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About the Institute
The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

An 18

Inside end cover. general in 17th cent. lit.

(17) IV

Grew etc

Descartes & Russell
transferred to OW 23

MA.51.9 Cuvier, G (1843)

Cuvier Histoire des Sciences Naturelles 1841–45 1

T IV Paris 1843. complétée par

Magdeleine de Saint-Agy

Very accurate account of Gesner

p57 This is written by St. Agy not Cuvier

"Le texte de Gesner est écrit avec chaleur, et d'un style plus agréable que celui de la plupart des auteurs qui ont écrit sur le même sujet" Gesner's style

Linnaeus finds no reference Gesner's relation
dates on which they began.

Hooke 1665
Micrographia. Ordered to be printed by R. S.
Dedicated to Charles II

Amidst the many felicities that have accompanied your Majesties happy Restauration of Government, it is none of the least-considerable, that Philosophy & Experimental Learning have prosper'd under your Royal Patronage. And as the calm prosperity of your Reign has given us the leisure to follow these Studies of quiet & retirement

Charles II a patron of learning.

Microscope

Preface (p. 3. of Pref. not numbered)

"a supplying of their infirmities [those of senses] with Instruments, &, as it were, the adding of artificial Organs to the natural; this in one of them has been of late years accomplisht with prodigious benefit to all sorts of useful knowledge, by the invention of Optical Glasses." ... By the help of Microscopes, there is nothing so small as to escape our inquiry; ... By this the Earth it self, which lyes so neer us, under our feet, shews quite a new thing to us, & in every little particle of its matter, we now behold almost as great a variety of Creatures, as we were able before to reckon up in the whole Universe it self."

Mechanistic view

p4. By help of glasses "we may perhaps be inabled to discern all the secret workings of Nature, almost in the same manner as we do those that are productions of Art, & are manag'd by Wheels, & Engines, & Springs, that were devised by humane Wit."

p5. The truth is, the Science of Nature has been already too long made only a work of the Brain & the Fancy: It is now high time that it should return to the plainness & soundness of Observations on material & obvious things."

Hooke 1665
Micrographia. Preface p5
(to the reader) Wherever he finds that I have ventur'd at any small Conjectures, at the causes of the things that I have observed, I beseech him to look upon them only as doubtful ~~Problems~~ Problems, & uncertain ghesses, ... I have produced nothing here with intent to bind his understanding (sic) to an implicit consent; I am so far from that, that I desire him, not absolutely to rely upon these Observations of my eyes, if he finds them contradicted by future Ocular Experiments of sober & impartial Discoverers.

p7
He is all for scientific method. If it is followed:—
"all the fine dreams of Opinions, and ~~[illegible]~~ universal metaphysical natures, which the luxury of subtle Brains has devis'd, would quickly vanish, & give place to solid Histories, Experiments & Works."

solid experimental ideal

gives details [illegible] ~~microscopes~~ [illegible]

I Illustrations

Also his engravings (preface 5 pages from end. opinions) "in divers) them the Gravers have pretty well followed my Directions & draughts; ... in making of them, I ~~have~~ have indeavoured (as far as I was able) first to discover the true appearance, & next to make a plain representation of it."

2 pages before end. Quotes Bacon (Lord Verulam) by name.

Simplifying mean

p1 He begins with "Of the Point of a sharp small Needle."
"Observations of Bodies of this [illegible]
He says to begin with single nature first, & so gradually proceed to those of a more compounded one. In the prosecution of this method, we shall begin with a Physical point" (cf Descartes)

cf Descartes

Hooke 1665

p7. Anticipation of artificial silk — *artificial silk*

p 80 microscopical exam of sand: finds figure of a small shell — *Foram'ised*

Fig 10 pl V. ? a foram

opp p. 44

pp 100–101 (see next page, notes drawn figure)

Observ. XVI. Of Charcoal, or burnt Vegetables

In charcoal besides "many great and conspicuous irregular spots or pores, if a better Microscope be made use of, there will appear an infinite company of exceedingly small, and very regular pores; so thick and so orderly set, and so close to one another, that they leave very little room or space between them to be fill'd with solid body, for the apparent interstitia, or separating sides of these pores seem so thin in some places, that the Texture of a Honey-comb cannot be more porous. x x x most of these small pores seem'd to be pretty round, and were rang'd in rows, that radiated from the pith to the bark; they all seem'd to be continued open pores, running the whole length of the stick."

He tried a number of different woods, found that the pores varied in size and number.

pith of wood p 106, 107

p 112

Observ. XVIII. Of the Schematisme or Texture of Cork.

He cut a section of cork, put it on a "black Ebony-Plate" (but he did not use transmitted light) and cast light on it.

"the Microscope informs us that the substance of Cork is altogether fill'd with Air, and that that Air is perfectly enclosed in little Boxes or Cells distinct from one another." (see next page of cork figures) *cellular structure*

p 115

I have found that the pith of an Elder, or almost any other Tree, the inner pulp or pith of the Cany hollow stalks of several other Vegetables: as of Fennel, Carrets, Daucus, Bur-docks, Teasels, Fearn, some kinds of Reeds, &c. have much such a kind of Schematisme, as I have lately shewn that of Cork."

cellular structure – other things as well as cork.

Hooke 1665

Hooke was ~~[illegible]~~ unable to find valves in pores / wood. p. 116

plate opp p 125. ~~Fungi~~ microscopic parasitic fungi

hair very 0.35 a good deal than would be justified.

Schem. IX opp p 93. Kettering stone (oolite)

Scheme X fig 1. Charcoal in pores, 2 sizes in irregular rows. Not so good as Grew's figures.

Schem XI fig 1. Cork A transversely, B longitudinally, shows the rectangularity of the long. section & the roundish transverse section of ~~individual~~ individual cells.

p 186. Quotation [illegible] dum nos) microscope rather than videm dissection

Hooke's Diary

p64

Friday Oct 10. 1673 "Spoke to Dr Godderd for Blackbourne he chose Dr Grew for his Deputy, & designd to give him £40 per annum.

p85

Sat. Jan 31. 1673/4

Dr Grew read first Lecture for Dr Godderd. (Waters & Colleys? Physics?)

p321

Thursday Oct 18. 1673 "Grew canvasing for Secretary's place at Jonathans etc"

(Jonathan's was a coffee house → frequented by Hooke ~~circle~~ ~~&~~ & other fellows of the Royal Society)

p144

Thursday, January 28th 1674/5 — The Society Receive from Malpighi a Discourse of the anatomy of Vegetables, 30 sheets in folio, with 54 folio plates of cutts besides a curious title page."

(It is thus clear how the title page was Malpighi's own suggestion A. A)

17

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TIMES

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A PARTNER WITH WREN

DISCOVERIES IN A DIARY

THE UNRECOGNIZED HOOKE

By M. I. Batten

In the Guildhall Library there is a Diary of Robert Hooke's which covers a period of 11 years, from March, 1672, to May, 1683. With other papers it was purchased at the sale of the library at Moor Hall, Harlow, in 1891.

Dr. Hooke was one of the most eminent scientists of his day, but this Diary, the importance of which seems to have been overlooked, throws new light on his activities as an architect, and also on Sir Christopher Wren. A very large proportion of the entries concern the architectural activities of Hooke and Wren. That Hooke was associated with Wren not only in scientific experiments, but also in building, has never been realized. Daily, almost, there are references in the Diary to Wren and his work, including, among other things, the City churches, and to the progress of the buildings upon which Hooke was engaged independently. Each consulted the other about his architectural work, though it would seem that, whereas Wren employed Hooke to assist him, the latter merely occasionally asked the advice of his more illustrious friend.

Early in the eighteenth century the Diary had passed into the possession of Richard Waller, but not apparently until after he had written his Life of Hooke. It seems to have been unknown to all Hooke's other biographers, with the exception of Dr. R. T. Gunther, who refers to it in the volumes of Early Science in Oxford, which deal with Dr. Hooke and were published in 1930. But from the death of Waller until the Guildhall Library purchased it the Diary was lost to students. It consists of 200 closely written folio pages.

AFTER THE FIRE

Robert Hooke was born at Freshwater, in the Isle of Wight, in 1635. At the age of 13, when his father died, leaving him £100, he took himself off to lodge in Dr. Busby's house at Westminster, where he seems to have made a great impression. It should be noted that both Hooke and Wren came under the influence of Dr. Busby, Wren leaving Westminster in 1646, only two years before Hooke's admission. In 1653 Hooke went to Christ Church, Oxford. From then until the Fire of London he appears in history only as a scientist. After the Fire he drew up a plan for the rebuilding of the City, in consequence of which he was appointed one of the City surveyors, "by which," says Aubrey, in his "Brief Lives," "he hath gott a great estate." Unfortunately Hooke's plan has been lost, though from Waller's description of it it would appear, roughly speaking, to have been of the gridiron type.

Aubrey also tells us that Hooke built Bedlam, the Physicians' College, Montagu House, "the Piller on Fish-street-hill," and that he was "much made use of in designing buildings." In "Parentalia" we are told that immediately after the Fire Wren took "to his assistance his in-

of the gridiron type.

Aubrey also tells us that Hooke built Bedlam, the Physicians' College, Montagu House, "the Piller on Fish-street-hill," and that he was "much made use of in designing buildings." In "Parentalia" we are told that immediately after the Fire Wren took "to his assistance his ingenious and able associate Robert Hooke," and Elmes, in his memoirs of Sir Christopher Wren, also has many references to Hooke as Wren's assistant. But Hooke being one of the City surveyors the authors of both these books have taken it for granted that his assistance was mainly a matter of measuring the sites.

Aubrey's statement that Hooke and not Wren built the "Piller on Fish-street-hill" is arresting because it must be remembered that Aubrey was an intimate friend of both. That Hooke had far more to do with the Monument than has so far been allowed becomes clear from his Diary. Throughout the whole time when the Monument was being discussed and built there are continual references to it, of which the following are interesting specimens. On October 19, 1673, is the entry "Perfected module of Piller." On September 21, 1675, "At fish-street-hill on the top of the column." On April 11, 1676, he was with Sir Christopher Wren "at the top of the Piller." On October 14 he notes, "scaffolds at fish-street-piller almost all struck," but a year later he went again "to piller about scaffold," and on October 26, 1677, "at fish-street-piller. Directed corners." He was also very busy with the inscription, but at last, on June 17, 1678, he "saw Monument inscription now finished."

These entries, coupled with Hooke's autographed Survey of the Monument, which is reproduced in Dr. Gunther's book, make it appear that though Wren may have been the final authority who approved or vetoed proposals, there is probably more truth in Aubrey's statement than has hitherto been supposed. The extracts from the Orders of the City Lands Committee given in the Wren Society volume which deals with the Monument would seem to substantiate this.

TOURS WITH WREN

Nearly all the City churches are mentioned in the Diary, those Hooke visited most frequently being St. Bene't Fink; St. Lawrence Jewry; St. Magnus; St. Stephen, Walbrook; St. Michael Bassishaw; St. Anne and St. Agnes; St. Martin, Ludgate. Sometimes Hooke went alone to a church, sometimes with Wren, as, for instance, on June 22, 1674, "with Sr Chr. Wren to St. Peter's and St. Clement's. Ordered pulling down St. Bartholomew's Tower." On July 12 he "set out the church in Mark Lane." A typical church visiting day may be quoted from April, 1675: "Sr Chr. Wren and Mr. Woodroof here, to Dionis Back Church Buttolphs Walbrook Coleman Street St. Bartholomews. . . with Sr Chr. W to Pauls." Saturday, April 29, 1676, has the note: "Agreed with Marshall about St. Bride's Church Tower." May 2: "to Sir Chr Wren with Filch and Scarborough agreed about Basingshaw Church." February 13, 1678: "to Sir Chr. Wren past Plaisterer for St. Lawrence. Proportion of estimate money of St. Peter's Cornhill." April, 1680: "by water to Sir Ch. Wren. Advised him about St. Clement's Church."

The visits to St. Paul's are equally frequent. On October 14, 1672, Hooke was "at Dr Wren's dined there saw big neat new furnished Rooms with him at Paules"; while on November 5 he "saw module of St. Pauls approved by the King at Pauls." February 8, 1673, "at Dr Wrens told me the designe of burying vaults under Pauls and of the addition of Library Body and porticos at the west." In June, 1674, he notes: "Pauls tabernacle ordered"; and in August he saw the Pauls "module finished painting and gilding." A few days later he was at Sir Christopher Wren's and "spoke for Filch to be Bricklayer to St Pauls." June, 1675, contains the entry: "he (Wren) promised Filch at Paules he was making use of my principle about arches and altered his module by it." On September 10, 1678, Hooke "Received a note from Tillotson to Direct masons at Pauls, the Bishop of Londons kindness." A year later comes

Notes on sections of cf. in Grew. Anat. of Trunks 1675.

Pear. – good general effect. The narrow corky margin with its radial rows of cells is indicated. The phloem, 2° xylem & annual rings & primary wood are indicated. The papery phloem fibres ~~[illegible]~~ capping bundles are seen but they appear to have got dislocated or [illegible] into the cortex, with the forming one discontinuous zone.

[Letters 3 on old twig of this]

Elm. Does best with wood. The cortex & bark are more conventional.

Apple scalloped inner edge of bundles shown. Otherwise rather conventional. The same scattered half moons of fibres in the cortex that he drew represent in oak, [illegible] pear, then seem to be fibres belonging to the primary bundles

Ash more successful. Here he has succeeded in seeing & representing the phloem fibres in their true relation to the bundles & what they belong. He distinguished & pencilled from the collenchyma an outer zone, completely representing the collenchyma in a succession of [illegible] [illegible] continuous zone. [illegible] wood interior.

Holly again is more successful than [illegible] continuous zone of phloem fibres in their right place, & he does not imagine any of the he has seen the more or less [illegible] in the cortex

Cabbage. The general effect of the cabbage stalk as seen with naked eye (Fig 3) with its rings [illegible] of vascular bundles [illegible] xylem [illegible] is clearly shown.

The Comparative Anatomy of Trunks. : BM 972.a.10.
Notes from photostat copy of annotated copy

Dedicated to (The Epistle Dedicatory)
To the most August Prince, Charles II

He speaks of Charles II having spoken well of his previous essays. ? was Charles really interested in science, looking up history of R.S. few other related admissible sentiments & Charles see next page.

Your Majesty will find; That there are Terrae Incognitae in Philosophy as well as Geography: ~~And Imay~~ For the discovery of This Part whereof, I did resolve to make an Adventure. And I may, without vanity, say thus much; That it was my fortune, to be the first that ever gave a map of the Country. [see III 45]

[But when he wrote this, Malpighi's "Idea" had been in hands of R.S. [illegible] * his second part had been received [illegible] 8 Feb 1675 [illegible] June 1675 [illegible] 2 letters written [illegible]]

"a Plant is, as it were, an Animal in Quires; even as an Animal is a Plant, or rather several Plants, bound up into one Volume.

The parts of plants are "as punctually, for their Place & Number, composed together; as all the Mathematical Lines of a Flower or Face"

[This must have been written of d'Arcy Thompson.]

He ~~[illegible]~~ states that "the Account of the Sap; ... written thus ~~[illegible]~~ Acts of Vegetation, is all continued & brought down in a Mechanical way.

Grew was definitely looking for mechanistic theory of plant physiology.

* Was Malpighi's Idea read in 1671 or 1672?

Grew 1675. Trends. 2 / 9

In sum, Your Majesty will find, that we are come ashore into a new World, whereof we see no end. Charles II

You have been pleased to Institute that Society, whose business is an Unbyassed, & Universal Search of Truth. Your Majesty deeming it as Noble a Design to enlarge the Territories of Knowledge, as those of Dominion.

He speaks of Charles as "Sol ac Anima hujus Insularis Mundi". The soul of Brit of this Island World"

In his further dedication to Ld Viscount Brouncker, the President of the Royal Society, he gives a full account of the relation to Malpighi. He recalls that the Royal Society have published his researches on the anatomy of plants, & have also given order for the ~~publication~~ "publishing of the like undertaking, by another (indeed more accurate) Hand. As well knowing, that it would be no disadvantage to the credit of those Matters, which were so new & strange, that the World should find a twofold Authority. For one, although he have no mind to deceive, yet may sooner be deceived, than two may be. Especially being in divers Countrys, & having had no correspondence. [Grew had written to Malpighi in Mar 5, 1672 — Letter in R.S. archives say III 11 ~~before~~ ~~...~~ — not being a communication ... the fair [?] books R.S.]

He speaks of Malpighi's "fuller ~~Book~~ (than the Learned collects his Idea)"

Mr Oldenburge & those worships ... Malpighi, & it does indeed appear that Malpighi did not himself use the word 'Idea' when he sent his preliminary sketch to the R.S., for he speaks of it in his 1671 letter as "Plantarum Anatomes" Corrections in the ~~...~~ as "Anatomes" he adds in a note that this is called in the present book Plantarum anatomes idea.

Grew speaks of Malpighi's observation of grief verses & says in the words of Grotius "Profecisse me non diffiteor, quin gaudeo etiam gloriorque" [I] do not deny having profited by it, nay even I rejoice & glory in having done so]

Grew 1675 - Trunks. He says also that he deliberately ~~[illegible]~~ [Grew & Malpighi] chose roots because Malpighi said little about them ~~[illegible]~~ so that "the Nature of both Parts might still more fully & perspicuously represented betwixt us both."

He speaks of honour the President & Royal Society has done him in having assigned unto ~~him~~ "so eminent a Colleague." He definitely aimed at examining different plants from Malpighi: "I have varied from ~~Signior~~ Signior Malpighi in, I think, all the Examples here exhibited."

He points out that "I have chosen to give my examples chiefly in the transverse Section; whereas those of Signior Malpighi are principally in cutting by the length."

He says he has done this because "the Size, Number, & Position" of the parts, "their Regularity & Constancy ... are this way much more clearly & certainly represented."

~~The Comparative Anatomy of Trunks~~ [illegible] he

[illegible] in Borage. The Description of "Vessels or Bubbles or Vesicles"

corrects "Bladders".

He deals in Chapter I with the "Trunks" of six plants: Borage, Dandelion, Colewort (cabbage), "Holyoaks", Wild Cucumber, & Thistle; & describes them ~~too~~ (as they are seen with the naked eye; & see a [illegible] can ~~see~~) their structure when cut transversely. He was thus in this way the ~~parts~~ [illegible] He notes especially that the microscope [illegible] [illegible] detail can be seen with [illegible] [illegible] when he describes [illegible] three things are necessary; viz. "a good eye, a clear figure, & Rasor Wherewith to cut." see p 7

Pl. I Fig ~~7~~ 3 T.S. Cabbage - check this.

He notices a difference as regards medullary rays between the root and the stem. In the root he speaks of

Grew Trunk 1675 4 11

Rays: root, stem

"Diametral rays; running through the Barks after the same manner, as do the hour lines through the margin of the Dial-plat of a Clock or Watch. Whereas here in the Bark of the Trunk, the said Parenchyma is rarely thus Disposed into Diametral Rays: nor when it is are these rays continued to the circumference of the Bark; as in the Bark of the Root they frequently are.

[The shelly [illegible] of the cortex by cork layers begins the centre cylinder [illegible] of medullary rays to the surface in the root, whereas the cortex survives more usually in the stem. Possibly when Grew saw wave rays in the phloem — (as far as he goes in modern sources by Eames A.J. & MacDaniels, L.H. An Introduction to Plant Anatomy 1925 the rays to the [illegible] xylem of roots has larger & more abundant rays than those of stems. — no; this does not fit in the rays in the bark)

Exam holly, apple, pear, elm ash & oak, thistle & cf in Grew's figures see p 7

From the description of the Holly figure it appears that he includes phloem as bark. "A Ring of Sap-Vessels in the inner verge of the Bark" = cambium, same sense as "Annual Rings" in same sense as

Uses expression new.

Chapter III. Rays Grew - stimulus the medullary rays; decides their relative size, number position = various pears the wood (bladder as he calls it)

p22 He considers that the rays are squeezed between the cell [bladder as he calls it] with a side, that the difference between a cell [illegible] in a Purse expanded, in the pith, & one of the ray is that "the one, is as a Purse expanded, & drawn up together as the same Purse contracted, or the other is as the same Purse contracted, & drawn up together with the strings." [Inclined to difference between turgid & non-turgid cells.

Grew Trunks. 1675

Secondary growth

5 12

p 23
every year, there grows a new Ring of Sap-vessels on the inner margin of the Bark. Which Ring, hardening by degrees, at the latter end of the year, is turned into a dry hard Ring of perfect Wood. So that every year, the Bark of the Tree is divided into two parts, & distributed two contrary ways.
... The innermost portion of the Bark, is annually distributed & added to the Wood: the Parenchymous part thereof making a new addition to the Insertions within the Wood; & the Vessels a new addition to the Lignous pieces between which the Insertions stand. So that a Ring of Sap-vessels in the Bark this year, will be a Ring of Wood the next: & so another Ring of Sap-vessels & of Wood successively from year to year

p 24

p 26 Ero; Perfecta
Mainly secondary of ?

Spiral tracheid

p 30 tracheid
Describes spiral vessels
"I would resemble it thus. As if a Ribband should be wound spirally, & edg to edg, round about a Stick; & so the Stick being drawn out, the Ribbon shall be left, in the figure of a Tube, answering to an Air-vessel".

MS Formation – better) p 30
"Air-Vessels are transformed, as caterpillars to Flys.

Sec. growth

Chapter IV of Pith

p 31
"the Skin, Parenchyma, Insertions, & Pith, are all one entire piece of work; being only filled up, diversly, in the Vessels.

"ground tissue"

p 33
The pith of the trunk & larger "appears in the Microscope, like other Cells of an Honey-comb.

p 34 "The Pith, though always originally composed of Bladders, & so one entire piece; yet in process as the Plant grows up, it hath diverse

Grew Trunks 1675

openings or Ruptures made in it: oftentimes very regularly, ... the Vessels it shrinketh up into transverse fibres or Membranes."

Fibres theory

p 35

The cells, of parenchyma of bark, roots, fruit and any other parenchymatous part of the plant are made up of fibres. "The pulp of an Apple, Pear, Cucumber, Plum or any other Fruit, is nothing else but a Bed of small transparent Threads or Fibers, all wrapped & wreathed up in close together. And even all those parts of a Vegetable, which are neither formed into visible Fibers, nor into Bladders, are yet made up of Fibers.

~~[I have supposed that the plant was inexplicably cellular. ... tended to call them~~
~~The analogy of animals ... since many parts of animal~~
~~more different & unusual, since many parts of animal~~
~~body are not obviously made of cells.~~

p 36

He believes that the "Parenchymous Fibers" ... make up the Bladders of the Pith ... And ... being continued; they ... weave & make up the Insertions in close work. ... He even describes these fibres as also wrapping themselves about the vessel, "thus tying many of them together;" the very Fibers, whereof the Vessels are ... composed. He regarded them as wrapping about" By what means is it that all the said Fibers of the Vessels are tacked or stitched up close together into one coherent piece, Much after the same manner, as the ... Twigs of a Basket, are, by those that run in our horizontally. And the same Parenchymous Fibers, being still further produced into the Bark; they then compose the same work over again ... as in the Pith.

Fibres theory continued on next page.

Grew Trunks 1675

The fact that Grew really visualised the whole structure of the plant as formed of continuous threads or fibres, & not primarily of cells is shown by his comparison with lace. p37 14

"The most unfeigned & proper resemblance we can make of the whole Body of a Plant, is, to a piece of fine Bone-lace, at such time, as the women are working it upon the Cushion". He compares the vessels to the pins which stand up vertically to the lace. Fibres they

p36

"The whole substance, or all the parts of a Vegetable, so far as organical, they are also Fibrous" Corrects

(p36; p121 of 1682 ed.) Grew's explicit verbal alterations in the text & marginal additions have been incorporated in the 1682 edit. But some editing had evidently happened in between — probably it was the "interleaved book" which was the final copy — for the additions & alterations are not adopted exactly as they stand.

There are many minute alterations of words & capitals. He could not have attributed a ~~[illegible]~~ clear meaning to these capitals, or he would not have taken so much trouble to alter them, but it is impossible to come near being confident of all occasions when the principle is ... Emphasis was the principle cause: important nouns, but not always.

The account of the anatomy of Trunks is followed by an account of their "Vegetation" i.e. physiology

p46

He realises that capillarity would be a sufficient explanation of the ascent in the ~~[illegible]~~ of sap, he supposes that the parenchyma assists in the rise of sap process.

p53

"The reason why the Bark ... strips so easily from the Wood, is plainly this. Because most of the Young Vessels & Parenchymous parts, are there every year successively formed; that is, betwixt the Wood & Bark: where the said parts newly formed, are as tender, as the tenderest Vessels in Animals." Cambium

p54

He accounts for the reduction in size of the pith as a tree gets older, by supposing that vessels are formed "in the utmost verge of the Pith".

Phil Trans 1675 Physiology 8 15

It is curious that considering how good & cautious an observer Grew was, then in the case of physiology [theorizing] he should have offered quite baseless guesses more dogmatically & with less qualification than he used in presenting his careful visual observations. To take an example almost at random. He writes:–

p54 "The Reason why Plants are made ... & become hollow, is partly, for the ripening of the Fruit or Seed; which is the better effected by a more plentiful supply of Air continually received into their hollow Trunks."

Geotropism

p71
He describes an experiment in which a plant is reversed with its stalk in mould, & the root upwards, but the root embedded in mould, & points out that the root will curve down & the stalk up, from which he deduces that it is not the earth that the root is seeking after, nor the air which attracts the stalk, but that the root has the nature of the downward motion, & the trunk has an upward motion.

p72 root thickening
He understands root thickening "For the Trunk Roots growing out of some Plants near the ground, & sinking thereinto, do like so many Ropes, pluck(?) the Trunk annually lower & lower into the ground together with the Stem."

p73
He noticed that some twining plants coil from right to left & others from left to right: "Some winding together with the Sun, in its Diurnal motion, by South from East to West: And others contrary with the Moon, in its Monthly motion, from West to East." He adds "This possibly, may be one sensible way of distinguishing betwixt Solar & Lunar Plants." Superstition

p75
"smaller Pictures in Water-colours" I did not know that water-colour was used so early. When did it first come in? ? O.E.D.

p75. He compares the flax & hemp "in the Sap-vessels of the Bark", & "And Scotch-cloath, is only the Housewifry of the same parts of the Bark of Nettle."

In the Explanation of Figures, he uses the expression "transverse section"

Grew 1682 References

In his preface refers to "Dr Highmore in his Book of Generation, Dr Marriott of the Propagation of Plants, & Mr Hooke in his Micrography, as having said something about anatomy "yet but collaterally, & without shewing any purpose of managing this Part of Natural History." (The ingenious Mr Marriott also referred to on p 105 of [illegible])

Preface p. 2.

Early in his studies of plant anatomy Grew in 1668 (after 4 years work) imparted his design to his Brother-in-law (i.e. half brother) Dr Henry Sampson, who mentioned to him the passage in Glisson's "de Hepate" Ch I, which he had not then read.

"The Anatomy of Vegetables Begun" was sent to the Bishop of Chester in a letter dated Dec. 26. 1671. He speaks of [illegible] plant anatomy as "one of the non-Noble & therefore [illegible] parts of Philosophy"; & [illegible] Nevertheless, encouraged by Sampson & the Bishop of Chester, he began to draw up "a Scheme of the whole Design"; then he heard of Malpighi's work "which Mr Oldenburgh, then it came to be printed, called his Idea" Grew's scheme preceding his hearing of M's work. Curator

Entry in R.S. Journal Book April 18 1672 records Grew's appointment as Curator to the Royal Society for the Anatomy of Plants. Grew & Malpighi

Grew says that to Society in appearing both him & Malpighi because it was well for "matters, which were so new & strange, to be offered to the World from a double Authority. ... Likewise then the same Subject, being prosecuted by two Hands, will be the more illustrated by different Examples produced by both."

Grew. 1682

"Some of the Plates, especially those that I did not draw at the Engravers hand, are a little hard & stiff: but they are all well enough done, to represent what they intend." Figures

Grew begins w/ Idea (except Anat. Veg. Begun)
An Idea of a Philosophical History of Plants

& adds a little about botanists e.g. a mention of Clusius, Columna, Bauhin, Boccone, Ray, Evelyn et which was not in the first edition. of refs to other botanists; the different herbal literature

p 2. He adds (not in 1st ed.) "If you turn over an Herbal, you shall find almost every Herb, to be good for every Disease"

He suggests (not 1st ed.) that "as for their Figures it were much to be wished, that they were all drawn by one Scale; or at most, by Two; one for Trees & Shrubs; & another for Herbs." Scale measurement

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1st ed. p 8

The present Design ... may properly conduce unto more ... than are not to the consideration of the state of Animals; & whether there are divers material agreements betwixt them both, & what they are ... And besides, not only to compare what's already known of both, but also by that which may be observed in the one, to suggest & facilitate the finding out of that which may yet be unobserved in the other." argument for analogy

---

1st ed p 11

For it is not more certain, that the three Angles of every Rectilinear Triangle, because all ways equal to two Right Angles, are therefore, if put together, always the same: than that one property appearing in divers Vegetables, should have one cause*: for although the Shape and may vary, yet the cause, as it is the cause of that property, must be one: & consequently must also compare some Identity in the Nature of all those Vegetables wherein it acts."

This ~~is very like~~ might be reminiscent of Descartes who was very fond of referring to the notion of triangles to illustrate his arguments — but Grew's use of it to comparison has no validity whatever.

Grew 1682

p. 12

"Yellow Flower, of this, chiefly, of Spring Plants ... of Winter-plants, more usually, a White Flower"

p. 40 In the sec. ed. of Anat. of Veg. Begun "Prunus A Purple [illegible] of the [illegible] still does not give the Stamens Attire"

Grew's whole method was essentially broadly comparative — Treats trunks as a whole, roots as a whole, leaves as a whole etc. - within these divisions deals of tissues - e.g. of bark, the pith, etc. comparatively.

1682 (more clearly than p. 79 ed. [illegible]) p. 170 "The Parenchyma of the Barque being distributed, for the time, partly outward, into the Skin, & partly inward, into the Wood". see Thickening

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1682 p. 72. Makes an attempt at a computation of number & size of vessels in different plants. He has to express himself vaguely having no means of microscopic measurement. He says that "Amongst all Roots they vary by above Twenty Degrees; ... Some of those in the Vine, being of the greatest Size; appearing through a good Glass, as near one Third of an Inch in Diameter." (This shows the difficulty)

Pl 23. Hazel branch.

P = Common Sap-Vessels (in posterior phloem)

but the same there is also a zone in the cortex which he calls

"Special Sap-Vessels" "O O, the common

Tab 25, Apple cambium & phloem region ~~cambial region~~ (marked ~~Sap vessels~~) the Wood: He also marks

Sap-vessels which begin to turn into Wood. "H I, Special Sap

"~~E F, the Sap Vessels in the margin of the pith~~ phloem fibres

Vessels in another parcel, which appear to be ~~(?)~~

detected by the knife in the cortex.

Tab 15. Horse radish root "B L, the Sap-Vessels (secondary phloem)

in the form of a Glory" (this appears to be the "zone on the

"G E, A Ring of more Sap-Vessels" sometimes in the

margin of the ~~pith~~ pith.

It appears that he had no very clear idea of sap vessels — sometimes he

means phloem after cambium, sometimes other tissues.

Tab XVII Vine root. Sap vessels = ph 2

Tab XXVII Pear cambium ph 2, sap vessels, the the they may be

primary phloem ph, cb + groups of fibres in the cortex

Tab 28. Elm branch

Tab 30. Walnut-stem ~~Sap vessels~~ he calls ~~those~~ he

the sec. ph + cb lymphaeducts which he usually calls the

region sap vessels. [He uses lymphaeducts & sap vessels in a very vague way, &

often he means ct. phloem, but he may also be referring to zone in

the inside of the phloem, & in the cortex.)

Thus

The Anatomy of Plants

p 114

The true Wood is nothing else but a mass of antiquated

Lymphaeducts, viz. those which were originally placed on

the inner ~~Margin~~ Margin of the Barque. For in their place every

year, a new Ring of Lymphaeducts. Which losing their

original softness by degrees, at the latter end of the year, is

turned into a dry and hard Ring of perfect Wood

See thinking

Vessels etc

1682 p 66 by the Diversity of those Liquors,

He describes vessels "by the Diversity of those Liquors, which they severally contain." [a sap vessel (a succiferous)] In which he calls them Lymphaeducts or sap vessels (a succiferous vessels) he is not really making a morphological distinction. He includes also resin, latex tubes (Lactiferous) What we mean by vessels now, he distinguishes as air vessels. (milk vessels p 69)

p 68

He describes them as making a ring "at the Inner Edge of the Barque ... in their places position, they are found in most, if not in all, Roots." But he also describes a ring of sap vessels near the skin in some roots

p 119

(Trunks) sap-Vessels ... are here usually to so posited, as to make a Ring on the Margin of the Pith.

An Idea of a Philosophical History of Plants [not Vegetables as is called?]

In 1682 edition include 2 [?] editions of An Idea of a Philosophical History of Plants Begun [Bk IV] The Anatomy of Leaves. The Anatomy of Roots, Given on to the The Anatomy of Flowers, Read before the R.S. Nov 26, 1676; The Anatomy of Fruits Read before R.S. Nov 5. 1676. The Anatomy of Seeds, the Figures presented to the R.S. in Jan 1677.

Centers

R.S. in Jan 1677

The Anatomy of Leaves. p 145. Deals with potation [?] & various ways folding of leaves. Very good vivid description of leaves in buds are potentiated. p 146 "And it is a general Rule of Nature, where the Stalks of the Leaves are so long, that they cannot lap over one another, & where no [?] other Special Provision is provided; if the bottoms of the Stalks to be produced into broad Membranes, as Blanches to the succeeding Bud; as in Crowfoot, Dovesfoot, Claver ----.

To the 8 ways of folding of leaves in a Bud which he mentions in the 1672 volume, he adds four more

Folding of leaves in bud 6 21

Grew (1682)

"in some Plants, as Ground-Ivy, St. Johns Wort, & Divers others, where the Leaves are ~~small~~ small, pretty numerous, & grow by ~~pairs~~ pairs, they have no Fould, but stand Flat & Tangent; like a pair of Battledors clapt together."

p149

these Thorns grow not like hooks, erected; but ~~[illegible]~~ all downward, like so many Tenters or Hanging-hooks; as in the Bramble, chiefly on the Stalks; & in Cleavers also on the Leaves [illegible]; whereby they catch at any thing ~~that~~ stands next them; & so, although weak, slender & feeble Plants, yet easily climb & carry themselves ~~high~~ high;

scramblers

p150 heterophylly

the Figure of the Leaf "is infinitely varied in the several kinds of Plants; there are some, that have Leaves (besides those Dissimilars) of Two kinds ~~[illegible]~~ or Two distinct Figures; as the common ~~[illegible]~~ Little Bell, Valerian, Lady-smocks, the Bitter-sweet. ~~Dissimilar~~ For the Under-~~Leaves~~ of Bitter-sweet, are Entire; the Under Leaves of the Little Bell like those of Sweet [illegible]. the Upper, with two Lobes: the Upper like those of Carnation, or of Pansy; ... Nature affecteth a kind of Villeam. And in some Plants, the Leaves ~~whereof~~ whereof are of no one ~~[illegible]~~ certain Figure, as in Dragon, Fenny, Bishops-Weed etc. Irregularly; but the Regular Leaves of most Plants, being of a Length & Circuit, always Defineable.

both the Regularity of Figure, numerical relation between the length & [illegible] of the lobes in Gooseberry; highest point [illegible]

(mathematical dest. of leaves T.O.)

He proceeds to try [illegible] & numerical relation between the lengths of the lobes in Gooseberry! but it clearly breaks down over Clematis, & of the [illegible], but & clearly he goes on to the Circles; then is clear. He then goes on to define or measure by Circles

"All Regular Leaves are defined by the Arches or Segments of several Circles, having either the same, or Divers Centers & Diameters. ... the Length of the Leaf is the Standard Measure, for the Diameter of those Circles: these being either its full Length, or certain equal parts subtracted, or a multiplied; as half its Length, or its Length & half, etc."

Grew 1682

He gives figures ~~purporting~~ to show that leaf shapes can be defined in this way. It requires 7 circles to make out the form of Cornelian Cherry & even then a large part of the outline is not ~~followed by any circle~~ coincident with any of the circles. The thing seems pointless.

p156

He notes that the leaves of Virgin Clary "have not only a Prone or Horizontal Posture, but also make that Forceable Pressure on the Ground, which can by no means be imputed to their Weight, ... the Arched-Fibre* standing before the Center of the Stalk, and the Round ones being uppermost, on the Ridges of the Stalk; they put on the upper part the easier to a more full and forward Growth, and so to bow the Leaf backward. And the Fibres being broad, yet almost flat, doth hereby the more easily yield to that Motion."

~~[* the pattern [illegible] is not consistent [illegible] there is no "green arched fibre" [illegible]]~~.

altogether a physiological contrary to dorsal vascular arc

* p154 The Strings of the Leaf, or those Fibres which are visible to the bare Eye, are composed of Vessels of the Two General Kinds, viz, for Sap, and for Aer ... Their Position's in the Body of the Leaf as in the Stalk, various regular, not only in the Stalk, but likewise in the [illegible] they stand in Six Oblong above shewed; In the Stalk of the Mallow-Leaf, they stand near the Circuit, in a Ring, and Paired of equal Size,

Petiole anatomy gives figures of various of the types of bundle arrangement

Buds

p157

the Buds of all Trees ... consist of a great Number of Leaves, notwithstanding, all perfectly formed in the Centre; where, not half so big as a Cheese-Mite. So that all the Leaves which stand upon a Branch ... of one whole Years Growth, were actually existent in the Bud. ... these Buds ... are ... entirely Formed, as to all their Integral Parts, the Autumn foregoing. (cf. doct.! ref.!) Chestnut-buds Foster

Had he lived he would have been interested [illegible] chestnut [illegible] years after. Moore E. (1909) (11) 88

p158 Grew 1682 Chem Morph 23 8

Grew made an attempt to explain the forms of leaves by what is very much he called their "principles", as seen ~~those [illegible]~~ the salts which he believed to govern their growth: He regarded the Saline Principle as consisting of four subsidiary principles — Nitrous, Acid, Alkaline & Marine. All these four salts he treats as having a share p159. in the Formation of Leaf, or other Part of a Plant: this was a sample method account of the process's working of growth; we quote a few words of his account: "all these Parts of the Plant which are thus Hygroscopic, by the Marine Salt, with the contributions of the Alkaline, but especially of the Nitrous, are made to shoot into Length ... these Salts being, altogether, determined to receive and conform to any other these Impulses which might incline them to the Chemistry Figure". He had arrived at the idea that chemistry was a kind of morphology of a lower order of scale

numbers of parts of flower

Flower p163

where the Leaves [petals] of the Flower are few; those of the Empalement or Green Bud [sepals], are either of the same number, or just half as many ..... in great Celandine, and in Poppy, there are Four Leaves, but two Empalements; so is Nature's way whose modell of other the Automaton of Geometry."

Hairs p165 Hairs, are best seen among many Flowers writen of small Parts, in nearly in with a great Number of small Parts, sometimes well, as in Snap-dragon, prow, but having the Head... Sometimes well, as the plummers like the Horns of the Butterfly, or in Deadly Nightshade but usually Globular, as in Deadly Sodeing-Iron. like so many little Mushrooms sprouting among the Flowers

He does not call these parts hairs unless it is something hair-like

p 165
Quote Sir Thomas Browne on ~~bea~~ petals in fives. 9 24

The gamopetalous construction
even those Flowers, which are not properly parted into Five Leaves, have yet their Tops usually divided into five Scallops;" He instances Toad-Flax, ~~Broom~~ Clary, etc., to be detected to five petals when they were not ready visible.

Lack of standards of measurement
p 169. He compares them as then "type of good Microscope" size of pollen grains. He compares them to seeds. For instance he says ... with a variety of the size they then looks like. ... the least Cheese-Mite ... than some are then no bigger than ... Cannot look bigger ~~than~~ ye Turnip seed, ... which ... naked Eye"; like those of ... etc.

Style & stigma
"In ... ; hath a round Head, like those of a great ... Pea. ... In the Common Bell, ... its divided into Three Parts. In ... Geranium, into Five.; In Asarum, ~~into~~ Six, into Six."

Compound Flowers
every Flower with the Flaid Altire, Embosomes, as is, a Posy of perfect Flowers.
He found ... there ... in some cases "every one of these Florets, is encompassed with an Hedge of Hairs; or every Hair branched on both sides almost like a Sprig of Fir; as in Golden Rod, ..." ideas.
p 171
He understood the difference between the ligulate- radiate type of composite ~~flowers~~ ... the ligulate florets ... each ... p(171) "The Basis of every Leaf is formed into ... Tube or Pipe, whereby it embosomes its own Attire within it self ... the Leaf it self answering to the Flower in other Flowers,

Grew (1682)

he also distinguishes the ♀ [illegible] flowers, when there is also. Dish, for the [illegible] type.

♂ Stamens — Grew's model of Sedleian [?] see 17 IV 85

171

Of the use of the Attire.

"In discourse hereof with our Learned Savilian Professor Sir Thomas Millington, he told me, he conceived, That the Attire doth serve, as the Male, for the Generation of the Seed. I immediately reply'd, That I was of the same Opinion; and gave him some reasons for it, and answered some Objections, which might oppose them."

p172

"That the same Plant is both Male & Female, may the rather be believed, in that Snails, and some other Animals, are such."

Animal analogy Hermaphrodites

p173

He vigorous [?] ~~[illegible]~~ of the animal analogy of his rep:– "If any one shall require the Similitude [?] [illegible] [illegible] every Thing; he would not have ~~[illegible]~~ a Plant to resemble, but to be, an 'Animal'."

Flower buds. Early formation.

p173 flower buds. "In all Perennial Plants, Early formed.) the Flowers of any one year; those Flowers which appear and are called [?] in that year, but were actually in Being, and almost formed in all Parts, the year before; as in many Herbs, so in all Shrubs & Trees. This will best be seen by some Dissections. So the Flower of Mezereon, which opens in January, is entirely formed about the middle of August in the year foregoing. At which time, the green Leaves of the Bud being carefully removed, the Leaves of the Flower, the ~~[illegible]~~ ... Attire, encompassing the Seed-Case, through an indifferent Glass, are all distinctly visible."

p174

He suggests that now that he has observed when the flowers are already formed, ~~[illegible]~~ they might be induced to expand in winter "by keeping the Plants warm," thereby enticing the young [?] lurking Flowers to come abroad." artificial forcing

See p10 a

26 109

Plate 63

The figures of longitudinal section of the tulip bulb "Shewing the young Tulip (a) as it was form'd in ye bottom of ye Root in September, & figures are of the flower for the bud magnified & opened out to shew also than the stamens the pistils are already formed.

(This is a good plate & would do for reproduction)

(early formation of flowers)

Stamens

Acc to OED { Chives = threads or filaments / applied improperly by Ray to the anthers.

Grew's word { semen = semen-at (not microscopic) = anther

Appendix 5th account of flower is a plan for a key by which plants might be recognised, from leaf & flower.

"a third Method merely Learners, seeing a Plant they know not, may be informed of what Sort it belongs, & so be directed where to find it described & discoursed of. For, except they have a Master to conduct them, which few have; they must needs, by seeking at random, lose a great deal of time, which by a regular Enquiry might be saved. Besides, that which is learned by their own Observation, will abide much longer on their mind, than what they are only Taught by another. Now the most Philosophick way of distinguishing or sorting of Plants, were by the Characteristick Properties in all Parts,"

relate to reader

He decides to discard the most minute or hidden characters, as "fit for the discernment of dissection & magnifying glass", says that "for the Use here intended, those Properties are the fittest to be insisted upon, & those Parts, such as are the most Conspicuous, & in those Parts which the Learner may the most readily & without any difficulty [illegible]. The Flower hath Varieties where the Learner may [illegible] as in the Flower & Leaf. [illegible] when the green [illegible] or [illegible] of the wanting, when [illegible] by both, & then the [illegible] enough of it self. [illegible] is therefore convenient, that the Leaf is not; as [illegible] Varieties of both be distinctly reduced into Tables."

He goes through to various characters of position size & shape of leaves, & colour of flowers. He proposes a & position, size, shape, & colour [illegible] e.g. those one inch or under [illegible] standard of size in leaves e.g. those one inch or under small, 1–5 in, Mean, & 5 in over Great. He distinguishes palmate "from all their main Fibres proceed from the Stalk, as in Holyoake [Hollyhock]", & pinnate as those "whose other fibres arise from the middle Stem of the leaf [midrib]".

"Stem" of leaf. Palmate pinnate venation

He considers the apex & margin of leaves also. He proceeds to [illegible] the characters of flowers, being reduced to say "Half for these, & some other like Distinctions, in any Sort of Plant, may be Tables, will serve for the finding out of any Sort of Plant, may be conceived, if we consider, how great a Variety, a few Bells, in the ringing of Changes, will produce. And to search which is easy, & successful."

permutations combinations

in every foregoing Table, reference to made to those then follow; & in the Tables ~~[illegible]~~ containing the [illegible]-Dursting, the Names of Plants therein pointed out, be expressed.

It must be noted that though Grew treats all these aspects, he does not himself compile a key!

The Anatomy of Fruits. Read before the Royal Society, [illegible] 1677

p177 p181

Grew's description of the Lemon pulp is very good

"A cluster of ... little Bags, about the bigness of an Oate, all designed one from another, & having their distinct Stalks, of several Lengths, by which they are all fastned to the ultimate Side of the great Bag, wherein they are contained."

Unluckily Grew did not stop his description at this point; he ~~added that~~ "Within each of these lesser Bags are contained many hundreds of Bladders, consisting of most extream fine Threads woven up together ~~in that Figure~~."

— an instance of his tendency to think he saw a degree of minute structure which was a result of his ~~[illegible]~~ inevitable lack of experience of the ~~[illegible]~~ inevitable use of minute plan-organisation, [illegible] upon by the an inferior ~~[illegible]~~ microscope.

his leaning [to] use of microscope, and the [illegible] which is difficult to achieve [illegible] whether or not one is seeing things clearly

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p186

The Seed-Case is either [illegible] open; Or only when the Seed is ripe; Or never opens at all..! [Spring graces]

Of the Class, [illegible] of the former Sort is that of Sentcole; of the latter one & the same Pair, is both the Hyssop, & the like: therein once that is gone, serves as the Empalement of the Flower, & then [illegible] Case of the Seed.

19. he recognised the openness of the ~~[illegible]~~ mustard the nettles mignonette (Reseda) away, but he [more] in the same category as Sentcole.

of Labiatae seeds, to give them [illegible] calyx & calyx first an envelope for the flower - afterwards a seed case.

The Poppy-Head p187 is a little Dove Coat; divided by Eighteen or Twenty Partitions, into so many Stalls. On both sides the Partitions, hangs a most numerous Brood of Seeds. The 13
see also top of p. 30
... ~~as [the Head]~~ The Head ... as it ~~dries~~ dries, ... gradually opens at the Top, with several Windows, one for every Stall: which are all covered with a very fair Canopy. [see also extract of p. 151 copied on next page]

p188. Uses & expression "Vascular Fibres" of vascular bundles.

Mechanism of an explosive fruit — Impatiens Noli me tangere

p188 The Seed-Case of Codded Arsmart, neither opens at the Top, nor at the Sides, as do all the former; but at the Bottom. It is composed of Four Sides: the Outer Part of which, ?? is a ~~little~~ little & is softer & more succulent; the Inner a strong Membrane. In the Centre of the Case is erected a Pole or Column upon which the Seeds do all hang very loosely. From this Mechanism, the manner of their violent & surprising Ejaculation of the Seeds is intelligible; Which is not a motion arising in the Seeds themselves; but contrived by the Structure of the Case. For the Seeds hanging very loose, not at the sides of the Case, as sometimes, but on the Pole, in the Centre, with their thicker end downward, they stand ready for a Discharge: & the Sides of the Case being lined with a strong & tensed Membrane, they thereby perform the office of so many little Bows: which, remaining fast at the Top, & (contrary to what we see in other Plants) opening or being lett off at the Bottom, forcibly curle upward, & so drive all the Seeds before them. Impatiens fig (Pl 71) opposite
(This fruit picture (Pl 71) opposite
Noli me tangere)

p190

Grapes [have a thicker skin] than Plums; these having as were, only a Coat of Kid, but those of good tough Buff. cf grapes' pictures (word style)

p 151 Of the Seed-Case of Poppy, it's particularly to be (see p 29) noted, That as the several Windows, serve to let in Aer, after the drying of the Seeds, after their full growth: So the Canopy over them, serves to keep out Rain. For here, the Case not cleaving down the Side, as it usually doth; should the Rain get in, it would stand in it, as in a Pot, and so rot the Seeds. And as the Canopy serves to preserve the Seed; so the several ~~partitions~~ Particions or Walls for their better Storage. For by an easie Survey of the little piece of ground, it is plain, that as they stand on both Sides every Wall, there is a much more ground for them to stand upon, as if there were no party Walls, but the Seeds stuck all round about upon the Ambit or Sides of the Case; or upon a great Bed or Placenta within it, as in Hyoscyamus, Anagallis, etc. where there is a less numerous Brood.

p 152 Garden Radish... the Parenchyma in the Seed-case gradually drys, breaks, and shrinks up into several soft Membranes, in which the Seeds, or at the Case lie swadled, as in so many fine Calico Clouts.

(Strong feeling of the "thingness of things")

158, 159 Detailed calculations as to the number of seeds borne by the poppy — 32 000 seeds by one plant, & Typha major, 120,000 seeds on one plant. (numerical calculations)

p 199. Discusses the use of springs & feathery arrangements in seed dispersal — also explosive ~~and~~ firing out when the seeds are "either Sparted, or Flung away"

Explosive mechanism of fern sporangia.

p 200 The Seeds of Harts-tongue, ... of all that Tube, are Flung or Shot away. ... Every Seed-Case, as it appears through a good Glass, stands upon a pedicle for $\frac{1}{2}$ an Inch to an Inch or more in length;

on the fitter down is much green as a Horse-hair, . . . little thicker on the Cup, on which stands the Case, of a Silver Colour; about ~~the~~ the bigness of a Cherry-stone, of a Sphericks Figure, & girded about with a strong Tendon or Spring of the Colour of Gold: the whole Machine not much unlike a little Padlock. The Surface of the Spring resembles a fine Screw, or some of the Air-Vessels on the Wood of a Plant. Soo soon as ... this Spring is become stark enough, it suddenly breaks the Case into two halfs, like two little Cups, & so flings the Seed

He reckons ~~reckons~~ 1,000,000 seeds as numerical relation ~~production~~ of the plant.

"Ten thousand are not so big as a white Pepper Corn"

(No mean exact means of expressing size of small objects then by saying how large they looked when magnified) p211, he has for better, uses "about 1/5th part as big as a Cheese-Mite" as a unit.

R. 75: Embryo of Ricinus begun to be [illegible] in the fruit – [illegible]

A much fuller account of seeds & embryos than [illegible] & fruits.

A Discourse Read before the Royal Society Decemb. 10. 1676, Concerning the Nature, Causes & Power of Mixture. MIXTURE

Atomic theory of the world.

p223

By Principles here & [illegible] he means Atoms, the [illegible] these as indivisible & ~~[illegible]~~, immutable, ~~[illegible]~~ of divers kinds.

p. 225

Nature worketh every where as by Mixture

By ... Mixtures [Nature] brings, & within the Conveniences of agreeing Forms, must produce all the variety in the material World.

The Formation & Transformation of all Bodies, can be nothing else, but the Mixture of Bodies.

p 226 "in the self same ~~analogous~~ analogous way, as the Letters of the Alphabet, are the Principles of Words; so Principles, are the Alphabet of Things."

Principles

p 226

He defines "an intelligible account" as "such as is grounded upon the Notions of Sense, & made out Mechanically."

mechanical outlook

p 227

the more perfect Mixture of Bodies, can go no higher than Contact. For all Principles are unalterable; & all Matter is impenetrable; as hath been said. In the more visible & Loose Mixture, there is Contact; & in the more ~~subtile~~ subtile & perfect, & in Generation it self, there is nothing more.

A ~~fundamentally~~ the independence [illegible] of ~~changes~~ [illegible] in the fertile eggs)

Art it self may go far in doing what Nature doth; And who can say, how far? For we have nothing to make; but only to mix ~~those~~ those Materials, that are already made to our hand. Even Nature her self, as hath been said, Maketh nothing new; but only mixeth all things. So far, therefore, as we can govern Mixture, we may do what Nature doth.

[Enormously the ~~[illegible]~~ possibility of making again compounds in the laboratory

p 232

By Mixture ... we may be taught to Imitate the Productions of Nature. ... Of Vegetables, to Imitate a Milk, Mucilage, Rosin, Gum, or Salt. ... I do not say I can do all this; yet, upon good Premises, we can conclude this possible to be done; which is one step to the doing of it.

1682 2nd ed. Course of Lectures 33 17

~~suggests~~ Tests "Earths, Stones Ores etc with "Oyl of Vitriol" Sees if they effervesce — a ~~process~~ procedure regularly used today in field work w some acid.

p287 ".. ~~Who~~ whoever doth undertake the Natural History of a County, (such as that the Learned Dr. Plot hath exceedingly well done of Oxfordshire) the foregoing Method, seemeth so easie, cheap, & undeceitful, for the finding out & well distinguishing the natures of all kinds of Metalls, Ores, Salts, Earths, Stones, or other subterraneal Bodies; as cannot, I think, be supply'd, but by others of greater difficulty & expence."

numbers its teaching methods & acid tests – to field

An Essay of the Various Proportions Wherein the Lixivial ~~Salt~~ ~~Is found~~ in Plants. Read bef. the Royl Society, March, 1676.

Grew did a great deal of detailed ~~quantitative~~ chemical work, setting before himself definite & specific questions.*

~~Foundation~~ As an instance we may take his "Number 2" which is

p256 Whether any Plant growing in a Garden or the Field, doth not yield a lesser quantity of Lixivial Salt, than another of the same kindred growing on the Sea-Coast; & ~~whereby~~ what difference?

For this, I took Garden & Sea-Scurvygrass, of each 1 lb. The former yields 2 Drachms & 1 Scruple; the latter, being well washed, 9 Drachms, which is more than 4 times as much."

Lixiviation is the process of extracting alkaline salts from ashes by mixing them with water, & then running off & evaporating to dryness.

---

p267 A Discourse Concerning the Essential & Marine Salts of Plants. Read before the Royl Society, December 21 1676

Shorements manuel of Sea Ivens.

* In the ~~practical~~ practical part of the work he acknowledges the assistance of an apothecary Mr. John Blackstone.

p 269

A Discourse of the Colours of Plants. Read before the Royal Society, May 3. 1677.

(p269 mentions Boyle, Des Cartes, Hooke, Newton, as having worked on colour.)

p 273

But there is no Vegetable yet known which gives a true Red Oyl, except Alkanet Root; with which, some colouring either common or other Oyl, vend it under the name of the Red Oyl of Scorpions. [~~tending some~~ [illegible] — by trade the oil coloured with Alkanet root was sold then as Red Oyl of Scorpions)

Scarlet origin! held Winter [?]

p 277

Flowers of Lathyrus or Peaseverlasting

The effecting of [the variation of the Colours of the Flowers], by putting the Colour desired in the Hollow of the Body or Root of the Plant, is vain; & being such a piece of cunning, as for obtaining a painted face, to eat good store of White & Red Lead.

Lecture VI. A Discourse of the Diversities & Causes of Tasts chiefly in Plants. Read before the Royal Society, March 25. 1675.

p281. Speaks of the penury of Language — describe the variety of Tastes that plants reveal.

p 286

To speak of the Causes of Tasts, before we have well enumerated or distinguished them; is to provide Furniture for a House, before the Rooms have been counted & measured &c.

Domestic character

mathematical analysis of possibilities & tastes.

p 294

Deals with the permutations & combinations of tastes — places & gives a table showing how many ~~tastes~~ three-fold tastes can be produced by the combination of 10 simple tastes. He ~~[illegible]~~ reckons (p 282) that every ~~[illegible]~~ tasting be present in 5 degrees of strength on an average, which produces altogether 1800 ~~[illegible]~~ "sensible &"

19
35
1

defined the Varieties of Taste" based on the system of
three fold tastes in plants e.g. bitter-sweet-aromatic etc

Experiments in Corrosion upon the Solution of
Salts in Water. Read before the Royal Society, Jany 18. 1676/7

Plates

Plates
for figures of seeds & seedlings I, II, ~~III~~ III
Pedicle anatomy as seen with naked eye. IV
III has a been seedling partly in [illegible] drawing but
cut across below the plumule & ~~[illegible]~~ Cylinder on the
[illegible] wooden body — [illegible] semi diagrammatic drawing
Cf. unseen other anatomy. [illegible]
Also Burdock — an improved version of the figure in
Anat. of Veg. Begun? [illegible] bundles both in length & transverse
section. Primrose,
V. for [illegible] drawings of [illegible]
Woodsorrel, devil's bit, Dandelion, Iris etc
VII, VIII, IX Anatomy of roots as seen with naked eye.
X Asparagus root — detail reproduced from 1st edn
XI root of Jerusalem Artichoke. Really
of course a stem
( ) have not compared all the roots but they
seem mostly a larger version of 1st edition.
18. Stalks & branches cut transversely as seen
with slight magnification or naked eye.
19. F4 ~~[illegible]~~ segmented pith of Walnut
73. Many seeds.

1682. Plate 37 ~~19~~ 20

Corn branch cut transversely radially + tangentially. 36

The rays in the R.L.S. are represented as ~~weaving~~ weaving in much like basket work. basket-work analogy

Plate 41. Sumach unenclosed bud:
Dock leaves + stipules

42. Fistuly, leaves in the bud

plates 5~~5~~6 etc, detailing stamens + compound flowers

Grew (Musaeum) 1681.

p 254 Sir Thomas Millington not always full of insight!

Although I have not seen it my self, yet I have been told by one (c) that doth not use to phancy things, that the Volatile Salt of Vipers, will figure it self into the semblance of little Vipers. (c) Sir Thomas Millington

This belief that salts of plants represented as it were the essence of the plant & would display its characteristics, was widely held. He quotes Sir Thomas Browne as an authority of this.

When the resemblance of plants is found in stones, he says "There can be no convincing Argument given, why the Salts of Plants, ... washed down with Rains, & lodged under ground; should not there be disposed into such-like figures...?

Plant Salts & Fossils

The Preface Classification

I like not the reason which Aldrovandus gives for his beginning the History of Quadrupeds with the Horse; Quod praecipuam nobis utilitatem praebeat. [because it's of the greatest use to us] Being better placed according to the degrees of their Approximation, to Humane Shape, & one to another; and so other Things, according to their Nature. And less should I choose, with Gesner, to go by the Alphabet. The very Scale of the Creatures, is a matter of high speculation.

Measurement in natural history

In his descriptions "And have added their just Measures. Much neglected by Writers of Natural History."

Quotation

... of Aristotle, must be brought to prove a ... end of Preface "as if

Man hath ten Toes"

Importance of full description

"it were ... very proper, That not only Things strange & rare, but the most known & common amongst us, were also described"

Grew (Musaeum)

38

p 6
notes in company 2 skeletons ♂ & ♀ of ? same height
that the skull of the male skeleton is much bigger than of
the female, "& so capable of more Brains." Buy he
adds "Although a little House may be well furnished, & look better than
a great one that stands empty."

p 15
Grew proves by experiment ~~that~~ the ~~teeth of the~~ hippopotamus [inserted, circled: in teeth of Museum that]
~~will~~ cannot produce sparks of fire by striking is[?] hard
teeth together, & thus not ~~seeing~~ seeming of the fire,

Variety true or superstitious

His account of animal specimens in the Museum seems to include
new species, for he gives detailed descriptions of certain ~~animals~~
specimens of which he finds no description in previous authors, &
no accurate account e.g. of flying squirrel p 20

Description Needs.

Intermediate types

p 53
The Bat stands in the Rear of Beasts, in the Van of
Birds.

p 56
refers to legend of the Bird of Paradise having no legs
as a "silly fancy."

common sense

Ref to Wray p 57, 93, 94

Natural history specimens in spirit

p 58
"The Honourable Mr. Boyle "... so far as I know, was
the first that made trial of preserving Animals ~~thy way~~
[i.e. in "rectified Spirit of Wine"] [circled: See Singer p 44. He gives 1663 as date] [circled: the in Brazil humming birds may arise]

p 62-63 ~~Pernits~~ Recounts a tale of a ~~butterfly~~ ~~a oldbill~~ humming bird ~~that~~ ~~causes~~ Charitable tolerant way of regarding mistakes
~~Brazil~~ ~~and a bird~~ the Brazilian
being ~~transformed~~ formed in Brazil ~~and a bird~~ told by Piso of a
by transformation of a caterpillar or butterfly. He says, those
who sponsored the tale "But we will rather suppose these men
were themselves deceived, than that they designed to deceive others.

Tolerance[?] of mistakes

Grew (Museum) p 150-153
Exhibit keys of the identification, shells

p 158
in the Seeds of all Plants that occur, which are not merely Metaphorically, but really so many Eggs (like these of many Animals) without a Yolk.

Seeds

p 210
Nux-Vomica Officinarum

Strychnos seedling
Cotyledons; Cordus

"I find that Cordus goeth thus far, as to observe, That within this Nut is contained a Rudiment of the future Plant, consisting as it were of two little pretty veined Leaves, or Plant, consisting as it were of two little pretty veined Leaves, ... But that these Leaves were the two lobes or main body of the Seed, that the Stalk of these Leaves, as he calls it, was the Root, and that between these Leaves was couched the Bud, of the future Plant, any thing whereof he had not the least notion. Neither did he know (that the observation is as a peculiar) that the like conspicuous foliation, is, as in Cedar, Acacia, Arvelle in the Seeds of a great many other Plants.

Rose of Jericho

p 219
The Rose of Jericho, or Christmas-Rose. Rosa Hierochuntina
Either an ignorant, or a crafty Name, agreeing neither to the place, nor nature of the Plant. For it is not Jericho 'tis no where to be found, but in Arabia, upon the Shore of the Red-Sea. ... All the Branches are closed up together, with some resemblance to the Umbel of the Plant called Bees-nest, or some others of that kind.

Being set in Water, its several Branches will gradually be expanded. Which some Impostors knowing, choose Christmas-Eve for the Experiment, to make people believe that it ~~opens only~~ only opens on that time.

Bamboo

p 223
Mambus, a great Indian Cane

Fossils

40

Muszaeum p 253

Of Animal Bodies Petrify'd; & such like.

Which hath been much disputed, & is not yet resolv'd, of many subterraneal Bodies, which have the semblance of Animals, or Parts of them, Whether they were ever such, or no. ... If I may speak my own Sense a little, Why not? Is there any thing repugnant in the matter? Why not a petrify'd Shell, as well as wood? ..."

He talks of petrified shells seen not to be of known species, this is probably due to an ignorance of modern shells.

p 254 He is quite clear about lusus naturae.

He says "altho Nature cannot be said to imitate Art: yet it may fall out, that the effects of both may have some likeness: Those white Concretions which the Italians from the place where they are found, call Confetti de Tiboli, and sometimes so like round Confects, & the rough kind of Sugar'd-Almonds, that by the eye they cannot be distinguish'd. To call them Petrify'd Sugar-Plums were senseless.

Thus his general attitude towards petrifactions shows common sense, but he had no glimmering of the real nature of fossils.

p349

American Bole — Common sense in giving doses, letting things alone

Jouber-sister, as a Testimony of its Virtue, Their four men preparing some Cathartick of Antimony, were all well nigh suffocated. As to him upon his giving them each 3ii of the Bole, they became very well. But the question is, Whether so soon as they were grown (ready to use Antimonial Emetics) (for they would not have been such were they but, save he broke them) well without it?

p351-2 — Humane touch

Oil of Tobacco

"This very Oil I have several times prescribed to my own Father (who takes Tobacco) in Lint to be held between his Teeth, against the Tooth-ach, with a good effect, & so all so, But I, who take none, having once us'd it, my self in the same manner ... it made me extremely sick."

p374 — Scientific grass

A plain Indian FAN, used by the meanest sort. Made of the small stringy parts of Roots, spread out in a round flat Form, & so bound together with a Splinter-Hoop. ... When they use them, they sprinkle them with Sweet Water, which perfumes the wafted Air. (More likely was a fragrant Andropogon AA.)

p356. Earths & things relating to Chemistry — miscellaneous mineral agents

Salts, metals, stones, gems

p357 air pump & weather-clock.

Coins p 381

Roman pottery, mosaic etc

Curiosities in R.S. Mus: "the gentleman's cabinet" of 17th century

p 379

His comments on a carved figure in armour represent "parts of plants & insects laid on to rosin or wax — "Part of the Armor ... with the Wing-Sheaths of the Green Brown Cantharis"; "the Eye, with Gromwell-seeds" & so on.

p 378

Detailed description of "A Carved Shell of Mother of Pearl" with Pieces & a representation of Andromeda & the Monster, with Pegasus flying to the rescue. "All done" as Grew remarks "with extraordinary Art"

All first tour Royal came to the Society's rooms in those days.

Ivory carving.

p 375

"A Mediaeval Landship, or Prospect of Ruines Buildings in Stone. Humorous Oberkirche Tree painted over it."

p 375.

Catoptrick Pane, on a Table or Board, given by Bishop Wilkins. On one side, the Pane looks as if it were altogether rude & irregular, so as nothing can be made of it. But a Metalline Cylinder being placed perpendicular upon a center Point of the Table; the Rays are in such sort incident thereon, & thence reflected to the Eye, as to represent a variety of curious Work: sc. a Shepherd playing on a Pype; & his Wife dancing with a Child in her Arms, & a Basket on her Head.

p 372

A little Box Turn'd out of a Nutshell."

p 360

"A Way-Wiser" to affix to the wheel of a coach to determine travelled

p 360. A reflecting telescope + p 359 Ear trumpet

Museum. BA copy
Manuscript corrections

p 62
(The Humming-Bird)
His Feathers are set in Gold by the Phrygians, & sold at a great rate.
"The Phrygians" heavily blacked out & "Embroyderers" substituted.
(The fact is alluded to Charlton Onomasticon Zoic.
on p. 375 "Embroyder'd" is so spelt

p 81
The Joynt of the Back-Bone of a Whale. By Anatomists called a Vertebra. 'Tis only one of those Parts or Joynts which answers to a single Rib on each side
"'Tis only" blacked out & replaced by "Less than"

p 235.
"The Negro Glyster or Stramonium Tuber." These words blacked out & "Glyster bag" substituted. "Solid" is added.
A few lines further on "See p. 385" and "ponderous" blacked out & p. 385. These corrections are in accordance with a correction in appendix

p 312 entry "Plated Marble" "white & pink colour'd", lines which he describes as "white & pink", the word "colour'd" are blacked out, & "all of a brown" is substituted, & so since the stones he describes are unnumbered, & so individually unrecognizable, it shows Grew's knowledge must have been good; who else could have known what stone he meant, especially if the "white & pink" was in fact incorrect.

p 343. A blank left for the name of a donor "Henshaw Esq" & "Thomas" added.

A COPY OF MILTON'S "EIKONOKLASTES"—I

By D. S. ROBERTSON

In Vol. XVIII of the Columbia edition of the works of John Milton (1938), p. 270, under the heading "Book Inscriptions From Presentation Copies,"-is listed:

[3. From a copy of Eikonoklastes, presented to the Earl of Carbery, 1650]

For my very good Frend Mr William Thomas at Laherne, to be presented to the Earle of Carbery.

Dr. J. Milton French, one of the editors of this Columbia volume, had already mentioned this copy in his article "The Autographs of John Milton" in *E.L.H.* (iv, 1937, p. 311). He there quotes only the second part of the inscription, but with slightly fuller wording, "To be presented to the Right Honble the Earle of Carbery." He gives references to Lowndes, the *Bibliotheca Heberiana*, and Masson's *Life of Milton* (iv, 246 n. 2), mentions some of the copy's recorded owners, and adds: "Its present location is unknown." The statement in the Columbia edition is derived, as a note on p. 549 shows, not from direct inspection, but from a description in the 111th Catalogue of Bernard Halliday, 1929 (item 99). Mr. Halliday has had the kindness to send me an extract of this description taken from the file copy of his catalogue.

This copy, which I shall call the Carbery copy, has lately come into my hands, and deserves a fuller account than has yet been given. Apart from the Carbery inscription, to which I shall return, its history can be traced almost continuously since 1755. The second edition of *Eikonoklastes* was first reprinted in 1756 by Richard Baron, and this is the copy which he used, as the following entry shows:

From this copy, which I discovered June 1755, was given, under my care, a new impression in Quarto: and this Book I presented to my ever honoured & esteemed friend Thomas Hollis of Lincoln's Inn, Esqr,
April 14, 1756. R. BARON.

The word "given" is written in an erasure, perhaps of the word "printed." This entry is opposite the title-page of the treatise, on white paper reinforcing the inner face of what seems to be the original brownish paper wrapper of the volume; the same externally brownish paper, similarly reinforced, appears also after the last printed page, and there are further end-papers outside the Carbery inscription, and ending with the words: "The copy was presented April 1756 by R. Baron to Thomas Hollis." Comparison with a marginal note on page 89 ("observe T.H.") shows that the writing on this card is that of Thomas Hollis, the well known "republican," who lived from 1720 till 1774.

In the editor's preface to the 1756 reprint Baron says that "the last summer" he "discovered" the second edition, previously overlooked, but gives no further details, except that he afterwards found "that this Edition was not unknown to some others, tho' from low and base motives secreted from the Public." The volume next appears in the possession of the elder John Disney (1746-1816), whose bookplate it contains: he evidently gave it its present binding of blue morocco, which bears, with other ornament, his cipher on the front and his crest on the back. In 1804 Disney inherited, through Thomas Brand, later Brand Hollis, most of Thomas Hollis's property, and presumably he got this book with the rest. On Disney's bookplate is a note, certainly by Richard Heber: "Dr. Disney's sale Apr. 1817. 3. 3. 0."

The Carbery copy reappears, as Lot No. 2354, in the *Bibliotheca Heberiana* (Part V, 1835, p. 169); the description there given is the ultimate source of Masson's footnote, and Bohn's *Lowndes* (Vol. II, 1859, p. 1566) adds the information that at Heber's sale it fetched £1 11s. 6d. In March, 1928, the copy was sold by Sotheby as part of the library of Lieutenant-Colonel Sir George Holford (Lot 648), and is described as "from the collection of Lord Vernon." I have already mentioned its appearance in 1929 in Bernard Halliday's catalogue. I bought it from Thomas Thorp of Guildford, and Mr. Hugh N. Thorp, who kindly gave me the Sotheby reference, tells me that he himself bought it privately from a lady.

The Carbery inscription is written on the front outer face of the brownish paper wrapper already described and runs as follows:—

for my very good frend mr
William Thomas at Laherne.
To be presented to the right ho: the
the Earle of Carbery

All four lines may well be in the same hand, but the last two are written in supposed to be the hand-writing of Mr Milton."

The hand of the Carbery inscription does not seem to be Milton's, but it is obviously of the seventeenth century.

William Thomas (1613-89) ordained priest in 1634, had in 1644 been ejected from the living of Laughearne with Llansadwen in Carmarthenshire, and from then till 1660, when he was restored to his livings, he supported himself and his family by keeping a private school at Laugharne. In 1665 he became Dean of Worcester, in 1677 Bishop of St. David's, and in 1683 Bishop of Worcester. The second Earl of Carbery, Richard Vaughan, born about 1600, succeeded to the earldom in 1634, and died in 1686. According to Nash's *Worcestershire* (Vol. II, p. 159), William Thomas remained at Laugharne till 1670, but such an inscription could hardly have been written after 1660, when *Eikonoklastes* was burnt by the hangman. Dr. French may be right in assuming that it was composed by Milton at the time of publication, but he presented a copy to the Bodleian as late as 1656. His failing eyesight explains in any case the use of an amanuensis.

The inscription, if it is Milton's, is of some biographical and historical interest. So far as I know, there is no other evidence of Milton's friendship with William Thomas, who does not figure in the index to Masson's *Life* or in that of the Columbia *Milton*, or, as Dr. French remarks, with Lord Carbery, though in 1652 Carbery married, as his third wife, Lady Alice Egerton, the pupil of Henry Lawes, who in 1634 had played the Lady in the first production of *Comus*. It appears that Carbery, though early in the Civil War a prominent Royalist general, and again in favour at the Restoration, had before 1650 made his peace with the Parliament, but it is difficult to think that either Thomas or Carbery would welcome the gift of this virulent attack on the dead King. There is, indeed, no proof that the book actually reached either of them, but if, as seems likely, it did pass through their hands, they at least treated it with respect, for its condition is perfect.

In a second article I shall discuss the evidence afforded by pen-and-ink corrections in the Carbery

title-page of the treatise, on white paper reinforcing the inner face of what seems to be the original brownish paper wrapper of the volume: the same externally brownish paper, similarly reinforced, appears also after the last printed page, and there are further end-papers outside the wrappers at both ends. To one of these end-papers, at the beginning, is pasted a card, describing the contents of the volume, transcribing in full the

ish paper wrapper already described and runs as follows:—

for my very good ffrend mr
William Thomas at Laherne.
To be presented to the right ho^ble
the Earle of Pembroke

All four lines may well be in the same hand, but the last two are written in lighter ink, perhaps after an interval of time. Below is a note, I think in Baron's hand (it is included in Thomas Hollis's transcript): "The above is

There is, indeed, no proof that the book actually reached either of them, but if, as seems likely, it did pass through their hands, they at least treated it with respect, for its condition is perfect.

In a second article I shall discuss the evidence afforded by pen-and-ink corrections in the Carbery and other copies for the establishment of the text of the treatise.

(To be continued)

LATIN MANUSCRIPTS OF FRANCE

E. A. LOWE (Editor): *Codices Latini Antiquiores.* A Palaeographical Guide to Latin Manuscripts Prior to the Ninth Century. Part V. France: Paris. Oxford: Clarendon Press. London: Cumberlege. 100s.

The preceding volumes of this monumental work have been noticed in these columns and it is therefore unnecessary to dwell once more on its peerless scholarship, its indispensability for every student of pre-Carolingian palaeography and the perfection of its typography and illustration. All this, indeed, can be taken for granted in a publication of which Professor E. A. Lowe, of Munich, Oxford and Princeton is the begetter and Mr. Charles Batey the technical executant. The present volume is devoted to the treasures of the Paris libraries, which, of course, primarily means the Bibliothèque Nationale, although St. Geneviève, the Arsenal, the Louvre and the Papyrological Institute of the Sorbonne have contributed a number of less well-known but by no means negligible specimens.

The palaeographical problems presented by each item are treated with the customary wealth of detailed observation which renders Professor Lowe's account the final word in virtually every case. However, the very finality in matters of palaeography—which includes provenance and similar matters of librarianship—raises the question whether the author might not, with little extra trouble, have given his readers still greater cause for gratitude. Professor Lowe would, no doubt, be the first to acknowledge that palaeography (like patriotism) is not enough; and that the quest for the precise delimitations of the b-type, az-type and the rest must not obscure the fact that, after all, the contents of the manuscripts are more important than their outward appearance. It is in his respect that the reader of the *Codices Antiquiores* cannot help feeling that he might have been given more. "Certain manuscripts," Professor Lowe says in the introduction to the present volume, "by their very existence are pages of history," and he goes on to give a fascinating example of a codex (Lat. 10837) the importance of which rests solely on a marginal note in the hand of St. Willibrord. Explanatory and amplifying comments of this kind are too few. How helpful, for instance, would have been some historical and philological notes on the two manuscripts of Gregory of Tours (nos. 670 and 671), especially as the bibliography, on principle, again confines itself to the palaeographical aspects, so that not even the new Gregory edition by [B. Krusch and] W. Levison is mentioned. How valuable would be an indication of Professor Lowe's opinion on the vexed problem of the *Regula Magistri*, beyond the tantalizing short statement that it "has aroused much discussion in recent times." If this complaint should seem ungracious, the author may be reminded of a passage in St. Luke's Gospel (xii, 48)—which is not shown in any of the facsimiles of New Testament manuscripts.

REGIONAL HISTORY

The Cheshire Historian. No. 1. Spring, 1951. Cheshire Rural Community Council. 2s.

Those who are attracted to the exploration of regional history find a wide choice of paths to follow, and many of these are indicated in the first of an intended annual series of booklets produced by the History Committee of the Cheshire Rural Community Council. The emphasis is very decidedly on field work; not only in its exact sense of digging up the past but also in the sense that the reader is encouraged to go and study his county's domestic architecture, its traditional industries, its painted glass and so on, at first hand. These pages will send him out into the countryside, or into the museums, rather than to the research library.

For the beginner in the study of local domestic architecture Dr. W. A. Singleton has a useful paper on the characteristics of Cheshire houses and the materials which have influenced them; a county so rich in timbered dwellings might naturally be expected to arouse in those who live there a special interest in domestic architecture, and Dr. Singleton's article (to which he adds a list of books on the subject) has the leading place in this first issue. It is followed by an introduction to the treasures of the Lady Lever Art Gallery at Port Sunlight by the former assistant curator, Mr. Andrew Tait; his limited space has obliged the author to devote himself chiefly to the gallery's great collection of pictures, but he indicates also the wealth of furniture, Wedgwood pottery, masonic jewels and other objects to be studied there. Two other papers are concerned with archaeological field work, another with the Cheshire clay pipe industry, and others with the county's stained glass and with the civic regalia of Chester. The series of publications now begun should do much to interest Cheshire people in their county's history and bring fresh enthusiasm to the History Committee's work. It is a pity that the few illustrations have had to be gathered in a separate section, some of them far removed from the articles to which they relate.

In the report on the sale of Part II of Mr. Lucius Wilmerding's library, published in the issue of April 20, it was incorrectly stated that the copy of Bosio's *Istoria della Sacra Religione*, 1594, with the arms of Henry of Navarre, did not derive from the library of Horace Walpole at Strawberry Hill.

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A COPY OF MILTON'S "EIKONOKLASTES"—II

By D. S. ROBERTSON

In a note in *The Review of English Studies* (Vol. VII, 1931, p. 72) and in *The Manuscript of Milton's Paradise Lost Book I* (p. xlii n. 2), published in the same year, Miss Helen Darbishire called attention to the occurrence in seven different copies of the first edition of *Areopagitica* and in five different copies of the second edition of *The Doctrine and Discipline of Divorce* of an identical series of contemporary pen-and-ink corrections, which in her judgment are neither in Milton's hand nor confined to presentation copies. Her note in *R.E.S.* led to similar notes about pen-and-ink corrections in other early printed books by A. K. McIlwraith and W. W. Greg, but no one seems to have applied this evidence systematically to the establishment of the true text of any of Milton's prose works.

The Carbery copy of the second edition of *Eikonoklastes* contains a similar run of contemporary pen-and-ink corrections, and I have found an almost identical series in all the other copies which I have examined, namely that in the University Library, Cambridge, the two copies in the British Museum, that in Emmanuel College, Cambridge, and that in Christ's College, Cambridge. There is, however, no trace of them in the presentation copy in the Bodleian, which was kindly examined for me by Miss Darbishire.

One of those which I have seen, the Grenville copy in the British Museum, is also a presentation copy, for on the titlepage is written "G. Duzy 1650" and below "Ex dono authoris." Both inscriptions seem to be in the recipient's hand: Dr. French's identification of him with John Durie (*E.L.H.* iv 1937, p. 311) is impossible. It should be pointed out that the Carbery copy is unusual, perhaps unique, in preserving its original wrapper, and that some other copies, which have lost their wrappers, may have had presentation inscriptions on them.

Internal evidence proves that most, at least, of these pen-and-ink corrections in *Eikonoklastes* express the author's choice, and this conclusion is confirmed by the fact that almost all are implied by John Durie's French translation (London, 1652), described on its title-page as "Le tout traduit de l'Anglois sur la seconde et plus ample édition et revûë par l'Auteur." Richard (p. 324) was set up from a photostat of a copy in Yale University Library which he compared with one in New York Public Library.

The pen-and-ink corrections are as follows:

(1) Preface, p. A 3 r. l. 5. The word "in" is duplicated: the first "in" is crossed out in C U L1 L2 E X, but not in O.

(2) Ch. II, p. 19, l. 21: "But that indeed it was a facil conscience? and could dissemble." The indefensible question-mark is crossed out in C U L1 E X, but not in L 2 O. A has a comma; B prints a comma, but H prints the question-mark.

(3) Ch. IV, p. 35, l. 27: "Papistical innovasions." Corrected to "innovations" (the reading of A) U L1 L2 E X but not C O.

(4) Ch. VI, p. 51, l. 23: "Was it not the shame of his manifold errours . . ?" A omits "not"; "not" is printed but crossed out in C U L1 L2 E X, untouched in O. D has "étoit-ce la honte." B omits "not" but H prints it.

(5) Ch. VI, p. 52, l. 26: "in case of so high concernment." A has "cases": "case" altered to "cases" C U L2 X, but not L1 E O. B prints "cases," H "case."

(6) Ch. VI, p. 57, l. 14: "If then the King be only set up to execute the Law, which is the highest of his office: he ought no more. . . ." A has a comma after "office": the colon is altered to a comma in C U L2 X but not in L1 E O. B prints a comma, H a semicolon, perhaps from the misreading of an unobserved pen-and-ink correction.

(7) Ch. VI, p. 61, l. 17: "what his own, or the Churches Right." A has "or" ; "or" corrected to "and" C U L1 L2 E X but not O. D has "et." B prints "and," H "or."

(8) Ch. VI, p. 62, l. 17: "the resolution may more befit a foolish than a Christian king." This is a curious case. A has "foolish," and so have all my copies of the second edition, but I mistakenly noted that in C, and less certainly in U, "foolish" is altered to "fool." In fact this effect is due to the correction of "or" to "and" on the previous page showing through the paper. I should not record it, but for the fact that D has "insense." It looks as if Durie was misled as I was, but "fool" is attractive in itself, and

(13) Ch X, p. 89, l. 14: "overspread." A has "overspredd"; all my copies have "overspread," but in U LI E X, though not in C L2 O, it has been altered to "overspredd," a striking example of Milton's interest in spelling.

(14) Ch. X, p. 89, l. penult.: "What enemy durst have don him that dishonour and affront which he did therin to himself." The passage is absent from A. In C, alone of my copies, the necessary question-mark is substituted for the full-stop after "himself." B has a question-mark, H a full-stop.

(15) Ch. X, p. 95, l. 16: "liberty of persons." The passage is absent from A: "persons" is altered to "person" in C U L1 L2 E X but not O. D has "des personnes." B prints "person," H "persons."

(16) Ch. XI, p. 110, l. 8: "could swell up to *Caligula* to think himself a God." A omits the meaningless "to" before "*Caligula*": this "to" is present but crossed out in C U L1, but omitted in printing in L2 E X O.

(17) Ch. XII, p. 120, l. 26: "so long as Magistracy and Warr is not laid down under the Gospel." A has "is" and so have all my copies, but in C alone "is" has been altered to "are." B prints "are," H "is."

(18) Ch. XIII, p. 125, l. 26: "it would in some reason be thir part." The passage is absent from A: "some" is crossed out in C U L2 E X, but not in L1 O. D has "avec raison." B omits "some" but H prints it.

(19) Ch. XIII p. 128 l. ult.: This is interesting only because it illustrates the various states of the printed copies. The words "a furious inroad of bloody Bishops" are correctly printed (as in A) in L1 O, but in C U L2 E X have become a muddle of letters, which in C and E has been corrected by hand. H gives the muddle in a note, so it must be the reading of the Yale copy.

(20) Ch. XVI p. 144 l. 7: The necessary [word] "and" after "Prayers" (present in A) is omitted in printing in all my copies, but added by hand in all except O.

(21) Ch. XVIII p. 158 l. 17: "What the Parliament in that point were willing to have don, when first after the [illegible] Petition him at *Colebrook* to vouchsafe a Treaty, is unknown." A has "is unknown" and so have C L2, but U LI E X O

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D. J. OSBORNE, Town Clerk.

Town Hall, Leyton, E.10.

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E. T. VERGER, Clerk of the County Council.

County Hall, Truro. 13th June, 1951.

Further
APPOINTMENTS VACANT
and
CLASSIFIED ADVERTISEMENTS
will be found on the preceding page
(page 395).

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tions in *Eikonoklastes* express the author's choice, and this conclusion is confirmed by the fact that almost all are implied by John Durie's French translation (London, 1652), described on its title-page as "Traduite de l'Anglois sur la seconde et plus ample édition et revûe par l'Auteur." Richard Baron tacitly adopted almost all the pen-and-ink corrections which he found in the Carbery copy, and they have thus found their way into the old vulgate, most familiar from J. A. St. John's Bohn edition. Dr. William Hallen, however, the editor of *Eikonoklastes* in the Columbia *Milton* (V, 1932), ignores both the pen-and-ink corrections and the evidence of Durie, with the curious result that this standard edition is, except for its retention of Milton's spelling, notably inferior to the *textus receptus* which it has driven into the shade. I do not know whether Hallen's Yale and New York copies have any pen-and-ink corrections: he gives no hint that they have.

The lack of pen-and-ink corrections even of obvious blunders in the Bodleian *Eikonoklastes* is surprising, especially since, as I have said, it is a presentation copy. It has on the verso of the blank page next to the title-page the following inscription:

Lib. Bibl. Bodleianae ex dono Authoris
Jun. XI CIↃ IↃC LVI

Mr. L. W. Hanson informs me that this is the handwriting of Thomas Barlow, Bodley's Librarian, 1652-60. It is, perhaps, relevant that by 1656 Milton had for several years been totally blind.

To prove the importance of the corrections I now list those which I have observed. There was some correction by the printers during the production of the edition and a few errors are altered by hand in some copies, but put right in printing in others. There is no evidence in any of the copies of a printed *Errata* list. I first list my authorities, with the symbols used.

(I) The first edition, 1649: I used four copies, but they never differ significantly where I quote them. I use the symbol A for them all.

(II) Copies of the second edition, 1650. (1) The Carbery copy: C. (2) The Camb. Univ. Lib. copy (Bb*.9.47): U. (3) The Grenville copy in the Brit. Mus. (G.11718): L1. (4) The other copy in the Brit. Mus. (599.c.18): L2. (5) The Emmanuel College copy (330.4.86): E. (6) The Christ's College copy (Cc.4.1): X. (7) The Bodleian copy (4° Rawl. 408): O.

(III) J. Durie's French translation, 1652 (the Camb. Un. Lib. copy): D.

(IV) Later editions. (1) R. Baron, 1756: B. (2) W. Hallen (Columbia edition, V) 1932: H. Hallen's text to "fool." In fact this effect is due to the correction of "or" to "and" on the previous page showing through the paper. I should not record it, but for the fact that D has "plus propre à un fol, qu'à un bon Chrestien." It looks as if Durie was misled as I was, but "fool" is attractive in itself, and it seems just possible that Milton accepted this accidental change as an improvement and told Durie to use it.

(9) Ch. VII, p. 64, l. 18: "how great mischeif and dishonour hath befall'n to Nations." A has "to," and so have all my copies, but it is crossed out in C. B omits "to," but H prints it.

(10) Ch. VIII, p. 67, l. 2: "who had already made som attempts, & the latter of them under a disguise, to surprise that place." The passage is absent from A. The sense requires "former," and this correction is made in C U L1 L2 E X, but not in O. D has "le premier." B prints "former," H "latter," but with a note "probably should read *former*."

(11) Ch. IX, p. 82, l. 18: This important passage needs a rather long quotation. "To the passing of those Bills against Bishops, how is it likely that the House of Peers gave so hardly thir consent, which they gave so easily before to the attaching them of High Treason, 12. at once, onely for protesting that the Parlament could not act without them. Surely if thir rights and privileges were thought so undoubted in that House, as is heer maintain'd: then was that Protestation being meant and intended in the name of thir whole spiritual Order, no Treason: and so that House it self will become liable to a just construction either of Injustice to appeach them for so consenting, or of usurpation. . . ." In the closing phrase "consenting" is altered to "protesting" in C U L1 L2 E X, but not O, and D has "ou d'Injustice pour les avoir accusez à cause de leur Protestation." Careful inspection shows that "protesting" must be right. In A, Milton wrote "either of injustice in them for so consenting," where "them" is the House of Peers: in his revision "them" becomes the 12 bishops, and this requires the change of "consenting" to "protesting." B missed this correction, or more likely rejected it, and H prints "consenting," so that except in Durie's French the true reading has probably never been printed till now.

(12) Ch IX, p. 84, l. 13: "And that the King who of Princely grace." The passage is absent from A: "his" is inserted before "Princely" in C U L1 L2 E X, but not O. D has "de sa grace Roialle." B prints "his Princely," H "Princely."

(21) Ch. XVIII p. 158 l. 17: "What the Parliament in that point were willing to have don, when first after the War begun, they Petion'd him at *Colebrook* to vouchsafe a Treaty, is unknown." A has "is unknown" and so have C L2, but U L1 E X O have "is not unknown," but with "not" crossed out except in O. D has "On ne sait point." H prints "unknown" without a note, so it must be the reading of the Yale copy, but B surprisingly prints "not unknown," probably by an easy slip.

(22) Ch. XXII p. 178 l. 20: "an hireling Army." A has "a": all my copies have "an," but it is corrected to "a" in C U L1 X. B prints "a," H "an." This is another interesting proof of Milton's care for spelling and pronunciation.

(23) Ch. XXVII p. 211 l. 16: "hypocritical." The passage is absent from A: in C, alone of my copies, the second "l" seems to be crossed out.

I ignore a few obvious slips of typesetting corrected by hand in some of my copies, *e.g.*, on p. 63 ll.4, 5 and p. 164 l.1, also the incorrect or inverted printing of some page numbers in some copies, which, as they have not been touched by hand, serve only to illustrate the various states of the printed text.

From all this it seems clear that any future editor of *Eikonoklastes* must carefully compare as many copies of the 1650 edition as possible, and should not hesitate to admit to the text at least those pen-and-ink corrections which are found in several copies, especially when they are confirmed by Durie's translation. Miss Darbishire's notes on the pen-and-ink corrections in *Areopagitica* and *The Doctrine and Discipline of Divorce* suggest that the same principle might profitably be applied to other prose works of Milton.

Since this was written I have seen a note by Dr. James Craigie in *The Scottish Historical Review*, XXX, 1951, pp. 107 ff., which calls attention to a closely similar series of identical pen-and-ink corrections in six copies of King James's *Poeticall Exercises at Vacant Houres*, 1591. R. P. Gillies, who used one of these copies for his reprint of 1818, silently adopted the corrections, just as Baron did those of *Eikonoklastes*; Gillies's copy happened to have belonged to Ben Jonson, to whose hand he attributed the corrections, but Dr. Craigie considers that they must have been made in the printing-house.

(*Concluded. The first article appeared last week*)

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LIST OF ADVERTISERS

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Of the annotated (Anatomy of Trunks)
Manuscript corrections:
the addition sign ¦ K is precisely similar on
p 62 + on frontispiece of Anatomy of Trunks. etc
The extra correction of right hand arm.
The handwriting of corrections is very closely similar except that a different type of "e" is used.
whereas in Anat. of trunks it is ε or e

I think the final conclusion must be that the form of the e precludes these corrections being Grew's.

The same ink corrections as in my copy are in the Univ. Lib. 1681 copy M.14.22
+ the Univ Lib 1686 copy Lib. 3.68.3.
The 1686 version contains different portrait of Daniel Colwall as an older man to R. White delin. et sculps. 1681.
The Univ Lib. 1681 copy has not got the portrait at all.

It is clear that the corrections, as they are exactly reproduced in the four copies, must have been done in the publisher's office.
The 1686 is (see B.V.C. Cat) of 1681 version with another title page.
This is confirmed by the corrections ~~now~~ being marked in as in the other two
These corrections show Grew's extreme care & desire to get things right.

Royal Society 1694 edn. seen May 15. 41 the [illegible] lent to Lincei has identical corrections in ink on
pp 62, 181, 231, 312 [I cannot find pp 343, 385]

The Comparative Anatomy of Stomachs and Guts Begun. Being several Lectures Read before the Royal Society. In the Year, 1676. London. Printed by W. Rawlins, for the Author, 1681

units of measurement. Difficulties
p6 uses "the breadth of a Marsh-mallow-Seed or little Spangle" as a basis then describes glands in the Vaccum of a Dog

human trait
p20
And there are few, but my remember, how different wrote, when they were Boys, & drunk written Heads down and spring.

tolerance
p21
Grew is not by nature a controversialist & here when he differs from Dr. Willis on an anatomical point he adds: "The Doctor's Books, of whom I have learned much; & therefore I mention these things, only because they lie in my way; & that we may still remember Nullius in Verba"

p32
He corrects a mistake of Willughby to amend others, he adds: "This was only a slip of that man's accurate Pen" But in humanity but he adds "I would have the sight of animals occurring & exactly represented". in p 62 he ~~cultivated~~ Willughby's figure of the ... learn, ...

Amount of dissection done

p. 1.
He describes the Stomachs and Guts of six Carnivorous Quadrupeds, viz Mole, hedgehog, Squirrel, Rat, Rabbit, Hare & Pig, Sheep, calf

About 40 birds of which he describes 13

Fish, Salmon, Jack, Tench, Barbel, Bream, Plaice, Perch, Roach, Whiting, Trout, Cod

15 Shell-creatures, about 12 fish

i.e. he studied ~~to~~ anatomy of a diversity of animals carried of dissection of 15 quadrupeds, about 40 birds of which he describes 13, & ~~12 fish~~ a ... (which he describes) account of 12 fish: ~~His~~ Seven of plates how the figures drawn not on an exact scale unlabelled, though he gives relative measurements of results of his dissections.

Cosmologia Sacra: or a Discourse of the Universe As it is the Creature & Kingdom of God. Chiefly Written, To Demonstrate the Truth & Excellency of the Bible; which contains the Laws of his Kingdom in this Lower World. London. Printed for W. Rogers, S. Smith, & B. Walford: At the Sun against St. Dunstan's Church in Fleetstreet; & at the Prince's Arms in St. Paul's Church-Yard, 1701

Ded. to William III, also to the Archbishop of Canterbury & the Archbishop of York

on perfections of Chemist (6)6

46

The Preface

The many Lewd Opinions, especially those, Anti-Scriptural, which have been published of late Years; in Latin, Dutch, & English; & by Spinosa & some others; have been the Occasion of my Writing this Book. As seeing too, that many Men of Education, as well, & of late more Bookish, than ever, both Citizens themselves, & some of their Apprentices, are thereby dangerously infected. There is no man can but see a Play of this Tooth, among ... Apprentice, who can but see a Play of this Tooth, formerly all his Vice & Prophaneness; & his Bible stuffed with Thieves, Whores, & Actors, by this, & his ... the Authority of the Heralds, therefore, & contributes towards the City & Kingdom, against a Contagion so dreadful in itself, & the Consequences of it. ...

I can truly say too, That the Writing, neither of This, nor of any other Book, hath in any time occasioned the omission of my Duty as a Physician in London. It is very well known, That I have no other than my Spare Hours. And I will believe any Day, but he hath his Spare Hours, & if I have dedicated my Own, unto this Work, it is Excusable.

And having addicted my self, to the Contemplation of Nature, from my Youth upward: as I hop'd, I was in some measure qualified, for an Essay of this kind; so I concluded, the applying of my small Talent hereunto, to be the Best Use, I should ever be able to make of it.

In "The First Chapter Concerning God", ... I have Demonstrated the Nature of God, a Priori; viz. from the Necessity of his Being. In the following Chapters, a Posteriori; or from the Universe, his Handy-Work.

He mentions that his astronomy is all second-hand.

"For all the following Chapters (III onward A.A.), both of Things, & of [illegible] to Sense & Their Books; to mention only excepted [illegible]: Historical: Nature hath been, in a manner, my only Book: Which I have Read, & Copied, as exactly as I could. In doing of which, I have purposely avoided the perusal of some Works of much Esteem. That this Copy of Mine, might be no where Interlined, nor my Thoughts diverted, from their own proper Motion & Compass."

He speaks, being learned Hebrew [for his independence of mind, for the purposes of the book] [for his [illegible] & learning]

"I have made no Quotations, in proof of any Assertion or Opinion, Excepting in point of Fact. And have seldom troubled the Reader, or my Self, in answering Objections. For, if the things I have Written are True; as no Authority can make them Truer; so a thousand Objections cannot make them false.

The First Book begins

It is very Natural, for all Men to desire, in the enjoyment of what is agreeable to them, to be Happy. It is therefore as natural for every wise Man to enquire, Whether there is not a Supreme Being, who is supremely Good; and communicable to us: so in the enjoyment of whom, our chief Happiness must exist.

p5

nothing ~~Made~~ ... can continue to Be, by virtue of its own first Being ... it is continued in its Being, by the same Divine Power, whereby it first began to Be.

p11

The Royal Society must have been a stimulating place in those days

~~Also some~~ ~~famous physicists~~ "

Also some famous physicists" as I have heard the learned Mr. Newton affirm.

"The Principles of Bodies"; which, as they must of necessity have their Dimensions, and therefore their Shape or Figures; so they may be Infinitely Small, not only beyond all natural or assisted Sense; but beyond all Arithmetical Operation or Conception.

pp 12-13. He seems to mean by "Principles" the ultimate units of composition.

p16

chemical essence of plants

The Dew upon Windows, and Water upon flat, smooth, and broad Stones, will sometimes be elegantly flourished with a Vegetable Form, the Congealing Principle being assisted herein, by the Volatile Parts of Plants, which continually perspire, and have in this Lower Region of the Air in greater Plenty.

p17

In the Woody Parts of Plants, which are their Bones, the Principles are so compounded, as to make them Flexible without Joynts, and also Elastick. That so their Roots may yield to Stones, and their Trunks to the Wind, or other force, with a power of Restitution. Whereas the Bones of Animals, being joynted, are made inflexible.

Structure & function

p18
"The Geometry of Nature" in the Structure of the Parts of Plants.

p20
Lusts multiplying glands.

p23
The Water flows, the Wind blows, the Rain falls, the Sun shines, Heaven & Earth act & move, & all Plants live & grow, for the Use & Benefit of Sensible Creatures. And all inferior Creatures, for the Service of those above them.

anthropocentric attitude

The Eye, the "Stupendious Machine"
p25

eye p26
Nor is it only a Window, whereby a Man lets all the World into himself: But also a Door, whereby one Man lets himself into another. Love & Hatred, Envy, Fear and other Passions, by some Certain Motion or Posture of the Eye, or the Eye-lid, may be discovered. And in all manner of Conversation, what ever is said, or done, the Eye is every where Master of Ceremonies.

See Thomas Browne &c

"Whatever is is best" — p29. "For he must Argument have been made ... a Reasonable Bird ... But ... or could he have been less Sociable. For upon had he been, Bird, he had been less Sociable, & other every time a false ground of fear, or discontent, or other occasions, he would have been fluttering away to some other place: And Mankind, instead of cohabiting in Cities, would like the Eagle, have built their Nests upon Rocks.

(Grew, might seem of reasons gained — man being ugly "Whatever is is best" Why not man man a messenger of ...
other than he is.)

p43
No man could draw a Picture, or compose a Tune; if he had not every Stroak of his Pencil, & every Note, drawn & Sung in his Phancy beforehand."

? true ... ... my ...

p 47 5

How Excellent a Faculty of the Mind, is Phancy, that can see without Light? Can Hear, without Sound? And Imitate (sic) all the other Senses, without Use of the Organs of Sense. Can at once, perceive, what the Senses perceive distinctly, and several times? Can Travail over the World, while we sit still? And drawing a Landskip of the several Countries, Persons, & Things, seen or heard of by us, in their proper Time & Place, lay it all, into a Dark Room? All which, is ordinarily done in Common Discourse.

p 48 The notion of universals

The Notion ... of all Vital Beings, is utterly out of reach of Sense. ... And the Nature too, or Essence, of all other Beings As the Definition, suppose, of a Point. Which, ~~in regard it~~ cannot possibly be either Seen or Phancy'd; Among ... is peculiar Understood. ... the forming of Universals into an Intellectual Mind.

If you shew a Dog, a House, by the Name of House; he will know it again, as that whenever you say, House, he is directed to look upon. Individual piece of Building, whereby when you But the Housity of that Building, House in London, say, House, you understand any other House in London, as well as that; he can have no conceit of.

p 49 And the first point of good Understanding, in Ratiocination truly so call'd, is, To Doubt, in order to the finding out of Truth.

(Descartes AA)

noticed

p 52
Truth, is the Agreement of Things
[with] speech opposing of words

p 60

[For in all good Speech, there is a sort of Musick; with respect to its Measure, Time, and Tune. Every well-measured Sentence is proportional Three ways; In all its Parts, To other Sentences, And to what it is intended to express. And all Words, have their Time allow'd to their Syllables, as is suitable to the Letters whereof they consist; & the Order wherein they stand in a Sentence. Nor are Words without their Tune in Notes, even in Common Talk; which together, compose that Tune, which is proper to every Sentence; & may be prick'd down, as well as any Musical Tune.] Only in the Tunes of Speech, the Notes have much less Variety, & have all a Measure, the Poetick with respect also to Time & Measure, than that of Oratory. short-time. is less Various, & therefore less Powerful, the former, being like that of a short Country Song repeated to the end of the Poem. But that of Oratory, is varied all along, like the Divisions which a skilful Musician runs upon a Lute.

noticed

p 62
The best Cure of any Passion. For few People having Reason enough to master their Conceits: the ready way, is to serve one Conceit, to master another.
J. Spinoza
Spinoz. Ethics. Prop. VII p148 Everyman

p 63
He that pleases himself over-much, in the Surface & Colour; his own Vice or anothers: will seldom look into, much less to the Centre of Things. p 63

Exalted ~~[illegible]~~ artistic attitude or game to

Of all Opinions, some of these, we lay up in our Younger years, are most prevailing. As being first sown, having time to take Root & spread themselves. So as not only to abide the later Encounters of Reason; but by these to grow ~~the~~ Stronger: as some Roots hold the faster, the harder they are pulled. A point of great Consideration, in the Education of Children.

adoption of originative children impressions

p67 Mecenters | Mecenages 52

to the Use of Spectacles, by an Adequate Connection of Truths, gave Men occasion to think of Microscopes & Tellescopes. Apart of [illegible] With the Inventors; yet was the Art of Spectacle-making improv'd.

p61

For every Truth being productive; there is no Truth which can be despicable. Many a Peasant has been Ancestor to a Prince. He that first made Gunpowder, did not think, he then first began to introduce a new Scene of War. Nor the first Spectacle-maker, that he was leading the way, to the Discovery of new Planets. Nor the first Observer of the Loadstone, that he was finding the way into a new World. [illegible] on progress

p62

Friendship can make Truth & Goodness once perceived; not the desirable & lovely above all things.

p63

Understanding, being expressive of Learning, among all [illegible] Mountains. Every Truth ~~[illegible]~~ shines into its own Beams; & lends them, for the Discovery of other Truths. process of discovery

print 63 of [illegible] 73

Begin of copying par. 8, p63 (~~2 the 63~~)

The Kinds & Degrees of Goodness, may also be

§8 Considered, in relation one to another. In the Congruity of their Relation, the Perfection of every thing consists. Flying is a more Excellent Animal-Motion than Creeping. Yet, if a Catterpillar had Wings, which hath no Eyes to govern that Motion; it would be a Creature, not more, but less Perfect. whatever is being [illegible] perfect

p64 §9 The Gradation of the Parts of the Universe, is likewise necessary to the Perfection of the whole. Which consideration very much, in the Order of Things. So that

Thing, though not Equal in Goodness to an other, yet is then perfect, when it hath all the Goodness it ought to have. That is, when it hath all its own Convenient Parts, & when it hath the Convenient Relation to other things, as is it selfe a Convenient Part of the Universe.

§12 all Virtue, or that we call, Morality, is founded in Truth. And consequently, cannot be variable, as some Men think, with the Opinions & Manners of Men; as if those things were "Virtuous" in one Country, which are Vitious in another.

§19 p73 Virtue, is the Entire Operation of Human Mind & the Sway of Phancy, In which there is a certain "Symmetry" under the Command of Reason.

Begin §20 p73

§20 A clear Reason, acting in Conjunction with a well Disciplyn'd, but strong & vigorous Phancy, will seldom fail to attain their End. Phancy, without Reason; is like a Horse without a Rider. And Reason without Phancy; is not well Mounted. But those who are so happy as to possess them both; are usually the Authors of the greatest Performances. When Phancy neither bridles Reason nor drives it forward; but is the Flying Charriot wherein she rides on, in the Prosperity & Success of [illegible].

[illegible] might be design [illegible] Grew's Saints

§24 Wherever ... any one Virtue exists; there is a disposition unto all Virtue: As consisting every where in Proportion.

§31 p74. "Intellectual Love" "the Love of whomsoever or whatsoever is Good."

p75
Quote Aristotle's Ethics no detailed references.

p75
§37 "a growing Greatness of Mind" ... is promoted by Humility. "For who will take one Step further, that deems he hath no further to go?"

p76
§39 "we may as well weigh a Peacock's Tail, against a Prince's Crown; as the former Parts, against any thing great and weighty, whether the Cares and Pains which are equally great."

pamulosity

p76
A Philosopher therefore, properly so called, is one that enquires so far into the Particulars of Art, and Nature; both into the Nature of Man, and of all other Things; and into their Relations one to another; so as to be able to adapt them to the Methods of Life; and to use both the Arts and their Masters, for the private and Publick Good."

p80
§14 .... For if the Transition from Humane unto Perfect Mind, is made by a Gradual Ascent; we cannot conceive, that the Personal Relation, which Mind hath to Body, should be quitted all at once; but answerably, by degrees: till we come at last, to Abstracted Mind, advanc'd above all Corporeal Nature.
15. Abstract Mind, in its Consummate Estate, is, I agree [illegible] Abstracted from Body, is evident. For you be the [illegible]. Thus the Abstracted from Body, the united unto Mind: then is the Perfection of Body, the Abstracted from Body. And how came he Perfect Mind. Perfection of Mind, the Abstracted from Body. God himself, is the more Pure and Perfect Mind; otherwise, then as God hath made Body, which is wholly Dark; and of them, God hath made [illegible] Side: we must believe he hath Embody'd Mind, with Dark who make a Mind, as far as it is capable, wholly Light,

p 81

7 + neares in Likeness to himself. As therefore a sensitive Body, or Imbodyed Mind, are the two proximate Parts; so Abstracted Body & Mind, the two Extreams, of the Visible & Invisible World.

§30, p 83 (+ 82)

We must go above [the Heavens] to the Pure Mind, ... unto Single and Uncompanied Mind. To transcend is severed, not only from Body & Sense; but also from Phancy; existing, as an Abstracted Understanding Mind: of all the Species of Superior Mind, merely we can have any Distinct Conception thereof ... Intellect under one Mind; "being Order: "in Mind "Phancy & Intellect ... Corporeity; may see, that it sees, freed, for the Shades of ... the first View: Just in Conformity with Intuition, or as the ... Reminiscence; or Phancy, may be obliged to see things, either of ... one after another. But the some other way of Succession, ... between Intuition, Supream Created Mind aforesaid, ... purely enjoys, Contemporary View of every Thing.

p 84

+ to ... Intellect, can ever be drawn, is a Contradiction to say, ... adhesion unto Truth & Rectitude.

p 85

from its ... from Being; ... Being of nothing can continue to Be, by virtue of its ... Continued Being of Things: the Divine Energy be necessary, so the ... There is also, of their Operation."

mechanical ... a ... analogy ... of man

p 87

the Whole [Universe] is not a meer Aggregate, or Heap of Parts, but one great Engine, having all its Parts fitly set together, & set-to-work: or one Entire Movement, Divine Art. To suppose then, either to stand still, or to move irregularly, in the Whole, or in any the least Part, without the supervening of a New Divine Power: is to suppose the Author of it, not to be his Arts Master.

"as Reason governs the whole Body; so God, the Supream Reason, governs the whole World."

p 88

The Sun ... By its light, it exhibits the Furniture, & conducts the business of the whole World. And in shewing all the varieties of Colour; becomes the Paint & Varnish of Visible Nature.

p 97 Commissure of Joints

Nor is the Body fitted only to preserve, but also to cure, & mitigate Diseases ... Besides Wounds, of hope-clean, & from the Air; for which the Use of Plaisters in Wounds, chiefly consists: the Flesh will glue together, which is our Native Balm.

p 99

Corn, so necessary for all People, is fitted to grow, all over the World. A seed, as a free Denison,

p 101

Contemplative men, may be written the Pleasure, of Laying open, or Discovering the Secrets of State, at Home, or in other Countries. And Men of Action, taken up in the Pleasure of business of the World, are commonly without the Tracy & Secrets of Divine Art, so unsearchable is the Affectiveness of Nature.

(Walton, Angler i. 15, 1653. Is not yet resolved whether contemplation or action be the chiefest thing.

more of action

2 Hen. IV ii 4. 106

p 105

Complete optimism down to government of World of providence.

.. As believing, that He, who is maker of World, brought Light out of Darkness, & all things out of nothing: Can never fail, in the Government hereof, to bring good out of Evil; yea the greatest Good out of the greatest Evil

Chapt III p105 Of Providence over Publick States.

In the use of Sundry Means ... among which, the Counsels, & Effects of War, have ever been the Chief; The Deity fails not, to exhibit his Justice Benevolence & the World.

Chapt IV p115 Of a Celestial Life

the Stock of Matter, is always the same. ... And ... the Stock of Motion in the World, is likewise, without diminution, always the same.

p116

the Clear & Strong Conception, which the Mind of Man hath of Futurity. Pillars, Statues, & other Memorials, are a sort of Shaddow of an Endless Life; & shews an Inextinguishable Desire which all Men have of it. ... If Man ... were not intended for an Endless Life: His Faculties would have been Extra, & than an Endless Life, his intended End. And so, there would have been an Over-match to his intended End ... & Ideas of Things, & in his Faculties, & no answerable Works: As having made a Creature, unworthy of the End." [This argument is only one imagines; & is a reflection of Descartes. SH]

God being ~~ignorant of~~ may be called god an impossible ~~Effect~~

p117

Of [God] maintains the Being, & state forecast the Use, of every single Atome: He much more, having made the Mind of Man, hath he also forecast the Disposal of it, unto which Condition, here & every where, as it is for fit?

p120

And it is therefore reasonable to believe, That all those who shall be placed in any Station of the Blessed Life: Whereby by orderly Removes, be translated from one Station to another. Man being first advanced, above the Phantastick Union with Corporeal Nature; & above the Phantastick afterwards: they shall ascend, at length, unto their Estate, which enjoys the nearest-Station to the Deity; viz. that of Abstracted Intellectual Minds.

Which Estate, in regard it will not Consist with any Personal Relation, unto Phansy, or Body: Nor therefore, with any Sensible Relation, unto Motion, & Time: it seemeth to be translatio, which may properly & strictly be styled, Eternal Life."

p.124
Moral Good & Evil, are not founded on Custom or Opinion; but on the Immutable & Eternal Reason of Things.

p.124
And this Love, [our love of God] will oblige us to [illegible] & [illegible], every vain & unpious Conceit, in our selves, or others, of the contrary. As if it were below the Deity, to be any way Concerned about us; either to love us, or to value our Love. Whereas, if he pleases himself, in giving us our Being: it is impossible, but he must be also best pleased, when he sees us act according to it.

[Cf Spinoza "He who truly loves God will not hope that God will love him in return) Ethics. Part V Prop. XIX He who loves God cannot endeavour to bring it about that God should love him in return. Immutability]

p125
He thinks that when we pray we express [illegible] to move him, nor to have anything unless it accords with his Will. "But if Men sometimes petition [illegible] for these things [illegible] a Respect, must be granted: we [illegible] in a Respect, [illegible] Deity."

p 133. The Same Book.
Shrewdly [illegible] the Bible ... is God's Positive Law
Discusses chastity of Hebrew scriptures manuscripts of Old Testament (p 137a), copies before the

p 138. "And then, there were in the Library of Cleopatra, [Greek] translation, & of the Hebrew Code, is acknowledged by all.

p.135 "The Translation of the 72" is still used in the Greek Church made for Ptolemaeus Philadelphus about 300 BC. p 136

+ he [illegible] the basis of our Old Testament in English.

p143. He does not believe in the absolute inspiration, every word of the text, but he admits a few errata - says in "Nor are these few & lesser Errata found therein, inconsistent with its being of a Divine Original. For we are to look upon it as

Divine, only so far forth, as the Contents hereof were given by God, or transacted, in some extraordinary way. But as it was written, and hath been copied, it is, and must be called Humane. And to that instead of any gain we have, to expect the Copies to be, of the Divine Book, without Errata: it's a great Wonder, there are no more in it, than those we find. And argues, that the great Sanctity hereof, and the profound Regard men have had for it, from the Beginning; has been the Cause of it: for that the Copiers of this Book, had they been employed in copying any other, would have made Errata infinite more.
(sic)

p143

God may as well permit Errata in the Bible, as in Nature: he's as much the Author of the one, as of the other. Is it then impossible to distinguish the Divineness of this Book, from that which is Humane? Is the Design or Model of a good Piece of Architecture the less undervalued, because in the Work, there's a Brick or two broken by the Workmen, or misplaced? Is it of sound Reason, to make Nature capable of some other Default; of Judging, and then a Monster, or of making Beauty? shall we disown the Divine Stathos apparent in every Beauty of a very well-shaped Animal? Will we deny tolerance him, or from whose Hands it came, because of its Spots?

p155. He thinks that the Greeks were much indebted to the Old Testament, especially Plato

p162

No Book was ever so well writ, but through Ill Will, or Mis-understanding, it has been undervalued. And so it fares with the Bible it self. As Bad Men take it to be their Interest, so Witty Men, their Reputation, to say, as others do, make it a Fable. And they who are weak, some, from the Matter, others, from the Style, Method, or in some other account, either tax it with Falshood, or think meanly of it. And some, only because it is become Cheap and Common. As many People admire the tail of a Glo-worm, which is a rare Sight; more than they do the Sun, which shines upon them every Day.

p170 Grew's plan in Naturalist's Psalm

"The 104th Psalm, is an excellent Epitome of Natural History: delivered in exact Method; & elegantly, yet freely & unaffectedly exprest: so as to be fit for the use of plain Men, as well as Scholars."

p175

The Book of Job, I take to be, neither a History, as some do, nor a Parable, as some others; But a Divine Vision, made to the Prophet Isaiah; & grounded upon the real Story of Job. ..... ~~Which is made to St. Job~~ Which Book, especially toward the latter End, where God himself speaketh, & reads a most ~~[illegible]~~ methodick & Noble Lecture of Natural History, hath no where a Match

p178

In reckoning the Years of the Reign of King Charles the Second do in all publick Records, begin from his Father's Death, & those wherein he was in the Years of his Banishment, talking he actually reigned?

Detects contrary in Spinosa also to the

P179 Testament — "to what Reason have we to regard the Criticisms

p180 of so vain a Writer.

p180. Such Spinosa's conclusion "Tam Legem Divinam, quam Scriptura docet, incorruptam ad nostras manus pervenisse." ~~[illegible]~~ and "Et praeter haec, alia sunt, de quibus non possumus dubitare; quin bona fide nobis sint tradita; nempe summa Historiarum Scripturae, quia notissima omnibus fuerunt." "Which Invention, not for that we need his Testimony, or think it of any Value: but to show that Truth will dazzle the boldest Enemy, when it looks him in the face.

(unlike Bacon etc. (Natural Organon p 37) condemns the attempt "to found a natural Philosophy on the first Chapter of Genesis") 61

pp 184 etc [illegible]

p185

A detailed discussion of the credibility of Genesis story of Creation, including a Defence of Noah's Ark as containing an adequate amount of space for all the creatures which were described as housed within it.

p185

Believes in the derivation of all mankind from one man.

"Which way soever Islands came to be made; and is it necessary to suppose they were all made at once. As England and the Isle of Wight were formerly Continent: so in all likelihood, were many other Countries, now become Islands. As England and France; and why not Africa and America? There are but 24 Degrees between the most Easterly of Brasile, and the most Westerly Part of Africa, and therefore very likely they were once joined abutt upon one another. It was therefore only [illegible] with a Neck of Land.

earthquakes, land bridges

p187

No History, Romance, or Dramma, ever gave us a Composure, fuller of moving Scenes, than the Story of Joseph, wherein the Reader of a few Leaves, lives as many Years as Joseph did, [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible] a Consort of weeping Jays avoid joining with him at last, in a Consort of weeping Jays

p195

Miracles in the World, but what is indeed Daily miraculous, Ages, there is nothing in the World, in the Course of Nature, and in the Common Progress of its Relative Perfection, viz. in its own Nature, which, can we ever search out into Perfection. Universe: Nature of which, can we ever search out; yet of the Effects, But howsoever the Cause be unknown to us; yet the Effects of it be ordinary; that is to say, very frequently seen [illegible] [illegible] of it; it is not look'd on, as a Miracle. So is not, for Instance, the Splendor of the Sun: tho' no Miracle can be more admirable.

p203

Quits! Latin argues against Spinoza's remarks about the miracle of Joshua when the Sun and Moon stood still, and about Isaiah's prayer sending back the Sun 10 degrees.

p 316 I allow, too, that also infer, ... that Nature it-self is a Standing Miracle: the Operations whereof, we should as much wonder at, as any Miracle, if we did not see them every Day."

Daily miracle of Nature.

Notes from my photostat copy of the annotated pages in the copy of Cosmologia sacra in B[ritish] Museum

C. 44. g. 1

(I have not found the annotation which ~~Boult~~ Boulger quotes
"In culpa communis ... 17 III 2)

p 6. "That a known B is not X is surely no proof of an unknown A = X."
"But such must be the sophistic result of any & of all, wisest of the ~~Wt~~ pretensions to understand God by or without the Will of God. It is an attempt to see the Sun by Moonlight."

on blank page (I do not know whether at beginning or end of the book, a few-many notes including

"Matter ~~only~~ may be imagined without Spirit: Spirit may be conceived without Matter; but Matter cannot be conceived without Spirit, nor Spirit be imagined without Matter. Again Matter implies Spirit, for Spirit is the Substance; but Spirit does not necessarily imply (or rather supersume) Matter: for Matter is only an Accident of Spirit.

At top of same page
"It is from admiration of J. N. Grew, & my high Estimation of (I am almost tempted to say), than the Reasonings in his Pages, that have led him to the perception of the essential Chapt. III against phaenomenality of Matter

All is Spirit: but Spirit must be contemplated as − Sp + Sp.
And to account for − & + as follows —

p1 This Chapt. I — it is not all I could wish it — it does not grapple with the only, for men who attach a distinct meaning to their words, the only possible Question: Anti-Atheism? or Pantheism? Deus, quamvis Mundus non esset? or Deus Mundus? — for Atheism in any other interpretation — is mere blasphemy of a babbling Bravado — Yet O how it does not* to the shame of our Theology of 1833, weigh down the 8 Bridgewater 8000 £ Treatises S.T.C.

* If the word is rightly read as "not" the sense seems to demand "does it not" A.A. Feb 4. 41

Young, James. Malpighi's "De Pulmonibus" Proc. Roy Soc. Med. Vol 23 Part I 1930 pp 1–11 P. 300. 6. 161. 55 67

Malpighi discovered capillaries. Speaks of Malpighi's pure Latin. The 2 letters De pulmonibus with to Borelli "to ~~the~~ Praeclarissimus ac eruditissimus virus" "Moon the amiable author adored as his guiding star, although we may consider him much inferior to his correspondent in nearly every scientific qualification. Malpighi was a humble-minded man who accepted others as teacher and dictator;

Young translates "De Pulmonibus"
p 9. Malpighi speaks of using transmitted light with a simple lens in examining the frog's lung, "you will see this very well if you examine it by the microscope of one lens against the rays of the sun"
Also describes the use of transmitted light with the "microscope of 2 lenses"
Compound microscope of the lung

Leeuwenhoek
Phil Trans Vol XI. 1676 P.340.1.6.85.9
July 18. 1676 p 653

Monsieur Constantin Huygens of Zulichem showed him Grew's Comparative Anatomy of Trunks, but by reason of his "unskilfulness in the English tongue," he "could have little more than the Contentment of viewing the elegant Cuts."
He sent a figure of a transverse section of an Ash-Sprig of a year's growth, which is a slight improvement on Grew's drawing in that the tissue is rather more distinctly cellular, whereas Grew was apt sometimes to indicate a matrix. But in an accompanying detailed drawing of a ray seen tangentially, a matrix is shown.
There's also a detailed drawing of a pitted Vessel, perhaps the first to be figured, tho' Leeuwenhoek misunderstood it, & thought it consisted of "globules"
The figure is the first of two folded plates between pp 646, & 647

DNB

Sir Thomas Millington 1628–1704.

b. Newbury. Westminster. Trinity. MD Oxford 1659

Took part in Wilkins, Boyle, Wren, Willis & Oxf. meetings which originated R.S.

1675. Sedleian professor of Nat. Hist. at Oxford. retained post until his death.

(Article by G. S. Boulger)

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25 Mar 1712

b. Chesham – Parish Church. Dodson fam. vault [illegible]

m. Elizabeth Dodson

Obadiah Grew. Balliol Coll.

Sundry [illegible] 1648 Grew pleaded w Cromwell for King Charles' life. Later he seems to have [illegible] Cromwell at Whitehall & they remained.

He welcomed the Restoration. ~~outbreak of Civil War~~ outbreak of Civil War [illegible] [illegible] Parliament [illegible] [illegible] his [illegible] was conveyed in 1682 [illegible] [illegible] the Five Mile Act & imprisoned for 6 months in Coventry Gaol.

Ath. Oxon. 1643 & Coventry's letter on Grew's position in Coventry by [illegible] 1662 because he could not He resigned his living in 1662 [illegible] conform to Act of Uniformity. He privately relied [illegible] [illegible] preaching & founded a presbyterian congregation

[Of time bodily & references [illegible] O. Grew are of Boulger's article.

DNB Goddard as Professor of Physic at Gresham College

Biog. Universelle
Jean-Alphonse Borelli 1608–1679
Professor at Pisa. Appears interested in long things. Does not mention him as pupil of Galileo

Pierre Borel abt.-1608–1689
Wrote on inventor of telescope & also Hortus. 1666
. Observationum microscopicarum Centuria. 1656

91

Dobell, C. (1932) Antony van Leeuwenhoek and his "little animals". [If [illegible] 17th century [illegible] [illegible] dead [illegible] this)

p19 L. born in Delft in Holland, October 24, 1632
Died in Delft 26 August 1723 aged 90 years, 10 months, 2 days.

John Locke 1632–1704
B. de Spinoza 1632–1677
Christopher Wren 1632–1723
Jan Vermeer of Delft 1632–1675
Nicolaes Maes 1632–1693.

p22 ~~[illegible]~~ It has been stated that L. was a Jew, but there is no evidence of this.

p23. To the end of his life L. knew no language but his [illegible] (Dutch)

p23 At 16 he was placed in a linen draper's shop in Amsterdam. [illegible] [illegible] ... till his death in 1723 he lived in Delft.

p24. From 1654 he set up as a draper in Delft.

p29. At about 1654 he was sheriff's chamberlain in Delft.

p33–34. He was also municipal winegauger.

p37. He was also qualified surveyor.

p36 Vermeer died in 1675 aged 43 leaving his wife with eight children (all under age), an insolvent estate, & some of the world's finest pictures. L. was made "official receiver". Dobell thinks it [illegible] that he may have been a personal friend of the Vermeers.

p38 Among the Royal Society MSS are drafts of 400 letters & this exceeds 1200 ; the extant letters addressed to Oldenburg's numbered.

p42. In a letter to R.S. L. says that he cannot draw.

p45 "All Leeuwenhoek's recorded observations were

Dobell (Leeuwenhoek) contd.

described in letters. He never wrote book nor a scientific paper. ... "All his own original writings are distinguished by a certain business-like formality, but display total lack of coherence."

p 332. Dobell holds that the secret of L.'s
4 handy discoveries in protozoology & bacteriology, was some form of dark ground illumination which he kept rigidly to himself.

p 333. L. examined sections of cork etc in 1674 by transmitted light.

Bolsius 1903 Mém. Pontif. Accad. Rom. Nuovi Lincei. XX. 287
? P. 340. 4. 6. 10

Stimson D (1939)
p33. To the Puritans the new philosophy, experimental science, had special value: was a revelation of God's power in nature.

Largely due to foundation of the R.S.

Sir Thomas Browne. Religio Medici ⓒ 65 94

Everyman ed. (written 1635. published surreptiously 1642
authorized ed. 1643

p 51

(Describing to Creation)

"These six Days, so punctually described, ~~make us~~ ... rather seem to manifest the method & Idea of the great work of the intellect of ~~God~~ GOD, than the manner how he proceeded in its operation."

This exactly expresses the use of "Idea" in Malpighi & Grew's letters!

p 7

I could never divide my self from any man upon the difference of an opinion, or be angry with his judgment for not agreeing with me in that from which perhaps within a few days I should dissent myself.

The same temper as Grew — I would rather be understood than believed.

p 9.

I never ... endeavoured to inveagle any mans belief unto mine

---

15

In brief, all things are artificial; for Nature is the Art of God.

Malpighi & Grew certainly had this or a similar idea when they in 17th century compare plant structures to textiles, bread etc — artefacts of man's production.

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p 57

For there is in this Universe a Stair, or manifest Scale of creatures, rising not disorderly, or in confusion, but with a comely method and proportion.

the scale of the creatures

(Taxonomy)

Religio Medici

Microcosm & embryology

p 35
to call ourselves a Microcosm, or little World, I thought it only a pleasant trope of Rhetorick, till my neer judgement & second thoughts told me there was a real truth therein. For first we are a rude mass, & in the rank of creatures which onely are, & have a dull kind of being, not yet priviledged with life, or preferred to sense or reason; next we live the life of Plants, the life of Animals, the life of Men, & at last the life of Spirits, running on in one mysterious nature those five kinds of existences, which comprehend the creatures, not onely of the World, but of the Universe.

---

p 74
Yet I should rather without other opinions did not one digestion haunt me, (not wrung from speculations & subtilties, but from common sense & observation; not pickt from the leaves of any Author, but bred amongst the weeds & tares of mine own brain.

of Charles Lamb

The macrocosm

p 77
"our great selves, the world, whose divided Antipathies
p 77 & contrary faces do yet carry a charitable regard unto the whole, by their particular discords preserving the common harmony ... ~~keeping in fetters those powers~~

p 82
... There is no man alone, because every man is a Microcosm, & carries the whole World about him

p 83
whilst I study to find how I am a Microcosm, or little World, I find my self something more than the great. There is

Religio Medici

(p83) surely a piece of Divinity in us, something that was before the Elements, & owes no homage ~~the~~ unto the Sun.

---

of Spinoza p85

every man truly lives, so long as he acts his nature, or someway makes good the faculties of himself.

Letter to a Friend p162

"tho we may wish the prosperous Appurtenances of others, or to be another in his happy Accidents, yet so intrinsical is every man unto himself, that some doubt may be made, whether any would exchange his Being, or substantially become another Man.

unwillingness to change individuality

Garden of Cyrus. Chapter III p188 [
Everyman, his good deal that maybe [illegible]
the bio-mathematical arrangement in the
structure of plants

mathematical view of morphology.

Telephone:
CAMBRIDGE 5113.

BOTANY SCHOOL,
CAMBRIDGE.

July 21/41

Dear Mrs Arber

Can you kindly give me any information about a Dutch botanist who lived in the 18th century & whose name is variously stated to be GAMBIUS or GAUDIUS. I wish to know which is the correct rendering of his name. He is the first person to have published (in 1771) an allusion to the obtaining of crystalline menthol from peppermint oil. Although my enquirer states that Gambius was a botanist he may have been more of a chemist than a botanist.

If you can help me in this matter I shall be grateful.

With kind regards,
Yours sincerely F. T. Brooks

F. T. Brooks Dear

med. [illegible]
Born Durlach [illegible] Held professorship [illegible] Leiden [illegible]
Amsterdam.
Adversariorum varii argumenti
Leyd 1771
Opera academica omnia. Leyde 1787
Opera academica [illegible]
Hon. for [illegible] [illegible] [illegible] / [illegible]
[illegible] work. — [illegible]
died 1780 aged 75 [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible]

97

Telephone:
CAMBRIDGE 5113.

BOTANY SCHOOL,
CAMBRIDGE.

Jy 24/41

Dear Mrs Arber

Very many thanks for the interesting information about Gaubius, which I am sending to my correspondent. He is Professor of Chemistry at St Andrews University.

Yes, I am glad that all is now set for the publication of the Master of Christ's book on John Ray.

Thank you also for kindly sending a copy of your lecture on Nehemiah Grew, which I am very glad to have.

With best wishes,

Yrs sincerely

F. T. Brooks

it.

ave

& Decis

medic [illegible]

Benn doctor & [illegible] (the professorships) . Liber [illegible]
Amsterdam.

Adversariorum varii argumenti
Leyd 1771

Opera academica omnia . Leyde 1787

Hist. [illegible] [illegible] [illegible] [illegible] / [illegible]
[illegible] [illegible] — [illegible] [illegible].

die 1780 aged 75 [illegible] [illegible] his
All [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]

Flückiger, F.A & Hanbury, D. (1879)
IX. 2.55
Pharmacographia Lond.
p. 482
Gaubius "Camphora Europaea Menthae Piperitidis
Adversariorum varii argumenti liber unus. Leidae. 1771.99

Mentha Piperitis grown & cult. 1771 in Utrecht.
Mentha piperita Huds. (non. Linn.)

Biog. Universelle

Gaubius, J.-D.
(Jérôme-David Gaube)
b. Heidelberg 1705; Studied medicine under Boerhaave
Doctor. [illegible] at Leyda. [illegible] on [illegible]
(Although [illegible] Amsterdam
medical man at Deventer & then coll. 1727
Became doctor to [illegible] chemistry & medicine
[illegible] professorship) Amsterdam.
Adversariorum varii argumenti. liber unus
Leyd 1771
Opera academica omnia. Leyde 1787
Hort. [illegible] & [illegible] / medicine &
[illegible] work. — [illegible]
d. 1780 aged 75
[illegible] [illegible] [illegible] [illegible] his [illegible] [illegible] [illegible], [illegible] [illegible]

THE TIMES

SEPTEMBER 25 1941

JERUSALEM

"OLD AND TRUE"—DCXXII

Yet when the fire of war was . . . threatening the Christian world with disaster and desolation, I had no greater comfort than I found in the ancient promises of God concerning the supreme and final Light, that it should in the end put darkness to flight. And if any human aid were needed for this I thought that it could only come from the better instruction of the young in all matters from the most elementary and fundamental, if they are to be delivered from the mazes of the world.—COMENIUS.

THE TIMES LITERARY SUPPLEMENT

SATURDAY AUGUST 23 1941

Comenius in England

Jan Amos Komensky (Comenius), the great Czech philosopher and writer on education, author of the "Janua Linguarum," "Didactica Magna," and other books, paid a visit to England in 1641. His resolute internationalism and his plan of a "Pansophic College" for cooperative scientific research were among the influences leading to the formation of the Royal Society, which, in its first form, the Invisible College, began its meetings in 1649. Unfortunately the civil war, and his failure to find in any other country a patron able and willing to carry out his schemes, postponed the realization of his ideas, which he never lived to see.

To commemorate the tercentenary of this visit a meeting will be held in the Senate House of Cambridge University on Friday, October 24, at which President Benesh will talk of "Comenius's plans for Peace Leagues and his place in history as a great European"; M. Jan Masaryk of "Comenius as an educational pioneer"; Professor J. Desmond Bernal of "Comenius's visit to England and the foundation of the Royal Society"; and Professor Ernest Barker of "The debt of Europe to Comenius and to Czechoslovakia." These, together with contributions from other distinguished scholars, will subsequently appear in the form of a small commemoration volume. Official representatives will, it is expected, be present on behalf of the Embassies and Governments of Czechoslovakia, the U.S.S.R., Poland and Yugoslavia; the Board of Education, the Royal Society, the British Council, the Moravian Church (of which Comenius was a bishop) and other bodies.

The Tercentenary Committee consists of the Vice-Chancellor, Mr. Butterfield, Professor Haloun, Sir W. Dampier, Professor Owst, Mr. Downs and Dr. Needham, to the last-named of whom, at Caius College, any communications regarding the tercentenary should be addressed.

(see also next page)

99

"Brooklands," Lenten Street, Alton, where William Curtis was born

WILLIAM CURTIS, F.L.S.,

1746—1799

BOTANIST
AND
ENTOMOLOGIST

With some Notes on his Son-in-Law
SAMUEL CURTIS, F.L.S.

By W. HUGH CURTIS
Joint Hon. Curator The Curtis Museum, Alton, Hants.

Extract from Foreword:

'What follows has been written in the small room where William Curtis learned to compound pills and ointments and dispense drugs when he became apprenticed to his grandfather.'

WARREN AND SON LTD.
THE WYKEHAM PRESS, WINCHESTER

(see also next page)

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FROM LIST OF CONTENTS

1779.

The London Botanic Garden opens January 1st—Thomas Woodward anxious to promote Curtis's garden—many respectable subscribers—'how much amusement you can afford for two guineas'—breakfast at the garden—James Lee—Dr. Goodenough sends plants from Weymouth—Mr. Wenman a pupil.

1780.

Garden for British plants at Norwich—James Crowe the life of the Association (Norwich)—*Poa trivialis* and *pratensis*—Curtis's promised catalogue—J. Crowe travels 100 miles for *Statice reticulata*—Wm. Sole of Bath—*Cardamine* benefits the Duke of Gloster—Wavell still at 51 Gracechurch Street—Duchess of Portland's recipe for Pomade Divine—death of Dr. Fothergill—electricity in medical cases—Fl : Lond : Nos. 29-32 give much pleasure—Curtis at 6 Talbot Court.

1781.

Curtis's resources drained—appeal to Lord Bute—attack of rheumatism—designs a beer jug—Mr. Banks's herbarium—Hon. Daines Barrington—the garden at Charlton (Kent)—Duchess of Portland and larva of the Holly-blue—Mr. Busick Harwood—Elliot forestalls Dr. Lettsom in 'Life of Dr. Fothergill'—the Birkbecks of Settle.

1782.

Ravages of the Brown-tail Moth—January 13, last letter to 6 Talbot Court—Lichfield Society publication—Mr. Crowe amongst the Fungi—*Carex depauperata*—Expedition to Settle—Duchess of Portland sends rare plants.

1783.

Catalogue of plants published—Fools Parsley found to be poisonous—Unripe blackberries a cure for stone and gravel—Sir Joseph Banks sends seeds from Lincolnshire.

1784.

Dr. J. C. Lettsom considers it a National honour to assist Curtis—Entomology at Coombe Wood.

1785.

Dr. Goodenough visits Littlehampton and Arundel—sends Curtis an oyster-catcher and a sanderling—he shoots a screech owl—takes Curtis to Charlton in a chaise—The Society for Promoting Natural History—Curtis appointed to Botanical Committee.

1786.

East Coast expedition—Malden—Dr. Goodenough to Harwich—Curtis and Edwards to Ramsey and Ely—mention of another expedition to Mersey Island—interest in Oyster catching—'Decades of Medicinal Plants' a failure.

204 pages, demy 8vo., and Pedigree of Thomas Curtis.
16 Illustrations.
Cloth boards.

Price to Subscribers before publication,
8s. 6d. + postage **6d.**

After publication the price will be raised to **10s. 6d.**

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Name .....

Address .....

.....

99A.

THE TIMES FRIDAY JANUARY 11 1946

The portrait of William Curtis, by Wright, in the possession of the Royal Horticultural Society. He was born at Alton, where a special exhibition is being held.

A FAMOUS NATURALIST

BICENTENARY OF WILLIAM CURTIS

The bicentenary of the birth of William Curtis, author of the *Flora Londinensis* and founder of the *Botanical Magazine*, is to be celebrated to-day by an exhibition at Alton of some of his manuscripts and relics.

Curtis was born at Alton, Hampshire, on January 11, 1746. He came to London to qualify as an apothecary, and practised for a short time at 51, Gracechurch Street before he abandoned medicine for botany. From 1773 to 1777 he was "demonstrator of plants and *præfectus horti*" to the Society of Apothecaries. In 1779 he opened a private botanic garden at Lambeth Marsh.

His best known work, *Flora Londinensis*, was issued in 72 parts between May, 1775, and 1798. The *Botanical Magazine*, of which Curtis began publication in 1787, was issued in regular monthly parts. It is still published, and is edited at Kew on behalf of the Royal Horticultural Society. He lived just early enough to record the flora of inner London. He was able to note many rarities from such places as Tothill Fields, St George's Fields, and Battersea Meadows. The last was a favourite place for his demonstrations, and no fewer than 27 rare plants, many of them aquatics, were recorded from Battersea in the *Flora Londinensis*. These include a marsh orchid, cotton-grass, bog-bean, and meadow cranesbill.

The inscription on his grave at Battersea has long been illegible, and a new stone bearing his name is to be put there. A commemoration meeting is to be held in St. Mary's, Battersea, Church Hall to-morrow evening and a memorial service in the church on Sunday morning.

THE TIMES
A GREAT NATURALIST

The bicentenary of the birth of William Curtis, author of *Flora Londinensis* and founder of the *Botanical Magazine*, is being commemorated this week-end. He was buried in the churchyard of St. Mary's, Battersea, and our photograph shows his grave between the two shrubs in the centre of the picture. The stone is to be replaced by a new one.

SATURDAY JANUARY 12 1946

Power, Henry   Experimental Philosophy in Three Books: Containing New Experiments Microscopical, Mercurial, Magnetical. London, Printed by T. Roycroft, for John Martin, & James Allestry, at the Bell in S. Pauls Church-yard. 1664

[Power a pupil of Sir Thomas Browne.

p 49

Observ. XLII   of the Pendents of the small Dust or Powder on the Lillies.

In all our common Garden-Lillies ... out of the middle of the Flower groweth a long style or poyntel, beset round about with small chives, ~~every single pendent~~ which are tipped with pendents, on the head of every Chivall powdered over with a small Dust or Powder, which will cleave to and smut your fingers: this Powder (taken from the yellow Lilly) looks very pleasantly in the Microscope, of a golden colour, and sometimes Diaphanous: where you may see every Atom very distinctly to be of an Oval Figure, exactly like some sort of Seeds: the Powder of the white Lilly pendents, looks of a pure pale yellow, and like so many pieces of polished Ambar.

p 50

Observat. XLIII

The "Leaf of English Mercury, called bonus Henricus, looks, as if rough-cast with silver, & all the ribs are stuck full & round white transparent Balls, the innermost Stages, or Ochre Apples, & Bracelet of Crystal; & we could discover little foot-stalks in many of them, by which they were fastned to the ribs & fibers of the leaf, which is a very pleasant Spectacle.

A Sage leaf looks like white Rugge, or Rugge, full of knots, tasel'd all with silver Threads, & one or two fine round Crystal beads or pendents, as big as Peas, fastned to every knot.

Observat. XLIV

Pink-pendents

The chives which grow on red Pinks, & which are topped with red Pendents, besmeared over with small Mealy Powder, looks very pleasantly in the glass; for every Pendent looks like a red Taffata Cushion, all beset & sprinkled over with round white Beads, or Gromwell-seed.

Observat. XLV
Of Nettles

Look on the backside of a Nettle-leaf, you shall see it all full of Needles, or rather long sharp transparent Pikes, & every Needle hath a Crystal pummel, so that it looks like a Sword Cutler's Shop, full of glittering drawn Swords, Tucks, & Daggers; so that here you may out optically see the Causes, as well as you have formerly felt the Effects, of their Nettling.

p 83

These are the few Experiments that my Time & glass hath as yet afforded me an opportunity to make, which I hasten out into the World to stay the longing thereof; But you may expect shortly from Doctor Wren & Master Hooke, two Ingenious Members of the Royal Society at Gresham, the Cuts & Pictures drawn at large, (& to the very life) of these & other Microscopical Representations.

[C. Singer interprets this as meaning that Wren did some of the drawings of Micrographia. not all.
He disliked appending his name to scientific work

Preface

"The minute Bodies & smallest sort of Creatures about us, must have been by [Antiquity] but sleightly & perfunctorily described, as being the disregarded pieces & huslement of the Creation; then (alas!) those sons of Sense were not able to see how curiously the minutest things of the world are wrought, & with what eminent signatures of Divine Providence they were inrich'd & embellish'd, without our Dioptrical assistance"

Esdaile, K (1927) p35

Bust of Mrs. Grew, Christ Church, Newgate Street. (Plate XII C.)

"In Christchurch London Dr Grew's Lady — her over ye [illegible] Communion Table" [Quoted from Vertue]

This attractive but much begrimed bust of a lady whose very existence is unknown to the Dictionary of National Biography, which recognizes only Grew's second wife Elizabeth Dodson, deserves to be better known. Grew, a distinguished F.R.S., was an acquaintance of Pepys, & it is not unreasonable to suppose that the Diarist, whose wife, as we shall see, Bushnell had earlier commemorated, recommended the sculptor to his friend, when ~~the~~ he too, like Pepys, became a widower. The latter, with its baroque scrolls, recalls that of Mrs Pepys, & the little lady, with her expressive face & simply knotted hair, deserves the cleaning recently bestowed, with the great improvement, on Mrs Pepys herself.

p27
Bushnell died 1701. ~~not so date does~~
~~not give date of birth~~

p26
~~Date of birth~~ probably 1630-1 "approximately correct"

plate XII C is

The reproduction of monument is beautiful & decoration. The monument of Mrs Pepys is also reproduced & her rather badly formed face is very [illegible] than ~~so~~ relatively than. Mary Grew's more regular ~~&~~ ~~conventional~~ features are probably correct & not merely conventional

Copy of note sent to the Linnean Soc. Ap 1.42

Nehemiah Grew: a correction. (Agnes Arber)

In a paper last year on Nehemiah Grew and Marcello Malpighi (Proc. Linn. Soc., Session 153, pp. 218-38) I drew attention to a monument to Mary Grew in Christ Church, Newgate Street, and pointed out that she must have been Nehemiah Grew's first wife, but that this marriage did not appear to have been recorded previously, the Dict. Nat. Biog. referring to one marriage only, which was, in fact, his second. Mrs Arundell Esdaile has since drawn my attention to an article of hers in The Walpole Society, vol. xv, 1927, pp. 21-45, dealing with John Bushnell, the sculptor, in which she notes the existence of Grew's first marriage, describes his first wife's monument, and gives an admirable reproduction of it, with the surmounting bust (pl.xii,c). Mrs Esdaile suggests that it was perhaps ~~Grew's~~ his acquaintance with Samuel Pepys, which led ~~to him~~ Grew to give the commission ~~commissioning~~ to Bushnell ~~to do the work,~~ for this sculptor had already executed a similar memorial to Mrs Pepys. This monument is reproduced in Mrs Esdaile's ~~work~~ memoir, side by side with that of Mary Grew; the bust of ~~Mrs~~ Elizabeth Pepys shows that Bushnell had a strong feeling for facial character, so it seems likely that Mary Grew's more regular features are realistic and not merely conventional. It is to be hoped that after the war the broken bust may be restored and returned ~~and returned~~ to its place above the tablet.

105

Al 71

Tr.400.a.26

Loams End
West Hoathly
East Grinstead
Sussex

27. 3. 42.

Dear Miss Arber.

It is very kind of you, and I am interested in Nehemiah Grew as a person, because his wife's bust is stated by Vertue, after his interview with the sculptor's son, to be by John Bushnell, as you will find in Walpole Soc. XV, looking up the D N B gives Grew (1628-1711) one wife only: here we have — or had, in Christchurch, Newgate — and haven't got into Christchurch since the 3 blitz — a bust of a second wife, & I always longed to know something of her.

Yours

K A Esdaile.

If I had known the Linnean Society was interested, I would have begged them to clean it. Do you think the Secretary could write to the Rector & ask if it is safe, & if not, whether there are any fragments? These should be most carefully collected, & obviously the Society's request for information could not be ignored: it would be more effective than mine. Anyhow, it is reproduced (ie a tinted dirty state) in the Walpole volume. This may be news to you, and I really would press you to get the Society to act.

If I had known the Linnean
Society was interested, I would
have begged them to 'clean it'
... think the Secretary could: ...

I certainly did read & keep
today's Times leader: it is
most encouraging. I as I
am a member of the Society
for the Protection of Ancient
Buildings which started
the Historic London under Fire
exhibition (a quite incredible
success — packed daily from
11–7) I am very glad to
have what I said copied
with a notice of our show.
With sincere thanks — I do
love Nehemiah's vivid writing,
which I did not know. —
Yours sincerely
K A Esdaile.

105

Renati Des-Cartes Principia Philosophiae 1067.
Amstelodami, Apud Ludovicum Elzevirium,
Anno 1644 [M.5.26]
CIↃ IↃC XLI*V
On blank leaf Johannis Wray liber. (This was apparently written in Latin to start with)
rex " : Jo: Wray. Pretium - 17 - 0
August 21st 1651

Bound up in same order
Specimena Philosophiae. Amstelodami (translated from French into Latin)
Apud Ludovicum Elzevirium 1650
(This includes the Dissertatio de methodo)
Passiones Animae per Renatum Descartes
(translated from French into Latin)
Amstelodami
same publisher 1650

I have not seen any annotations in this volume
In M.5.27 (a later edition) there is an engraving of Descartes

(I found this Wray copy on Thursday Jan 28. 43.
Professor Raven did not know of it.
Royal Books. D. says they were bought
for a Bishop of Ely & given to the Library by the King.
Collection of John Moore DD Bishop of Ely I know
given to the University by George I in 1715.
Looked him up in the D.N.B. & find that he was 1646–1714.
admitted Clare College 1662. Fellow Clare 1667–1677
Life in Bibliographer 1884. He may well have bought
some of Ray's books which were sold after his death "Some 1500
volumes were sold by auction in London about two years after his
death." Raven p 481

Wray's knowledge of Descartes' this book.

D. John Wilkins

An Essay Towards Ren

And a Philosophical Language

London 1668

Read Chap IV plus p 6

Tables of plants p a Do

in Botany, Mr. J[illegible]

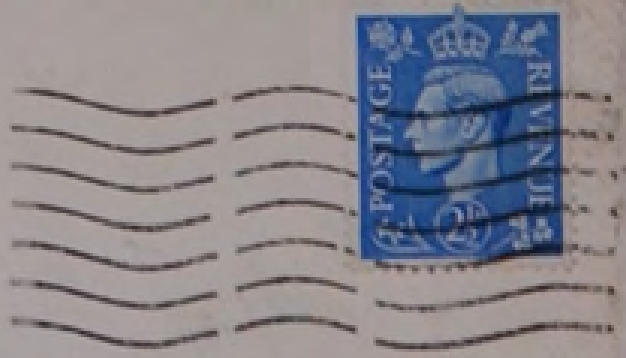
[illegible]

Tables classif. from at p. 75.

Hh. 9. 56

2.

107



Mrs Arber

5-2 Huntingdon Rd.

Cambridge.

John Ray · C.E. Raven · 1942 3 1 108

Preface p ix

emphasizes that the change from a world in which there was no settled frame of reference except that found by deduction from the Bible & of Aristotelian lore in the seventeenth century, that in the realm of ... botany & zoology, there was one man of outstanding genius " John Ray.

Raven's idea of Ray's position in history of thought

p x Raven is a Cambridge man & he says that he like Ray came under the shaping influence of the Cambridge Platonists. He has "collected nearly all the plants", birds, insects that he records, & often in the same localities, & the thing that he tried to do, to reinterpret the facts ... which is to them for him 'knowledge of nature', has been my continuous & chief concern.

Raven's appropriateness for the task

pp XIII – XIV a complete list of sources for Ray's life

pp XV – XIX.
Detailed epitome of Ray's life

valuable means to book

p 1. Born in a smithy in the village of Black Notley 1627 his father a smith ... with forge.

birthplace

p 2 The six roomed cottage of timber
his birthplace, still survives.

real naturalist

p 7 He had the countryman's love of living things, animals, birds, insects & plants, of the countryside etc. — dangers ... made him a real naturalist. This from Vindiciae — "Every grass — of field & clears field" footnote p 37

p 9 Ray's repeated this "a spangle or sward of grass showed a Deity as much as anything"

Ray in study of nature's fauna & religion & his emphasis on uses

His approach to botany was not only aesthetic & intellectual, but concerned also with the uses, virtues of plants

p 10 Contrast Ray's work in the chaos of lore & superstition which surrounded it. In 1652, the year in which his "Methodus", more eighteen ... improved ... was published, there was room for the ... fantastic character for witchcraft, on charges of & ... supplied the basis of Culler's Analysis

chaos of lore, legend & superstition which surrounded Ray

p 11. His Vindication of ... ... Analysis" Claim that the Vindication of God form basis of Culler's Analysis

p12

In addition [to] this work on botany & zoology he contributed widely to the advance of geology, & made contributions in astronomy & physics; he was a pioneer in the study of language & few [illegible] the importance of dialect & folk speech; "he did as much as any man of his time to develop a new understanding & intelligent appreciation of religion"

language

p17

View of Cambridge as 16½

life Cambridge

p24

Ray came to Cambridge in a time of conflict. It was not a struggle between religion & science – to suppose so is to read back into the 17 century the story of the nineteenth cent. It was a struggle between the old philosophy & the new methods of experiment & observation. The older men, as Ray [illegible] could not by the [illegible] to [illegible] (of lesser age) the lessons of their youth. A [illegible] to the Royalists clung to Aristotelianism & regarded the new philosophy as symptomatic of unrest & undisciplined of the rebellion.

p25 It was to Puritans who wished to reform the universities.

Henry More who had written enthusiastic letters to Descartes was obliged to apologize at length of his ardour & to explain that he disapproved of much in the Cartesian position –

Henry More & Descartes

life in Cambridge

p25 Ray had 2 years in Catharine Hall

p26 Ray [illegible] that he found Catharine Hall [illegible] concerned with disputations of [illegible], 'the polite arts & sciences' with the more liberal culture,

of Trinity. In 1646 he was transferred to Trinity

Cambridge

p27. In 1646 he was transferred to Trinity

p28 Ray says that he searched through the [illegible] of plants. Chances to [illegible] helps him in the study of plants. Chances of [illegible] for someone [illegible] produced by him & his friends in the pursuit of [illegible] than our [illegible].

Ray's beginning of science in Cambridge

Erdtman abt Ray's Latinity

p28. Ray has a Latin "the rich vocabulary, & dignity clarity of style, the ease of expression & sense of rhythm, which can only come w long & intimate knowledge

p29 He wrote Latin as easily as English
With the exception of English verses, his Autobiography, all his scientific writing are in Latin.

p32 Since Latin was declining in England by the end of the 17th century Ray was complaining that there was only one printer in London who could be trusted to set up a Latin book

The fact that Ray wrote in Latin seems to have increased his influence on the Continent but decreased it in England

Raven considers that it is Ray's Latinity that

p32 makes his descriptions so excellent

Helped him in that Ray could not afford the expense of plates

p32 obliged him to concentrate on really effective description in Latin a peculiarly suitable medium in words, description of [illegible]

Languages

p32 had a gift of languages, an absorbing interest in variety of dialects, their derivations & meanings, in collecting English Proverbs &

pp32-3 He published a Collection of English Words. The latter was a study of dialects when he was a pioneer

Naturalist's "concreteness"

p35 - His mind was essentially Concrete

Cambridge Platonists

p36-7 Benjamin Whichcote, Henry More & John Wilkins Ralph Cudworth — the Cambridge Platonists — who gave him a certain protestantism & catholicism in theology & in philosophy

"in which reason & science could find full exercise, & the [illegible] with observation & higher kind of mysticism goes harmoniously [illegible] & knowledge. p37 It is not known if he had any personal contact with these Platonists but there is no doubt he was influenced by them

p 38 Raven has been at great pains to identify Ray's rooms in Trinity. They seem to have been near to Great Gate – possibly those to be same in which Isaac Newton afterwards lived.

Life contd.

p 43
Ray was for 12 years a Fellow of Trinity

p 45
Thomas Willughby was at Cambridge 1646–9

p 46–7
Ray was appointed Greek lecturer in 1651, Mathematics lecturer 1653, Humanities lecturer in 1655

pp 46–47 Raven has traced all that is known of his Cambridge friends. p 48 He & a group of friends were interested in comparative anatomy. At this time Harvey's discoveries stimulated interest in such studies, & Descartes was also influencing Cambridge thought.

Cambridge thought

p 49
Ray regarded study of nature as a religious duty. Like the Psalmist, Job & Solomon, he agreed that the wisdom revealed in the creation was of God. "nature supplied him with a medium of worship which he could not find in the churches."

p 49 Soon after his election as a fellow his studies in botany seem to have begun.

Botany

friendship formed at Trinity

Willughby

pp 50–51
Francis Willughby came to Trinity as fellow commoner in 1652/3. W. was fired by Ray's enthusiasm. W's vitality was a source of inspiration to Ray, & W. was generous in financing their tours & subsequently in an annuity under his will to Ray.

p52 Philip Skippon, one of Ray's pupils, accompanied him on his journeys of 1661, 1662 & 1663-6. Edward Browne, the son of the author of Religio Medici wrote to Sir Thos. B. [illegible] the two in Rome [illegible] to his father [illegible] him to collect [illegible] the [illegible] made in north-Italy had been lost, because they were sent home with the servant Skippons, who had been captured by the Barbary pirates.

difficulties of to-home then able to parallels now

~~p55. Anthony Ray of Wimpey [illegible] has [illegible] to [illegible]~~

p55 ~~[illegible]~~ John Wilkins of five months was Master of Trinity & his connection with Ray was strengthened by their common friendship of Willughby. pp56-7

Wilkins wants Ray to translate his "Real Character" into Latin. He was evidently a stimulating personality & though he yet exercised not great himself in any particular field, he [illegible] a major influence on greater men

Lefs [illegible]

Wilkins

p60 ~~Ray refused to subscribe [illegible]~~ The religious difficulties of those [illegible] expelled Ray from Trinity. He refused to subscribe to the Act of 1662 declaring to Covenant to have been an unlawful oath. He ~~[illegible]~~ returned to his village having an offer for £6 (p61) in his father's [illegible]

Lost financial security & [illegible] of scholars. ~~[illegible]~~ books for [illegible] HC was 35 L

Effect of loss Ray's of fellows

pxvi Forfeit Fellowship under Act of Uniformity

His deliberate retirement to Dedham deliberately p64 [illegible] excused for the correspondence integrity of human interest.

Lack human interest

p81 Ray's Catalogus Plantarum circa Cantabrigiam nascentium published in Cambridge by John Field, printer to the University, -1660

p80 This ~~[illegible]~~ modelled on J. Bauhin's Catalogus Plantarum circa Basileam sponte nascentium

p 81. Preface to the Catalogus Cantab Catalogue

simmering in Cyclic of Raven. Says that Ray had been ill & had to rest from more serious study & rode or walk.

"There was leisure to contemplate the ways where lay constantly before the eyes & often so often trodden thoughtlessly under foot, the various beauty of plants, the cunning craftsmanship of nature. First the rich array of spring-time meadows, then the shape, colour & structure of particular plants fascinated & absorbed me: interest in botany became a passion."

Botany

p 82

Six yrs after he began his study of the botany, Cambridge he started on his book on which he spent 3 years.

His object he defines as follows: 'it was in general to illustrate the glory of God in the knowledge of the works of nature or creation; then to enhance the reputation of my University of Cambridge, which must suffer abroad if its equipment in this field were defective; specially to enrich the common life & extend the advantages which such studies can bestow.

religious aspect of his work

p 83

Preface to Catalogus "We would urge men of University standing to spare a brief interval from their pursuits of this study; rather than so occupied + of the vast library of creation.... there is for free man no occupation more worthy & delightful than to contemplate the beauteous works of nature & honour the infinite wisdom & goodness of God.

p 81

The Catalogus is a small octavo (modesty AA) suitable for the pocket-size no author's name. ~~footnotes~~ creaty int'ern

modest

p 83

The aim was modest — as Raven says a was to correct classification in a neglected subject.

p 89

He was not so much concerned in this book to correct classification & to fix the species as to collate the many familiar names & to which they belonged.

aim

p 90

In this latter he was amazingly successful. Of the species contained in Babington's Flora of Cambridgeshire, 558 are listed by Ray as having been seen or to be counted by him personally

success of his aim

see over

114 9 7

Thus of one species, a sedge, in the Catalogus were defies identification.

Pp 93–94. He includes a number of plants now lost to the County & at least 3 now extinct in Britain, Roemeria hybrida, Senecio paludosus & S. palustris

pp 95
A colonist, Geranium pyrenaicum, now common in the County is not mentioned by him; it was in his day apparently unknown in Britain.

pp 56–57. Ray mentions a number of plants grown as crops. Curiously enough he makes no mention of cabbage, ~~but~~ & Raven concludes that none of the varieties were then cultivated in Cambridgeshire. Can it be that Ray omits the cabbage because he regarded it rather as a garden than a field crop? It is hard to believe that it was actually unknown in Cambridgeshire in those days. p105 He

Cabbage

p99
Ray utterly ~~discarded~~ ~~as the time so firmly~~ disclaimed the doctrine of signatures of plants which at that time was very much in the air

"Many plants resemble natural or artificial objects for which they have no affinity & as Orchid flowers look like flies, spiders, frogs, bees or butterflies. Parts of some plants represent parts of the body which they evidently disagree.... There is such a vast number of plants that, even if they had come into existence altogether at haphazard, any ingenious & imaginative person could have found as many signatures as are known today.

Signatures plants

p107
Notes the fascination of ~~withered~~ cat-mint for cats.

Insects
p102–3
Ray's work on insects was in a field more his exploration than plants. 25 Catalogus he includes a good deal about insects under their food plants

Rose gall
p104 He describes & names, Rhodites rosae associated with the rose gall Bedeguar.

to 115 8

p105–6
Jung's Isagoge was communicated in MS to Ray by Samuel Hartlib, ~~&~~ before the appearance of his Camb. Cat. (& Worthington)

But as regards the catalogue itself, probably he did not receive the MS early enough to be useful.

Ray's Dictionary

p108 [illegible] in classification the father J. Bauhin's Historia generalis. He regards ~~this~~ as a good choice, indicative of Ray's sound judgement.

p109
It appears that in 1660 he was compiling a list of ~~garden~~ plants grown in gardens in Eng. in his time, but this list seems to have disappeared.

p105. He had a small garden 'a little spot of ground belonging to his chamber' (p38) in Trinity. His chamber must have been the 1st floor of N. of great-gate, as ground floor of the same, great gate, earlier possessed a small garden as to east between it & [illegible] the street.

Isaac Newton lived in the one N. of the great gate

p111
By c. Eng. in 1657 Ray was projecting a complete British flora. He gathered his material during the next ten years, & was thus enabled to publish the Catalogue of English Plants in 1660, the Synopsis in 1690 & of Camb. list in Camden's Britannia in 1695.

First Itinerary

p112 In his First Itinerary he left Cambridge on horseback 9 Aug 1658 p112 & rode to Northampton, Warwick, Coventry, Derby, Buxton, where he had his first experience of hill botany. Then he proceeded to Chester & N Wales, Anglesey & went for ringing up Snowdon. At Llanfair

p113 he heard the news of the death of "Oliver L. Protector". Then by Shrewsbury, Kidderminster, Worcester, Gloucester + St. Neots he reached Cambridge on Sept 18.

Garden plants of College p9

Trinity his rooms

Local British flora

116 # 9

p113 Every detail of trees & later tours & following of

p114 Raven, & he establishes the existence of a tone hitherto unrecognised, when in 1660 led him with Willughby to the Isle of Man where "myself ... in the strait between the Isle & the Calf of Man took up among the tall Fucus growing thick upon the rocks there ... Sea-Urchins as big as a man's two fists."

p116 This journey with Willughby was in fact, as Raven says, a turning point in the lives of both men, ~~and one of~~ ~~ease of his~~ The cooperation partnership which drew Ray from the study of botany to that of zoology, gave him means of getting material, encouragement & ease his livelihood. (see below)

pp116-7 Ray became known to Sir Thomas Browne about 1660. He speaks of B. having shown him Acorus growing near Norwich & drew of specimens of Seacadea maritima which B. had collected from the Norfolk coast. Browne's eldest son Edward had accompanied ... of Trinity, 1657.

Sir Thomas Browne

The journeys to the north described in Ray's ~~Itinerary~~ seems to have been planned rather for visits of cathedrals & great churches than for the collection of plants. He was with Philip Skippon. They went north, riding between 20 & 30 miles each day & visiting places of antiquarian & general interest, especially in Yorkshire. Off the Yorkshire coast they collected fish, seaweeds & fossils from the cliffs. They examined the plants around the Bass Rock.

p129. He records that while he was in Scotland about 120 women were burned as witches.

Superstition

p123 Ray's journey of 1662 with Willughby & Skippon ~~was~~ cemented the partnership between R & W. This gave Ray his life's work. Derham heard about it from Ray's own lips when he visited him at Black Notley on 15 May 1704. "These two gentlemen", he writes, finding the history of nature very imperfect, had agreed between themselves, before their travels beyond sea, to reduce the several tribes of things to a method & to give accurate descriptions of the several species from a strict view of them."

Partnership with Willughby

And furthermore as Mr Willughby's genius lay chiefly to animals, therefore he undertook the birds, beasts, fishes & insects, as Mr Ray did the vegetables."

The tour of 1662 transformed R. W's common interest into a settled & defined purpose & led to its fulfilment in the Continental travel of the following years, to the permanent botanic which Ray after W's death ~~discharged~~ their mutual obligation.

p126. This tour took them through Wales & to other places. & then when Willughby had left them, Ray & Skippon explored Devon & Cornwall p128

p129 They heard of one man, Mr Dickan Gwyn who could write the Cornish language.

Life after vacating Fellowship

It was in this year (1662) that he forfeited his Fellowship (under the Act of Uniformity pXVI) & took a tutorship at Friston Hall where he stayed for one winter, leaving it in spring 1663 to go on a continental tour with Willughby (p131). In 1673 he published a travel book on this tour. In this however Raven confesses that the ~~travel~~ details which he records of the dull uninspired ... than the ... of information, seem to have been given ... sell the list of plants.

Travels

p132. They travelled the Low Countries extensively & then up the Rhine & visiting various places in Germany (p133) to Basle & Constance. At Altdorf Ray found

Fossils

some fossils & he introduces a long & important digression in which he states his conviction that these 'were originally the shells or bones of living fishes & other animals bred in the sea', "Hapsburg" At Vienna they ~~noticed~~ ... of Europe & noted ... Padua where Ray attended lectures in anatomy. They spent the winter in ... to spring they travelled extensively in Italy. Willughby & Bacon stayed in Naples

Ray & Willughby

Eventually (p134) Willughby, ~~...~~ & Skippon was his sole & Ray & Skippon went on ... Raven here clears up a mistake of Derham's in his Life of Ray where he has been copied by all subsequent writers — the mistake of supposing that Willughby & Ray parted company at the end of the tour. p136 Tartufole in Italy were apparently mean truffles 12 months later at Montpellier. They came back to England through Switzerland & France. The details p137 of Ray's & Skippon's travels have very extensive ... their travels were ...

118 ~~12~~
11

On Feb 1 1666 the French King ordered all Englishmen to leave France within 3 months, this put an end to Ray's travels.

Travels (of Ray)

p142 The return from his three years on the Continent may be said to mark the close of Ray's apprenticeship to his work in science. In some sense the rest of his life was the examination & exposition of the data thus obtained. His subsequent field work, except in insects & to less extent in cryptogams was only supplementary.

p143
Many of the winter he spent with Willughby at Middleton. Here a panelled room overlooking the courtyard on the north side is still by tradition assigned to Ray. ~~The~~ Dried plants named by Willughby & Ray are still in the hands of Lord Middleton & Professor Raven has been able to study them (p. xii)

Published Catalogus Angliae
p15[illegible] 1670. "I do not know whether it will please others; in certainly [illegible] displeases me of: for I never satisfy myself in those I write"

change on words due probably to their having been [illegible] Ray [illegible] written [illegible]

Willughby died 1672 p163. W. was aged 36

Mother Willughby

p157. In the English Catalogue he deals a good deal with herbal medicine, being his evaluation of Johann Schroeder & other authorities (older sources say ~~say~~ W's ~~[illegible]~~ son made Lord Middleton

p164. ~~[illegible]~~ by Queen Anne.

Middleton title

Ray stayed on at Middleton
p166 After W's death Ray may have acted as
p166 During W.'s lifetime Ray may ~~[illegible]~~ but this is not certain. He resident chaplain at Middleton, but the friend & helper.

Life

may have lived with W. mainly & W's mother, Lady Cassandra, was
p167 ~~He was closely attached~~ closely attached to him, but his widow "evidently regarded him as the typical 'Levite' of the period & did her best to put him in his place." He did research not
Middleton was a good place for work. the family archives there, helped Wilkins with his "Real Character"

119 X

(Ray)
& problem to Catalogus Angliae + his Collection of English (12
Proverbs — a remarkable compilation of which he gives a list of sources
It is described — the Introduction to the Oxford Dictionary of English Proverbs as
"the [illegible] monument of the study of modern folklore."

Bibl. Proverbs

p169 Proverbs not all derived from earlier sources of it includes a
great number of proverbs, all kinds of which Ray himself is the earliest
authority. p169

- The book reached a 5th ed in 1813

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p169. The Collection of English Words published 1673
"the first serious attempt to gather & preserve the folk-speech
& to distinguish the local dialects of England."

Dialect Words

Skeat published an edition of Ray in 1874 & said it was the most
important book on English dialects before the 19th century
p171. Skeat calls him "the remote originator of the
English Dialect Society."

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p174 & footnote. he rejects spontaneous generation
Except in early works,

Spont. gen.

Willughby

p175 After Willughby's death, his residence & published books based on
Willughby's material compelled him to turn aside for nearly 10 years
from Botany.

Life

married Margaret Oakeley when he was 44 & she was
about 21, apparently governess at Middleton. Of his
marriage we know very little
After the death of Lady Cassandra W. 1675 Ray his wife
had to leave Middleton, he went with his wife &
children to Dewlands,
p178 1675 after his mother's death, the house at Black Notley which
he had built for his mother.

He refused p175 offers of work — a university fellowship & the
Secretaryship of Royal Society [ ] am not clear when he was
offered. HA]

p181
The move from Middleton cut Ray off from the collections & notes
& from books. Later on
latter day is continued [illegible] Sloane used to send him literature, in the

Wilkins' [p 182] ~~Essay towards a Real Character~~ philos:
1668. An ingenious but premature attempt to produce a
simplified speech. Classification of flora & fauna were required
in order to produce root-syllables for each group in accordance
with the general method of the vocabulary. [Ray] undertook the plants
& did them very hurriedly as Wilkins' book was already being
printed. Ray points out that he was constrained
not to follow the lead of nature, but to accommodate the plants
to the author's prescribed system. ... He says "What possible hope
was there that a method, thus [illegible], would be satisfactory,
& not manifestly imperfect & ridiculous? I frankly & openly admit [illegible]
that it was; for I care more for truth than for my own reputation." [illegible]
p 184 Morison [illegible] attacks the tables in [illegible] been clear that Ray
Dr. Raven defends Ray in is an ably ungratefully
~~[illegible]~~ began the attacks upon himself by his [illegible] & self-conferred
~~[illegible]~~ perversion of classification in the Wilkins' cards. He was
AA.

dogs

too much influenced by desire to serve his friends

Ray's, Morison & Wilkins' Tables

122 14

p 192
Methodus 1682
p 195
"for this difference: the seeds can be deemed a general distinction of plants, a distinction in my judgment the fairest by far the best of all — that is into those which have a seed-plant with two leaves or dicotyledons, & those whose seed-plant is analogous to the adult." [He does not seem to have understood the real nature of monocotyledonous seeds AA]

Monocot & Dicot

p 202
His great work, the Historia Plantarum, is in whole or in part all plants, an illustration in part & mostly his Methodus. The book was begun before the end of 1682

Historia Plantarum

Raven gives much detail about all Ray's friends & associates

pp 207 ff. (see p 217) MD
Tancred Robinson MD & Hans Sloane were the two brilliant young men with whom Ray's last years are most closely connected.

Robinson Sloane

p 210
under their influence he had 20 years of achievement despite age, ill health & loss of memory & isolation from London & from libraries & scientific societies & instead of a solitary period could His astonishing output in his old age would seem never have been achieved without the friendship, their confidence & the help of their contributions.

pp 210 – 211
Sloane corresponded with Ray, presented for his health, sent books & specimens, sweetmeats & venison
The first sample of maple sugar received in this country was sent to Ray by Tancred Robinson with the request that he would test it, & see if similar products could be obtained from native trees.

p 214 The expense of plates for the Historia Plantarum was impossible for Ray.

p 216 Eckwith [?] of 6 months to Carrier took a parcel of mss to London, & Robinson revised it in London. The affair was an almost intolerable strain.

p216 Historia Plantarum 1-23, 15

Historia Plantarum.

"This first volume, a very large folio, containing 22 unnumbered & 984 numbered pages, printed in a small type, is one of those works which by their sheer mass & magnitude create a sense of awe."

[No. of species was about the same as in Bauhin's Pinax" (see below) one is tempted to wish Ray had been more modest. A.A.]

p222

A long general introduction, frankly a compilation from his predecessors with some additions which seem of minor importance.

p225 Raven thinks his [struck: start] descriptions in detail, "are in their [characterization] masterpieces of brevity & completeness." Rather the descriptions were largely drawn from others.

p230

For each volume Ray seems to have received £30 - cash & 20 free copies.

payment

p234

Monocotyledons "herbs whose seed-plant is not two-leaved or rather not possessed of two cotyledons." Monocot & Dicot

[His emphasis here is on the difference between the two classes of monocot seedlings as evidence - imperfect meaning negative. - A.A.]

Monocots

p241

About 6000 species mentioned — about the same as Bauhin's Pinax

p243

It is surprising that in the years of the Revolution Ray's volumes should have been printed & published without interruption (1686 & 1688)

Ray lived & worked unmoved by the upheavals of this period.

Team work & independence of political upheavals

p246

He had gradually acquired a large band of helpers & correspondents who passed on the results of their field work to him.

p247 Synopsis Stirpium Britannicarum 1690

p251 In the Preface to this work, — "the empty sophistry that usurped the title of philosophy & within my memory dominated the schools has fallen into contempt, & in its place has arisen a philosophy solidly built upon a foundation of experiment ... the secrets of Nature have been unsealed & explored." He goes on to acclaim the Willens & Mays ...

The new experimental philosophy

p252
glowing terms, its prophecy wonderful advances in Philosophy & sound learning, "now that the favour of princes smiles upon the efforts & stimulates the industry of scholars!" 16
124 ~~18~~

p270
Raven has gone carefully into the question of the localities in Black Notley & other old names. *localities in Black Notley*

p271 *English words*
In 1691 he published a second & much enlarged edition of his "Collection of English Words", of this edition is regarded by Raven as "the starting-point for the study of dialect & folk-speech."
p273. The Wisdom of God "Divinity is my profession"
p274 This book in its enlarged edition "became in fact a textbook upon the adaptation of form & function in nature, the forerunner of Paley's Natural Theology"

Wisdom of God

1694. Publ. Sylloge Europeanum p283 "a compilation, a hand-list of European plants for the English traveller."
~~And~~ One of the notes in this book (p283) ~~...~~ is a curious meeting passage about chemists speaking of the typical Chemists' prodigality, one rarely finds untouched by a trace of madness.

view of Chemists

He devotes the greater part of the preface to controversy with ~~...~~ A. Q. Rivinus (Bachmann)
p284 Rivinus bases his classification on flower shape, ~~...~~ disregarding the herb, shrub & tree classification. Ray ~~...~~ again all these & even argues that it is quite reasonable to put Tree Mallows under trees, while Herbaceous Mallows are put under Herbs, etc.

Controversy with Rivinus
Trees & herbs & buds

p286. In this book he seems to have at last accepted Grew's discovery of the male nature of the stamens
p287 ~~...~~ & Ray's criticism Rivinus points out that all plants produce buds, not merely trees (as Ray supposes) asserted (p284)

Lack of reliance on dried specimens

p307 Ray placed no reliance on dried specimens as information for fruits & not (This seems that he was unlikely to rely so much on dried material. H.A.)

p 306 125

Raven considers Linnaeus ~~Linnaes~~ much more influenced by Ray than he allows, & underestimates Linnaeus

p 308 The Ornithology

Continuation of Willughby's work.

But botany was the field of Ray's greatest [illegible] interest. But after Willughby's death he set himself to produce books on birds, fishes, mammals, reptiles & insects, & these books, even more than his botanical writings, laid the foundation for serious scientific progress in each subject. It has been customary to regard this aspect of his work as little more than the editing of his friend's material, & to give Willughby the credit for the result. But Raven with a few incomplete note-sheets. As to Raven, Ray "created out of memoranda a series of books, each of which marks a new epoch in its special field." p 323. He regards the view that Willughby's was the master mind

Ray & Willughby

p 309. Ray wished to publish Willughby's results as "the publication of them might conduce somewhat to, first the illustration of God's glory by exciting men to take notice of & admire his infinite power & wisdom, displayed in the creation [illegible] so many species of animals."

Religious motive.

Aldrovandi

p 309. As usual he [illegible] has scant regard for Ray's predecessors, Aldrovandi he calls (as regards birds) "a compiler, jealous of Gesner & plagiarising Belon" — a damning complete estimate of the man.

Dissection of birds

Shearwaters & Soland geese

p 311 As early as 1659 Ray had dissected & studied birds. In 1660 he saw the ~~[illegible]~~ nocturnal habits & day time solitude of the Shearwater colony. In 1661 he had seen 'Soland Geese' (Gannets, Sula bassana) on the Bass Rock & he noted their boldness — "they sit in great multitudes till one comes close up to them".

p 318. A source of value for Ray was the Royal Aviary in St. James's Park near Westminster.. Here there were Pelicans — as there have been ever since, & many other birds, including a cassowary & vulture.

p 315. He used also the Royal Society's Museum

126 27

p 324 (Ornithology)

Besides arranging Willughby's notes & enlarging it by personal study, the subsequent part of works was the collation of the writings of others.

He expressed the intention of including all the kinds of birds he could, & figures of all he could. [Completely nature of the work]

p 324

Ray's classification of birds is based upon real structural differences.

p 325 The Ornithology published in 1675 & an English edition, popularised by accounts of fowling, falconry & the care of singing birds.

p 326 [Ray & Willughby's Descriptions]

In the birds that Ray & Willughby had themselves handled & described there is seldom any serious difficulty in identification.

p 329 [Habits of Nuthatch]

Sometimes admirable descriptions of habits: of the nuthatch (Sitta europaea) "It builds in the holes of trees, & if the entrance be too big, it doth artificially stop up part of it with clay, leaving only a small hole for it to pass in & out by. ... It's a pretty spectacle to see her fetch a nut out of her hoard, place it fast in a chink, & then standing above it, with its head downward, striking it with all its force, breaks the shell & catches up the kernel."

p 334 [Ray & Willughby]

The respective shares of Ray & Willughby has been hotly debated. Raven concludes that Willughby not only made possible the common task by his generosity, but stimulated the older man by his alertness, enthusiasm, fertility of ideas, boldness of vision. He had less experience of tradition, but also less knowledge, patience & judgment.

Raven contrasts Ray as "a scientist of genius" with Willughby as "a brilliantly talented amateur."

p 335. Raven calls Ray "a man of outstanding ability, in the old-fashioned sense of the word, obvious amenity & genius," & the neglect into which Ray has fallen"

[neglect of Ray]

[Linnaeus] Preface p x, ix Linnaeus "was assuredly not a pioneer"

Carlson p 482 "the neglect which has deprived us of any adequate record of his life."

Fishes

p 339
Having finished the Ornithology Ray turned to the fishes.
Among other helpers ~~he~~ Peter Dent the Cambridge physician
Sir James Mayfield to fishmonger who went up to the London markets
every Friday to look out for rare fishes.
Ray made a considerable first hand study of fishes
Wrote of the haddocks big ~~spots~~ spots of "a black spot on each
side [of the body] about the bigness of a three-pence which
(they say) is the print of St. Peter's thumb & forefinger."
p 341
Fish markets were a rich source. p 343. He
~~says~~ of the market in Rome "scarce any fish is to be
found anywhere on the coast of Italy but sometime or
other is to be met withal here." p 344 During the 8
or 9 months of his visit he constantly frequented the fish markets.
p 345. He also got much from individual fishermen
S. Fishes taken about Penzance & St. Ives, given us by
[illegible] of ancient & most experienced fishermen"

Change from old world of superstition

Preface p ~~v~~ ix
Raven says the "the change from the old world of
superstition ... the world of alchemy, magic, tortie
place not in the eighteenth century but in the seventeenth."
[illegible] actually it took place very gradually & the 16th &
earlier centuries fully played their part in it, & it does not
fit a few preachers to say that in this transition, as far as
~~not~~ botany & zoology are concerned "there was one man of
outstanding genius — John Ray

p 350 The Hist of Fishes Historia Piscium publ 1686
Ray Willughby p 352 This book was mentioned & Ornithology, Raven
thinks shows him essentially his own, rather than
Willughby's.

Unmerited [?] Team work of helpers

p 357
Ray was too trustful of his correspondents

p 365
In Epilogue to the Fishes he says "In view of the many famous scholars who have worked in this field we cannot claim to have discovered many new species; we have found some & can claim to have described, discriminated & classified more accurately".

modest estimate of his work

Raven considers this a modest but just estimate of his work.

Historia Plantarum

p 365
Raven calls the Hist. of Plants Ray's greatest work.

p 368
When Ray's work on fishes is based on first-hand knowledge it is astonishingly accurate. When he has seen & described a fish it is hardly ever difficult to identify it. It seems (A.A.) as if he had a natural instinct of specific characters.

Ray & Willughby

Preface XII
Raven has been able to see & study the relics of Ray's travels. He discovered Willughby's collections & prints [?] from Lord Middleton's [illegible].

Human anatomy

p 370
Ray saw on his travels in Italy & there dissected the human subject as well as animals.

p 371
Willughby's plan for a General History of Nature, & in 1653 [?]

Willughby — In pursuance of Willughby's plan for Animals & Reptiles, he set to work & ... published the Synopsis Animalium Quadrupedum et Serpentini Generis.

p 374. In discussing "What is an animal?" he rejects the Cartesian view of animals as automata. p 375. He rejects the idea of spontaneous generation of animals. Malpighi, Leeuwenhoek & others had already maintained this standpoint. p 376 In the work of forming & generating animals God employs the agency of Plastic Nature. This is Cudworth's — True Intellectual System of the Universe. ch III § XXXVII, Harrison ed. I p 222–6

Des Cartes

Spontaneous generation

Insects

p 388. After achieving his Synopses, British plants, & European plants, & of Animals & Reptiles, & of Birds & Fishes, between 1690 & 1694, he turned to Insects — the third & in those days a most comprehensive [illegible] ... the days of their learning. p 390 He had left insects to Willughby

Work for plants & insects

partnership; he had not travelled ... he was doing the birds, fishes, when he turned again to entomology he had begun alone in 1690. INSECTS 24 129

p354-5. His little daughters helped him collecting. Daughter helping collect

There are various records of finds of Margaret, Mary, Catherine + Jane + Mrs. Ray also helped.

p356. A long, loving [illegible] account of behaviour in a wasp ... Aristotle ... [illegible] cannot be regarded as mechanical. [illegible] insect bodily length.

p355 In his modest ... seclusion he did ... green ... of insects.

p403. In an ... unfinished form the book on insects was published 1710 posthumously.

p406-7 NATURE + GOD

The butterflies ... when the nearer approach of final treatment is reached, since it was revised — the last few months of his life. After discussing the etymology of papilio he proceeds "you ask what is the use of butterflies? I reply to adorn the world + delight the eyes of men: to brighten the countryside like so many golden jewels. To contemplate their exquisite beauty + variety is to experience the truest pleasure .... to admire the ingenuity of the art of God."

p416 He describes ... 47 British butterflies, or ... 6 of them very new to science ... large brightly coloured species, also ...

The moths were then, apart from a few large brightly coloured species, also filled... entirely unknown. Ray grasped that the Lepidopterists ... need to know the larva + pupa as well as the imago before a correct classification could be reached. Of the next 150 years were slow to appreciate, that ... better than ... on butterflies.

p417. In some respects his work on moths is better than ... distinctly of benefit. He has found his own way + ... on the specific distinctions ... his British ... 1663 ...

Geology p420. Geology. His own work was far in advance ... Contemporaries. Ray met Nicolaus Steno ... Steno's ... was published in 1669 book De Solido intra Solidum naturaliter Contento was published in 1669 + translated into English in 1671. Ray published his Observations relating to his foreign travels in 1672 (p172). In this book

(See Adams. Birth + Dev. of Geological Sciences, p115. Paul Boccone in 1674 + Steno in 1669 maintained that glossopetrae were sharks' teeth + were not produced ... in situ)

p421 he describes the buried forest which he saw at Bruges in 1663 "in places which 500 years ago were sea", + refers to beds of sand + cockle-shells said to have been found at a depth of nearly 100 feet when sinking a well in Amsterdam. In reference to them

Geology 130

he ~~wrote~~ suggests "that of old time the bottom of the sea lay so deep & that three hundred foot-thickness of earth arose from the sediment of those great rivers which there emptied themselves into the sea ... which is yet a strange thing considering the novelty of the world, the age whereof according to the usual account is not yet 5600 years" He (p 422) adopts Steno's view of the shark's teeth found at Malta where he considers those to have been "nothing else but great rocks wholly overwhelmed & covered with the sea, especially if we consider the multitude of sea shells of all sorts, sharks' teeth, vertebres of thornbacks & other fish bones petrified, found all over the island."* He quotes Steno as the adoption of his views, based upon Hooke's Micrographia (see below) though there were found frank. (p422) Ray writes in a ~~[illegible]~~ passage, "that these were the effects of some plastic power in the stone-quarries, being nothing else but the parts & shells or productions of Nature sporting herself in imitation of these animals I can hardly be induced to believe; Nature (which is indeed nothing else but the ordinary power of God) not being so wanton & toyish as to form such elegant figures without further end than her own pastime & diversion." Ray (p423) records the places in which petrified shells ~~or fish~~ have been found in England, & elsewhere, for both of his times

* p423 Ray had visited Malta in ... than his first friends. This an Adventure, — (p424) Raven points out that this is more relevant literature.

This remarkable argumentation ... the relevant literature has been held about p424 Ray proceeds to discuss the opinions which have been probable opinions that these stones, & says "The first & some more probable opinion is that they were originally the shells or bones of living fishes & other animals bred in the sea". He claims that this is the general belief) the ancients, & also quotes ~~[illegible]~~ Fracastoro in the 16th century & Steno & Hooke in his own time. Hooke in 1665 had concluded that their figuration was due not to any kind of plastick virtue inherent in the earth, but to actual living organisms, "for it seems to me quite contrary to the infinite prudence of Nature ... which it has long been a general observation & maxim that Nature doth nothing in vain." [See Micrographia 1665 pp 110-12)

Ray recognises & gives full weight to the two difficulties in this early p426 palaeontology were confronted — their conviction of the "novelty" of the world, & their ~~[illegible]~~ great difficulty in believing in the extinction of many species in prehistoric times. 1696 (p xxviii) (see p 255) Butler p425. In the preface to the second edition of his "Catalogue" of Dean cowfield, he "Plants" after many fossil plants of 6 fossil] in future be taken into account; much in that that plant fossils men of botanists is forming a new dept. for their studies

131

p255
He holds many plants which once existed have now become extinct.
& not those these we find are "imitations of plants ... delineated by the hand or pen of sportive nature to display her proper art."
But at the same time he states various objections, & assents in the Universal Deluge, & other points. He could not "give my full & confident approval."

overrates his friend

p429
But new as always ... overrates the learning of others.

p432
In later publication he quotes Colonna of the origin of fossils.

Wisdom of God

p452
1691. The Wisdom of God manifested in the Works of the Creation. Went through successive editions & was according to Raven, extensively plagiarised in Paley's "Natural Theology"
"more than any other single book it included the true adventure of modern science, & is the ancestor of the Origin of Species or of L'Evolution Créatrice": Ray here ranges from identifying, describing & classifying to the of interpreting the problems of significance of physical & physiological processes, studies of adaptation to environment, of form & function & of [illegible] behaviour & instinct.
p453

p456
Ray does not adopt the simplified teleology of Cicero or Grew. He is too well aware of difficulties & of the evidence of incompleteness & monstrosity, to be content to assign the creation solely to the direct & initial act of God. He could not accept the anthropomorphic Deity as but designer & craftsman.
Ray regards an omnipotent deity to be accepted Cudworth's "Plastic Nature," which corresponds to the soul of the Universe in Plato's Timaeus, the world-soul of Plotinus, the seminal word of Clement or Augustine. More & Cudworth both use it in different senses: it is Cudworth's sense that Ray adopts.
p457. Raven claims that "A good case could be made for assigning the successive editions of the Wisdom of God a primary place in the development of modern science."

p459-60
"The second book of More's Antidote against Atheism 1652 supplies the sequence & underlies the contents of a large section of the Wisdom."

132 27

pp 463-4

Ray's purpose, "to show that nature is neither accidental nor arbitrary, expresses itself in a series of questions. Why does each species produce the same leaf, flower, fruit and seed, 'though you translate it into a soil which naturally puts forth no such kind'? ... What determines .. the shape of leaves and petals, 'the figure and number of the stamina, their apices, the figure of the style and seed-vessel and the number of cells into which it is divided'? 'There seems to be necessary some intelligent Plastic Nature which may understand and regulate the whole economy of the plant.'"

p466

Dealing with the usefulness to man of the animal creation, Ray's view is that the purpose of creation is not limited to its usefulness to man.

p467

The divine insistence upon the essential unity of natural and revealed, as alike proceeding from and integrated by the divine purpose, had not found clear and well informed expression until Ray's book was published.

For the third of the eighteenth century the note that Ray struck had been almost entirely mute.

p467

Ray says: ... learned to read what others have written and to ... let us ourselves examine things ... Let us not suffice to be book-learned ... truth, but let us ... look upon Nature as well as in books ... Let us not think that the bounds of science are fixed like Hercules his pillars; and inscribed with a Ne plus ultra." ... we have opportunity, and converse in Nature ... to which range ... "familiar" ... his previous books proved his

p471. In the Wisdom of God he Ray shows "... which ... mastery of anatomical and medical research and to work done in botany and zoology."

p476.

In a series of editions he develops and enriches the theme. ... half then followed the wide influence in the century ... the books and enormous influence ... to admire the products of the Wisdom of God and Ray's purpose ... the desire to understand nature as well as ... became a natural characteristic of the Church of ... God of the worth of ... justification of the Church ... the works of the Lord. The type of theology ... faith in a scientific ... depth of gay ... appropriate expression of the Christian faith in a scientific age was ... given set forth in The Wisdom of God.

p481

A great grand daughter of Ray's was still living in Essex in 1851 the year my mother was born.

Ray and books. Ray must have been quite well off for books for ... some 1500 volumes were sold by auction in London about 2 years after his death.

Raven's claims

Naturalist and outlook

wide range of reading

Raven's claims

The Correspondence of John Ray, ed by E. Lankester
London Ray Society 1848

p14 Ray to ~~Willughby~~ Lister. 1667

"I rejoice much that you still pursue the study of nature, not only because of the propensity I myself have to it, — & consequently to love such as agree with me, —" ~~only~~

Born naturalist

He goes on to speak of Lister "having taken the right course & method; that is, to see with your own eyes, not relying largely on the dictates of any master but yourself, & comparing things with books, & so learning as much as can be known of them."

p22 Sir Phil. Skippon to Wray. Dec 13. 1673

Wilkins "says he is confident no man can translate his book, 'Real Character,' better than yourself."

Latinist

Ray to Hans Sloane p130. June 8. 1681

"I am too conscious of my own weakness to own that you entertain of me, yet, both upon it as if an effect of your kindness & goodwill, it being a common fault in friends to permit their affection too much to influence & bias their judgment."

Diffidence of friends modest

p141 Tancred Robinson to Ray April 18 1684 S.N.

"I am engaged how so vast a memory, so exact a judgment, & so universal a knowledge, with the application & industry of a general body of plants, an undertaking for any of your exhausting talents."

extensive admiration

p142. Robinson had "several conferences with S. Malpighi at Bononia .... June 2 1684 Bononia I had a lamentable spectacle of Malpighi's house all in flames, occasioned by the negligence of his old wife. All his pictures, furniture, books, & manuscripts were burnt. I saw him in the very heat of the calamity, & methinks I never beheld so much Christian patience & philosophy in any man before; for he comforted his wife, & condoled nothing but the loss of his papers, which are more lamentable than the Alexandrian Library, or Bartholine's ~~Bibl~~ Bibliotheca at Copenhagen." Tancred Robinson

Concrete ~~...~~

p229. Ray of ~~painters~~ & ancients & their language, ~~...~~ "only wise men those arts of polishing & adorning consumed as far inferior to the study of things, words being but the pictures of things"

Corr. p 362

"having not been conversant 1698/9 among dried plants."

p 374

"nor am sufficiently versed in dried plants." 1700

p437 1703

Dried specimens cannot represent all the principal parts.

} for Ray's use of herbarium studies cf 134

p446 Sir Thomas Millington prescribed remedies for Ray's ill health. This is mentioned in more than one letter e.g. to Dr Hans Sloane 1704 p446

Ray to Hans Sloane Aug 16 1704 p 452 [on history of insects]

"The main reason which induces me to undertake [it] is, because I have Mr Willughby's History & Papers in my hands, who had spent a great deal of time, & bestowed much pains upon the subject."

Ray for Willr

Insects.

1

The Wisdom of God Manifested in the Works of the Creation. ~~30~~ 135
Seventh ed. 1717. London. 8. 31. 7

Ded. to Lady Letten Wendy — one of the reasons "Because I owe to the liberality of your honoured Brother, that I have thus Leisure to write any Thing." W Ray's generosity

In his modest preface one of the reasons he puts forward for writing the book is "that all the Particulars contained in this Book, cannot be found in any one Piece known to me, but lie scattered and dispersed in Many; and so this may serve to relieve those fastidious Readers, that are not willing to take the Pains to search them out".

Wisdom of God Completed

He tells us how "being not permitted to serve the Church with my Tongue in Preaching, I know not but it may be my Duty to serve it with my Hand in Writing.

John Moore 1646-1714 Admitted Clare College
1662 Fellow Clare 1667-77 -
Life - The Bibliographer 1884

31
136

Cudworth, R. (1820) The True Intellectual System of the Universe: wherein all the Reason & Philosophy of Atheism is Confuted. Ed by T. Birch

pp 53–64 are of Preface to 2nd ed 1743

p 53. "We conceive this Atomic physiology as to the essentials thereof, to be unquestionably true, viz.— That the only principles of bodies are magnitude, figure, site, motion, & rest; & that the qualities & forms of inanimate bodies are really nothing but several combinations of these, causing several fancies in us; .... this Atomic physiology, rightly understood, is so far from being either the mother or nurse of Atheism ... that it is indeed the most directly opposite to it of any, & the greatest defence against the same. For ... the principle, upon which this Atomology is founded, ... was no other than this, nothing out of nothing..... from whence it was concluded ... that souls are substances incorporeal, not generated out of matter. ... And it is from this very principle, rightly understood, that ourselves afterwards undertake to demonstrate the absolute impossibility of all Atheism. .... We do by no means here applaud Plato, nor Aristotle, in their rejecting this most ancient Atomic physiology.

p 64
Cudworth says that he maintains "the perfection of the creation, that the whole system of things, taken altogether, could not have been better made & ordered than it is. And, indeed, this Divine goodness & perfection, as displaying & manifesting itself in the works of nature & providence, is supposed in Scripture to be the very foundation of our Christian faith.

(no account of 5th chap. [illegible] etc in preface to 2nd ed. 1743)

Perfection of Creation — Ray's idea [illegible]

Plastic Nature

p 216 (XXXVII. 2, A digression)
For unless there be such a thing admitted as a Plastick Nature, that acts ... in order to Ends, Regularly, Artificially & Methodically, it seems, that one or other of these two things must be concluded; That Either in the Efformation & Organization of the Bodies of Animals, as well as the other Phenomena, everything comes to pass Fortuitously, & happens to be as it is, without the Guidance & Direction of any Mind or Understanding; or else, that God himself doth all Immediately, & as it were with his own Hands, form the Body of every Gnat & Fly, Insect & Mite, as of other Animals in Generations, all whose Members have so much of Contrivance in them, that Galen professed he could never enough admire that Artifice which was in the Leg of a Fly (& yet he would have admired the Wisdom of Nature more, had he been but

Perfection of creation

acquainted with the Use of Microscopes): Checked w/ 1st ed. p147 32 137

p 317 Now to assert ... that all the Effects of Nature come to pass by Material & Mechanical Necessity, or the mere Fortuitous Motion of Matter, without any Guidance or Direction, is a thing no less Irrational than it is Impious & Atheistical. p148 checked 1st ed.

avoid of mechanical cause

p 319 (1st ed. vers. see 140)

On these, & on consideration, it will plainly appear, that there is a mixture of life or plastic nature, together with mechanism, which runs through the whole corporeal universe. (Mixture of Life or Plastick Nature p148

plastic nature mechanism

He p319 agrees with Aristotle ~~that~~ that it is a ridiculous pretence to suppose "~~that~~ not only that all corporeal phenomena may be sufficiently solved mechanically, without any final, intending, & directive causality, but also that all other causes of things in nature, besides the material & mechanical, are altogether unphilosophical."

Final & mechanical cause

p321 The idea "that every thing in nature should be done immediately by God himself; ... it is not so decorous in respect of God neither, that he should ... set his own hand, as it were, to every work, & immediately do all the meanest & triflingest things himself drudgingly, without making use of any inferior & subordinate instruments."

plastic nature

p322 God's immediate action is ~~refuted~~ "Confuted by that Slow & Gradual Process," in the Generation of things, which would seem to be but a Vain & Idle Pomp, or a Trifling Formality, if the Agent were Omnipotent.

Wherefore, since neither all things are produced Fortuitously, or by the Unguided Mechanism of Matter, nor God himself may reasonably be thought to do all things Immediately & Miraculously; it may well be concluded, that there is a Plastick Nature under him, which, as an Inferior & Subordinate Instrument, doth Drudgingly Execute that Part of his Providence, which consists in the Regular & Orderly Motion of Matter ... p323 As by this means the Wisdom of God will not be shut up nor concluded wholly within his own Breast

plastic nature

check 1st ed. p150

p322 He also argues that the existence of a plastic nature is the conclusion of intermediate between God & the creatures

p150 ed 1 — Mechanick & plastic nature — 33 138

"Those Errors & Bungles, which are committed, when the Matter is Inept & Contumacious, which argue the Agent not to be Irresistible, & that Nature is such a thing as is not altogether uncapable (as well as Humane Art) of being sometimes frustrated & disappointed, by the Indisposition of Matter. Whereas an Omnipotent Agent, as it could dispatch its work in a Moment, so it would always do it Infallibly & Irresistibly; no Ineptitude or Stubbornness of Matter being ever able to hinder such a one, or make him Bungle or Fumble in any thing." Chud 1st ed. p150

p 323

And indeed those Mechanick Theists, who, rejecting a Plastick Nature, affect to concern the Deity as little as is possible in Mundane Affairs.... would have God to contribute nothing more to the Mundane System & Oeconomy, than only the First Impressing of a certain Quantity of Motion upon the Matter, & the After-conserving of it, according to some General Laws; p324 ... these Laws of Nature concerning Motion are Really nothing else but a Plastick Nature... Now if there be a Plastick Nature, that governs the Motion of Matter every where according to Laws, there can be no Reason given, why the same might not also extend further to the Regular Disposal of that Matter, in the Formation of Plants & Animals, & other things in order to that Apt Coherent Frame & Harmony of the whole Universe. (Chud 1st ed. p151)

pp 324-5 He then goes back to Aristotle, Plato & earlier philosophers

1st ed pp 151, 152

p 331 p154 1st -155

He then asserts a Plastick Nature, assigns a Determinate & proper Cause ... of that which is the greatest of all Phaenomena in the World, namely ... the Orderly, Regular and Artificial Frame of things in the Universe, whereas the Mechanick Philosophers, however, pretending to solve all Phaenomena by Matter & Motion assign no Cause at all. Mind & Understanding is the only true Cause of Orderly Regularity; & he that asserts a Plastick Nature, asserts Mental Causality in the World; but the Fortuitous Mechanists, who, exploding Final Causes, will not allow Mind & Understanding to have any Influence at all upon the Frame of things, can never possibly assign any Cause of this Grand Phaenomenon, unless Confusion may be said to be the Cause of Order, & Fortune or Chance of constant Regularity. ||

Perfection of creation

Final efficient causes

(Can Plastic nature be equated with the formal cause AA)

p333. He describes Aristotle's idea of the plastic nature as being "... an inward Principle ... Act itself, acting Immediately upon the Matter as an inward Principle" 1st ed p 153

(over 7 8)

19 pp 333-4 p166 R° *Nature & God* 139 34

Nature is Art as it were Incorporated & Embodied in matter, which doth not act upon it from without Mechanically, but from within Vitally & Magically. .... as God is Inward & Living | thing, so Nature Acts Immediately upon the matter, as an Inward & Living Soul, or Law in it.

Holism & perfection, nature

p 353 p 163 R ed

not Oversoul in 1st ed after the

in the Efformation of the Bodies of Animals it is One & the self-same thing that directs the Whole. That which Contrives & Frames the Eye, cannot be a distinct thing from that which Frames the Ear; nor that which makes the Hand, from that which makes the Foot; the same thing which delineates the Veins, must also form the arteries; & that which fabricates the Nerves, must also project the Muscles & Joints; it must be the same thing that designs & Organizes the Heart & the Brain, with such Communications betwixt them; One & the self-same thing must needs have in it the entire Idea, & the

p164 complete Model ... of the (p 354) whole Organic Body. ... The same is to be said likewise concerning the Plastick Nature of the whole Corporeal Universe ... [there] being one & the same thing, which formed the whole, or else it could never have fallen into such an Uniform Order & Harmony.

p 361 p 167 R ed

"That Nature of Hippocrates, that is the Curatrix of Diseases, ... and that Archeus of the Chymists or Paracelsians, to which all Medicaments are but Subservient, as being able to effect nothing of themselves without it: I say, there seems to be such a Principle as this in the Bodies of Animals, which is not Mechanical but Vital; & therefore, since Entities are not to be multiplied without necessity, we may with Aristotle conclude it ... a Lower Inconscious certain part of the Soul of those Animals, or Power lodged in them.

p 371 (ditto p 171 ?)

plastic nature

the Plastick Life of Nature is but the mere Umbrage of Intellectuality, a faint & shadowy Imitation of Mind & Understanding; upon which it doth as Essentially depend, as the Shadow doth upon the Body, the Image in the Glass upon the Face, or the Echo upon the Original Voice ... If there be Φύσις, then there must be Νοῦς : if there be a Plastick Nature ... that there must of necessity be

a Perfect Mind or Intellect, that is, a Deity, upon which it depend.

p375 p174 (1st edn) better * p175

He talks about Descartes as an atomist*, but [p376] censures his rejection of plastic nature & dismissing of causes for "the whole System of the Corporeal Universe, ... by mere Fortuitous Mechanism [p384] without any Final or Mental Causality":

Nature the artist

p179 Whereas Human Artists are often to seek & at a loss, anxiously Consult & Deliberate, & upon Second thoughts Mend their former Work, Nature is never to seek, nor Unresolved what to do, nor doth she ever Repent afterwards of what she hath done, changing her Former Course. Human Artists themselves Consult not, as Artists, but only for want of Art; & therefore Nature, though never Consulting, may act Artificially. Concluded, that what is called Nature is really the Divine ~~Art~~ Art. Nevertheless, that Nature is not the Divine Art, Pure and Abstract, but Concreted & Embodied in matter ... Not the Divine Art Archetypal, but Ectypal. Nature differs from ~~the Divine art~~ the Divine art, as the Manuary Opificer from the Architect.

Nature art

p167 1st ed.

Besides this Plastick Nature which is in Animals, forming their several Bodies Artificially, as so many Microcosms or Little Worlds there must be also a general Plastick Nature in the Macrocosm the whole Corporeal Universe; that which makes all things thus to conspire every where, and agree together into one Harmony.

microcosms
macrocosm

p148 1st ed. "Final, Intending and Directive Causality"

Plastick Nature, or life distinct from the Animal"

p146.

p146 Whereas to those who are Considerative it will plainly appear, that there is a Mixture of Life or Plastick Nature together with Mechanism which runs through the whole Corporeal Universe.

* But Descartes was not an atomist in Part II Principle XX of Principles of Philosophy demonstrates the non-existence of atoms see 17 IV 63

p147. Plastick Nature ... acts ... for the sake of something, and in order to ends

p149 Final or Intending Causality ←

~~135~~ 142-36

More, Henry An Antidote against Atheisme, or An Appeal to the Naturall Faculties of the Minde of Man, whether there be not a GOD. London 1653

Tab title

Dedicatorie

For as the bare Eyes of men able to behold the pure Light doe not unwillingly turn to the backs of the Sun to view his refracted Beauty in the delightfull colours of the Rainbow; so the perfectest Minds and the most living possest of the Divine Image, cannot but take contentment and pleasure in Observing the glorious Wisdome and Goodnesse of God so fairly drawn out and skilfully variegated in the sundry Objects of externall Nature.

Perfection of creation

p66

(regular plants) for variety, which is the delight; for otherwise it would become dull and cloying, too much harping upon the same string.

(Between regularities)

p82 Creatures are made to enjoy themselves as well as to serve us, and it is a grosse piece of ignorance and Rusticity to think otherwise.

Man's use not the only purpose

= Abstract heading Chap XII of Bk II

"Unavoydable Arguments for divine Providence taken from the accurate Structure of Man's (outward) Body, from his Passions, his Mind, and fitnesse of the whole Man to be an Inhabiter of the universe.

Perfection of creation

B2 Preface

And so in the consideration of Animalls, I do not so much urge my Reasons from their diversity and subsistence (though the framing of matter into the bare subsistence of an Animall is an effect of no lesse cause then that has some skill and counsell) but that (what I drive at) is the exquisite contrivance of their parts, and their structure is farre more perfect, than will meerly serve

More cont 143

for their bare existence & entrance into the world; What is an undeniable demonstration that they are the effects of wisdome, not the results of Fortune or fermented Matter.

p 40

the Soul is not a meer Modification of the Body, but a Substance distinct therefrom.

p 41 Microcosm - macrocosm

And therefore as wee can consider the Substance & Motion of the vast Heavens on a little Sphere or Globe, so we may with like facility contemplate the nature of the All-mighty in this little Meddall of God, the Soul of Man, enlarging to Infinity, what we observe in ourselves when wee transferre it unto God.

p 43 Book II Chap I

purpose in creation

He invites the Atheist to "walke with me a little in the wide Theatre of this Outward world, & diligently & attentively those many & most manifest Marks & signes that I shall point him to in the outward frame of things that naturally signify unto us that there is a God."

p 81. Bk II Chap 9

justification of existing little insects

For if a good man be mercifull to his beast, then surely a good God is bountifull & benigne, & takes pleasure that all his Creatures enjoy themselves that have life & sense & are capable of any enjoyment. So that the swarmes of little Vermine, & of Flyes, & innumerable such like Diminutive Creatures, we should rather congratulate their coming into Being, then murmure sullenly & scornfully yawn at their Existence; ~~for they find nourishment in the world, that would be lost~~ ... But besides, life being an individuall sense & pleasure & are into such infinite numbers that have their distinct sense & pleasure in a manner as sufficiently filled with Contentments, these little Souls are in a manner as considerable for the taking off a carrying away of themselves the over-flowing ~~benignity~~ benignity of the first Original of all things, as the Oxe the Elephant or Whale. For it is sense, not bulk that makes things capable of enjoyment.

More
Chap. X. Bk II The Frame & Fabrick of the Bodies of Animals & plants argue that there's a God.

Creation of perfect:

Having enumerated a number of adaptations (which would now be called [illegible]), he adds "But I have fallen upon a subject that is infinite & inexhaustible, therefore that I be not too tedious I will confine my self to some few observations in ordinary Beasts & Birds (these being more known & obvious being many of all their purposes) and then I shall come to the contemplation of Man.

Johnson <u>To the Reader</u> 1633

993
Aristotle's botanical works "there is much doubt of these bookes carried downe in his name."

Gesner. "He was a very learned, painfull, honest & ~~good~~ judicious writer"

" <u>Pena</u> (as I think) was a French man"

gives an account of Gerard's peregrinations

"my loving friends & fellow Travellers in this study, & of the same profession, whose companie I have formerly ~~eng~~ enjoyed in searching over a great part of Kent, & who are still ready to do the like in other places.

(He names seven)

Micrographia. p110. Very good description of fossil shells, 41 showing a clear understanding of the difference between casts & impressions, & concluding ".. I cannot but think, that all these, ... do owe their formation & figuration, not to any kind of Plastick virtue inherent in the earth, but to the Shells of certain Shel-fishes, which, either by some Deluge, Inundation, ... or some such other means, came to be thrown to that place, & there to be filled with some kind of Mudd or Clay, or petrifying Water, or some other substance, which in tract of time has been settled together & hardned in those shelly moulds into those shaped substances we now find them." *

146

He also describes fossil wood.

* His description of the Serpentine-stones found near Keinsham (4 or 5 miles from Bristol)

p112

"And he that shall throughly examine several kinds of such curiously formed stones, will (I am very apt to think) find reason to suppose their generation or formation to be ascribable to some such accident as I have mentioned, and not to any Plastick virtue: For it seems to me quite contrary to the infinite prudence of Nature ... to design every thing to a determinate end, & for the attainment of that end, makes use of such ways as are (by the Ingenious consonant) & wonderfully agreeable to mans reason, & of no way or means that does contradict, or is contrary to humane Ratiocination; whence it has a long time been a general observation & maxime, that Nature does nothing in vain; It seems, I say, contrary to that great Wisdom of Nature, that these prettily shap'd bodies should have all those curious Figures & contrivances ... generated or wrought by a Plastick virtue, for no higher end then only to exhibite such a form."

He urges that a good collection of fossils ("figured stones") ought to be made & a "History of Observations well rang'd" made upon them.

U*. 4. 35. (C)

See 146 A

THE TIMES
ARY SUPPLEMENT
SATURDAY JANUARY 5 1946
POSTAGE INLAND 1D ABROAD 2D
PRICE 3D

[By courtesy of the Walker Art Gallery, Liverpool.

"Partridge Shooting," from an oil painting by Samuel Alken, reproduced in "Sporting Pictures of England," by Guy Paget, which is reviewed on page 8.

THE NEW WORLD OF ROBERT HOOKE

"IT is the great prerogative of Mankind above other Creatures, that we are not only able to behold the works of Nature, or barely to sustein our lives by them, but have also the power of considering, comparing, altering and assisting them to various uses. And as this is the peculiar priviledge of human Nature in general, so is it capable of being so far advanced by the help of Art and Experience as to make some Men excel others in their Observations and Deductions, almost as much as they do Beasts. And by the addition of artificial Instruments and Methods, there may be a reparation for the wilful and superstitious deserting the Prescripts and Rules of Nature, whereby every man is very subject to slip into all sorts of errors."—*Robert Hooke, "Micrographia,"* 1665.

* * *

Of our two ancient universities, Cambridge is the more often thought of in connexion with the sciences. This comes primarily from Newton's influence: yet Oxford was the unquestioned nurse of the sciences as she it was that gave the first home to that "Invisible College" which grew into the Royal Society. Dr. R. T. Gunther spent many years expounding the activities of this early school. Not least of his services is the last work that he lived to print, a facsimile of the "Micrographia" of Robert Hooke (1635-1703).* This beautiful book is rare in itself and the more hard to come by since it is a bibliophile's prize. Until Dr. Gunther's beneficent intervention it could be found in few of the humbler libraries of those who can best appreciate its revelations. We could wish that he had added a running commentary on them. But since neither he nor anyone else has done so, it is not inappropriate now, two hundred and eighty years after its appearance, to review the book.

In Hooke's "Micrographia" there was for the first time brought into full view a world so new and strange that previous generations had not even dreamed of it. Unlike the boundless world of the heavens, that of the minutely small had had no prophets. We have heard not a little of Copernicus and Bruno, Tycho and Galileo, Kepler and Newton, of their revolutions that disturbed theology, of the dethronement of Aristotle and Aquinas, and of determinism's long philosophic reign. All this came about as Hooke wrote,

> because of the care taken (by certain men) in respect of the Senses, as supplying of their infirmities with Instruments and, as it were, the adding of artificial Organs to the natural. This has been of late years accomplished, with prodigious benefit to all sorts of useful knowledge, by the invention of Optical Glasses. By means of Telescopes there is nothing so far distant but may be represented to our view. By the help of Microscopes there is nothing so small as to escape our inquiry; hence there is a new World discovered to the understanding. By this the Heavens are open'd and a vast number of new Stars to which ancient Astronomers were utterly Strangers. By that the Earth itself, which lies under our feet, shews quite a new thing, and in every little particle we now behold almost as a great variety of Creatures, as we were able before to reckon up in the whole Universe.

* * *

Hooke's instrument had been known for but half a century. A few random observations had been made with it. Now it had been somewhat improved and, in England especially, it was beginning to attract attention. Henry Power (1623-68), disciple of Sir Thomas Browne, had been overwhelmed by what he saw through it. His lovely writing echoes the softly glowing music of the "Religio Medici."

> Dioptrical Glasses [he wrote in 1663] are but a Modern Invention, neither do Records furnish us with anything that does antedate our late discoveries of the Telescope and Microscope. The want of which incomparable Artifice made the Ancients not only erre in their fond Coelestial Hypothesis and Crystalline wheelwork of the Heavens but also in their nearer observations of the smallest sort of Creatures which have been perfunctorily described as the disregarded pieces and hustlement of the Creation. In these pretty Engines are lodged all the perfections of the largest animals: and that which augments the miracle, all these in so narrow a room neither interfere nor impede one another in their operations. Ruder heads stand amazed at prodigious and Colossean pieces of Nature, but in these narrow Engines there is a more curious Mathematicks.

Power preceded Hooke a little in his microscopic observations. But from early in 1663 to late in 1664 Hooke devoted all his spare time to microscopy. The pioneer work which he produced in 1665 would alone entitle him to lasting fame. Yet beside the gift for observation there displayed, he had almost incredible inventiveness and skill. Many of his discoveries are now so much a part of our civilization that we, whose lives are regulated by them, forget their originator whose memorial we carry—if we are lucky enough—in our watch pockets. The vital spring that Hooke added to the balance-wheel of time-keepers and the anchor escapement of pendulum clocks are but two of his innumerable inventions. The wheel-barometer, which came by its own again when war withheld the weather forecasts, was of his contriving. It was he who suggested that the freezing of water should determine a fixed point on our thermometers. He was one of the first to construct an air-pump, the *pièce de résistance* at many a meeting of the Royal Society. With it he laid the foundation of modern chemistry in proving, with Boyle, that the air has weight and must therefore be treated as a kind of matter and not mere void. His pump became the parent of Thomas Newcomen's "Atmospheric Engine," and through it of James Watt's steam-engine and our whole industrial development.

* * *

Hooke was a born practical mechanic. When he solved the primal difficulties of making a metal piston properly fit in a cylinder he begat the child which, by another line, was also an ancestor of our steam-driven machines. The microscope is proof enough of his excellence in making and using optical instruments and of his talent as an illustrator. As an astronomer he was by no means insignificant and, though no mathematician, he made highly important mathematical suggestions. He was an effective architect and built Bedlam, the Royal College of Physicians, Montague House, and Aske's Hospital, and prepared plans for rebuilding

* EARLY SCIENCE IN OXFORD. By R. T. GUNTHER. Vol. XIII. The Life and Work of Robert Hooke, (Part V) Micrographia. Oxford (Printed for the Subscribers by the Oxford University Press), 1945. £2 2s.

THE NEW WORLD OF ROBERT HOOKE *(continued)*

London. His theory of combustion has the respect of chemists. Little wonder that Gunther did not find four large volumes too spacious to recount his activities and ingenuities.

But here we are concerned neither with his inventions nor with his constructions, nor even with the man, but with what he saw in the world that is invisible to the unarmed eye. Into that boundless field for exploration he was the first to break at large. About a third of the "Micrographia" is occupied with "artificial substances," such as the points of needles, edges of razors, structure of silk, linen, tabby, which is another name for taffeta, &c. These show little that we might not expect. Another sixth is given to astronomical matters. The rest of the book, with its superb plates of microscopical discoveries, is our present quarry.

It is now common knowledge that plants and animals are built up of "cells," little masses of living substances, each limited by a more or less definite cell-wall or membrane. Hooke was the first to adumbrate this view of the nature of living things. One of the best known of his figures is of the cut surface of cork which he saw

to be perforated and porous, much like a Honeycomb. The pores or *cells* consisted of boxes separated by certain Diaphragms. These were indeed the first microscopical pores I ever saw and, perhaps, that were ever seen, for I had not met with any that had made mention of them.

The passage introduces this sense of the word *cell*. Yet it is not cells themselves that he here depicts but their walls. Neighbouring diagrams, however, do show complete living cells on the underside of the leaf of the stinging nettle, together with the stinging hairs and their little basal bags of poison. In these cells the eye of flesh slightly aided by the eye of faith can discern, though as in a glass darkly, that essential cellular organ, the nucleus. It was not more clearly seen for perhaps a century after Hooke's death.

* * *

Of the known species of animals about half are insects. It is natural that a high proportion of Hooke's observations were made on these creatures. His acuteness is nowhere more remarkably shown than in his examination of their eyes. These, in their more perfect form, are exquisite marvels of complexity. They are "compound," that is, they consist of collections of elements each of which is provided with a lens and an elaborate nervous apparatus, including a sensitive retina. Each element must yield a picture of an object from an angle slightly different from that formed by its neighbours. These organs in some insects amount to many thousands. How all the resulting pictures can be fused into one—if they are fused—and how the insect can react to them is a current problem of animal psychology. Hooke's genius is marked by the rapidity and assurance with which he instantly seizes on such problems.

I took a grey Drone-Fly that had a large head and, cutting it off, I fixed it with the forepart or face upwards upon my Object Plate. I found this Fly to have the biggest clusters of eyes in proportion to his head of any small kind of Fly that I have yet seen. The greatest part of the head was nothing else but two large and protuberant bunches. The surface of each of these was shaped into a multitude of small Hemispheres, scaped over the whole surface of the eye in very lovely rows, between each of which were left long and regular trenches perfectly intire. I was assured of this by the regularly reflected Image of Objects which I moved to and fro between the head and the light, and by examining the Cornea or outward skin after I had stript it off, and by looking both upon the inside and against the light. Every one of these Hemispheres reflects as exact and perfect an Image of any Object from the surface as a small Ball of Quick-Silver of that bigness would do. In each of these Hemispheres, I have been able to discover a Landscape of those things which lay before my window, as I could also the parts of my window, and my hand and fingers, if I held it between the Window and the Object. A small draught of nineteen of these [hemispheres] as they appeared in the Magnifying-glass to reflect the Image of the two windows of my Chamber, is delineated [in the Figure].

These rows [of hemispheres] were so disposed that there was no quarter visible from his head that some of the Hemispheres were not directed against; so that a Fly may be truly said to have an eye every way and to be really circumspect. And where the trunk of his body did hinder his prospect backward, these protuberances were elevated above the plain of his shoulders and back, so that he was able to see backwards. In the living Flies I have observed that, when any small mote chances to light upon any part of these knobs, the Fly presently makes use of his two fore-feet instead of eyelids, with which, as with two Brooms or Brushes, they being all bestruck with Bristles, he sweeps or brushes off whatever hinders the prospect of any of his Hemispheres. Then to free his legs from that dirt, he rubs them one against another, does cleanse them as those that card Wool cleanse their Cards.

As for the number of these hemispheres, Hooke says that in this fly it was near 14000, which I judged by numbering certain rows of them several ways. Other animals I observ'd to have yet a greater number, as the Dragon-Fly. The order of these eyes or Hemispheres was altogether curious and admirable, they being placed in all kind of Flies and aerial animals in a regular ordination of triangular rows in which order they are ranged the nearest together that possibly they can. But in Shrimps, Crawfishes, Lobsters, and Crustaceous water Animals, I have yet observ'd them ranged in a quadrangular order, the rows cutting each other at right angles, which is admits of a less number, so have those creatures a recompence by having their eyes movable in their heads which the other altogether want.

It affords us a very pretty speculation to contemplate their manner of vision, which is very differing from that of biocular Animals. That each of these Hemispheres is a perfect eye we need not doubt, if we consider onely the figure of any one of them. For they, being each cover'd with a transparent protuberant Cornea and containing a liquor resembling the humours of the eye, necessarily refract all the parallel Rays that fall on them into a point within them, where the Retina of the eye is placed. And if so, then is there, a little Picture of the objects without, painted or made at the bottom of the Retina: so that there are as many impressions on the Retinas as Hemispheres on the cluster. But because it is impossible for any protuberant surface whatsoever, whether spharical or other, so to refract the Rays that come from lateral points of any Object, as to collect them again in a distinct point, it follows that only the Picture of those parts of the external objects that lie in or near the Axis of each Hemisphere are discernably painted on the Retina of each Hemisphere. Therefore each of them can distinctly see only those parts near perpendicularly opposed to it, or near its optick Axis. So that though it has pleas'd the All-wise Creator, to indue this creature with such multitudes of eyes, yet has he not indued it with the faculty of seeing more than another creature; for whereas this cannot move his head, at least very little, without moving his whole body, biocular creatures can in an instant move their eyes so as to direct the optick Axis to any point. Nor is it probable, that [insects] are able to see attentively at one time more than one physical point; for though there be a distinct Image made in every eye, yet 'tis very likely, that the observing faculty is only imploy'd about some one object for which they have most concern.

* * *

In many beings, ourselves included, the process of development from early embryo to adult is gradual. Insects, however, exhibit a series of dramatic changes of form, as from caterpillar to chrysalis and from chrysalis to moth. These are known as "metamorphoses," from the title of Ovid's poem which tells of miraculous alterations of shape. It opens:—

In nova fert animus mutatas dicere formas corpora.

"My mind is bent to tell of forms changed into new bodies."

Hooke was not the first to observe metamorphosis in insects, but he was the first to watch a metamorphosis closely and to describe and figure it in minute detail. This he does most admirably for one of the common species of gnat. His account is a classic of natural history.

'Tis a creature [the aquatic larva of the gnat] wholly differs in shape from any I ever observed; nor is its motion less strange. It has a very large head of a spheroidal form, and body. It has two horns, almost like the horns of an Ox, inverted and as near as I could guess, hollow, with tufts of bristles at the top. These horns they could move easily this or that way, and might, perchance, be their nostrils [these structures are the antennae]. Both its motion and rest is very strange and pleasant. Where it ceases from moving its body, the tail, lighter than the rest and a little lighter than the water it swims in, presently boys it up to the top of the water, where it hangs suspended with the head downward like our Antipodes. If they do, by a frisk, get below that superficies, they presently ascend again unto it. The hanging of these in this posture, put me in mind of a certain creature I have seen in London, brought out of America, which would very firmly suspend itself by the tail, head downwards, and was said to sleep in that posture, with her young in a Purse, provided by Nature for the production, nutrition and preservation of her young ones.

He is here referring to an opossum, a marsupial creature which must have been lately on show in town. He now proceeds to describe very beautifully the change of the larva into the still aquatic pupa and the emergence from the pupa of the perfect winged insect.

But that which was most observable in this [insect] was its Metamorphosis or change. Having kept several in a Glass of Rain-water, I found, after about a fortnight, that several flew away in Gnats, leaving their husks behind in the water floating under the surface. This made me more diligently to watch if I could find them at the time of their transformation. Not long after, I observ'd several changed into an unusual shape, wholly differing from that they were of before, their head and body being grown much bigger and deeper and their belly, or hinder part smaller, and coyl'd about this great body [they are now pupae]. The head and horns now swam uppermost, and the whole body seem'd much lighter; for when by my frighting of it, it would, by striking out of its tail sink towards the bottom, the body would more swiftly re-ascend than when it was in its former shape.

I still marked its progress and found it to grow bigger and bigger. Nature accounting it for the lighter Element, of which it was now going to be an inhabitant; for, by observing one of these with my Microscope, I found the eyes of it to be altogether differing from what they were before, appearing now all over knobb'd, like the eyes of Gnats. At length, I saw part of this creature to swim above, and part beneath in the water, which it would quickly plunge in if I, by any means, frighted it, and presently re-ascend. After a little I found that the head and body of a Gnat began to appear and stand clear above the surface. By degrees it drew out its legs, first the two foremost, then the others, at length its whole body perfect and entire out of the husk (which it left in the water), standing on its legs upon the top of the water, by degrees it began to move, and after flew about the Glass a perfect Gnat.

* * *

The most famous or notorious of his illustrations are his really terrifying figures of a flea and of a louse, the former seventeen inches long in the original, the latter nearly twenty-two. These loathsome creatures are still what they were then, but from his narrative we may gather that there have been some happy changes in their hosts.

The Louse is a Creature so officious, that 'twill be known to every one at one time or other, so

THE NEW WORLD OF ROBERT HOOKE (*concluded*)

busie, and so impudent, that it will be intruding itself in every ones company, and so proud and aspiring withall, that it fears not to trample on the best, and affects nothing so much as a Crown; feeds and lives very high, and that makes it so saucy, as to pull any one by the ears that comes in its way, and will never be quiet till it has drawn blood. It is troubled at nothing so much as at a man that scratches his head, as knowing that man is plotting and contriving some mischief against it, and that makes it often time skulk into some remoter and lower place, and run behind a mans back; which ill conditions having made it better known than trusted, would exempt me from making any further description of it, did not my faithful Mercury, my Microscope, bring me other information of it.

Hooke gives an even better reason for the employment of his faithful Mercury in describing another insect:—

I could perceive, through the transparent shell, several motions which I may, perhaps, endeavour more accurately to examine, and to shew of how great benefit the use of a Microscope may be for the discovery of Nature's operations in Animal bodies. By it we have the opportunity of observing her through these pellucid teguments acting undisturbed, whereas when we pry into her secrets by breaking open the doors upon her and dissecting and mangling creatures whilst there is life yet within, we find her indeed at work but put into such disorder by the violence offer'd, as it may easily be imagin'd how differing a thing we should find, if we could, as we can with a Microscope in these small creatures, quietly peep in at the windows, without frighting her out of her usual byas.

Hooke was the first observer of many classical test-objects for the microscope such as the-fly's foot and the fish's scale. He contemplates the growths of moulds, the activities and ubiquity of mites, the stings of bees. His descriptions of the structure of feathers were the best till well into the nineteenth century. We have given here but a few samples of his many observations of minute life. His reflections are always picturesque, usually acute, often profound. Like many another naturalist he brooded on the theme of purpose. *Cui bono*? For what is this endless complexity of minute things? For him it was easier than for us, who live in the days of the theory of evolution, to separate man from the sequence of organic things, but the claim for the uniqueness of man provides no real answer to the question of Nature's purpose, made more insistent by the revelations of the microscope. For purpose man must find in his tabernacle. To be cast into a purposeless universe offends his dignity, isolates him from his world, drives him in upon himself. To find a purpose is harder for the biologist than for the physicist. Hooke's colleague, the devout Boyle, could more easily discern a divine purpose in the simpler inorganic world than could Hooke, who was peering for the first time into this great new world of life which the subsequent three centuries of vast cooperative research has hardly yet even outlined. Hooke can give us only pious clichés. For one of his investigations he hit upon that most interesting, because most primitive, of insects, the so-called "silver-fish" (*Lepisma saccharina*), and on it he reflects at the end of his book:—

When I consider what a heap of Saw-dust or chips this little creature (which is one of the least of those convey'd into its Intrals) cannot choose but remember and admire the excellent contrivance of Nature, in placing in Animals such a fire, as is continually nourished and supply'd by the materials convey'd into the stomach, and fomented by the bellows of the lungs; and in so contriving the most admirable fabrick of Animals, as to make the very spending and wafting of that fire to be instrumental to the procuring and collecting more materials to augment and cherish itself, which indeed seems to be the principal end of all the contrivances observable in brute Animals. So, according to Hooke, animals are but fires which burn—in order to burn. An emptily melancholy reflection concerning the limitless treasures of living beauty on but the remotest fraction of which any human eye can ever feast. May there not then be other eyes that can enjoy these treasures? Can that be true beauty which is not enjoyed?

The Ornithology of Francis Willughby of Middleton in the County of Warwick Esq. Translated into English By John Ray Lond. 167[illegible] Hh. 2. 26

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~~138~~
147

Willughby &c.

Preface W. was the only son of Sir Francis Willughby Kt.

Ray describes W. as of "~~[illegible]~~ great Apprehension, piercing Wit, & sound Judgment"; speaks of his "great industry" & [illegible]

He says that "in natural History being [illegible] [illegible] & [illegible] with any man either in England or beyond Seas of so general & comprehensive knowledge therein [as to History of Animals, Birds, Beasts, Fishes & Insects]

For my part I know no man who hath seen more Species, been more exact in noting their differences, & more [illegible] Characteristic Marks whereby they may be certainly distinguished; or more curious in dissecting them, & observing the make & constitution of their parts as well internal as external.

Speaks of his descriptions. ~~[illegible]~~ sometimes too minute but he dared not to ~~[illegible]~~ omit or alter any thing [illegible]

1932

1433 **WHITLOCK** (F. B.) The birds of Derbyshire, pp. viii, 239, *map and 6 plates*, 8vo, *cloth*, 1893, *scarce* 12s 6d

1434 **WHISTLER** (H.) Popular handbook of Indian birds, pp. xvi, 438, 85 *text figures and* 17 *plates* (4 *coloured*), 8vo, *cloth*, 1928 15s

The illustrations are from drawings by H. Grönvold.

1435 **WHYMPER** (C.) Egyptian birds for the most part seen in the Nile Valley, pp. x, 221, *with* 51 *coloured plates and* 11 *text figures*, 8vo, *original cloth*, 1909, *scarce* £1 8s

1436 **WILDER**, Gee and Moffett.—A tentative list of Chinese birds, pp. xii, 378, roy. 8vo, *wrapper*, *Peking*, 1926-27 12s 6d

Forms vol. 1 of Bull. of Peking Soc. of Nat. Hist. Text in Chinese and English.

1437 **WILKINSON** (E. S.) Shanghai birds, *with* 23 *coloured plates by Grönvold*, roy. 8vo, *cloth*, *Shanghai*, 1929 A study of bird life in Shanghai and the surrounding districts. £1 12s

1438 **WILLETT** (G.) Birds of the Pacific slope of Southern California, 122 pp., roy. 8vo, *Hollywood, Cal.*, 1912 Pacific Coast Avifauna No. 7. 4s 6d

1439 **WILLUGHBY** (F.) Ornithologiae, libri tres, *etc.*, totum opus recognovit, digessit supplevit Joannes Raius, 2 *tables and* 77 *copper plates*, folio, *old calf* (*neatly rebacked*), *margins of a few plates repaired*, 1676 £3 5s

1440 —— The same, another issue, title reset and printed in red and black with cuts of arms and the addition of the words "*sumptus in chalcographos fecit illustriss. D. Emma Willughby Vidua,*" 2 *folding tables and* 78 *copper plates*, folio, *old calf* (*neatly rebacked*), 1676, *scarce* £5 10s

This issue differs from the ordinary latin edition in that is has the "widow's title" in red and black and 78 instead of 77 plates. Large paper copies are known, see Mullens and Swann, Bible Brit. Orn. p. 651. These however has 77 plates.

Dr. Casey Wood writes "One of the most important treatise on ornithology of all time, being the first systematic classification of the Birds of the world."

A Catalogue of British birds is found on pp. 17-23.

1441 —— Ornithology, translated and enlarged with discourses on art of fowling, ordering of singing birds, and falconry, by John Ray, folio, pp. 441, with index, *and* 80 *plates* (78 *of birds and* 2 *of snares*) *and* 2 *folding tables*, *calf* (*neatly rebacked*), *rare*, 1678 £

THE TIMES

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EARLY EXPERIMENTS IN OPERA

VECCHI AND MONTEVERDE

BY OUR MUSIC CRITIC

Last Friday Monteverde's *Il Combattimento di Tancredi e Clorinda* was performed with strings and harpsichord; next Friday Orazio Vecchi's *L'Amfiparnasso* will be played by puppets to the vocal accompaniment of the New English Singers. Purcell's *The Fairy Queen*, which opens at Covent Garden on Thursday, will complete an object lesson in embryonic opera. The musician is indeed fortunate in that for him history is not of the dead past but is capable of resurrection at his will. Scholarship can recreate art and bring history to life.

The basic fact recorded in every history book is that at the turn of the sixteenth and seventeenth centuries the highly developed art of vocal polyphony gave place almost suddenly to melody. Counterpoint, which had taken 500 years to evolve from the single-line melody which had sufficed for musical experience up till the first millennium, was suddenly found to be tiresome as it obscured the words and so poisoned the relations of poet and musician. So music swung back once more to single-line melody, but now with some sort of harmonic accompaniment. Perhaps the presence of an audience had something to do with it. While people sang madrigals for their own pleasure they knew what they were singing about, but when others overheard them what had been chamber music for their own consumption became public music and the words must be heard. The abrupt change in England from madrigal to lutenist ayre was a clear instance of the wider tendency observable in Italy, where literary influences conspired with musical to bring about the change from the weaving of vocal lines to declamation. The instrument of the change was drama. The career of Monteverde is an epitome of the forces responsible for one of the greatest changes of taste in artistic history. With *Orfeo* opera was born, but only as a result of several experiments in making words dramatically expressive.

Polyphonic technique was not immediately cast overboard, and the form of the madrigal was considerably stretched towards drama and even provided with instrumental accompaniment in the hopes of making the old medium meet the new needs of music drama. *L'Amfiparnasso* shows how expressive even dialogue could be made without abandoning counterpoint, but it also shows why in the end it was bound to fail—the characters cannot speak *in propria persona*. The date of *L'Amfiparnasso* is 1597, of Peri's *Eurydice*, the first opera consisting of accompanied recitative in which the characters speak for themselves, 1600. In Monteverde's *Orfeo*, performed in 1607, madrigalian influence survives only in the choruses, which are fairly homophonic in style and essentially dramatic in function. In *Il Combattimento*, which came later, in 1624, Monteverde is aiming neither at drama nor at cantata but at a hybrid which will allow him to express anger and martial rage, emotions that had hitherto been excluded from his *concitato* style. The two principal characters are to mime the action in time to the music, but they have not much to sing; the chivalric story is entrusted to a narrator. Much of the interest of the piece is in the instrumental accompaniment, which realistically depicts the clash of battle.

L'Amfiparnasso is a comic opera based on the traditional Comedy of Masks. Since the outlines of the story would be known to the Venetian audience, the need for explaining the characters and the dramatic situations does not arise. There is no call therefore for the recitative which it was Monteverde's task to develop to a high pitch of flexibility and expressiveness. If not all the words are heard [illegible]ill not matter very seriously; the great thing [illegible] make music dramatic and reinforce the [illegible]—Vecchi called it a "Comedia [illegible] rapidly developing; first [illegible] secondly

in fond detail the life and character of the community as a whole. The landscape of cliff and moor, as might be expected in a novel by Mr. Gunn, is set before us vividly and intimately, and the figures of a crofter or two, a few fishermen, the policeman, the shopkeeper and secretary of the sheep club, the minister at the manse, and a knot of small boys are touched in sympathetically if with no great depth. In their various responses to the strange event which has encompassed them Mr. Gunn traces the pattern of a community existence and, more significantly, of a community soul.

That, as it happens, is the trouble. The mere fidelity to circumstance of his picture of life in Cruime matters less to Mr. Gunn than the moral and metaphysical conclusions to be drawn from the inwardness of life in Cruime. And such inwardness takes symbolical shape in the passion of the smouldering Charlie and the fair Flora, the divinely simple-minded daughter of the manse, and discursive substance in the conversations of the doctor, the explosively "creative" Michael at the lodge and his friend the literary Mr. Gwynn. It is one of these who speaks of "the search back for imaginative wholeness in the primitive," and it is evidently in support of the idea that Mr. Gunn resorts so often to a certain large and vague Gaelic mysticism of thought and speech. The type of irrationalism evidenced in such a statement as "The girls knew, with the intuition that begins where logic ends, that Flora was the only one upon whom the absolute had come," does no great harm, but the constant illustration of human desire and motive by reference to the ancestral unconscious and literal magic and the totemistic absolute can only play havoc with the saving commonplaces of fiction. Mr. Gunn's story has its excitements and its intellectual stimulus, but does not compel belief.

SPANISH PORTRAIT. By ELIZABETH LAKE. Pilot Press. 8s. 6d.

The title, "Spanish Portrait," describes the book exactly. Miss Elizabeth Lake has devoted her first novel to the drawing of a single character and drawn it with considerable skill. Her subject is a painter who knows his limitations. The English Maria is perfecting her Spanish in San Sebastian—the year is 1934—when she meets him, a tall, plump, philosophical young Spaniard. Maria is accustomed to have her friendships, and her love-affairs, follow a certain pattern, and the friendship with Alonso, which never develops into a love-affair, is something new in her experience. For Alonso pays her the extraordinary compliment of being always happy in her company while asking only that she should be happy in his. The cynical, of course, would complain that this gets a girl nowhere, and on the whole Maria is inclined to agree with them. But the friendship—which really needed an older or more experienced woman to appreciate it—is renewed in Madrid a year or so later, with Alonso still happy, still undemanding, and ended only when Maria, who has the normal youthful objection to a failure, taunts him with being one. Little enough, perhaps, to make a novel about: but the beauty of this one is in its very inconclusiveness. Miss Lake could very well have forced her plot, could have made them lovers and then either dispatched them with a businesslike "happy ending" or parted them with all the trappings of a stock situation in fiction. She does neither. They are obliged to be friends, not very satisfied with each other, perhaps, but still persuasively themselves. The character of Alonso, and the urban life of Spain before the Civil War,

was rather unfortunate in his relations certainly Cherry was not a cousin to be fond of.

The tale progresses and Henry, leaving childhood behind, learns something about life outside his kind home, in offices for example, but remains rather bewildered and lost, inarticulate and on the whole frightened, although there are moments when he sunbathes and plays tennis and sings songs with a group round the piano and forgets his timidity. And after Cherry and the typist, Marge, with her golden hair and her sensible love for study, her ambition and her friendly honesty, comes into the picture. No love-making, no special friendship, but somehow Henry the law clerk begins to feel that Marge is somebody to think about. A final severe illness leaves him struggling back to health, ready as usual to shirk beginning work again but older now and ready to admit "I don't know a thing!" Having reached this point with Henry, the reader realizes that the pains and penalties of youth have had a skilful interpreter in Mr. Sargeson.

THE SOUND OF A TRUMPET. By STEPHEN WATTS. Selwyn and Blount. 8s. 6d.

Many novels will be written on the topic of Major Watts's—the plight of men who have served as officers during war and find themselves at a loose end when they return to civilian life. Major Watts has written almost a good novel. A fault is that his study of Martin Foulkes is too analytical for readers who want "a good story" and too commonplace to interest those who enjoy psychological fiction. He mixes up not very skilfully three problems which Martin tries to solve. What sort of work shall he try for? Which of three women, his wife and two others, does he want for a life companion? What are his views about God and his fellow-creatures, about social arrangements such as education, inheritance, land ownership, and so on? Much of the book consists of conversations on these matters. The nearest we get to an explanation of the state of the world is that which Cardinal Newman adopted:—"We have abused the gift of free will and got ourselves into the most shocking mess."

It is probably a true picture, as far as it goes, of a group of people accustomed to comfort and an easy life, but none of them emerges as a genuine character. Even the major, who is chaffed for being "red," accepts meekly the decisions of his wife, a quite ordinary little "number," as the major's C.O. would say.

PINCH OF SALT. By PETER BLACKMORE. Comyns Publishers. 8s. 6d.

Sooner or later an enquiring or pedagogic mind will decide what relation the emotional or intellectual content of a play bears to that of a novel. Until that unpublished standard work can be referred to, there is nothing for it but to point out bleakly how much a play must be judged as a tale to be acted. When Mr. Blackmore brought ancient history up-to-date in his comedy "Lot's Wife," there was a kind of gay impudence about the idea of using a disaster as background for the strange predicament of people who attend a memorial service to themselves. That quality became a highly accomplished actress piquantly, and the performance was thankfully received. The book seems to lack that impudence. While lightly treated and imagined with vivid confidence it succeeds simply in being a bright little story to while away the hours.

ver
inse
heav
jung
more mud. This disjointed succession of small
acquisitions and discouraging obstacles
dictates the form of the narrative, in which
events are recorded diary-fashion as they
occur, with little emphasis on other relations.

The reader must do his own collecting from it in accordance with the demands of his mental museum. If its political department specializes in ammunition for bombarding totalitarians he will note what he reads of the stupidity of the "big-headed officer" in charge of the road operations of leaf-cutting ants. On the other hand for sagacity—per-

THE TIMES LITERARY SUPPLEMENT SATURDAY FEBRUARY 9 1946

AN AGE OF RICHES

THE WRITERS OF THE SEVENTEENTH CENTURY

WHEN Professor Whitehead surveyed the centuries in his "Science and the Modern World," on coming to the seventeenth he did not give its mere number as he did to the eighteenth and nineteenth, but boldly labelled it "The Century of Genius." It was for him the century of Galileo, Kepler, Pascal, Grotius, Boyle, Wren, Newton. In our English literature of that century, if reluctantly we assign Shakespeare to the Elizabethan age, there is no giant but Milton, though there is a host of writers whose appeal to the present age is stronger than it has ever been. The reasons for this increased interest are not far to seek. The vogue of John Donne is the most striking instance of this revolution in taste. His reaction from the Elizabethan facility, his blend of thought with passionate utterance, his cynicism and mental disquiet, and perhaps also, for some, his return to faith, appeal to a generation that has lost its illusions and has a spiritual hunger which is not to be satisfied with any material success. It is significant that Mr. Aldous Huxley should tell in "Texts and Pretexts" of his discovery in middle life that Herbert and Vaughan could give him some mystical insight which the poets of other ages did not. Again, the modern interest in psychology is stimulated by finding how searchingly Donne analyses the relation between body and soul in sexual love, how Burton examines the causes of religious melancholy, and why Hobbes can be held to be the founder of empirical psychology. Others find their way to this century because the roots of our English political and social thinking are [illegible] exacted by [illegible] me for a fresh [illegible] Of the other [illegible] collected a [illegible] well three outstanding writers: Hobbes with his bare, athletic, homely style; Harrington, whose "Oceana" had its main influence in the American colonies; and Milton, who figures largely in the political and theological chapters as well as having alone a chapter to himself as poet.

Bacon rang "a bell to call other wits together." If he made no contribution to scientific discovery, he prepared men's minds for the conquest of nature and illimitable material success. He sought to protect the freedom of inquiry by keeping religion and science apart. Most of his successors were orthodox, and the Christian view of the universe was not seriously challenged till after this period. The new astronomy did indeed perturb some minds; Drummond of Hawthornden complained that the new opinions "leave the Imagination in a thousand Labyrinthes," and the sturdier Burton confessed to being "almost giddy." Sir Thomas Browne, because of his literary gift, has too large a place in the chapter on scientific thought. It is difficult to accept the view that he made great endeavour to keep his mind "abreast of modern science." Robert Boyle deserves more attention than he receives in this chapter.

Religion was still the main preoccupation of men's minds. Nearly half the publications were religious, ranging from popular books of piety and sermons to solid divinity. Among the former, besides much that served its day and is forgotten, there were books that continue to find readers—Jeremy Taylor's "Holy Dying," Baxter's "The Saint's Everlasting Rest," "Sancta Sophia," and Bishop Andrewes's "Devotions," which generally have their due, and their individual quality is recognized. For instance, there should be no mistaking of Vaughan for Herbert, or of Crashaw for either, and none of them is heavily indebted to Donne. The court poets—Carew, Suckling, Lovelace—often wrote carelessly, but each of them every now and then achieved something perfect in its way. One of the happiest revelations of the age is that so many of the minor poets will on occasion produce a memorable poem. We have but to recall a few of such instances—Wotton's "You meaner Beauties of the Night," Sidney Godolphin's "Lord, when the wise men came from far," Habington's "Nox nocti indicat scientiam," Montrose's "My dear and only love," Cowley's "On the Death of Mr. Crashaw," the anonymous "Yet if his majestie, our Soveraign lord," and Henry King's "Exequy" on the death of his wife in her twenty-fourth year, with the ardent affection of its closing lines:—

> 'Tis true, with shame and grief I yield,
> Thou like the Van first took'st the field,
> And gotten hast the victory
> In thus adventuring to dy
> Before me, whose more years might crave
> A just precedence in the grave.
> But heark! My Pulse like a soft Drum
> Beats my approach, tells Thee I come;
> And slow howe'er my marches be,
> I shall at last sit down by Thee.

Such poems could only have been written in that age, and the bare rehearsal of a handful of them shows what a rich harvest there is to glean by those who make themselves at home in that age.

There are also prose works of the lesser