, and divers Other Erected Bodies, and keep himself Suspended in the Air, and continue at what Distances he pleases from the Ground. And because he is furnish'd with *Teeth*, which other Birds want, to Chew his Food, and thereby prepare it for Digestion : He needs not have a Crop, or such a Strong and

Muscular Stomach , as is usually found in Birds : And (in short) to Omit the peculiar Structure of Other Internal Parts, wherein the *Batt* differs from Other Birds : Since the Female was not , like Them, to be Oviparous, but, like *Mice* and Other Quadrupeds, that bring forth their Young Ones alive : She is not only furnish'd with an *Uterus* fitted for that Purpose, but, in regard She does not, like Birds that lay Eggs, Exclude, together with the *Fetus*, a competent Stock of Aliment to Nourish It, till it can Shift for Itself : The *Batt* is furnish'd with Dugs, to give Suck to her Young Ones : And by Zoographers 'tis observ'd, That, *as* she has but Two Teats, *so* she brings forth but Two Young Ones at a Birth ; whereas *Mice* are much more Prolifick.

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The Writings of Zoographers, and the Relations of Travellers, afford divers other Instances of the
Various

Various, and yet Excellent, Contrivances, that are to be found in several Animals that differ from Man, (who is an Animal endow'd with numerous Teeth,) in the Fabrick of the Mouth, and Other Parts inservient to the Reception of Aliments, and their Preparation for Digestion.

But passing by the Mouths of Tortoises, Camelions, and Other Animals, the Hardness of whose Gums, in reference to their Ordinary Aliments, suffices to make Amends for their Want of Teeth. There is one *American* Beast, which I think, I ought not to forbear mentioning here, as a Notable Instance, to manifest how the Wise Architect can Compensate the Want of Teeth, by the rare Structure of the Mouth and Tongue, and Their Fitness to Seize on and make Use of those Aliments, which, tho' Uncommon for a Beast of His Bulk, He seems to have been destinated

to Live upon. The Animals of this Kind are by *Hernandus*, who retains their *American* Names, call'd *Achoas* and *Tamendoas*; and of These, and particularly of the Parts they are provided of to Eat with, he gives us this Account.

vid. Schotti Phys. Curios. l. 8. c. 5. Offenduntur apud Tucatuses Quadrupedes quidam, dorso prædorso & fulvi, agnorum magnitudine, sed qui ventre circiter Terram attingant, dentium omnino expertes sint, & solo formicarum venatu vivant, quarum cumulos duobus magnis ungibus quibus singuli anteriores pedes armantur, excavant turbantque; ac dein exerta lingua, que doctanto longior est, scabra tores ac pennam anserinam crassa, formicas eam conscendentes ac densantes suscipiunt, eademque contracta, & in os, quod mirum in modum angustum ac parvum est, recepta, gratum sibi pabulum capiunt, & innocentium Animalium præda potiuntur. Of the same sort of Beasts, the Ingenious *Piso*, in his

his *Hist. of Brasile*, (where he Practis'd Physick) mentions Two kinds, the Greater and the Less, which He, like *Hernandus*, calls *Tamanduas*, but adds the new coin'd Name of *Myrmecophaga*; and of Both gives this Account. *Utraque* (says

he) *sunt noctambulae pabuli causa; Cicurate*

Gulielmus Piso
l. 5. *Hist. Nat.*
& *Med.* c. 22.

carne quoque vescuntur, sed minutim concisa quia non solum capite, promuscide, sed & ore sunt angusto, acuminato, edentuloque, lingua denique, instar chraffioris Chordae, tereti adeoque longa praesertim: in Tamandua majori, ut duorum pedum longitudinem excedat, atque proinde duplicata (quod notatu sane dignum) quasi canali incumbit inter inferiores genas, quam esuriens madidam exerit, & arborum truncis diu imponit, mox formicis opertam repente retrahit. Si alte fodiendo latebra earum detegi postulant, Unguibus id praestat commode, quibus pedes posteriores instructi sunt satis validis & longis numero quinque, anteriores quatuor, iisque re-

curvis, duobus in medio maximis.

'Tis also to be consider'd, That Divers Things may be Useful in an Organical Part, besides That whereby its Function is primarily and mainly exercis'd: As, *tho'* the Eye-lids and their Motions, together with the little Glandules that belong to them (most of which lye conceal'd under the Edges) *are not* at all necessary to the Act of Vision, (no more than Curtains are to a Window ;) *yet they are* to the Compleatness and Welfare of the Eye, which is the necessary Organ of Vision: As is manifest by the Pain and Prejudice the Eye receives, if the Eye-lids, which are subject to more than One Distemper, be considerably Disaffected.

I may hereafter have occasion to take notice, that, besides those Uses of the Parts of a Human Body, which I venture to call *Anatomical*, because they are such as Anatomists have

have discover'd by meer Dissections; there may be of several Parts Other Uses, which I call *Chymical*, because These Parts do Elaborate Spirits of several Sorts, and perhaps Exercise some other Spagyricall Functions of great Importance, if not of Necessity to the Welfare of a Living Man.

And, besides, the Anatomical and Chymical Uses, there may be others very fit to be consider'd in some parts of a Human Body; as the *Mechanical* Advantages, for which the Various Shapes and Structures of differing Muscles, and the seeming Irregular, and as it 'twere Casual Fabrick of the Bones, and especially of the Processes and Protuberances, are admirably Fitted. And there are also in some Parts, as the Eyes, *Optical* Reasons to be consider'd, before One can otherwise than Rashly Censure, what the Author of Nature has done about them: As, tho' the figure of the
Chry-

Chryſtalline Humour be much more Globous in moſt Fiſhes, than in Men and Tereſtrial Animals, yet he that underſtands the Doctrine of Refractions, and conſiders that Fiſhes under Water are to ſee Objects through a far thicker *Medium* than Air, will readily acknowledge, that this Difference between the Eyes of Fiſhes and thoſe of Men, is not an Imperfection in the former; but whilſt thoſe Creatures are in their own Element, a great Advantage. And, to be ſhort, I think there are ſo many Sciences, and other Parts of Knowledge, ſome of them perhaps ſcarce yet Discover'd, that may be required to warrant a man, to Cenſure the Ends of God in the Bodies of Animals, that very Few have Knowledge enough to be capable of Condemning them without Raſhneſs: And they that have Knowledge enough to Judge aright, will not be forward to Condemn them, but Admire them. But, *tho'* this Conſideration be not here diſplay'd,

yet

yet the now mention'd Intimation of it may afford us this Reflexion, That Men may easily be too Rash, if they think a part Bunglingly Fram'd, upon Supposition that, by the Anatomical Inspection of it, they know all the Uses that the Skill of the Divine Opificer could Design it for.

Nor will it necessarily follow, that, because in some Particular Bird, or Beast, or Fish, we may not be able to give an account, Why this or that Part is not to be found, or Why it is otherwise Fram'd or Situated than that which is Analogous to it in Man; it must therefore be Casually or Improvidently Fram'd or Plac'd: Since we cannot expect from Brute Animals, Answers to those proper Questions about their own Bodies, which we can receive from Men about their Human Ones. And yet, notwithstanding the great Assiduity, with which the more curious Physicians
are

are oblig'd to Cultivate Anatomy, and the frequent Opportunities they have to do it, and to ask Living Men Questions about what they find, when the Natural Use of their Parts is Hindred or Perverted : Our Sagacious Moderns are to this day at a Loss, as to the True Uses of the Visible Parts of the Body ; to say nothing of the Invisible, such as Spirits, Salts, &c. So that it ought to be no Wonder, if in Animals, whose Fabrick we have much less Concern to Inquire into, and and much less Opportunity to Examine, we sometimes find Parts, of whose Uses and their Fitness for them, Men are not yet able to give a satisfactory Account. For I consider, *that* even in Man himself, tho' there be numerous Valves found in his Veins, yet for those many Ages that the True Uses of them lay Hid, an *Asclepiades*, or some Other bold *Epicurean Physician*, might have thought himself well grounded, to look upon them
as

as Superfluous Parts : Which, now that the Circulation of the Blood is discover'd, they are acknowledg'd to be far from being.

On this Occasion it may help us if it be consider'd, That, since God is both a most Free and a most Wise Agent, it need not seem Strange that He should Adorn some Animals, with Parts or Qualities that are not Necessary to their Welfare, but seem'd Design'd for their Beauty : Such as are the Disposition of the *Camelion* to Change Colours ; and the lovely Greens, Blews, Yellows, and Other Vivid Colours, that Adorn some sorts of Pigeons, and of Parrots, and divers Lesser Birds, as Gold-finches, Canary-Birds, and especially those admirably little Winged Creatures Humming Birds. And on the Other side, sometimes God's Wisdom seems to be as it were Thrifty, and Solicitous not to bestow on an Animal, or a Part of it, more than
is

is Necessary for the Use for which 'tis Design'd. As the Veins are by Anatomists observ'd to have but One Coat or Membrane, and usually to lye more Expos'd than the Arteries that accompany them; These having Stronger and Double Coats, because they are to convey a more Important Liquor, (the Arterial Blood,) which besides that 'tis more Agitated and Spirituous, is forcibly impell'd into Those Vessels by the Muscular Contraction, or Strong Impulse of the Heart. And to the same purpose it may be observ'd, That the Arteries within the Skull are far more Thinly Coat-ed than elsewhere; the Solidity of that Bony Part being a Fence to the Vessels that it covers. And to add That on This Occasion, we may observe, That, *tho'* the Nerves usually lye Deep in the Parts, to be kept both Safe and Warm, being very lyable to be offended both by Cold, and the Contact of External Bodies; *yet*, it being necessary that

that the Optick Nerve should Expand itself into the Eye, the Membranes that Invest the Nerve and Other Coats of the Eye, (except the *Retina*, which seems to consist of the Medullar Fibres,) are made by great Odds more Firm than the *Dura* and the *Pia Mater*, whence they proceed; and tho' Expos'd to the Free Air, are less sensible of the Cold than most Parts of the Body, and will bear, without Danger, divers Liquors, and Other Offensive Things, whose Pungency would put Other Nerves of the Body into Convulsive, and perhaps very Dangerous Motions. This (Conduct) looks as if God, like an Excellent Writing-Master, did, in the great Volume of his Creatures, Intend to bestow on some of These, Things rather Ornamental than Necessary, as Flourishes on the Capital Letters of the Alphabet of Nature; and sometimes, to Imploy Characters, and divers of them very differing Shap'd, (as the

— *NB.*

Latin

Latin are from those of the *Greek*, the *Hebrew*, the *Saxon*, &c.) to Express the Same Letter ; and sometimes also, to Imply Abbreviations, as a Stroke or a Dash, instead of a Letter or a Syllable, to Express Compendiously that which might be very Justifiable, had it been more Fully set down or Delineated.

If That be admitted, which We have formerly propos'd as very Likely, that God Design'd, by the great Variety of His Works, to Display to their Intelligent Considerers, the Fecundity (if I may so speak) of His Wisdom ; One may readily conceive, that a great part of the Variety Observable in the Analogous Parts of Animals, as their Eyes, their Mouths, &c. may be very Conducive to so Reaching and Comprehensive a Design ; to which the Beauty of some Creatures and Parts, as well as their more Necessary or Convenient Structure, may

may be subservient; especially if the Innocent Delight of Man be also Intended, as it may seem to be in the Curious Colours and Shapes of divers Flowers, and in the Melodious Musick of Singing Birds, and in the Vivid and Curiously Variegated Colours of the Feathers of several Winged Animals, particularly those that make up the Peacocks Train.

We are not near so Competent Judges of Wisdom, as we are of Justice and Veracity: For These last named are to be Estimated by Eternal and Fixed Bounds or Rules, which are very Intelligible to a Moderate Understanding. But as for Wisdom; the more Profound it is, the less we are able to Look through it, and penetrating to the bottom of that, to Judge knowingly of its Actions. And therefore, *tho'* we may safely Conclude that God Acts Wisely, when he does something that has an Admirable

rable Tendency to those Ends we justly suppose him to have Design'd; *yet* we cannot safely conclude in a Negative way, That this or that is Unwise, because we cannot Discern in it such a Tendency. For so Wise an Agent may have Other Designs than we know of, and further Aims than we can Discern, or perhaps Suspect: And may have at hand, or furnish himself with, such Means to compass his Ends, and that even by the Co-operation of those Means we think Useless or Improper, as are far above the reach of our Conjectures, and without the knowledge of which we but Rashly Censure the Wisdom of his Proceedings.

In the Double Horizontal Dial formerly mention'd, it would be Rashly done of those, who should Condemn or Despise the various Lines they find trac'd upon that useful Instrument, because they see that they are not necessary to shew the Hour of the day; since the Ma-
thema-

thematician that drew those Lines so curiously, may be well suppos'd to have had more Ends than One or Two in making the Instrument, and not to have drawn them by Chance or Unskilfully ; tho' the Inconsiderate Censurers do not know, for what Other or Further Purposes the Artist may have Design'd them.

Suppose some Indian Fisherman, unacquainted with European Arts and Affairs, should happen to come aboard a Man of War under Sail : Tho' he would quickly perceive by the use that was made of the Ropes, Pulley, &c. that this Floating Building was very artificially Contriv'd : Yet if he should fix his Eyes upon one of the Guns, and the Anchors, and perceive that no use was made nor like to be made of them in Sailing, He would be strongly tempted to think, that those heavy Masses were useless Clogs and Burdens to the Vessel. But if he were told the Necessity and Use-

fulness of the Guns for Defence, and of the Anchors to stay the Ship in Convenient Places in Storms; he would easily Alter his mind, and Confess, that he Blam'd the Builders and Furnishers of the Ship, for That which nothing but his Ignorance kept him from highly Commending.

I have dwelt much longer than I intended on this Third Proposition, because I think it a Duty our Reason owes to its Author, to endeavour to Vindicate his manifold Wisdom, in this Libertine Age; wherein too many Men, that have more Wit than Philosophy or Piety, have upon Epicurean, and some also even upon Cartesian, Principles, labour'd to Depreciate the Wisdom of God, and some of them presum'd to Censure the Contrivances of these living *Automata*, that (in their Protoplasts) were Originally His. And it was not only the Seasonableness of saying,
about

about so Important a Subject, some-
 things that possibly have not yet
 been met with, or at least duly Con-
 sider'd, That has made me thus
 Prolix ; but a Desire, that my
 Reader should not barely observe
 the Wisdom of God, but be in some
 measure Affectively Convinc'd of
 it. To which purpose in my O-
 pinion, 'tis very Conducive, if not
 Necessary, besides General Notions,
 to observe with Attention some
 Particular Instances of the Divine
 Skill, wherein it is Conspicuously
 Display'd. 'Tis true, that in the
Idea of a Being Infinitely Perfect,
 Boundless Wisdom is One of the
 Attributes that is Included. But
 for my part, I shall take leave to
 think, that this General and Inde-
 finite *Idea* of the Divine Wisdom,
 will not give us so great a Wonder
 and Veneration for it, as may be
 produc'd in our minds, by Know-
 ing and Considering the Admira-
 ble Contrivance of the Particular
 Productions of that Immense Wis-
 dom,

dom, and their Exquisite Fitness for those Ends and Uses, to which they appear to have been Destinated.

PROP. IV.

That we be not Over hasty in Concluding, nor too Positive in Asserting, that This or That must be, or is, the particular Destinated Use of such a Thing, or the Motive that induc'd the Author of Nature to Frame it thus.

IT has been above declar'd, That some Parts are *so* Excellently, and *so* Manifestly, Fitted for a certain Use, as the Eye for Seeing; and *so* much better Fitted for That, than for any Other; *that* 'twere little less than Heedlessnes or Perverseness, to Doubt of Its being Desti-

Destinated Thereto. But the like cannot be said of all the Other Parts of the Body, especially of the Internal. And there are divers Uses, either Necessary, or highly Conducive, to the Welfare of the Animal, to which no One Part is so much more conspicuously Fitted than any Other, but that 'tis more Difficult than many think, to determine the True and Primary Uses or Offices of some Parts, especially with so much Certainty, as thereon to ground Physiological Inferences : And of this Difficulty I conceive there may be *four Reasons*, tho' they do not All, nor perhaps Most of them, occur in Each particular Case.

And *First*, the whole Animal itself, the Use of whose particular Parts is under inquiry, is but a Part of that greater Body, the *Universe*; and therefore cannot easily be suppos'd, to have been fram'd and furnish'd with the Parts it consists of,

meerly for its own sake. And when we say, that all its Parts are Contriv'd for the best Advantage for the Animal, I conceive it is to be understood in this Limited Sense ; That the Parts are excellently fram'd for the Welfare of the Animal, as far forth as That Welfare is consistent with the General Ends of the Author of Nature, in the Constitution and Government of the Universe : which *Ends*, because they relate to the whole World, or to very considerable Masses of it, as the Terraqueous Globe, the Planets, and other Stars, I have formerly, for brevity's sake, styl'd *Cosmical*: And *tho'* it has not been prov'd, that None of these *Cosmical* Ends are investigable by us : yet to discover them All, is not an easie Task. And yet it seems presumptuous to suppose, that the Welfare of particular Animals is any further design'd and provided for, than will consist with the *Cosmical* Ends of the Universe, and the Course of
 Gods

Gods General Providence ; to which his Special or Particular Providence, about this or that meer Animal, ought in reason to be Subordinated. And *tho'* I think it a great Rashness for us men to Determine positively, and *exclusively to others*, what Ends the Omniscent Creator propos'd to himself, in giving to the World the Frame we see it has ; *yet*, as far as I can hitherto discern, I see nothing that is *more* likely to have been One Grand Motive of so great a Variety as we may observe in his Corporal Works, especially in Animals, *than* that which hath in part been elsewhere intimated, *viz.* That He might, by so many and so very differing Contrivances, as are to be met with in the Structure of Men, Four-footed Beasts, Birds, Fishes, Reptiles, &c. Exercise and Display (what could not be by a less Variety so fully manifested) that which an *Apostle*, speaking of things of another

Ephes. 3. 10.

ther

ther Order, Emphatically styles the πολυ-ποίησις σοφία τῆ Θεᾶ (*the Multifarious or Manifold Wisdom of God.*) Man being acknowledg'd, upon the account of his very Body, the most Perfect of Animals; if God had simply Design'd the giving of every Animal, the most Advantageous Structure that could be devis'd, it seems that He should have Made no Other Animals than Men. But then there could not have been that Diversity of Contrivance among Living *Automata*, that does so much recommend the Wisdom of Him, that could Frame so Many and so Differing Animals, tho' not All of them equally Perfect, yet All of them admirably Furnish'd for those Purposes to which He Destinates them. And therefore it does not argue any Want of Providence, that He has not Furnish'd Man with Wings, as he hath Birds; nor Fishes with four Feet; nor Birds with Fins and Scales: because these Parts would have been
either

either Superfluous and Burthenfom,
 or would not have Suited with his
 Design, of making Some Animals
 Live on the Earth, and Some in the
 Water : And if He Design'd any
 to Live, tho' not equally, in Both,
 He furnish'd Them with Parts of a
 Peculiar Structure, as I have else-
 where noted of the *Beaver* and the
Frog. If it were not for the fore-
 mentioned Consideration, 'twould
 be hard to give a Reason, why Ve-
 getables were not made the Food of
 all Animals ; But Some should be
 Carnivorous, and furnish'd with
 Appetites and Organs to Devour
 Others, and Live, as Birds and
 Beasts of Prey do, upon the De-
 struction of the Weaker. And
 'twill be hard to shew, why, even
 in Animals of the same Kind, the
 Safety of Some should be so much
 better Provided for than that of
 Others ; as We see, that some
 Ants, and some Glow-worms,
 are Furnish'd with Wings ; and
 Some not. And in Mankind
 itself,

itself, Those of the Female Sex are not so happily Fram'd, in order to their own Welfare, as Those of the Masculine : Since the Womb, and other Things peculiar to Women, which are not Necessary to the Good of Individual Persons, but to the Propagation of their *Species*, subject that tender Sex to a whole Set of Diseases, belonging to them either peculiarly, as they are Women, or as they are with Child, or brought to Bed ; from all which Men are exempt. So that, to apply these Things to Our present Purpose ; Men may sometimes Mistake, when they peremptorily Conclude, that This or That Part of an Animal Must, or Cannot, have been Fram'd for such an Use, without Considering the *Cosmical*, and therefore Primary and Over-ruling, Ends, that may have been Design'd by *Nature* in the Construction of the whole Animal.

Secondly,

Secondly, Men sometimes erroneously Conclude, that such an Office cannot belong to such a Part, because they think, It is not so Commodiously Framed for it, as may be wish'd or devis'd; without considering, *whether* the Structure which they Fancy would do Better for that Particular Use, would not, in some Other as considerable Regard, Oppose the Welfare of the Animal: Or, *whether* it would be consistent with the Other Uses design'd by Nature in that sort of Living Creatures. For in the Living Works of so Excellent an Ingeniour as *Nature*, it must not be expected, that any Particular End should be prosecuted to the Prejudice of the Whole; but rather it must be suppos'd, that She Aims not only at Particular Expedients, but Universal Symmetry; and does indeed excellently Fit the several Parts, for their respective Offices; but yet only as far forth as a due Regard to the Design and Welfare of

of the Whole will permit. The Reasonableness of this Observation, One need but be moderately Exercis'd in *Zootomy* (as That is distinguish'd from *Androtomy*) to discern. For, *tho'* Man be confess'd to be the most Perfectly Fram'd Animal in the World; yet, His Body is not made the Model, on which Nature has Fram'd the Correspondent Parts of Other Animals. The Lungs of Dogs, of Birds, of Frogs and Vipers, and I know not how many Others, are of a Structure very differing from Those of Man. He is not furnish'd with so many Stomachs as an Oxe or a Sheep, because *Nature* Intended not He should Ruminare like Them. *Tho'* His Gall be lodg'd in a peculiar Bag, so Plac'd in the Liver, as to give *Helmont* a colour to call it *Nucleus Hepatis*; yet 'twere unadvis'd to say, That the Secretion of Gall is none of the Uses of Those Livers, wherein Such a *Cystis* is not to be met with: Since in Some Animals,

mals, as in Horses and Pigeons, — *NB.*
 that Bitter Humour, (which in
Frogs I have often observed to be of
 a Deep and Transparent Green,) is
 not usually, as in Man, collected
 into one Bag : And in *Vipers*, tho'
 it be included in one *Cystis*, yet, as
 far as I have observed, That Bag
 does not at all touch the Liver :
 And store of such Instances may
 be met with among the Remarks
 of Zootomists : Wherefore I pass
 on to Observe,

That, in the *Third* place, 'Tis
 Difficult to Determine the True
 and Primary Use of a Part, because
Nature does often Fit One Part for
 Several Uses. To which I shall add,

In the *Fourth* place, That the
 Difficulty is sometimes Increas'd,
 because Nature may compass the
 Same End by Several Means, each
 of them Sufficiently, tho' not E-
 qually, Commodious. I joyn these
 Two together, because in Effect
 they

they do often Concur, in making it Difficult to determin the True Use of a Part. And the latter of the Two is sometimes Increas'd by this, that Nature does not as Constantly, as some Men presume She does, Imploy only one Part to perform such an Office; but the Intended Effect is sometimes produc'd by a *Series* of successive Operations, to which several Parts may in Differing manners Contribute.

And here I observe, (what perhaps has not been Consider'd,) that neither the Mechanism of a Human Body, nor that of very Considerable Parts of It, is to be judg'd of, only by the Structure of the Visible Parts, whether they be those Solid or Stable Ones that the Anatomist's Knife is wont to expose to Sight; or even by the Texture of those Fluid Ones, which are to be found in the Vessels and Cavities of a Dead Body when Dissected, tho' never so Skilfully. For I take the
Body

Body of a Living Man to be a very Compound Engine, such as Mechanicians would call *Hydraulico-Pneumatical* : Many of whose Functions, (if not the Chiefest,) are perform'd, not by the *Blood* and other *Visible Fluids* barely as they are Liquors ; but *partly* by their Circulating and other Motions ; and *partly* by a very Agile and Invisible sort of Fluids, call'd *Spirits*, Vital and Animal ; and *partly* perhaps, (as I have sometimes gues'd,) by little *Springy Particles* ; and perhaps too, by somewhat that may be call'd *the Vital Portion of the Air* ; and by Things Analogous to *Local Ferments* : the Important Operations of all which are wont to Cease with Life, and the Agents themselves are not to be Discern'd in a Dead Body. So that, besides those Manifest Uses, which the Visible Fabrick of the Engine may suggest to an Anatomist ; there may be Chymical Uses (if I may so call them) of some Parts, that

Q serve

serve for the Elaboration of Spirits and other Fluids : Which Uses, (as 'twas formerly Observ'd, and yet ought to be Inculcated,) are not suggested to the Anatomists, as Such, by the Inspection of the Structure of the Parts ; but to Discern them may require no mean Skill in Spagyrical Principles and Operations.

Such Considerations as the foregoing, make me think it more difficult than many do, to determin with any certainty the Main Use of divers Particular Parts, [for in some Others it seems manifest enough ;] especially if it be done with the Exclusion of Other Uses. Nor is it enough, to Secure us that we know the Chief Function and End of a Part, to Know that it is contrived for such a Purpose. For upon the things I have lately represented, One may ground this Answer, that this Fitness hinders not, but that the Primary Use of the
Part

Part may be another, (as not Anatomical but Chymical, or *Vice Versa*,) more Conducive to the General Welfare of the Animal, or else to the Cosmical Ends of Nature. And it ought not to seem Strange, that some Pieces of Workmanship, that consist of many Parts, all of them Curiously Contriv'd, may by One Learned Man be guess'd to be Intended for This Use, and by Others for That Use, and yet Both these Uses may be worthy of the Artificer.

When some very Politick Prince does some Great Thing, without declaring *Why*; the Guesses of the States Men are often very differing, whilst yet none of them ascribe to Him a Design mis-becoming a Wise Man. And so, when a Learned Author Expresses himself, as sometimes it happens, Ambiguously, tho' One Reader Interprets his words to This Sense, and Another to That, yet Both the

Senses pitch'd on, may fairly comport with the Context, and the main Scope of the Writer. These things, I say, because I would by no means Disparage the Wisdom of Nature, by proposing the Difficulties I have hitherto mentioned; tho' I confess, *that*, upon the account of These and some Others, I look upon many of the Arguments that several Authors have made bold to draw from *Final Causes*, but as Conjectural Things. And in divers Cases, I allow what is suggested to me upon the Supposition of the Intended Uses of Particular Parts, rather as good Hints to Excite, and give some Aim to, a Severer Inquiry, than as safe Grounds to build Physical Conclusions on.

PROP.

PROP. V.

I come now to the Last Caution I would recommend to you, about the Consideration of *Final Causes*; and I shall present it you in this Proposition: *That the Naturalist should not suffer the Search or the Discovery of a Final Cause of Nature's Works, to make him Undervalue or Neglect the studious Indagation of their Efficient Causes.*

'T Is true, that to Inquire, To what Purpose Nature would have such or such Effects produc'd, is a Curiosity worthy of a *Rational Creature*, upon the score of his being *so*. But this is not the proper Task of a *Naturalist*, whose Work, as he is Such, is not so much to Discover *why*, as *how*, Particular Effects

Effects are Produc'd. A Country-Fellow here in *England* knows something of a Watch, because he is able to tell you, that 'tis an Instrument that an Artificer made to Measure Time by: and That is more than every *American* Savage would be able to tell you; and more than those Civiliz'd *Chineses* knew, that took the first Watch the Jesuit brought thither, for a Living Creature. But the *English* Countryman, that knows no more of a Watch, than that 'twas made to shew the Hour of the Day, does very little understand the Nature of It. And whereas the two Scopes, that Men are wont to Aim at in the Study of Physicks, are to Understand, *how* and after what manner Nature Produces the *Phenomenon* we Contemplate; and, in case it be Imitable by Us, *how* We may, if Occasion require, Produce the Like Effect, or come as Near it as may be: These Ends cannot be attained by the bare Knowledg of the

the Final Causes of Things, nor of the General Efficient. But to Answer those Aims, we must know the Particular Efficients, and the Manner and Progress of their Operating, and what Dispositions they either Find or Produce in the Matter they work upon : as, He that would thoroughly understand the Nature of a Watch, must not rest satisfied with knowing in General, that a Man Made it, and that he Made it for such Uses ; but he must Particularly know, of what Materials, the Spring, the Wheels, the String or Chain, and the Ballance, are made : He must know the Number of the Wheels, their Bigness, their Shape, their Situation and Connexion in the Engine, and after what manner One Part Moves the Other in the whole *Series* of Motions, from the Expansive Endeavour of the *Spring*, to the Motion of the *Index* that Points at the Hours. And much more must a

Mechanician know this, if he means to be able to Make a Watch Himself, or Give sufficient Instructions to Another Man, that is more Handy, to do it for him. In short, the Neglect of *Efficient Causes* would render Physiology Useless: But the studious Indagation of them, will not Prejudice the Contemplation of *Final Causes*. For, since 'tis Truly said, if it be rightly understood, that *Opus Naturæ est opus Intelligentiæ*; the Wise Author of Nature has so excellently Contriv'd the Universe, that the more Clearly and Particularly we Discern, how Congruous the Means are to the Ends to be obtain'd by them, the more Plainly we Discern the Admirable Wisdom of the Omniscient Author of Things; of whom it is Truly said by a Prophet, that *He is Wonderful in Counsel, and Excellent in Working*. Nor will the Sufficiency of the Intermediate Causes,

Causes, make it needless to admit a First and Supreme Cause : Since (to inculcate on this Occasion what I more fully deliver in another Paper,) That Order of Things, by virtue of which these Means become sufficient to such Ends, must have been at first Instituted by an Intelligent Cause. And if it be Irrational to Ascribe the Excellent Fabrick of the Universe, *such as it now is*, and the Actions that have manifest Tendencies to Determine Useful Ends, To so Blind a Cause as *Chance* ; it will be rather More than Less Irrational, to Ascribe to *Chance* the *First Formation* of the Universe, of which the Present State of Things is but the Natural Consequence or Effect. For it may indeed be plausibly said, that in *the Present State of Things*, the several Patts of the Universe are by the Contrivance of the Whole *determin'd*, and thereby *qualify'd*, to Attain their Ends. But it cannot
be

be Rationally Pretended, that at the *First Framing of the World*, there was a *Sufficiency* in the Stupid Materials of It, without any *Particular Guidance* of a most Wise Superintendent, to Frame Bodies so Excellently Contriv'd and Fitted to their respective Ends.

THE

THE
CONCLUSION.

THe Result of what has been hitherto Discours'd, upon the Four Questions Propos'd at the Beginning of this Small Treatise, amounts in short to this :

That all Consideration of *Final Causes* is not to be Banish'd from Natural Philosophy : but *that* 'tis rather Allowable, and in some Cases Commendable, to Observe and Argue from the Manifest Uses of Things, that the Author of Nature Pre-ordain'd those Ends and Uses.

That the Sun, Moon, and other Coelestial Bodies, excellently Declare

clare the Power and Wisdom, and consequently the Glory of God ; and were Some of Them, among Other Purposes, made to be Serviceable to Man.

That from the Supposed Ends of Inanimate Bodies, whether Cœlestial or Sublunary, 'tis very Unsafe to Draw Arguments to Prove the Particular Nature of Those Bodies, or the True System of the Universe.

That as to Animals, and the more Perfect Sorts of Vegetables ; 'tis Warrantable, not Presumptuous, to Say, That such and such Parts were Pre-ordained to such and such Uses, relating to the Welfare of the Animal (or Plant) itself, or the *Species* it belongs to : But *that* Such Arguments may easily Deceive, if Those that Frame them are not very Cautious, and Careful to avoid Mistaking, among the various Ends that Nature may have

have in the Contrivance of an Animal's Body, and the various Ways which she may successfully take to compass the same Ends. And,

That however, a *Naturalist*, who would Deserve that Name, must not let the Search or Knowledge of *Final Causes*, make him Neglect the Industrious Indagation of *Efficients*.

F I N I S.

have in the Conscience of an An-
nual Body, and the various Ways
which may possibly take place
compels the same Ends. And

Thus however, a Venerable, who
would believe that Nature must
not let the Search or Knowledge of
that Cause, make him Neglect
the Indispensable Investigation of the
cause.

And thus, I have said.

And thus, I have said.

And thus, I have said.

And thus, I have said.

And thus, I have said.

And thus, I have said.

And thus, I have said.

And thus, I have said.

And thus, I have said.

And thus, I have said.

And thus, I have said.

And thus, I have said.

And thus, I have said.

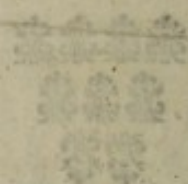
SOME
UNCOMMON
OBSERVATIONS
ABOUT
VITIATED
SIGHT.



L O N D O N :

Printed for *J. Taylor*, at the Ship in
St. Paul's Church-Yard, 1688.

SOME
UNCOMMON
OBSERVATIONS
ABOUT
VITIATED
SIGHT



LONDON:
Printed for J. T. Jones, at the Ship in
St. Paul's Church-Yard, 1682.

Advertisement.

THe Following Obser-
vations were not
written, with Inten-
tion that they Should be An-
nex'd to the Foregoing Essay,
but to Gratify a Philosophi-
cal Physician. Which is the
Reason why, besides those
things that are more purely
Optical, I thought fit to
mention Some Others, that
might be either Useful or
R Grateful

Advertisement.

Grateful to an Inquisitive Man of his Profession. But having allow'dt he Stationer to Expect, that this Book, tho' it have for Title but an Essay, should not be of too inconsiderable a Bulk; I made choice of these Papers, among Several that lay by me, to increase the Bigness of the Book, Because that, the Eyes being those Parts of the Bodies of Men and other Animals, that I pitch'd upon in the Foregoing Treatise, to Strengthen the Doctrine deliver'd in it about Final Causes;

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Causes; it seem'd Suitable Enough to my Subject and Design, to mention some Uncommon Things that related to Vision or the Organs of it, that We may be invited both to Admire the Wisdom of God, which, to furnish Man with a Sense that requires the Concourse of so very many things, has, if I may so speak, Crowded them into so Small an Engine as an Eye; and to Celebrate his Goodness too, which has been Display'd in that, notwithstanding that the Eye is so very Com-

R 2 *pounded*

Advertisement.

pounded a Part, and the
Sight so easily Vitiated yet
the most part of Men by far
do, from their Cradles to
their Graves, enjoy the Be-
nefit and Comfort of so Ne-
cessary and Noble a Sense.

OBSERV.

OBSERVATIONS
ABOUT
VITIATED
SIGHT.

OBSERV I.

EXamining a Gentleman, that
was already Almost Blind,
and fear'd to grow Altogether
so, about the Symptoms of his
Disease, (which came with a Stroke
upon his Head) I found, as I ex-
pected, by his Answers, that, tho'
he could not any thing well dis-
tinguish Objects of Other Colors,
Yet he could well perceive those
that

that were White, to be of That Colour. Which confirms what I mention in the History of Colours, concerning the great Quantity of Light, that is Reflected by White Objects, in comparison of those that are otherwise Colour'd. And this Observation it Self was confirm'd by another Patient, who, tho' almost Blind, could yet discern White Objects.

O B S E R V. II.

I Knew a Gentleman that had a Cataract growing, which, when I look'd on his Eye in a lightfom place, appear'd to cover almost just the Upper Part of the Pupil; and tho' He were a Young Vigorous Person, and the Weather was very Clear, he could not well discern Men from Women cross the Street. But this Gentlemans Misfortune came by a great Stroke he received on that Side of his Head, whereof he shew'd me the Scar; which

which Circumstance I therefore Note, because when no Outward Violence has been offer'd to the Eye, it has been observed by a good Oculist, and, if I misremember not, I have Seen an Instance of it, That a small Part of the Pupil, left uncover'd by the Cataract, would serve for more Sight than the Gentleman enjoy'd. In him likewise I had a further Confirmation, of what I was lately Observing about the Conspicuousness of White Objects. For tho' he could not, as I was saying, discern Men and Women that pass'd by, on the other Side of the Street, yet, having once desired him to tell me, if he could distinguish any Object there, he told me that he could; and that I might no longer Doubt of it, when I asked him what he saw, he said that it was a Woman that pass'd by with a White Apron, which Apron he saw directly, and therefore might easily conclude, without distinctly seeing the

Wearer, that the Person that Wore it was a Woman.

O B S E R V. III.

MEeting accidentally with a Man, by Profession a Farrier, whose Eyes look'd very odly, I questioned him about his Distemper; and found by his answers, that he had had Cataracts in both his Eyes, but either had them ill Couch'd, or had not behaved himself orderly afterwards. For there Seemed still to be ragged Films, that cover'd considerable portions of his Pupils; in so much that I somewhat wonder'd to see him go freely about, as he did, without requiring any body to help him, so much as up or down Stairs: and I hereupon asking him, whether he were able to Read in a large Print, he told me he was, with the help of his *Cataract Spectacles*, as they call them, which I doubting of, brought him a Book, whose Title Page he was not able to
Read

Read; this he Excus'd by saying that the place was too Lightsom, which tho' it did not Seem to Others, yet, considering that it was about Noon, I caus'd the Room to be a little darken'd, and then perceived that indeed he could Read well Enough.

O B S E R V. IV.

A Gentleman, having in a quarrel receiv'd a Stroke on one Side of his Head, which knock'd him down, found afterwards a great Weakness and dimness in his Eyes; into which when I look'd attentively, I plainly discern'd, that *tho'* above one half of his Pupil was yet uncover'd, so that when he look'd downwards, he could See well enough with That Eye, *yet* there was grown in it no less than two Cataracts, which, when I look'd on them attentively, and in a good Light, I could manifestly perceive to be Distinct; the One of them
seeming

seeming to be smooth & spread, as if its Circular Edge adher'd closely to the inside of the Eye; and the Other, that seem'd not altogether of the same Colour, hanging loosely, and as it were a Rag, at some distance above it. What afterwards became of this Gentleman I could not learn, tho' I would gladly have done it; Two Cataracts at a time in one Eye being some what Extraordinary.

O B S E R V. V.

A Learned Gentleman coming once to visit me, with design, as I afterward's perceive'd, to hear my Opinion concerning an odd Distemper he had in his Eyes; I found, by Discoursing with him concerning the *Phænomena* of his Disease, that *tho'*, when he look'd on Objects near at hand, he Saw them somewhat Dimly, but yet Single, *yet*, there were some Objects, particularly Posts and Rails, which, when

when he beheld at a certain distance (which was not very great) they appear'd to him both more Dark and Double. I found also that he complained of divers Black Flies and litle Leaves, that pass'd now and then before his Eyes ; which, *tho'* they do not always fore-bode a True Cataract, since Others and I also have observ'd them to continue many years without being more than a *Bastard Suffusion* (as Physicians Speake) *yet* in him they were probably Forerunners of a True Cataract ; in regard that I have known it observ'd by a skilful Oculist, that some Persons, before their Cataract, have complain'd that at some Distances they saw Objects almost Double; so that looking at ones Head, they thought they Saw a great part of a Dark Head a little above it: which Description, whether it proceeded from some Refractions made by the yet not Uniformly Opacous Matter of the Cataract , not having opportunity

tunity to examine those Persons my self, I dare not Venture to say.

O B S E R V. VI.

IT may be worth Observing, How long The better sort of Cataracts, tho' they hinder Sight for a time, as a thick Curtain drawn cross the Pupil, yet may remain in the Eye, without Spoiling the Optic Nerve or hindring Vision when once the Cataract is remov'd; Of which I remember, among other Instances, I took notice in the Case of a Woman, who told me she had Cataracts in her Eyes so long, that she was brought a Bed of Six Children consecutively, without being able to See any one of them, till after she was Cur'd by having the Cataracts Couched. But then she saw so well, that with Spectacles she could read in a portable Bible of a small Print. And divers considerable Persons of my Acquaintance saw One of Eighteen years Old, born

born with Cataracts in both her Eyes, Who not naturally Wanting the Faculty of Seeing, tho' thus Hinder'd of the Exercise of it, had been so happily Couched, as afterwards to have the benefit of Sight in them both.

O B S E R V. VII.

IT has been of late the Opinion of very Learned men, that tho Both our Eyes be Open and turn'd towards an Object, yet 'tis but One of them at a time that is effectually Employed in giving us the Representation of it. Which Opinion, in this place where I am writing but Observations, it were not proper to Discuss; especially because what is suppos'd to be Observ'd, will not always Uniformly happen, but may much Vary in particular Persons, according to their several Customs, and the Constitution of their Eyes. For I have, by an Experiment purposely made, several times

times found, that my Two Eyes Together see an Object in another Situation, than Either of them Apart would do. On the other side; I met with a Person, who told me he had a Cataract in his Eye for two Years, without discerning that he had any such Impediment in either of his Eyes; and when I ask'd him, how he knew that, he answer'd me, that others had taken notice of a white Filme that cross'd his Eye, so long before he himself did. But not knowing what a Cataract was, and not finding him to complain of it at all himself, the Thing remain'd unheeded, till the Patient, having one day occasion to Rub his Sound Eye, whilst the Lid cover'd it, was sadly Surpriz'd to find himself altogether in the Dark; and then resorting to an Oculist, was assur'd it was a Cataract, which, awhile before I met with him, had been Couch'd. But notwithstanding this Relation, what I had try'd about the Using
of

of Both Eyes, made me ask of a very Ingenious Person, that by an Accident had some months before one of his Eyes struck out, whether he did not observe, that upon the being confin'd to the use of One Eye he was apt to mistake the Situation and Distances of things. To which he answer'd me, that having frequently occasion to pour Distill'd Waters and other Liquors out of one Vial into an other, after this Accident he often Spilt his Liquors, by pouring quite Besides the necks of the Vials he thought he was pouring them directly Into. Afterwards inquiring of a Gentleman that was a Goodfellow, and had by a Wound a while before lost the use of One of his Eyes; he confess'd to me, that divers times pouring the Wine out of one Vessel into another, he would miss the Orifice of the Bottle or Glass that should receive it, and expose himself to the merriment of the Company. A yet more considerable Instance

stance of Such Mistakes, I afterwards had from a Noble Person, who having in a Fight, where he play'd the *Hero*, had one of his Eyes strangely Shot out, by a Musquet-Bullet that came out at his Mouth; answer'd me, that not only he could not well Pour Drink out of one Vessel into another, but had Broken many Glasses, by letting them fall out of His Hand, when he thought he had put them into Anothers, or set them down upon a Table. And he added, that this aptnesse to misjudge of Distances and Situations continued with him, tho' not in the same Degree, for little less than Two Years. But on this occasion I shall take notice that, I have often imployed a Dextrous Artificer, whose Right Eye (for in his Left there is nothing more remarkable) is constantly drawn so much a side towards the greater Angle of the Eye, that the Edge of the Pupil does almost touch it and one would think it scarce

scarce possible, but that he should see the Object double with two Eyes that seem so very differinglly turn'd; and yet he answer'd me, that he does not see at all, nor that he finds any Inconvenience, save the Deformity of this Unusual Situation of his Right Eye, which hinders him not from Reading as freely as other Men. This Accident happen'd to him by an unwary Mistake of Sublimate for another thing; after which, it seems one of the Muscles that mov'd the Eye, remain'd Contracted. But this having happen'd to him, as I found by Inquiry, ever since he was two Years of Age; he could not remember whether he had seen Objects Double, before he was accusom'd to judge of them by the help of his other Senses, and the Information of Others.

O B S E R V. VIII.

IT maybe worth while to Observe, that a very great Distention may be made of the Parts of the
S Eye,

Eye, without Spoiling the Sight ; of which I lately saw an Instance in a Patient of that Ingenious and Experienced Oculist, Dr. *Turbervill*. This was a Gentlewoman about one or two and twenty years of Age, Whose Complexion and Features would have made her Handsom, if she had not had that sort of Eyes, which tho' rarely met with, some call Ox-Eyes ; for Hers were swell'd much beyond the size of Human Eyes, in so much, that she complain'd, they often frightened those that saw Her, and were indeed so Big, that she could not move them to the Right Hand or the Left, but was constrain'd to look strait forward ; or if she would see an Object that lay Aside, she was oblig'd to turn her Whole Head that way. And so she answer'd me she was, when she set herself to Read in a Book, unless she did with her Hand move the Book from one side to another, to bring the ends of the Lines directly

rectly before her Eyes. She told me her Eyes did not always retain the same measure of Tumidness, and that the very day I saw them, they had been in the Morning much more Swell'd than when I look'd upon Her. But that which was more remarkable, was, that not only she could, for all this, See very well and distinctly, and, as I just now intimated, could Read Books, but her Sight had continued good, tho' she had this Distemper these twelve years. And, which is more strange, she answer'd me, that her Visive Power was so little Prejudic'd by this Distemper, when it first came upon her, that she never knew any thing was amiss in her Eyes, till her Friends told her of it, when they found it had continued too long to be a meerly Casual and Transient Tumor. But, tho' this odd Accident did not Impair her Sight, it occasion'd great Pains in her Eyes, for which she took Purging and other Medicines,

with so little Success, that both she and her former Physicians, thought her case Desperate; there appearing no way of dislodging a Humour so long settled there. Upon which I propos'd *Salivation*, as the least unlikely way that remain'd, to Resolve and carry off the Peccant Humour. But this, tho' much approv'd by her Doctor, the Modest Patient would by no means consent to.

OBSERV. IX.

I Once look'd into the Eyes of a Gentlewoman, where I could discern nothing that was Amiss, or any thing that was unusual, save the Narrowness of her Pupils, which is often esteem'd a good Sign. And yet this Woman was much troubled with Fumes and Weaknesses of the Head, and had a Disaffection of Sight very Uncommon; for she told me, that, whereas in the Day time her Sight was so Dimm that she could hardly discern

cern her way ; soon after Sun-set, and during the Twilight, she could discern things far better. And in this Condition she had continued a good while : In which odd Case, whether the smallness of her Pupils, which might possibly be Contracted too much by the Day-light, and might be Expanded by the Recess of so much Light ; or the greater Dissipation of the Visive Spirits at one time than at the other, may have any Intrest, I shall not now stay to Enquire. But this Patient brings into my mind the rare Case of a Learned old Divine, who complain'd to me that he was forced to write his Letters and Books by Night, because, during the Day-time, his Right Hand shook so much that he could not manage a Pen, and therefore was forc'd to make use of it only by Candle-light. And I remember that, upon his pressing me to propose some Possible Cause of so odd a *Phenomenon*, I told him, to put him off, that perchance the

few Animal Spirits that he had to Move his Hands with, were so Subtile as to be Dissipated or Exhal'd by the Warmth of the Day, but were kept in by the Coldness of the Night, that somewhat constipated his Pores; and commended to him the use of strengthening things, and, among the rest, of Chocolate; which when for sometime he had continu'd to drink; he came to me, and told me with joy, that he began again to be able to Write in the Day, and so I think he can do yet. But this upon the by.

OBSERV. X.

BEing acquainted with two Ladies of very distant Ages, but very near of Kin, who were both of them troubled with Distempers, that made me guess their Eyes might sometimes be oddly Affected, I Enquired of them, whether they were not troubled with sudden Apparitions of Flame or Fire? to which
one

one of them answer'd me, that oftentimes there would appear to her Multitudes, as she fancied, of Sparks of Fire, that were very unwelcome to her. And the other Lady, that was subject to Convulsive, but not Epileptick, Fits, told me, she divers times saw, as she fancied, such Flashes of Fire as I had mentioned, pass before her Eyes, which at first did not a little Frighten her.

OBSERV. XI.

THe following Observation is odd enough, to give rise to some curious Speculations and Disputes: And therefore I chose to set it down as I found it among my *Adversaria*, tho' I suspect part of it to have been lost, that the Relation may be the more Unbias'd, tho' if I had another opportunity to Discourse with the Patient, I should upon second Thoughts, have ask'd some Questions, and Written down some Circumstan-

ces, that I now wish had not been omitted.

The Gentlewoman I saw to day, seems to be about 18 or twenty years old, and is of a fine Complexion, accompanied with good Features. Looking into her Eyes, which are Gray, I could not discern any thing that was unusual or amiss; tho' her Eye-lids were somewhat Red, whether from Heat, or which seemed more likely, from her precedent Weeping. During the very little time that the Company allowed me to speak with her, the Questions I propos'd to her were answered to this Effect.

That about five years ago, having been upon a certain Occasion immoderately tormented with Blisters, applied to her Neck and other Parts, she was quit deprived of her sight.

That

That sometime after she began to perceive the Light, but nothing by the help of it: That then she could see a Window, without discerning the Panes or the Barrs: That afterwards she grew able to distinguish the Shapes of Bodies, and some of their Colours: And that at last she came to be able to see the Minuteſt Object; which when I ſeemed to doubt of, and preſented her a Book, ſhe not only without heſitancy Read in it a line or two, (ſot her Eyes are quickly weary) but having pointed with my Finger at a part of the Margent, near which there was the part of a very little Speck, that might almoſt be covered with the point of a Pin; ſhe not only readily enough found it out, but ſhewed me at ſome diſtance off another Speck, that was yet more Minute, and required a ſharp Sight to Diſcern it. And yet, whereas this was done about Noon, ſhe told me, that ſhe could ſee much better in the Evening, than
in

in any Lighter time of the day.

While she was looking upon the Printed Paper I shew'd her, I ask'd her whether It did not appear White to her, and the Letters Black? To which she answer'd that they did so; but that she saw as it were a White Glass laid over both the Objects. But the things that were most particular and odd in this womans case, were these two. The first is, that she is not unfrequently troubled with flashes of Lightning, that seem to issue out like Flames about the External Angle of her Eye, which often make her start, and put her into Frights and Melancholy Thoughts. But the other, which is more Strange and Singular, is this, that she can distinguish some Colours, as Black and White, but is not able to distinguish others, especially Red and Green: And when I brought her a Bag of a fine and glossie Red, with Tufts of Sky-colour'd Silk; she look'd

look'd attentively upon it, but told me, that to her it did not seem Red, but of another Colour, which one would guess by her Description to be a Dark or Dirty one: and the Tufts of Silk that were finely Colour'd, she took in her Hand, and told me they seem'd to be a Light-colour, but could not tell me which; only she compar'd it to the Colour of the Silken Stuff of the Lac'd Pericoat of a Lady that brought her to me; and indeed the Blews were very much alike. And when I ask'd her, whether in the Evenings, when she went abroad to walk in the Fields, which she much delighted to do, the Meadows did not appear to her Cloathed in Green? she told me they did not, but seem'd to be of an odd Darkish Colour; and added, that when she had a mind to gather Violets, tho' she kneel'd in that Place where they grew, she was not able to distinguish them by the Colour from the neighbouring Grass, but only by the

the

the Shape, or by feeling them. And the Lady that was with her, took thence occasion to tell me, that when she looks upon a Turkey Carpet, she cannot distinguish the Colours, unless of those parts that are White or Black. I ask'd the Lady whether she were not troubled with Female Obstructions? To which she Answer'd me, she was not now, but that formerly she had been much subject to them, having been obstinately troubled with the Green-sickness.

OBSERV. XII.

I Shall add on this Occasion something, that, tho' not so odd as It, has yet an Affinity with the newly recited Case, and so may make it the more Credible. And it is, That I lately convers'd with a Mathematician, Eminent for his skill in Opticks, and therefore a very competent Relator of *Phænomena* belonging to that Science? whose Or-
gans

gans of Vision are so constituted, that, *tho'* in his Eyes I could discern nothing Amiss, and *tho'* he makes much and excellent use of them in Astronomical Observations and Optical Experiments; yet he confesses to me, that there are some Colours that he constantly sees Amiss, and particularly Instanc'd in one, which in a clear day, (for so it was when we Discours'd together of this Matter) seem'd to him to be the same with that of a darkish sort of Cloath that he then wore, whil'st to Me and Other Men, it appear'd of a quite differing Colour.

OBSERV. XIII.

Discourſing with a Lady, who had been very long troubled with a very Unuſual Indispoſition in her Head, and, *tho'* She looks well, is never without Pain in it; *tho'* looking into her Eyes, I perceived nothing Amiſs, yet conjecturing that ſo Obſtinate a Diſtemper
muſt

must have had some Unusual Influence upon her Sight ; I learn'd by Inquiry that after the Violent Fits of Pain and Disorder she had from time to time in her Head, if she did but cast her Eyes, or turn them suddenly, from one side to the other, there would presently ensue a Convulsive Motion in One of them, whereby it would not only be drawn away, but, which was very strange, All White Things, and most other Objects, that she look'd on with that Eye, appear'd Green to her : And yet this was not a Transient Discomposure that would go quickly off, but would Molest her for a good while, and frequently Return'd upon her for a whole year; so that she despaired of Recovering the use of that Eye, vvherevvith yet she novv sees very vvell, tho' her Cephalick Distempers vv ere rather Mitigated than quite Cur'd. And vvhen I ask'd her, vv whether, vv hilest the Convulsion of her Eye lasted, she did not see Objects Double?

ble? She answer'd, that vvhilest that Distemper vvas upon her, if she vvent to Read in a Book, the Letters vvere so apt to appear Double, that when she vvas bent upon Reading, she vvas fain to shut the Distemper'd Eye, and Imploy only the Other.

OBSERV. XIV.

SOME may think that a Man has rather an Excellent, than a Viti-ated Sight, who can See Objects with a far less degree of Light than other Men have need of to Discern them. But tho' an Extraordinary Tendernefs may be a kind of Perfection in the Eyes of *Bats* and *Owls*, whose usral Food may be more easily Purchased by Twilight: Yet as to Man, the main part of whose Actions is to be perform'd by the Light of the Day, or some other almost Equivalent; it may Argue the provident goodness of the Author of Nature, to have given Him Eyes Constituted as those of
Men

Men generally are : Since, That a very great Tenderness of the *Retina*, or principal part of the Organ of Sight, would be, if not an Imperfection, at least a great Inconvenience, may appear by the Memorable Story I am going to Relate.

In the Army of the late King of Hapy Memory, (*Charles* the First) there was a Gentleman of great Courage and good Parts, that was Major to one of the Regiments ; who being afterwards by the prevailing Usurpers forc'd to seek his Fortune abroad, ventur'd to do his King a piece of Service at *Madrid*, which was of an Extraordinary Nature and Consequence, and there judg'd very Irregular. Upon this he was committed to an Uncommon Prison, which, tho' otherwise Tolerable enough, had no Window at all belonging to it, but a Hole in the thickness of the Wall, at which the Keeper once or twice a day put
in

in liberal provision of Victuals and Wine, and presently Clos'd the Window, if it may be so call'd, on the Out-side, but not perhaps very Solicitously. For some Weeks this poor Gentleman continu'd in the Dark, very Disconsolate. But afterwards he began to think he saw some little Glimmering of Light, which from time to time Increased; insomuch, that he could not only Discover the Parts of his Bed, and other such large Objects, but at length came to Discover things so Minute, that he could Perceive the Mice that frequented his Chamber, to eat the Crumbs of Bread that fell upon the Ground, and Discern their Motions very well. Several other Effects of his Sight in that Dark Place He Related. And that which Confirms that this Proceeded mainly from the great Tenderness the Visive Organ had acquired, by so long a stay in so Obscure a Place, was, that when after some Months, the Face of Affairs Abroad

T being

being somewhat Chang'd, His Liberty was restor'd him, he durst not leave his Prison Abruptly, for fear of losing his Sight by the Dazzling Light of the Day ; and therefore was fain to Accustom his Eyes by slow degrees to the Light. This Strange, as well as once Famous Story, I the less Scruple to set down in this Place, because I had the Curiosity to learn it from the Gentleman's own Mouth, who acquainted me with other Particulars about it, that, for want of the Notes I then took, I shall not now venture to speak of.

F I N I S.

ERRATA.

PAge 5. line 4. read *Benefit*, l. 14. r.
hominis, p. 14. l. 18. r. *Corporeal*. I
 say not this, p. 16. l. 20. r. *Eye*, p. 21. l. 20.
 r. *scil ad Object*. p. 26. l. 2. r. *eu egare*, p. 42.
 l. 6. r. *οὐστρακας*, p. 46. l. 24. r. *fortuitous*,
 p. 48. l. 26. r. *are brought*, p. 50. l. 1. r. *di-*
late, l. 5. r. *any notice*, p. 53. l. 23. r. *Cor-*
nea, p. 58. l. 20. r. *notably*, p. 59. l. 20. r.
Posture, p. 61. l. 10. r. *Cameleon*, l. 25.
 r. *slow*, p. 68. l. 17. r. *it was*, p. 79. l. 1. r. *it*
was not p. 79. l. 17. r. *הצדיות*, p. 90. l.
 27. r. *to be done*, p. 89. dele (;) p. 105.
 l. 15. r. *sort*, p. 106. l. 2. r. *Question*; *a-*
bout which, p. 129. l. 27. r. *live*, p. 139.
 l. 14. dele & L. 1, 2. p. 143. l. 23. r. *Chance*.
The, p. 151. l. 1. r. *Functions*, p. 172. l. 14.
 r. *produc'd*, p. 177. l. 5. r. *Inferiour*, l. 9.
 r. *several*, p. 198. r. *teres*, p. 199. l. 14.
 r. *crassioris*.

Page 1. The first part of the
book is divided into two parts.
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the world from the beginning
to the present time. The second
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world from the present time
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world from the beginning
to the present time. The
second book of the first part
is the history of the world
from the present time to the
end of the world. The first
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