Was Leonardo a “Copernican”?

Richard L Poss
University of Arizona

Leonardo da Vinci:

"Il sole no si move."

"The sun does not move."

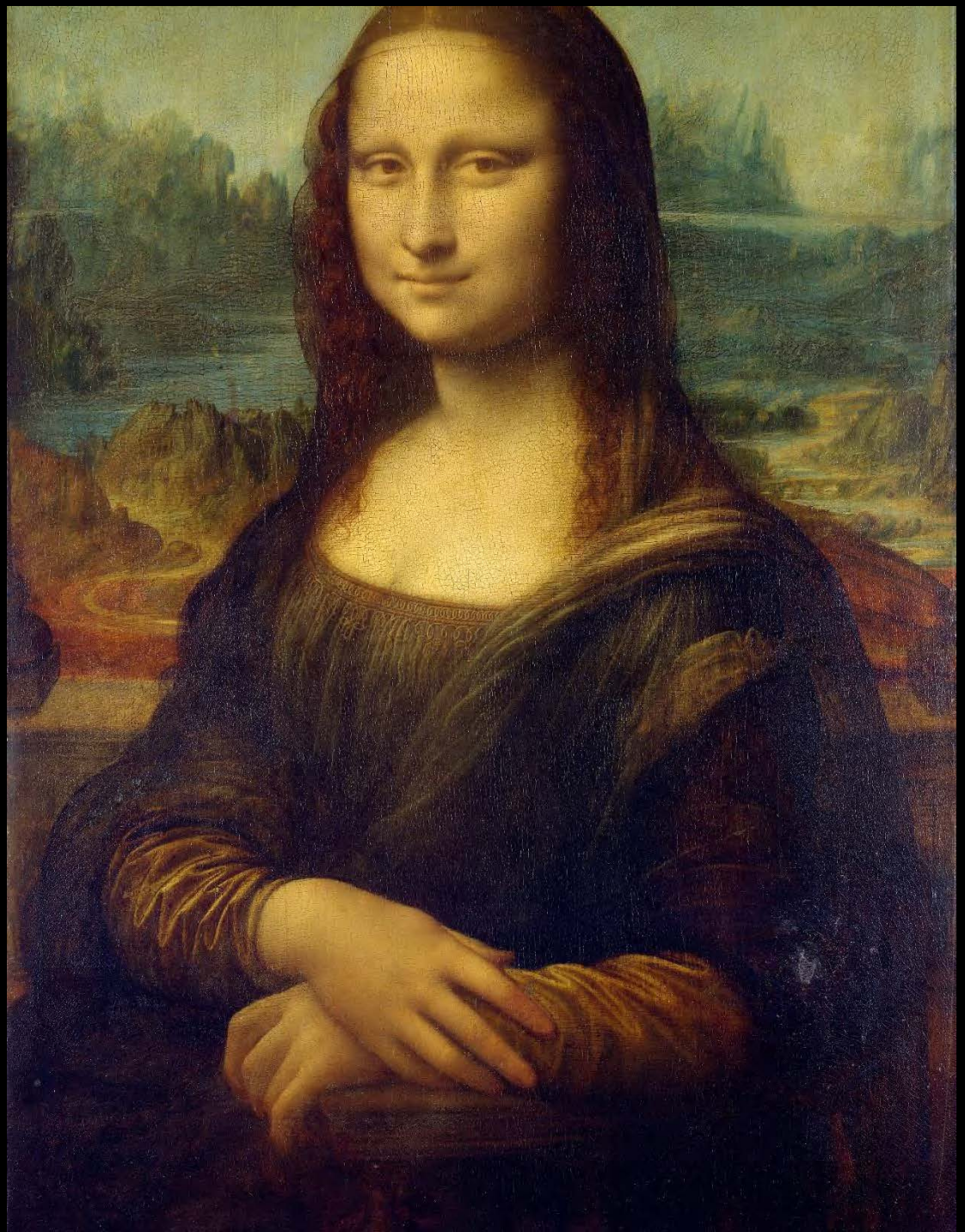
~1510

“The sun does not move.”

“a brilliant leap decades ahead of Copernicus, Galileo, and the realization that the sun does not revolve around the earth?”

Walter Isaacson, *Leonardo da Vinci*, p.441.

Leonardo, Last Supper, 1498. Fresco. Santa Maria delle Grazie, Milan.



Leonardo,
Mona Lisa 1504
oil on canvas
Louvre

Leonardo

Madonna and Child, St. Anne and infant St. John 1510

Cartoon

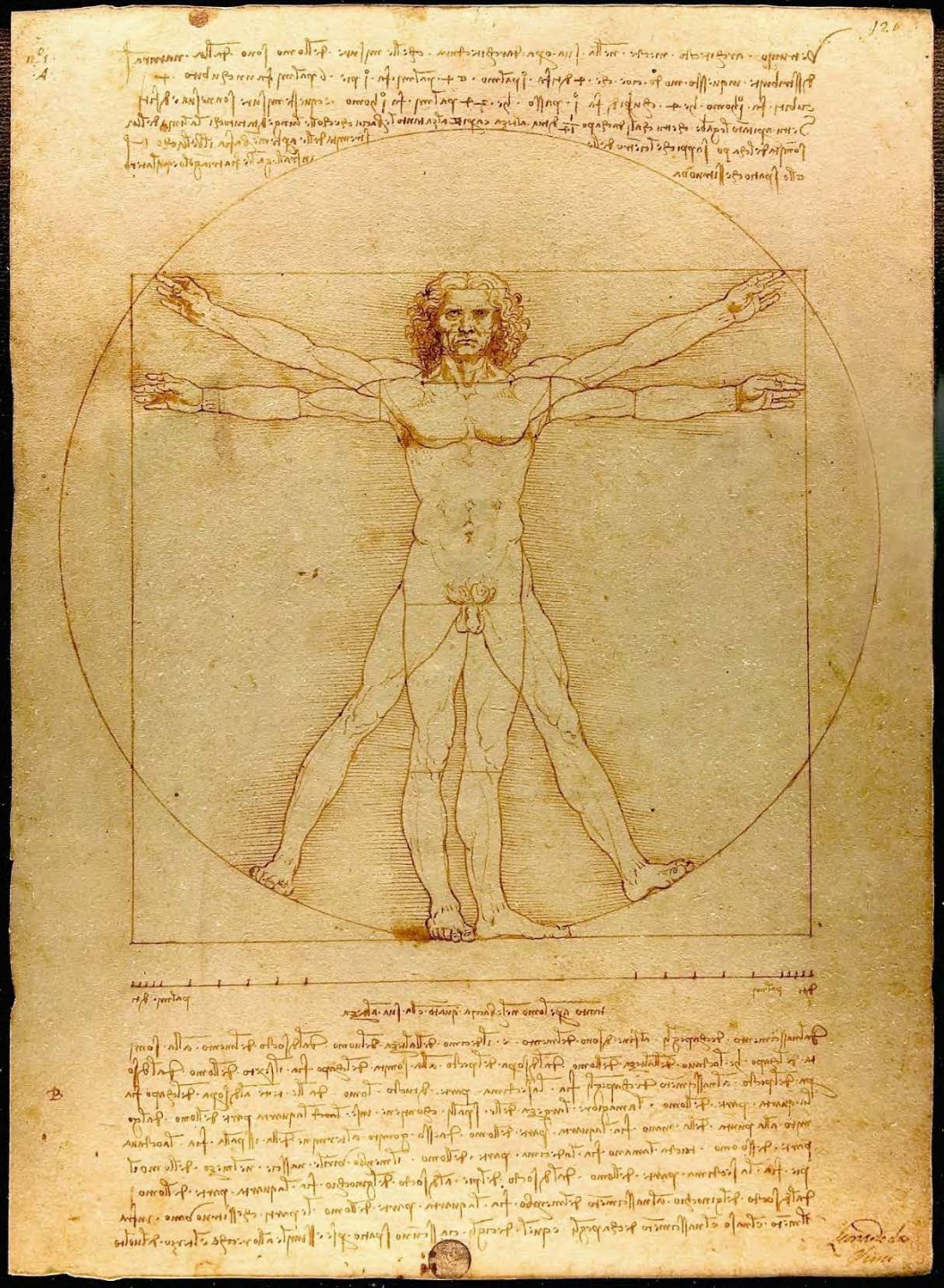
London National Gallery

Leonardo,

Madonna and child with St. Anne. 1519.

Oil on wood.

Louvre

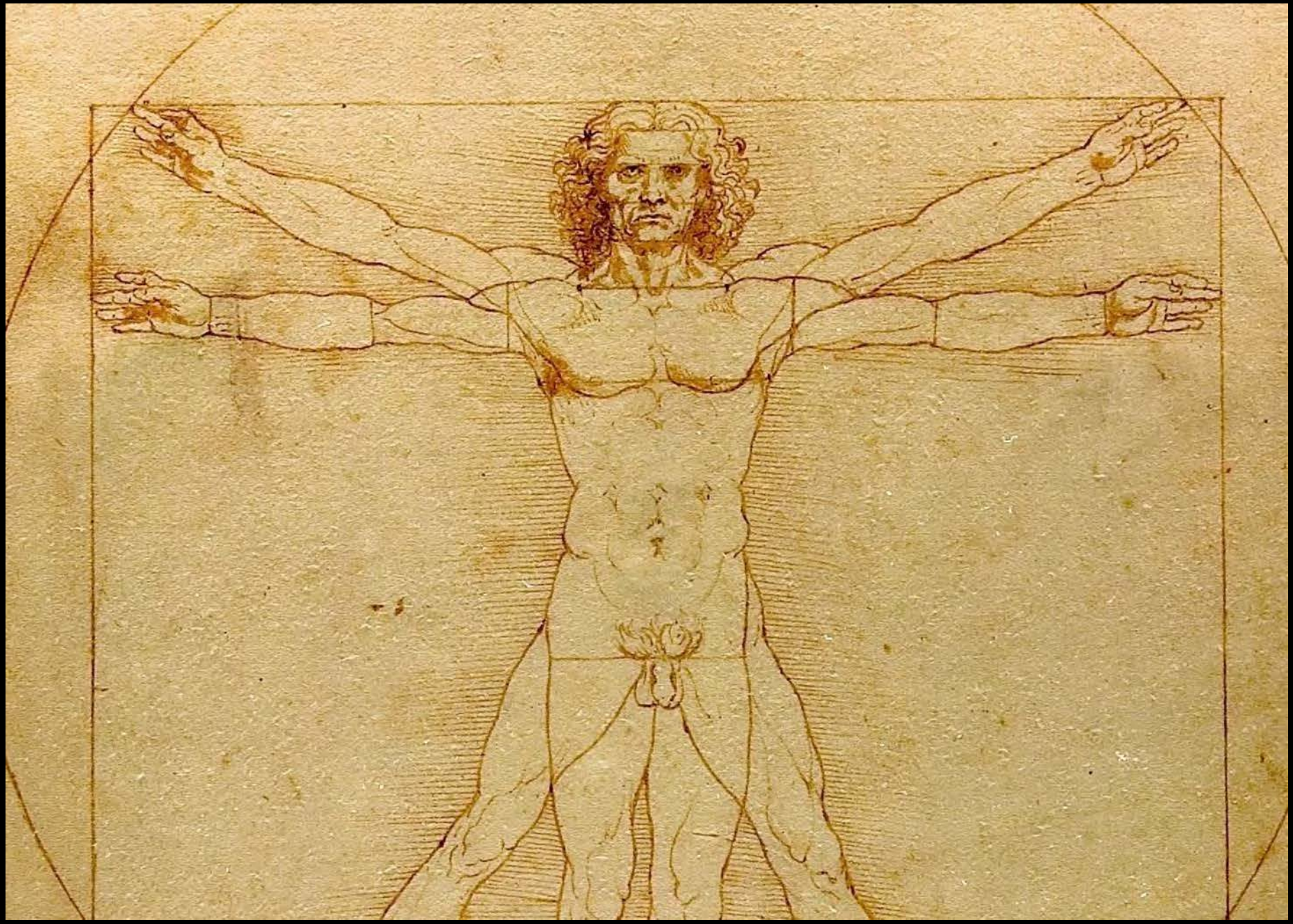


Leonardo,

“Vitruvian Man” 1490

Pen, brown ink and watercolor over metalpoint on paper.

Accademia, Venice.



Andrea del Verrocchio (1435-1488)

- Successful workshop Medici patronage.
- May have apprenticed under Donatello, or Fra Filippo Lippi.
- Students:

    Leonardo da Vinci (14)

    Domenico Ghirlandaio

    Francesco Botticini

    Pietro Perugino

    Lorenzo di Credi

Both Painting and Sculpture.

Primacy of Drawing.

Drawings and Studies

- Preparatory Sketches, Cartoons
- Architecture, Anatomy, Animals.
- Idea sketches, Meditations, Allegories
- Engineering Studies, Optics, Mathematics.
- Inventions, Illustrations,
- Studies from Life.
- “Brainstorming.”
- Psychological Self-Analysis.

Drawings and Notebooks:

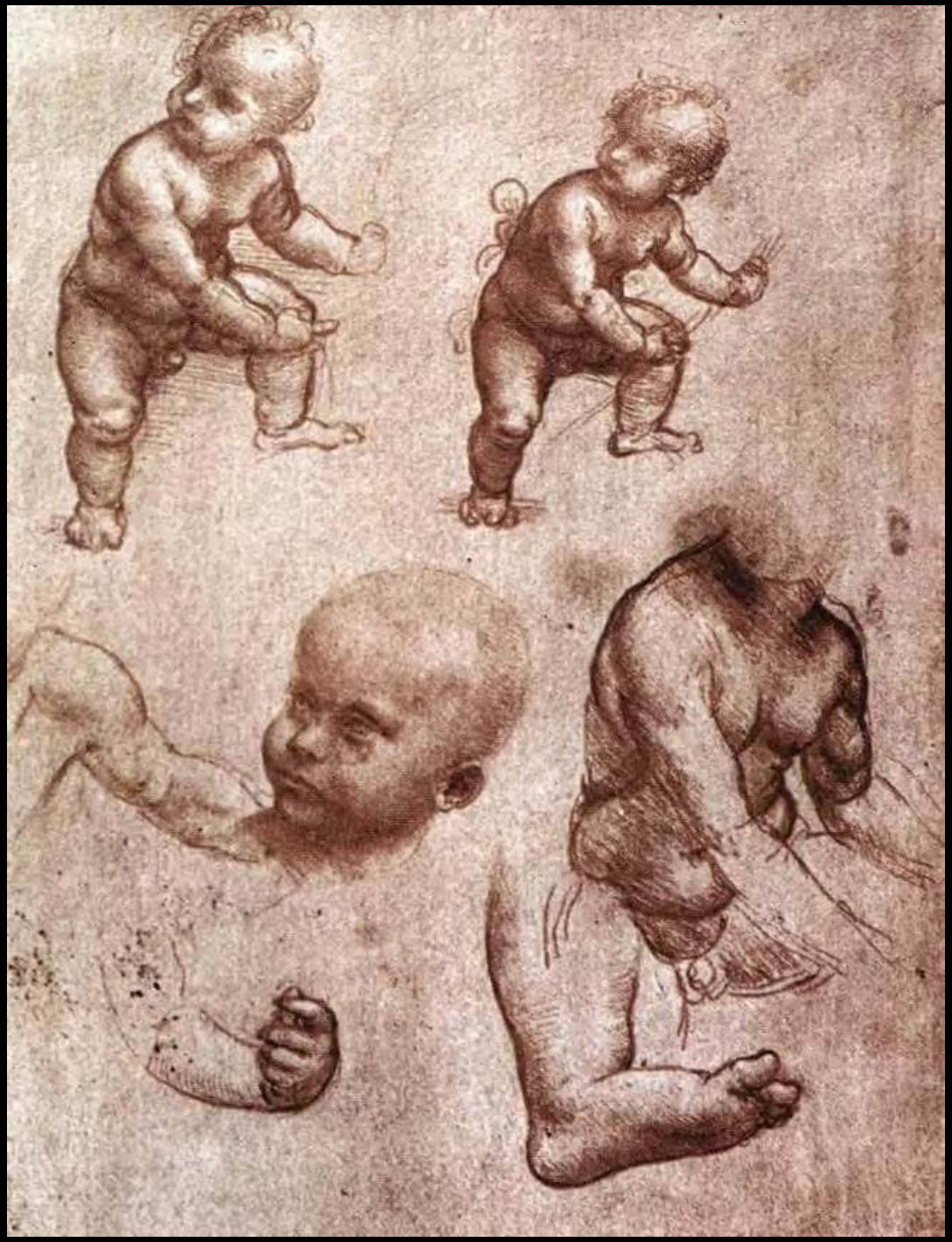
- Described variously as notebooks, sketches, journals, drawings, manuscripts.
- Scattered, disassembled, reassembled, bought, sold, lost, rediscovered.
- Estimated: Produced between 20,000 to 28,000 pages of notes and sketches spanning across 50 different notebooks.
- About 7,000 pages survive.

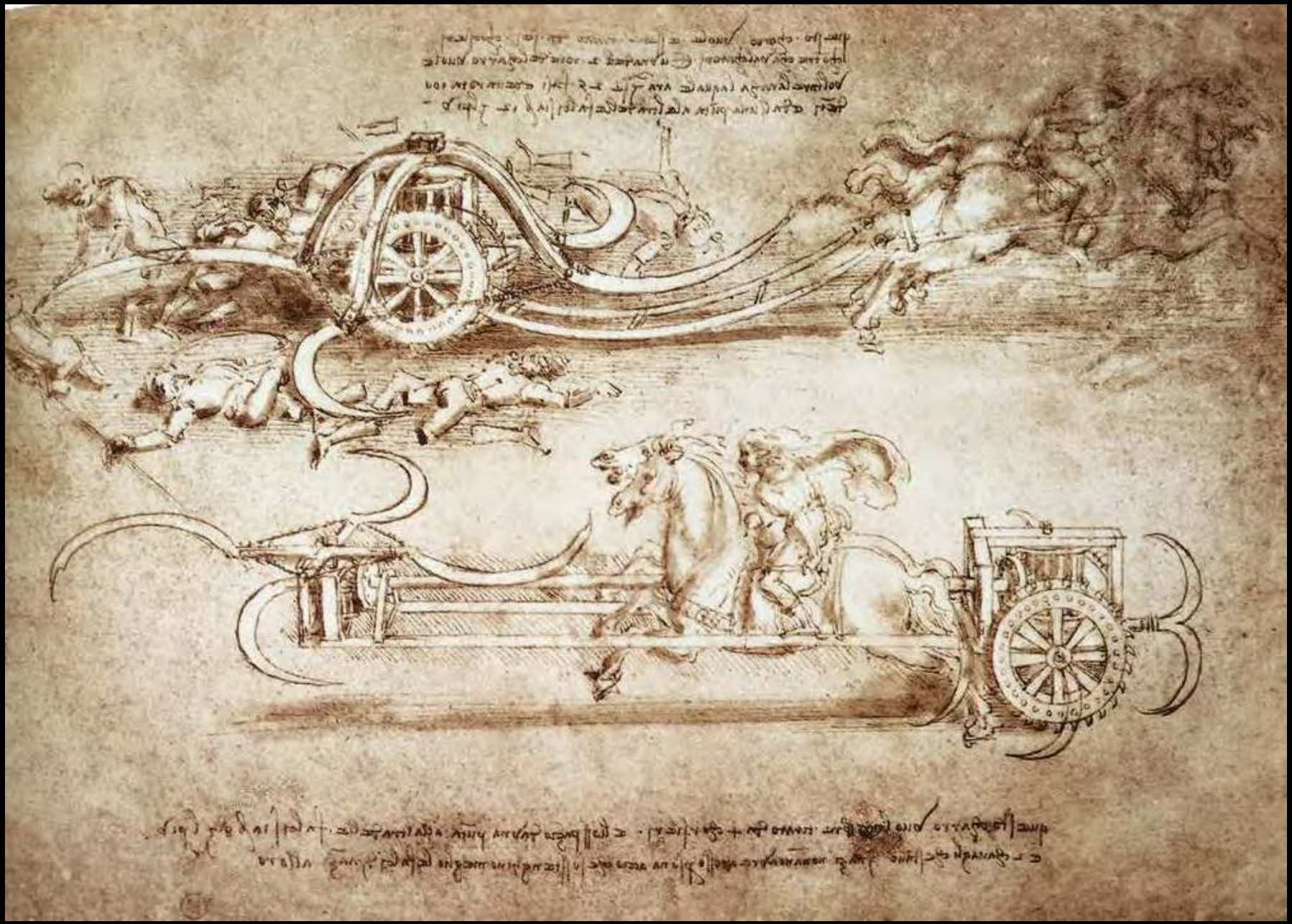
Collections:

- Codex Atlanticus, Ambrosiana, Milan. 1478-1519. 12 Volumes. Ordered by Pompeo Leoni. (1,119)
- Codex Windsor, 1478-1518. (153)
- Codex Arundel, 1480-1518. British Library. (283)
- Codex Trivulzianus, Sforza Castle, Milan, 1487-1490. (55)

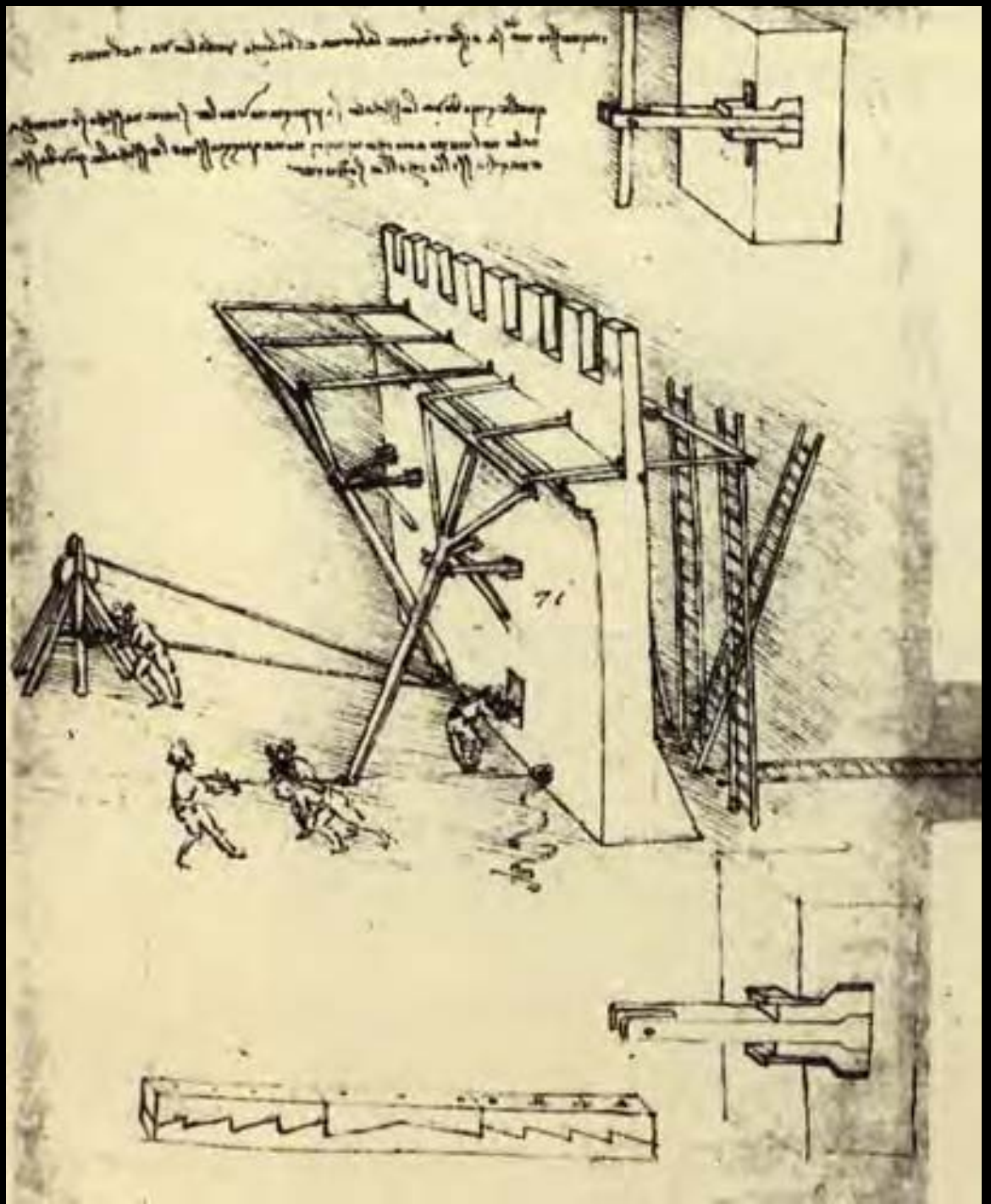
Collections, cont.

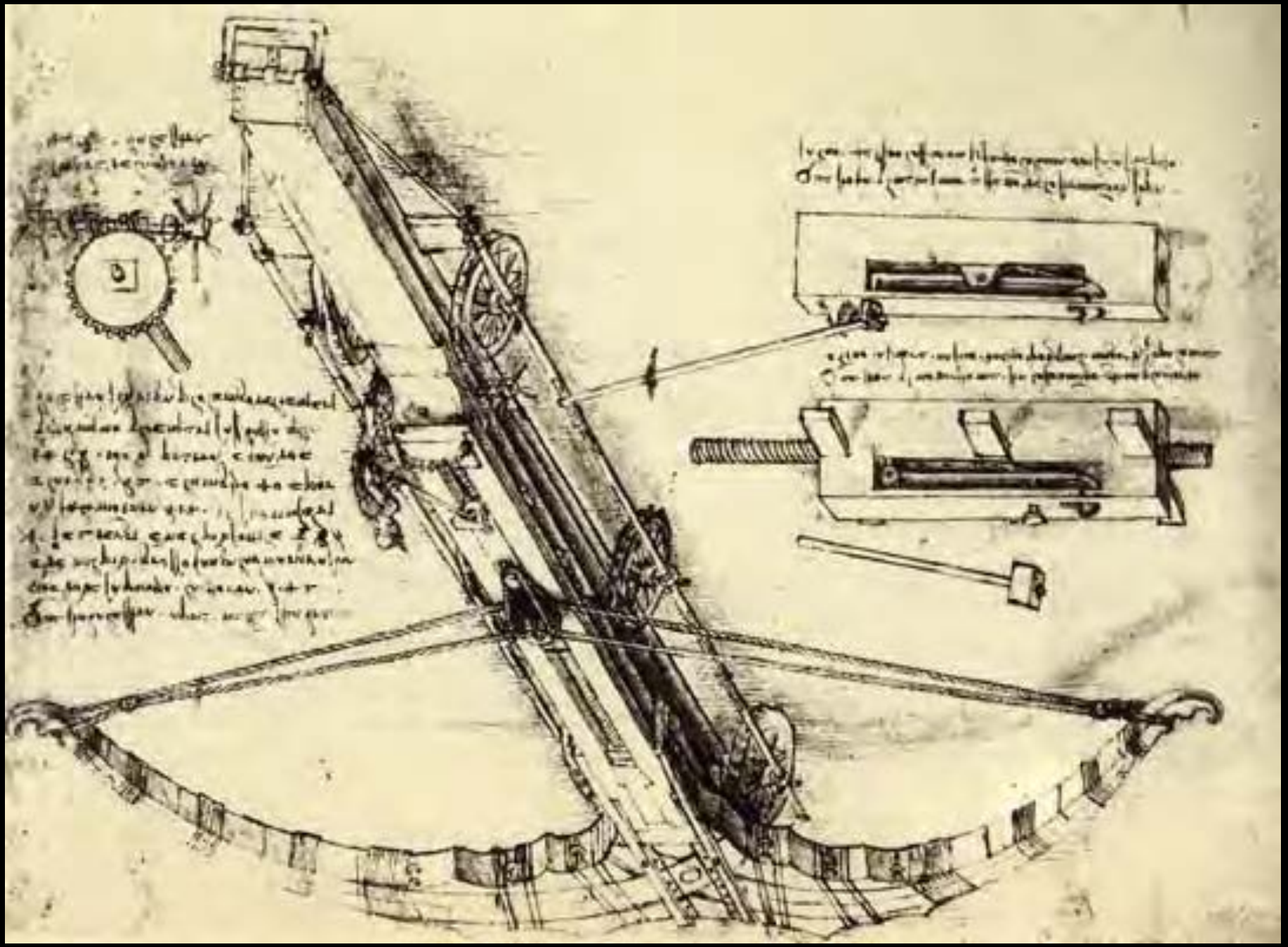
- Codex Forster, 1487-1505. Victoria and Albert. (354)
- Paris Manuscripts, 1488-1505. (2500)
- Codex Madrid, 1490-1504. (2 vols.)
- Codex Leicester, 1506-1510. Private. (72)
  (Armand Hammer/Bill Gates)

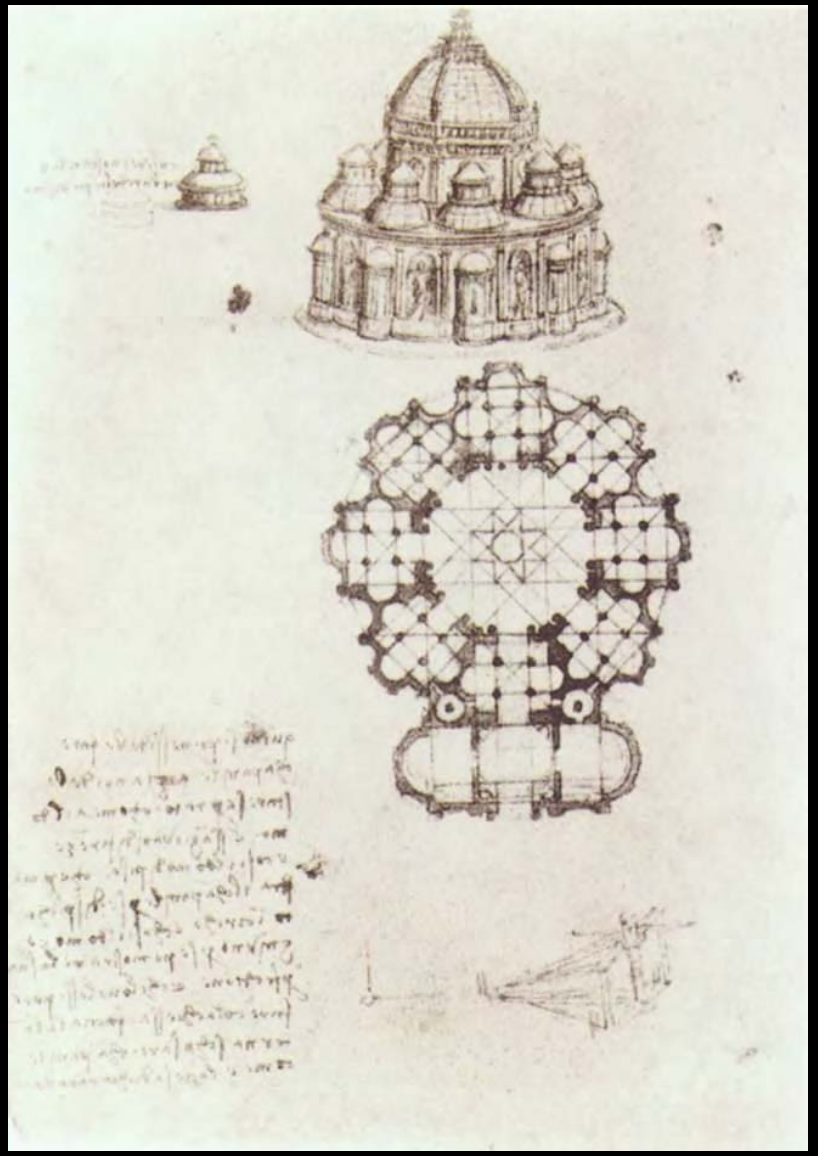


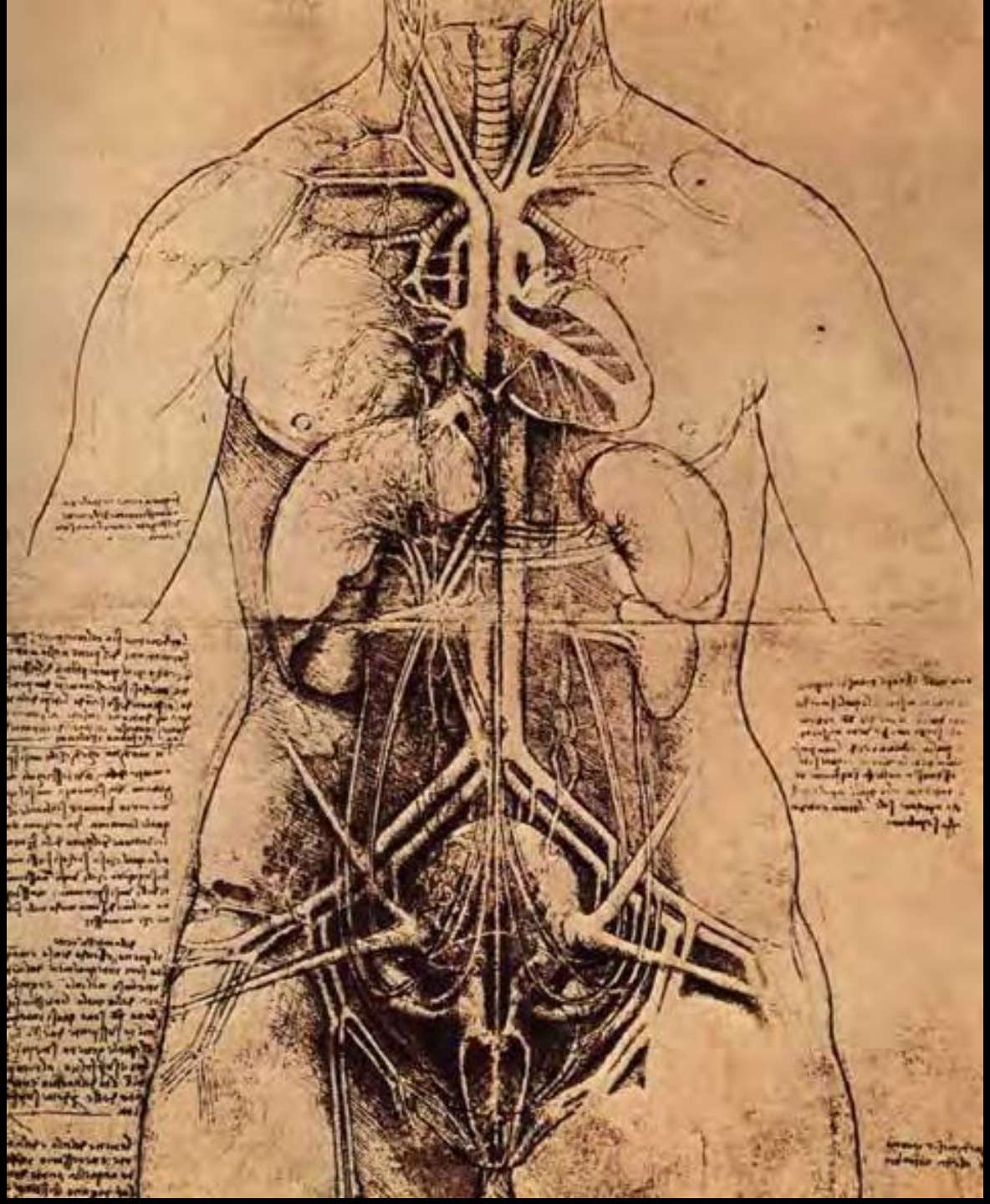


The Human Scythe.



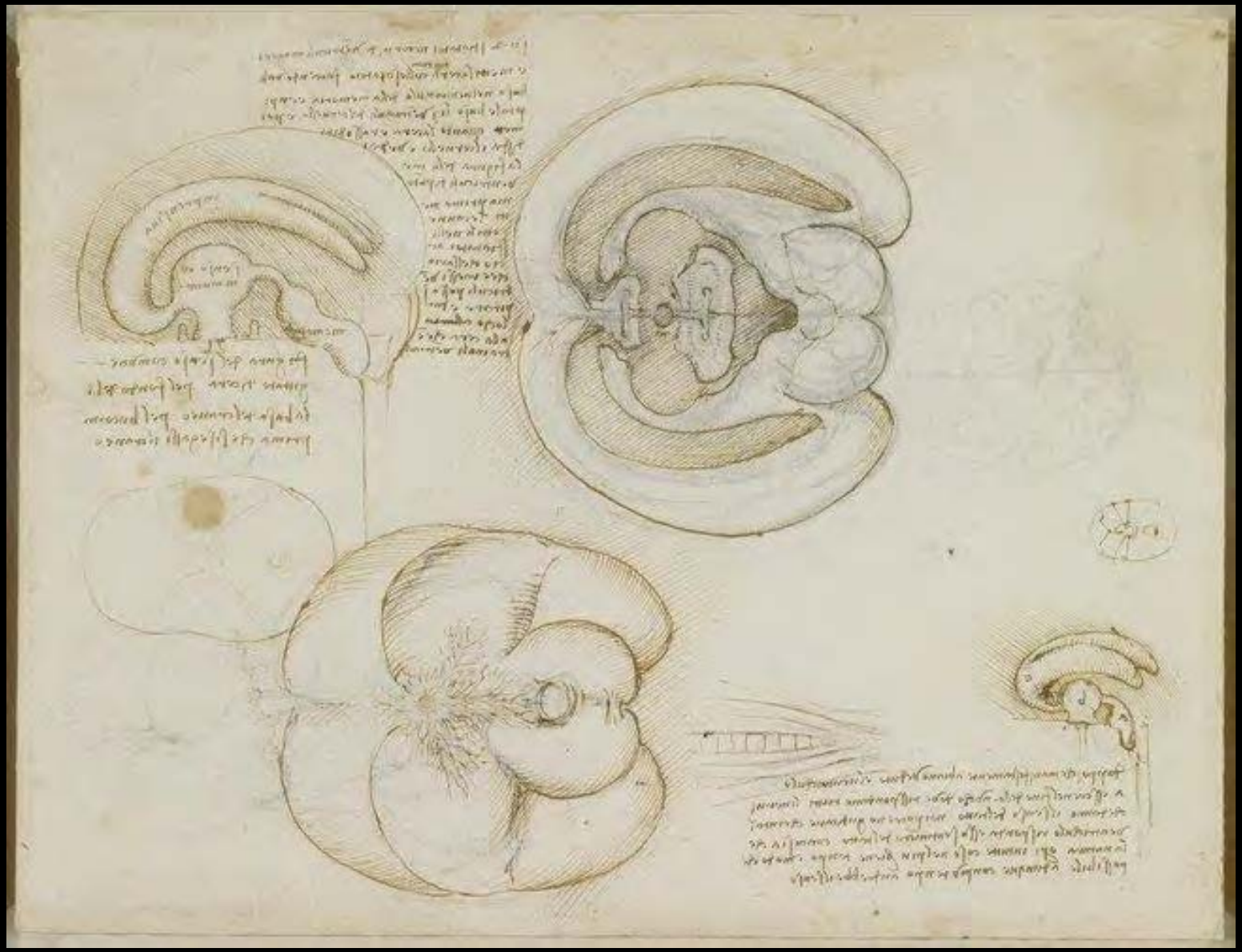




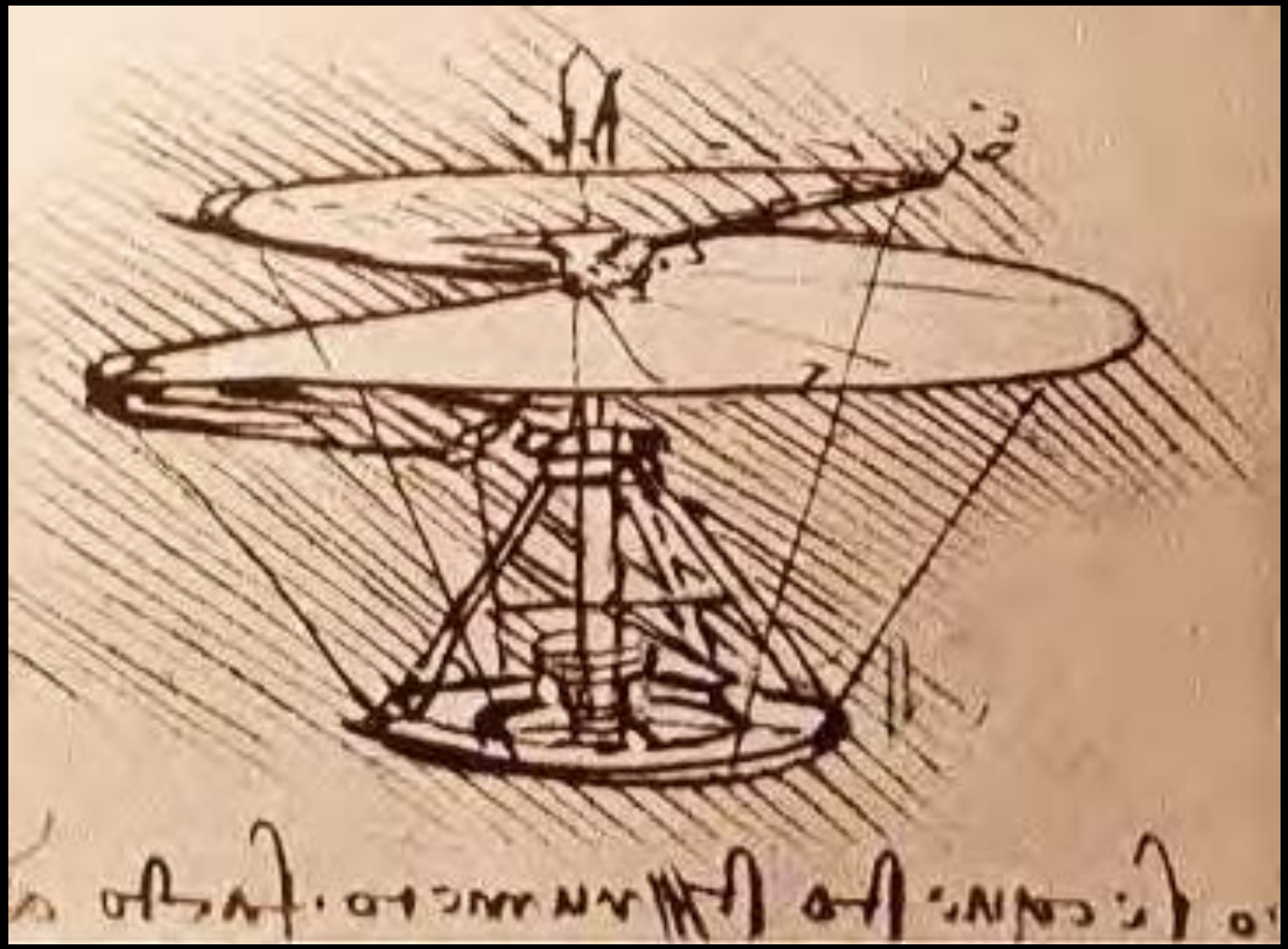


Marcantonio della Torre

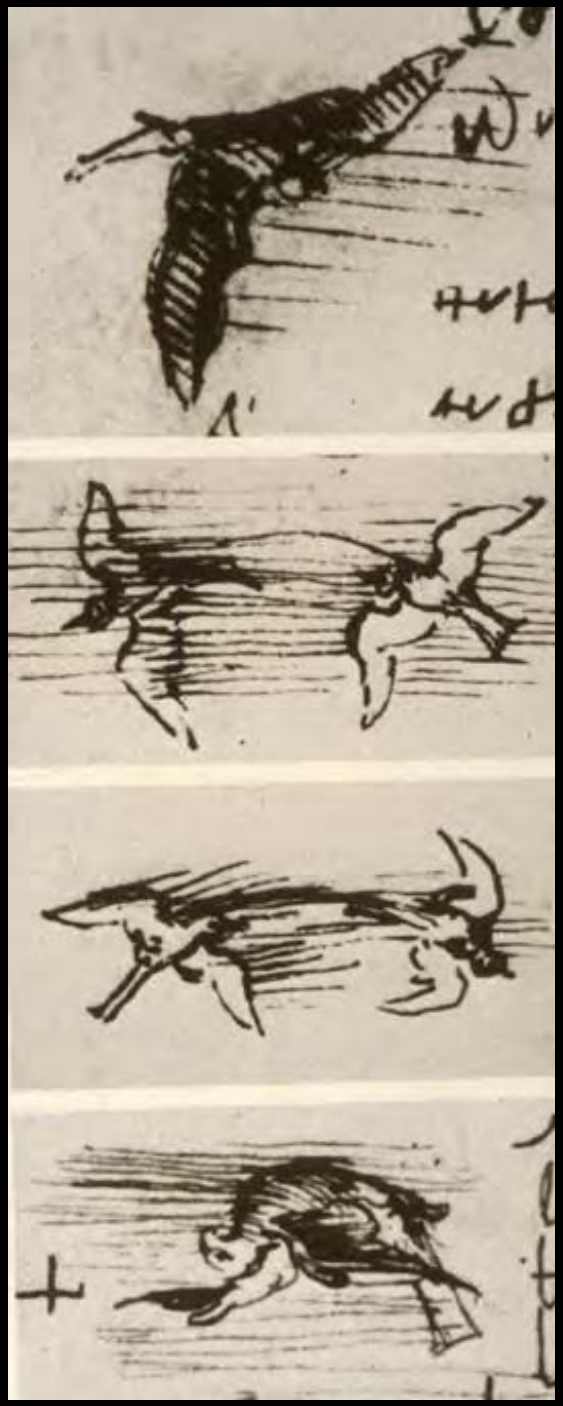
- 1481–1511
- Professor of Anatomy. University of Pavia and University of Padua.
- Collaborated with Leonardo on a treatise on Anatomy. Della Torre wrote the texts.
- Leonardo made some 750 drawings from dissections for this book.
- Della Torre dies in 1511. Leonardo drops the project.

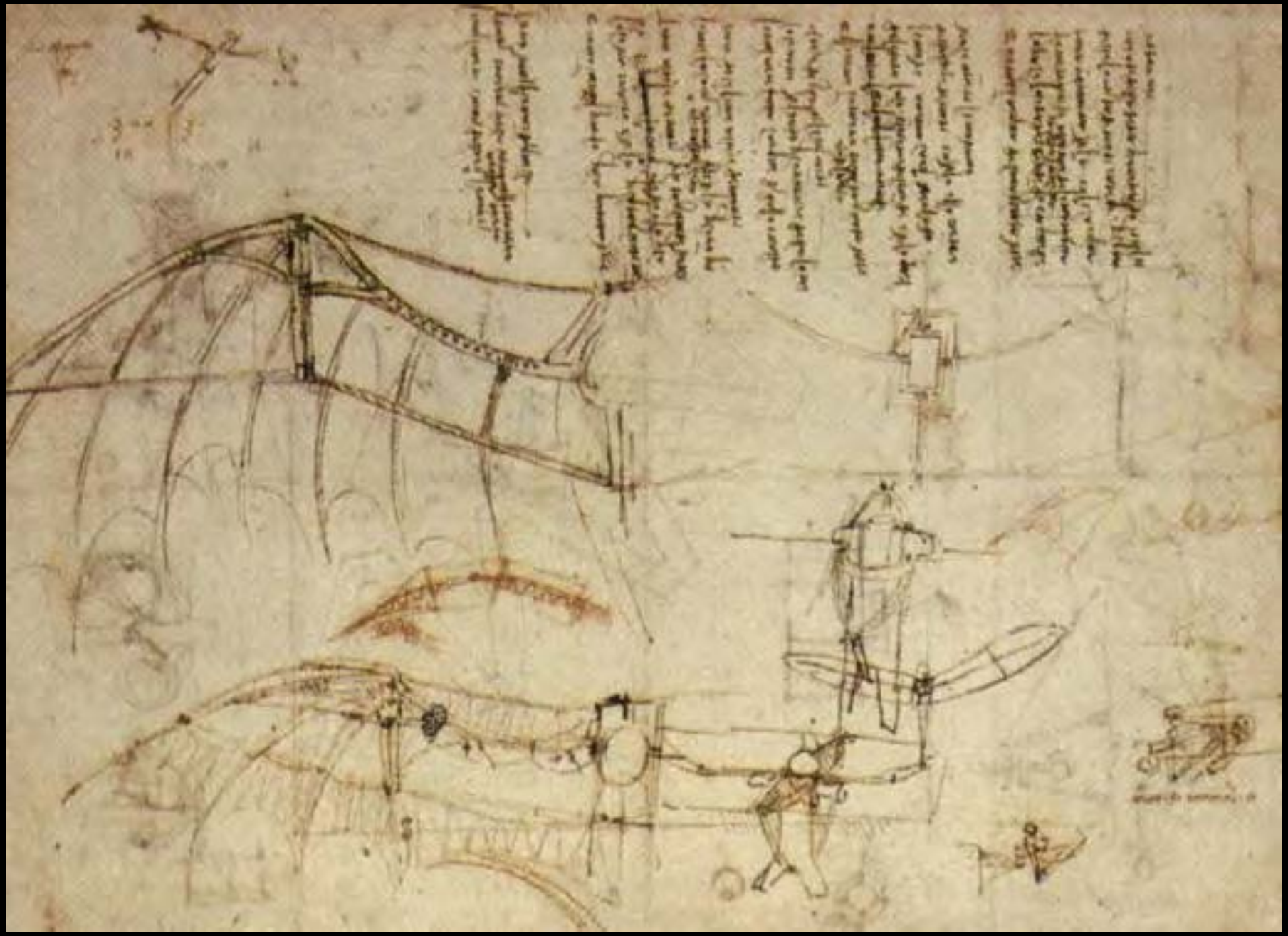


Leonardo injected molten wax into the brain of an ox to determine the shape of its internal cavities.



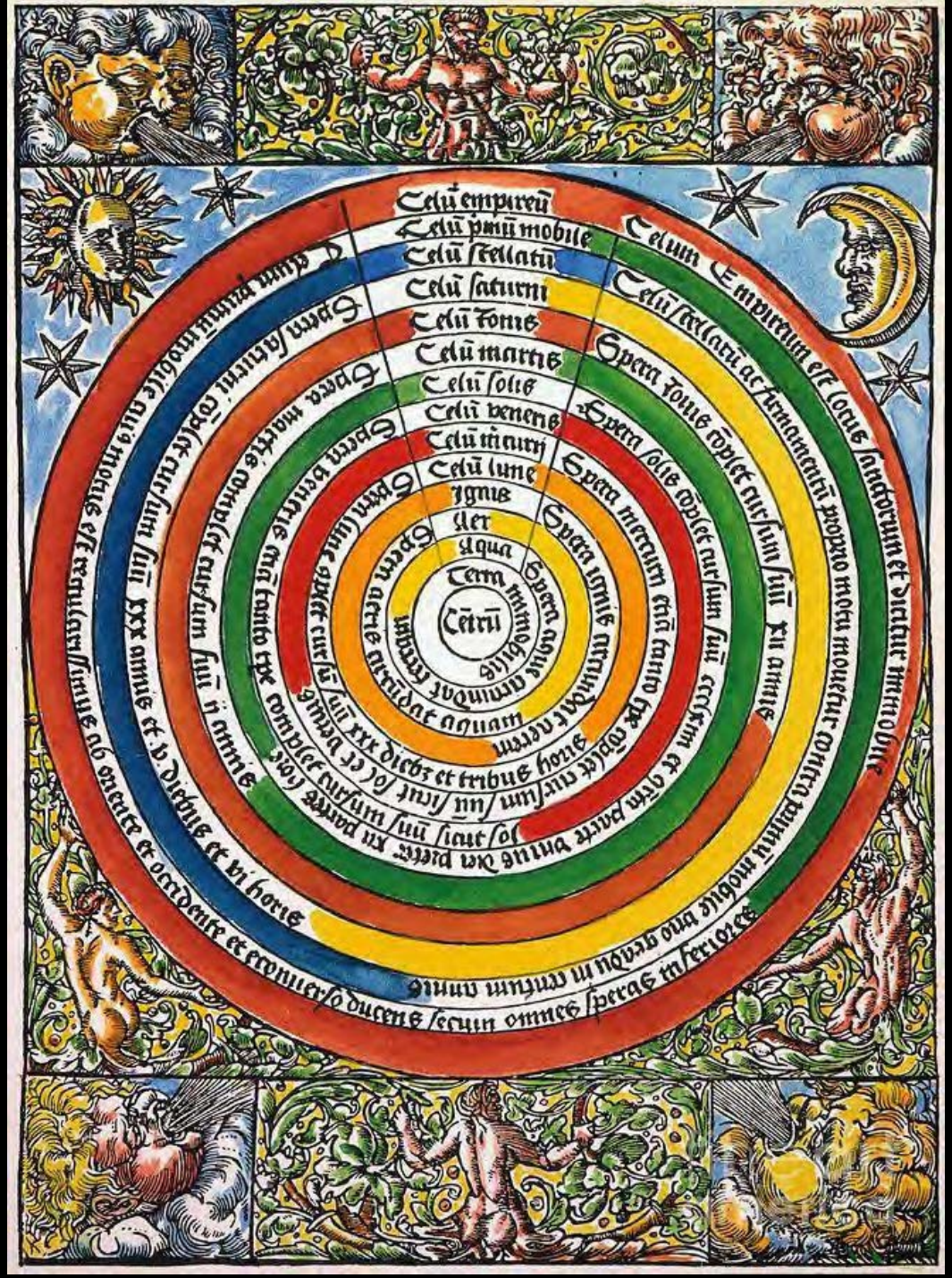
Leonardo's design: a proto-helicopter.





- Costume designs for a theatrical entertainment at court.

Allegory of boat, dog, and eagle.



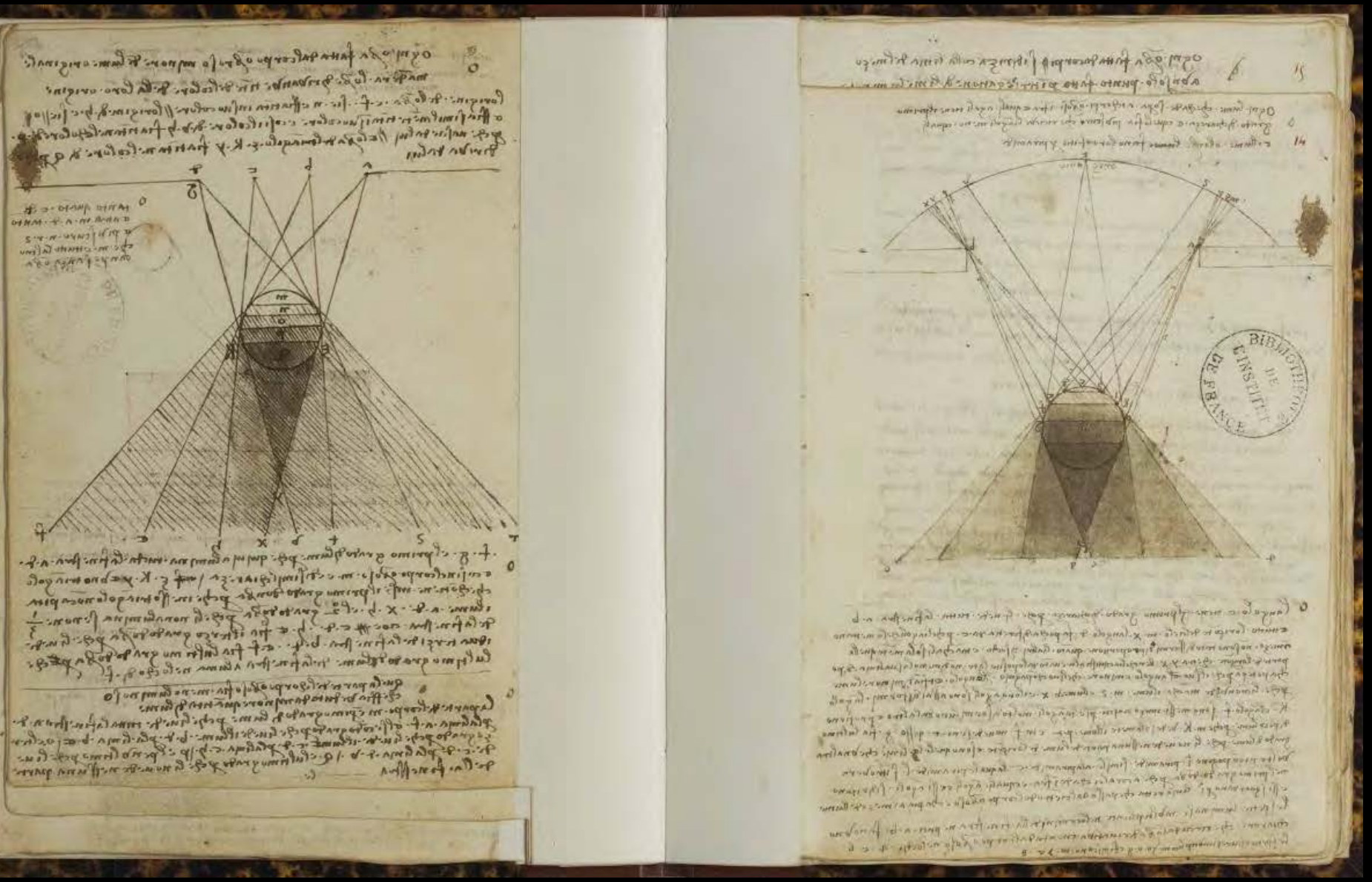
Cornelius Cornipolitanus,

"Chronographia",

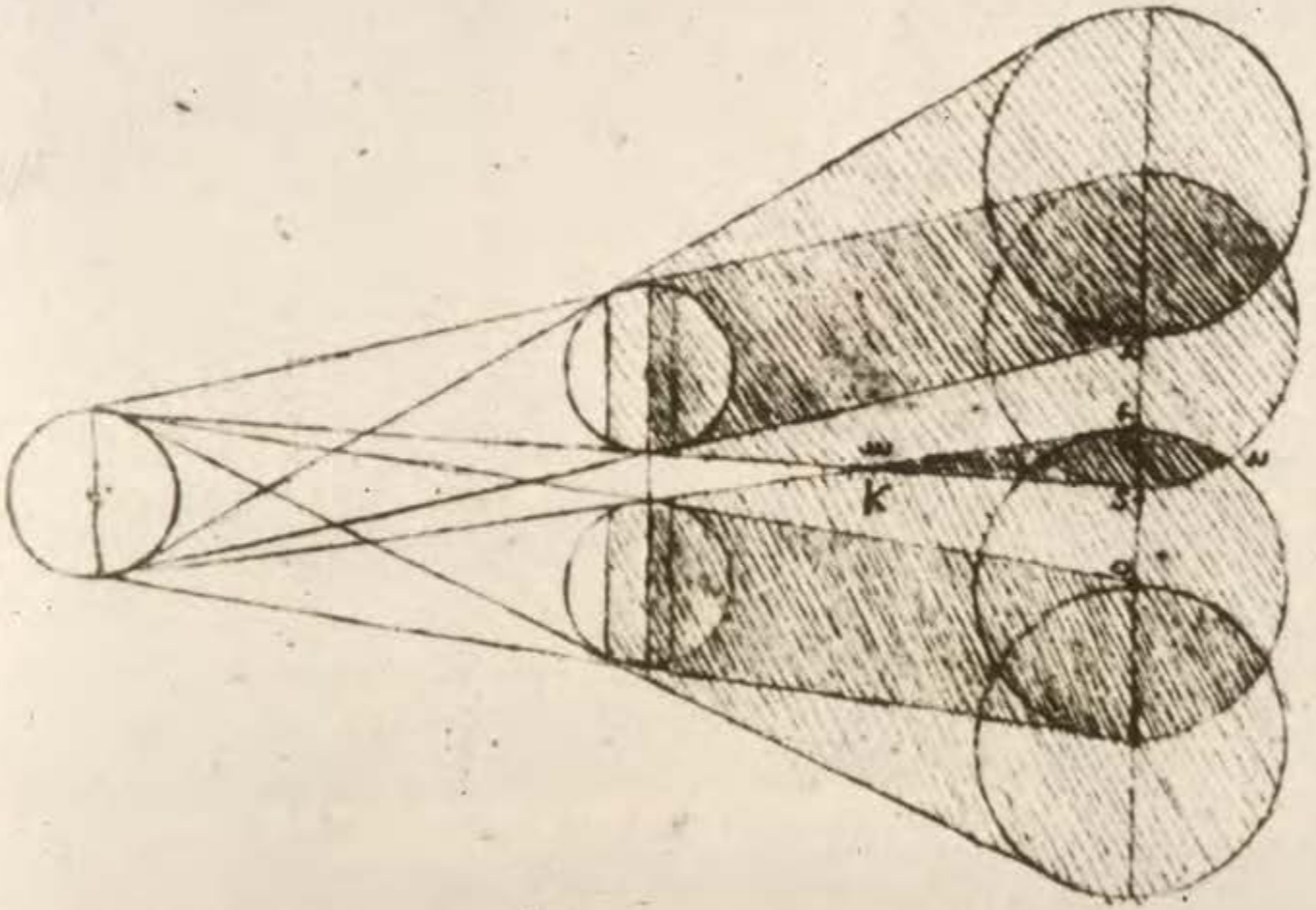
1537.

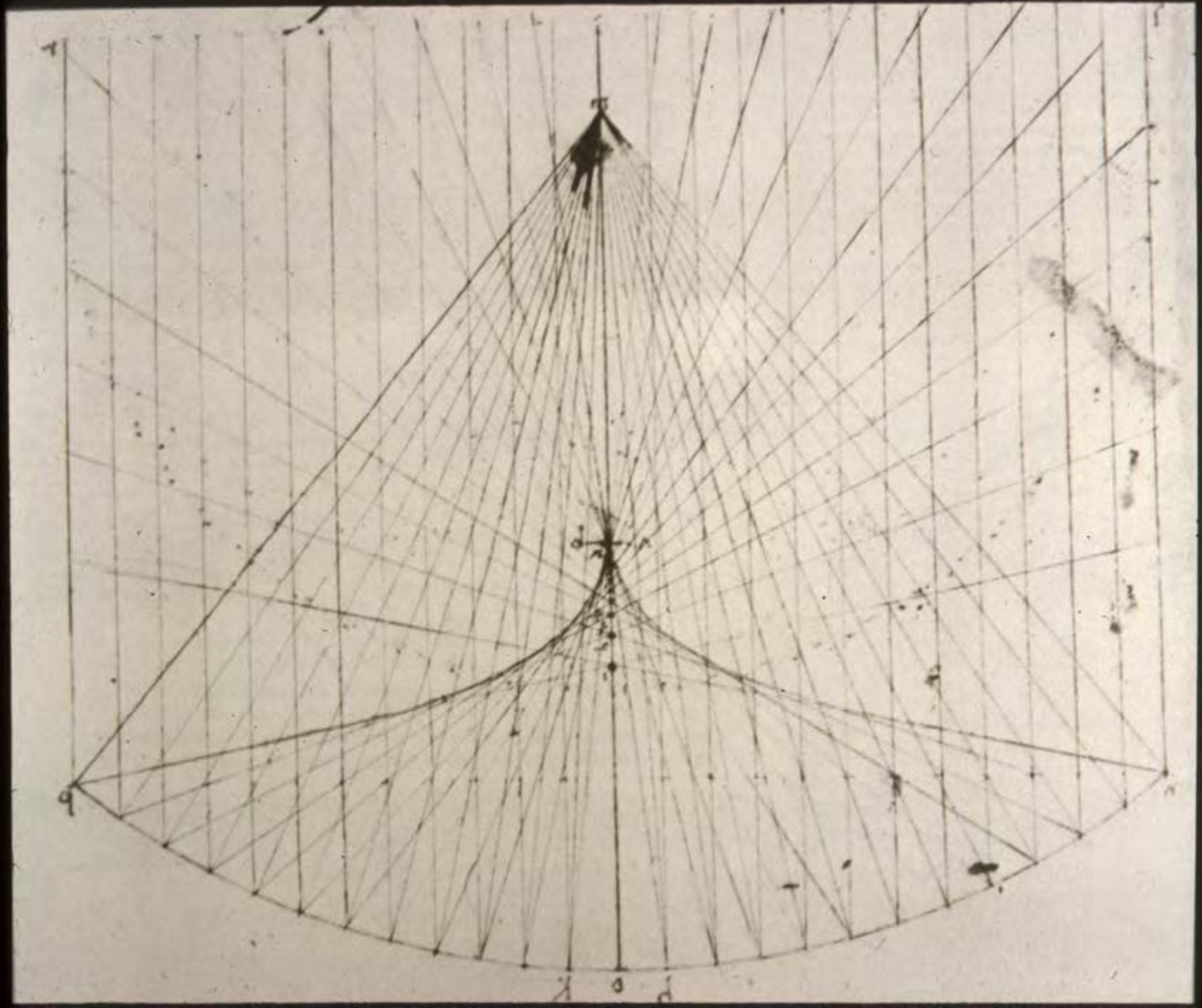
Leonardo's questions:

- Is the Earth covered more with earth or water?
- What is the interior of the Earth like?
- How to measure the size of the Sun?
- How do you get fossils on mountain tops?
- Does the Moon have oceans?
- Does the Moon give off any light of its own?



Manuscript A, Paris.


m
K
s
n
o



c
p

Leonardo da Vinci
Codex Atlanticus 674v

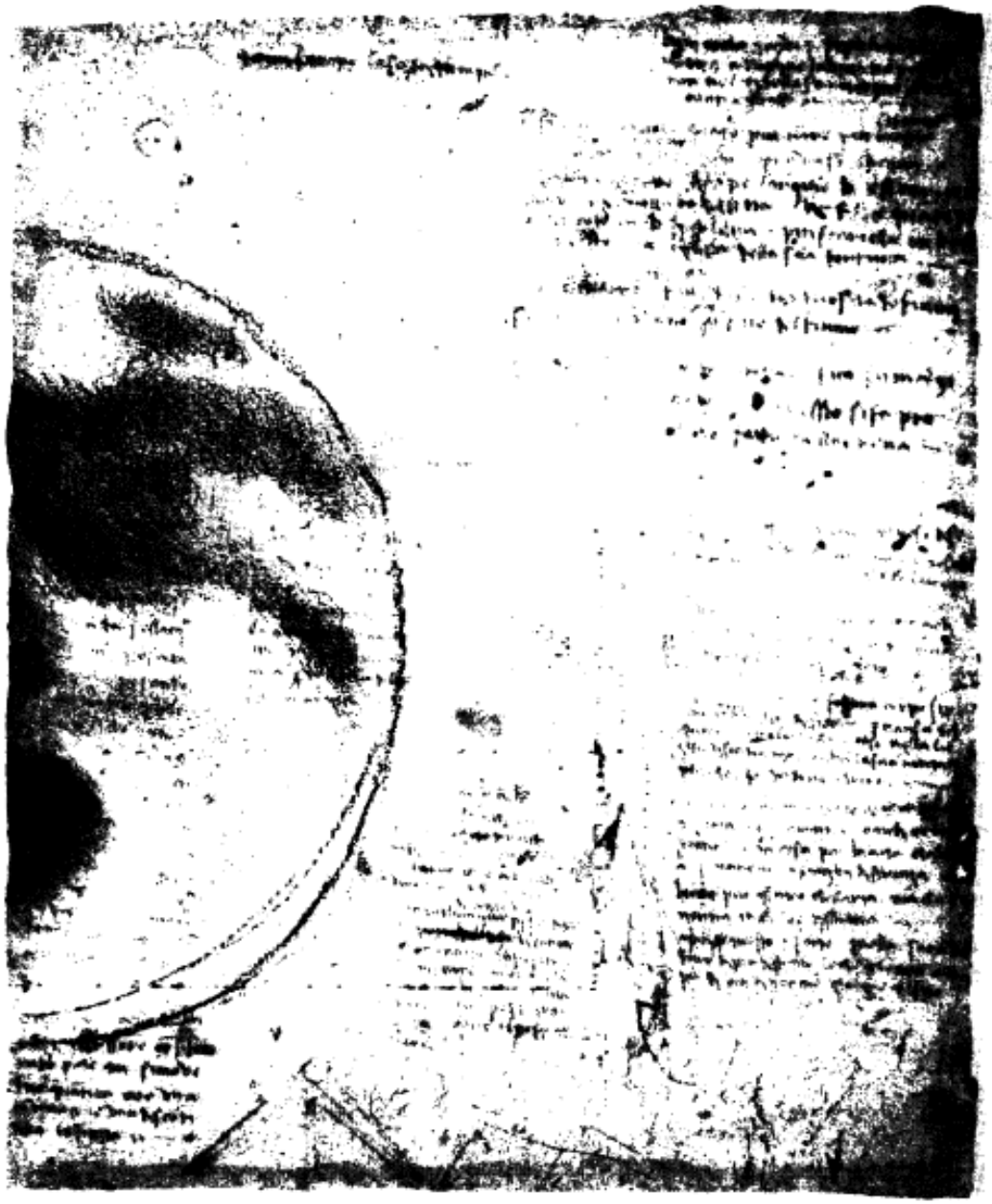
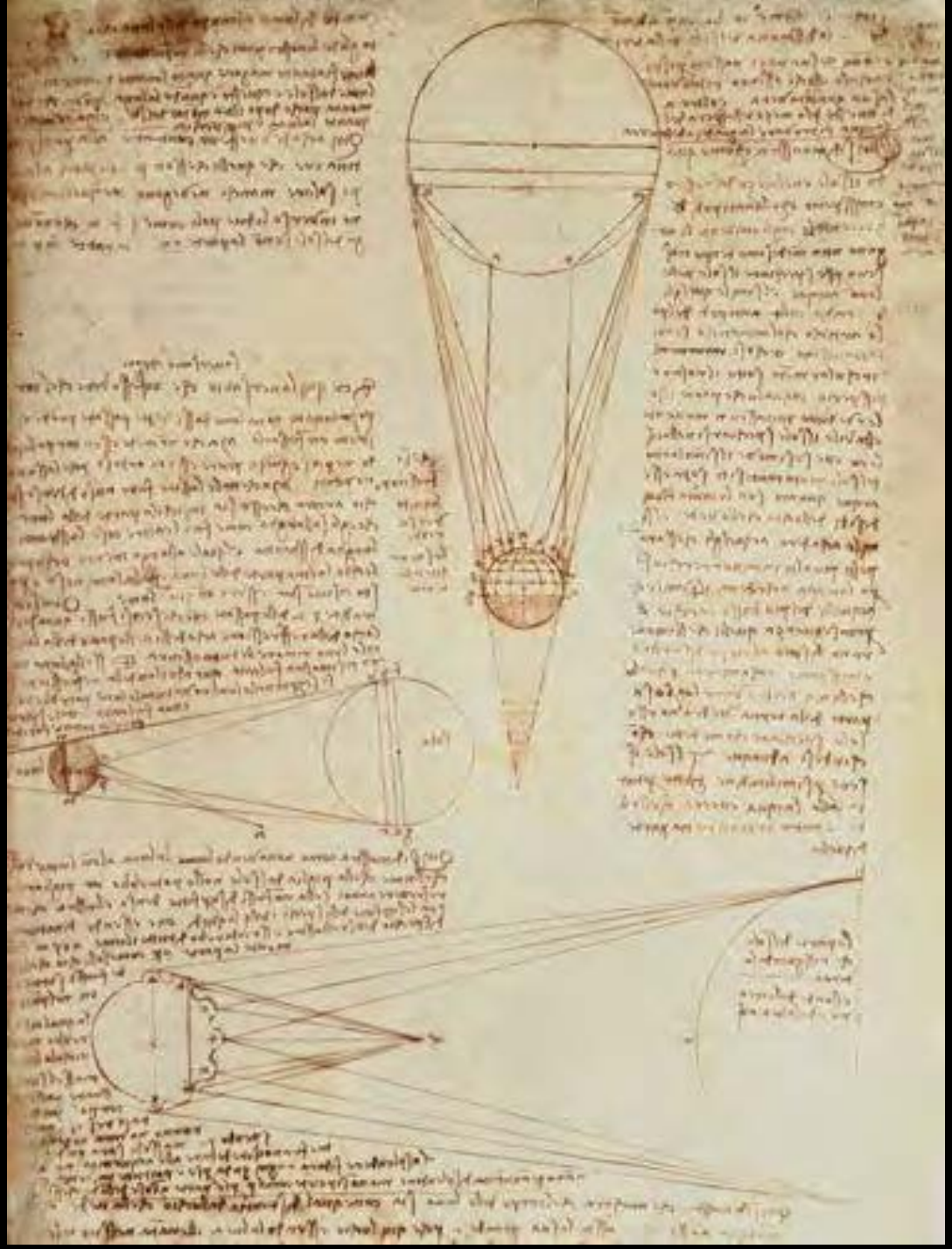


FIG 2. Drawing of the western half of the Moon by Leonardo da Vinci: Codex Atlanticus 674 verso (reproduced with the kind permission of Giunti Barbèra, Florence).



Codes Leicester,
Sheet 1A, folio1y.

Leonardo, Codex Leicester, 2A, folio 2r.

corpo lucente
A
P

Astronomical Fragments:

- “The earth is not in the center of the Sun’s orbit nor at the center of the universe, but in the center of its companion elements, and united with them. And anyone standing on the moon, when it and the sun are both beneath us, would see this our earth and the element of water upon it just as we see the moon, and the earth would light it as it lights us.”

  (Paris Ms.F, 41b/J.P.Richter, 858.)

- “Let the earth turn on whichever side it may, the surface of the waters will never move from its spherical form, but will always remain equidistant from the center of the globe.”

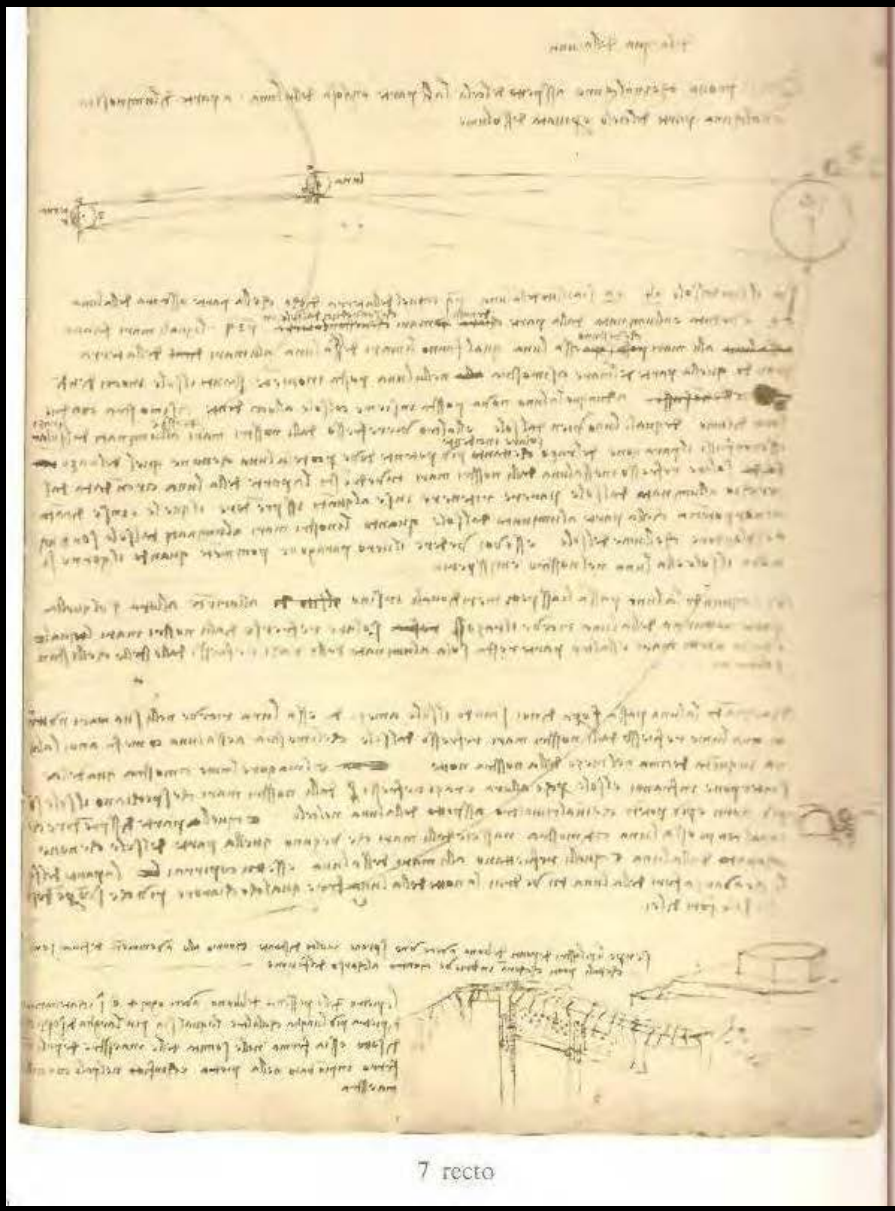
  (Paris Ms.F, 22b; Notebooks/J.P.Richter, 861.)

- “In my book, I propose to show how the oceans and seas must, by means of the sun, make our world shine with the appearance of a moon, and to the remoter worlds it looks like a star; and this I shall prove.”

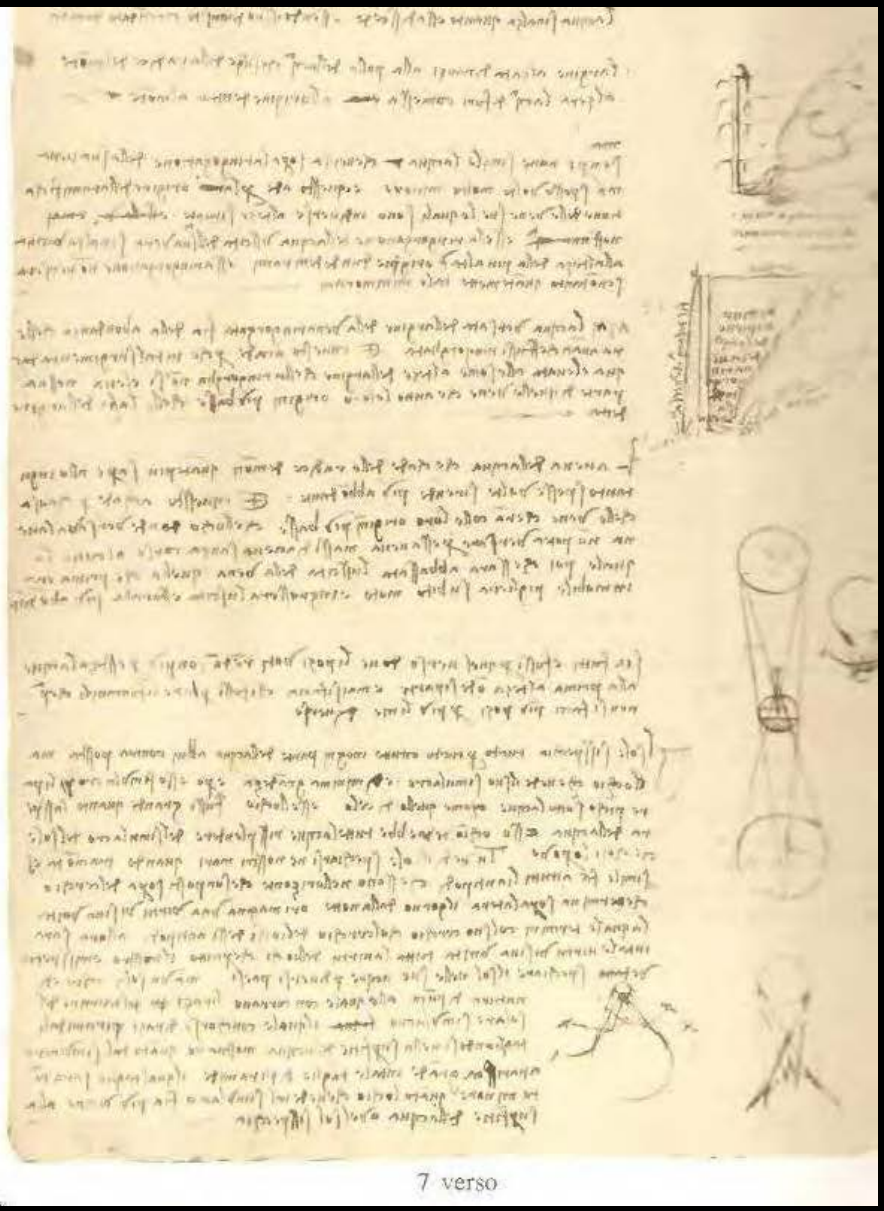
  (Paris Ms.F, 94b;/J.P.Richter, 874.)

- “Memo.: That I have first to show the distance of the sun from the earth, and by means of a ray passing through a small hole into a dark chamber, detect its real size; and besides this, by means of the aqueous sphere calculate the size of the globe.”

  (Codex Leicester,1a;/J.P.Richter, 864.)



7 recto

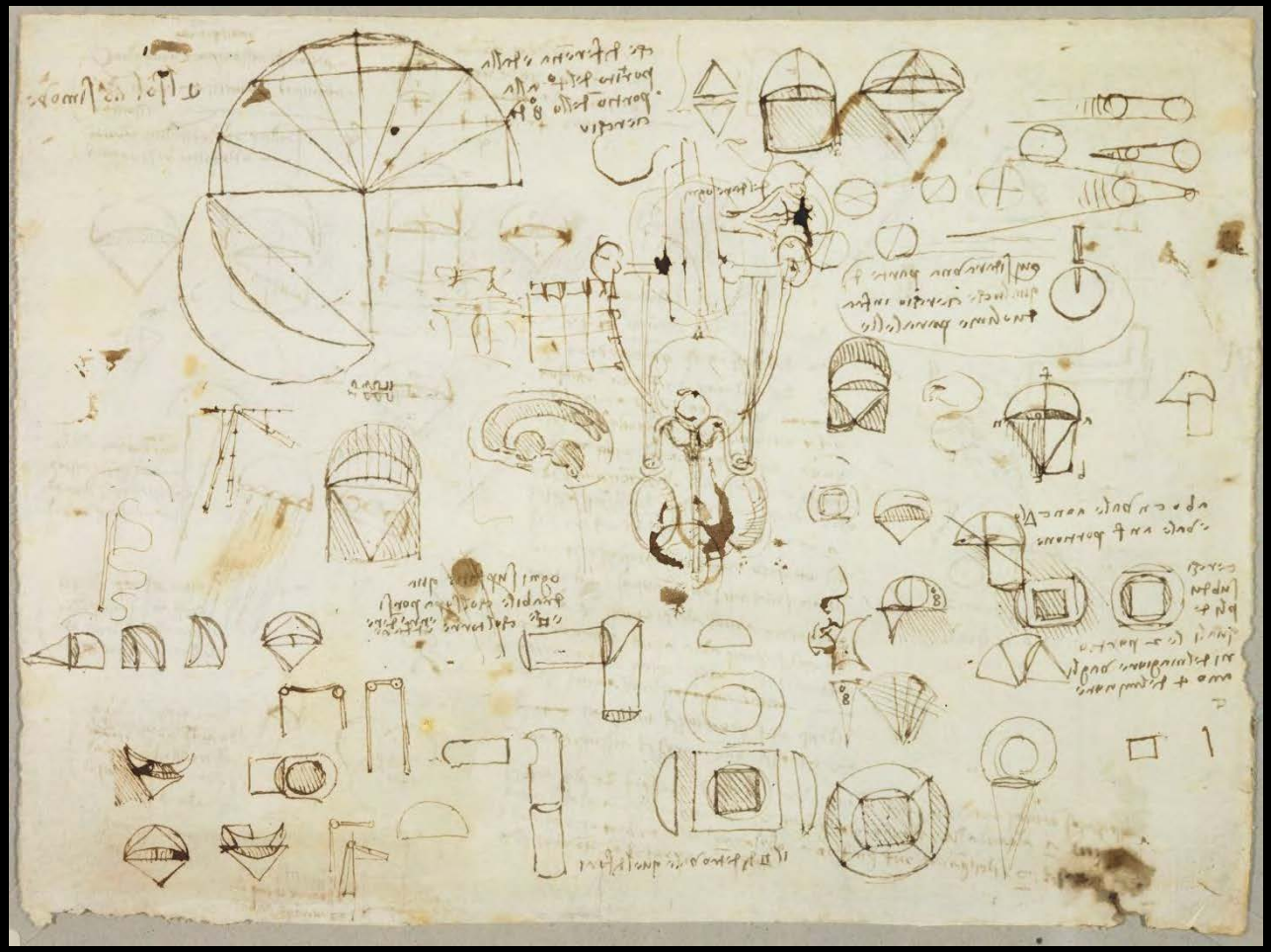


7 verso

Leonardo, Codex Leicester, Sheet 7A, folio 7r.

Fragments:

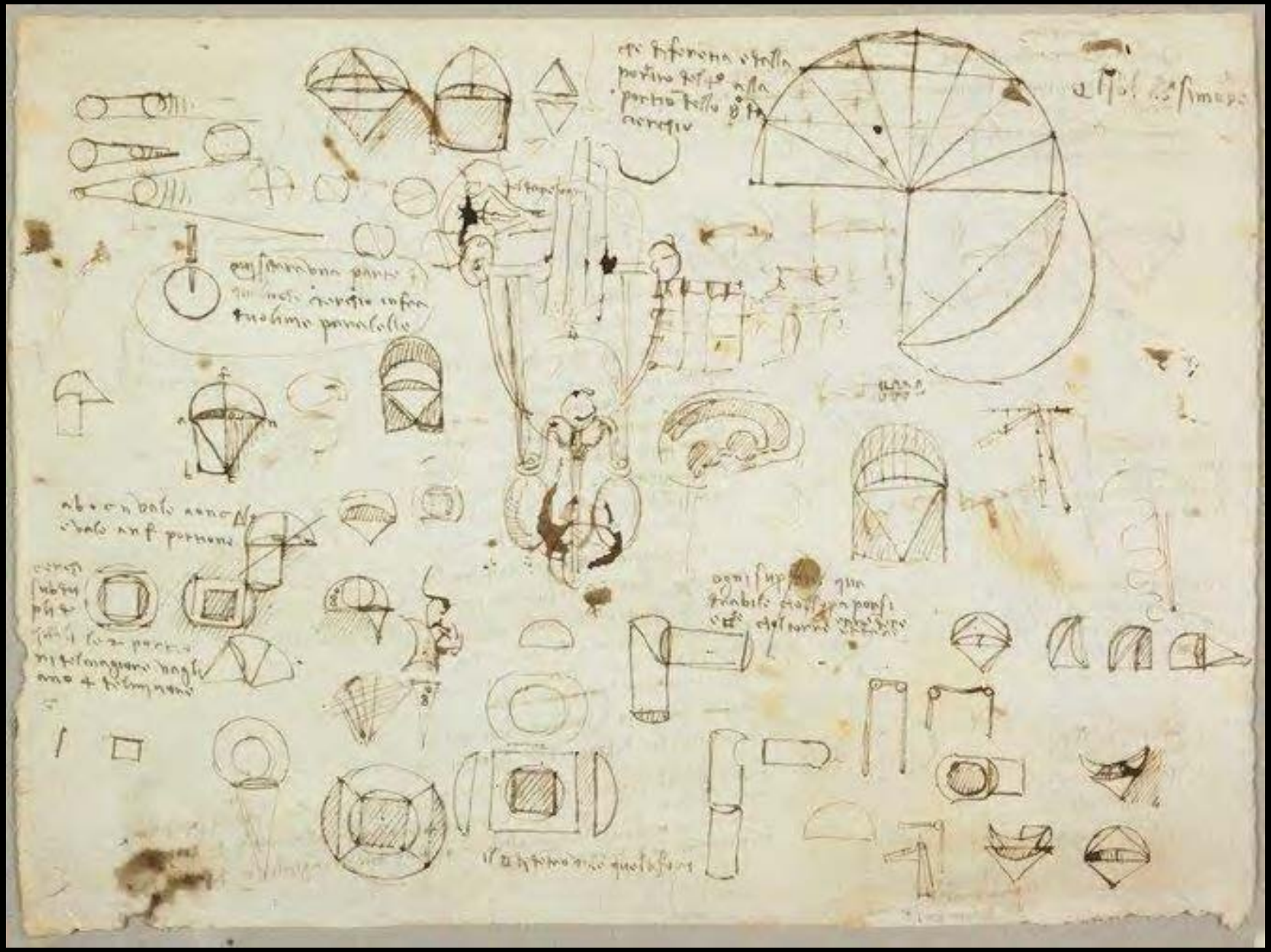
- "Construct glasses to see the Moon magnified.“ (Richter 910)
- “That the earth is a star.”
- “The Sun does not move.”



Leonardo da Vinci, drawing. 1510-11.
Windsor Castle, Royal Collection. RCIN 912669v.

RCIN 912669v.

- Around 1510.
- Geometrical sketches.
- Mathematical transformations.
- Cross section of a brain.
- Male urinary tract.
- Doodles.
- “The sun does not move.”



Mirror Image of RCIN 912669v.

Possible Influences:

- Aristarchus of Samos
- Andreas Capellanus
- Jean Buridan
- Nicholas Oresme
- Nicholas of Cusa
- Toscanelli
- Peurbach
- Regiomontanus
- Copernicus

Aristarchus of Samos (310-230 BC)

- Heliocentric theory.
- Transmitted through Cicero, Plutarch.
- Source in Archimedes.
- Leonardo says he models his intellectual method after Archimedes, physical, experimental, experiential, etc.
- Copernicus mentions him in the *Commentariolus*.

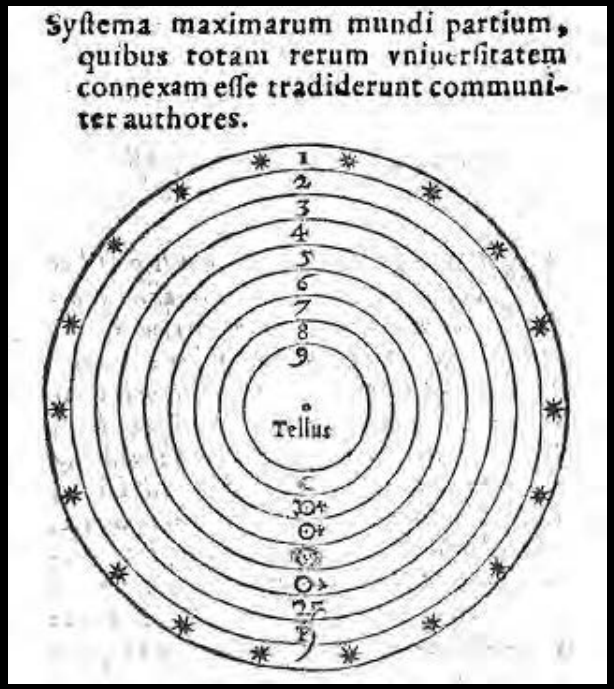
Martianus Capella (360 - 428)

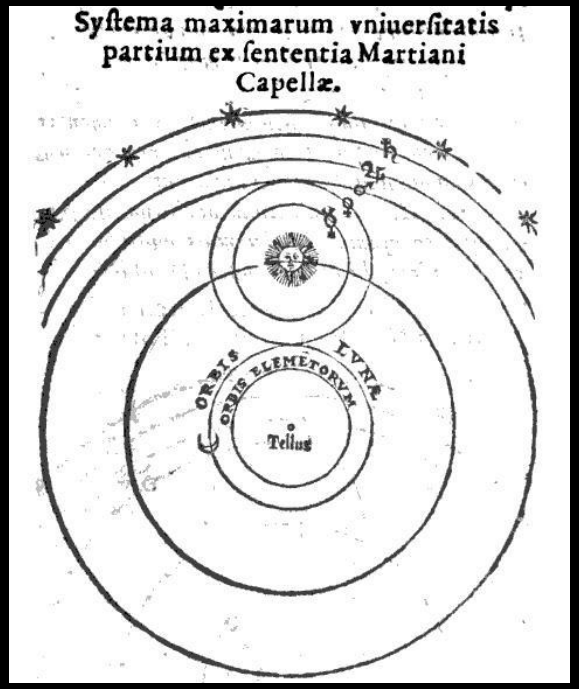
- Early 5th century Neoplatonist.
- “On the Marriage of Philology and Mercury”
- Enormously influential.
- Theory of 7 Liberal Arts.

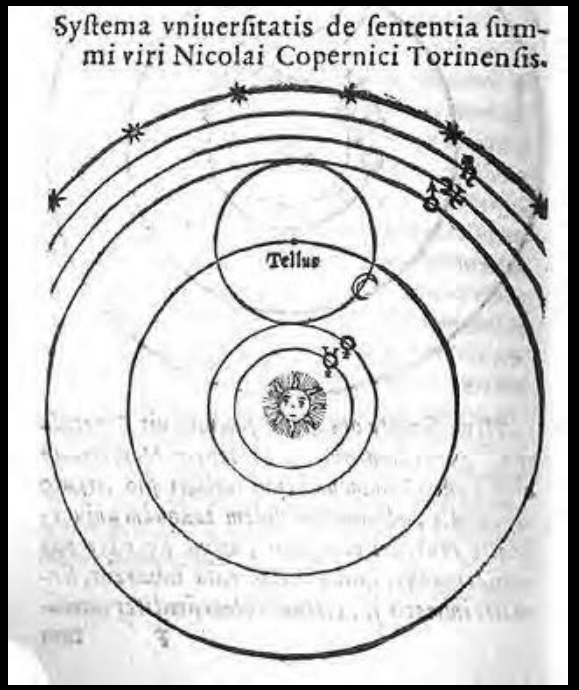
Martianus Capella's "Marriage of Philology and Mercury." (~420)

- The eighth book describes a modified geocentric astronomical model, in which the Earth is at rest in the center of the universe and circled by the moon, the sun, three planets and the stars while Mercury and Venus circle the Sun.

- This view was singled out for praise by Copernicus in Book 1 of the *Revolutions.*



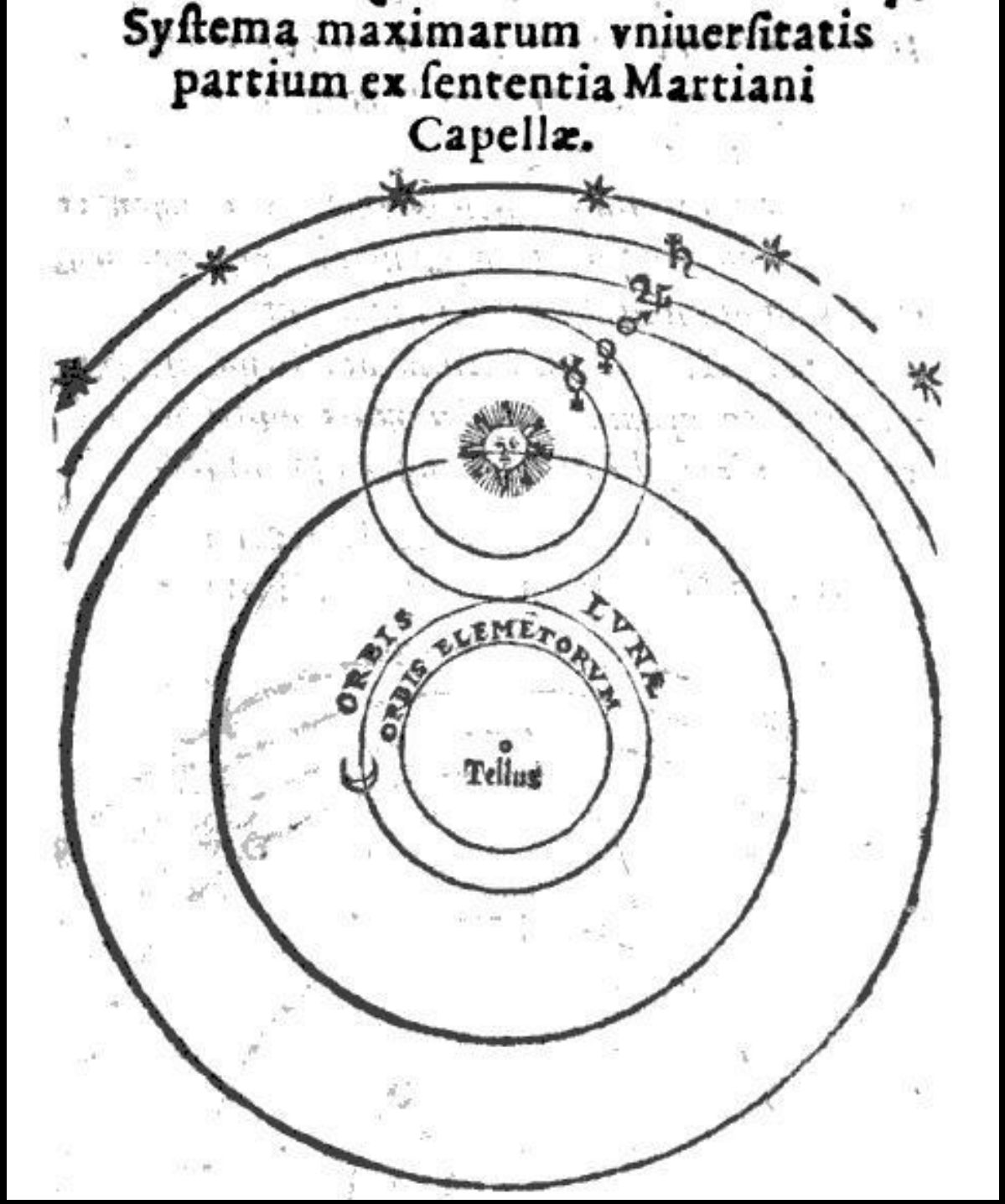




Aristotle, Martianus Capella, Copernicus

In Valentin Naboth, *Primarum de coelo et terra*. 1573.

Naboth's representation of Martianus Capella's geo-heliocentric astronomical model (1573)



Jean Buridan (1301-1362)

- French philosopher.
- Logic and the works of Aristotle.
- Contested Aristotelian explanation of bodies in continued motion.
- Concept of impetus. Trending towards the modern concept of inertia.
- “Sowed the seeds of the Copernican revolution.”

Nicole
Oresme

Nicole Oresme (1320-1382)

- French philosopher.
- Bishop of Lisieux.
- Counselor to King Charles V of France.
- Astronomy, theology, mathematics.
- *Livre du ciel et du monde*, 1377.
- Discusses the evidence for and against the daily rotation of the Earth.

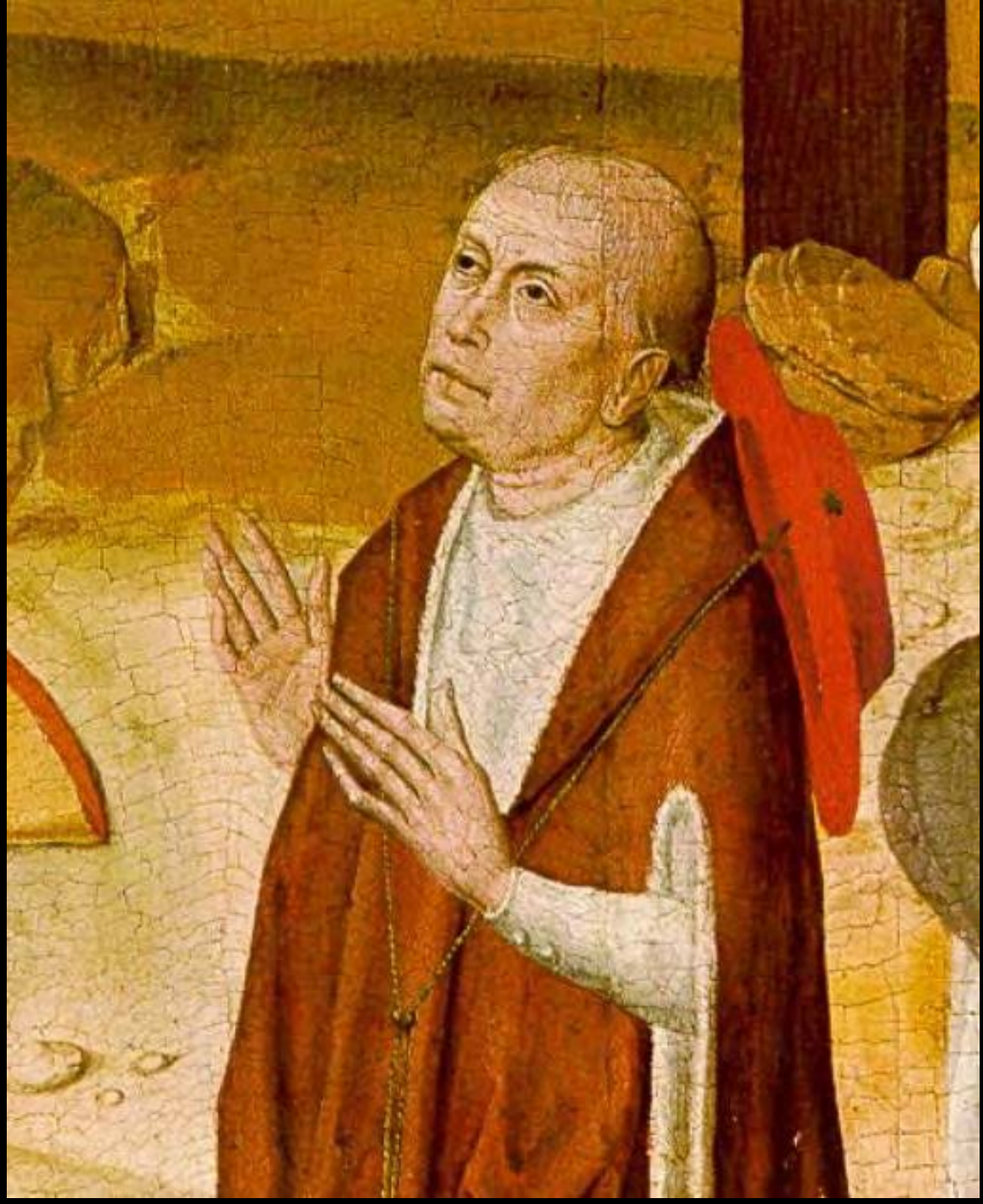
Nicole Oresme

- He rejects several arguments against the motion of the Earth, showing them to be invalid. Still, he concludes that he believes it is the heavens that move and not the Earth.


Saturnus
Jupiter
Mars
Sol
Venus
Mercurius
Luna

Nicholas of Cusa

1401 - 1464



Nicholas of Cusa (1401-1464)

Studied the liberal arts at Heidelberg, 1417.

Studied canon law at University of Padua.

Canon law expert at church councils

Ambassador to Constantinople 1437.

Cardinal 1448.

Christian Neoplatonist philosopher.

Reformer in Church administration.

De docta ignorantia, 1440.

Nicholas of Cusa

- In 1444 he became interested in astronomy and purchased sixteen books on astronomy, a wooden celestial globe, a copper celestial globe and various astronomical instruments including an astrolabe.

- That the Earth might move around the Sun.
- That the stars were other suns and that space was infinite.
- That the stars might have other worlds orbiting them.
- That those worlds might be inhabited by creatures suitable to those worlds.

Regiomontanus

- German Renaissance
- Mathematician, astronomer.
- Trigonometric tables for astrology.
- Designed his own astrological house system.
- *Algorithmus Demonstratus*, a book on arithmetic and algebra.
- Published the first printed astronomical textbook (1472).

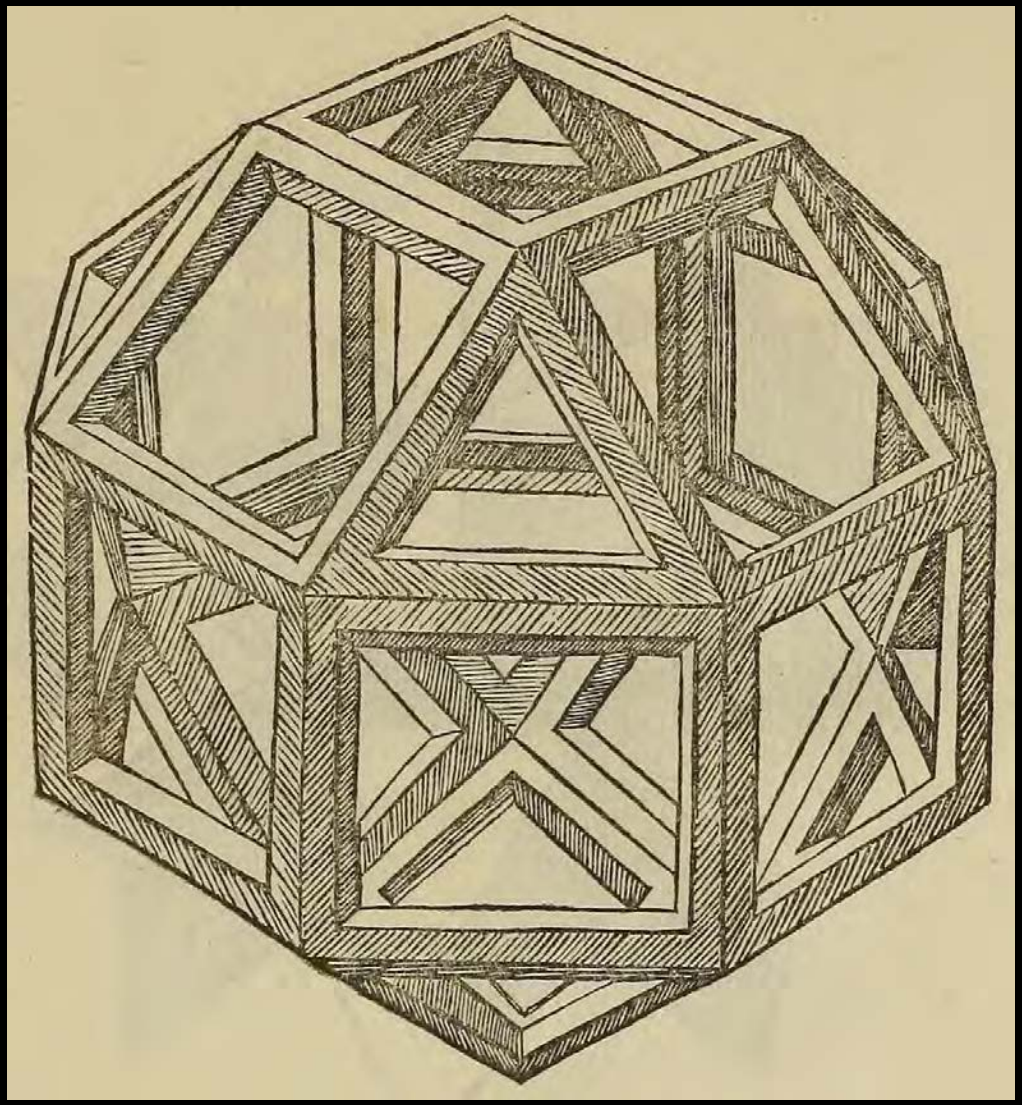
Regiomontanus (1436-1476)

- Peuerbach taught Regiomontanus.
- Regiomontanus taught Domenico Maria Novara da Ferrara.
- Domenico Maria Novara da Ferrara taught Copernicus.

- It is rumored that Regiomontanus arrived at a theory of heliocentrism before he died.
- Wrote about approvingly about Aristarchus, and mentioned the motion of the Earth in a letter.

Lucas Pacioli (1447-1517)

- Franciscan friar.
- First to publish an account of double entry bookkeeping. "Father of Accounting."
- Latin translation of Euclid's *Elements.*
- Plagiarized the work of Piero della Francesca.
- Collaborated with Leonardo.
- Tutored Albrecht Durer.



Luca Pacioli taught mathematics to Leonardo and lived with him from 1497 to 1499. Collaborators until 1506. Leonardo drew the illustrations for Luca Pacioli's "On Divine Proportion." 1509.

Jacopo de' Barbari, Luca Pacioli. 1495. Capodimonte, Naples.

Paolo dal Pozzo Toscanelli 1397-1482

- Florence, then University of Padua.
- Mathematician
- Astronomer
- Geographer
- Observations of Comets.
- Humanist
- Friend of Nicholas of Cusa.
- Influence on Columbus.

Toscanelli

Constructed the gnomon at the Florence Cathedral in 1468.

Observations and calculations of the orbits of comets of 1433, 1449-50, of Halleys Comet in 1456, 1457, 1472.

Toscanelli seems to have made the Portuguese repeated proposals as to the possibility of a western route, without, however, being able to convince them of the feasibility of his theory.

All aspects of the Columbus connection are controversial and contested.

Leonardo's contacts:

- List of 116 books in his library.
- Regiomontanus' epitome of Ptolemy's Almagest.
- Toscanelli.
- Francesco di Giorgio Martini.
- Luca Pacioli.
- Marcantonio della Torre.
- Machiavelli.
- Copernicus?

What about Copernicus?

- 1496 Studied in Bologna for 3 ½ years.
- Astronomical observations 1497.
- 1500 one year in Rome, lecturing on mathematics and astronomy.
- 1501 University of Padua.
- 1503 Doctor of Canon Law from University of Ferrara.
- Studies medicine at Padua, including dissections.
- Luca Pacioli was teaching at the University of Bologna at the same time that Copernicus was a student there.

The Commentariolus

- Complete description of the heliocentric system.
- In manuscript form by 1514.
- Not published. Circulated among friends and colleagues.
- “All the spheres revolve about the sun as their mid-point and therefore the sun is the center of the universe.”

Suggestions:

- Heliocentric ideas were present before the Renaissance.
- Copernicus' ideas were in circulation well before the publication of the *Revolutions* in 1543.
- Not necessary to read or understand the *Revolutions* to grasp the essentials of the heliocentric system.
- Not regarded as heretical by the Church.

Conclusions:

- Not enough to conclude Leonardo was “Copernican.”
- Lots of modifications of Aristotle/Ptolemy in the air, and among the intellectuals Leonardo knew.
- Mystique of Leonardo can lead us astray.
- We need more than the cryptic statement.
- (Theoretical example of Einstein.)

Leonardo,

The Landsdowne Madonna 1501

Oil on wood.

Private Collection.

If Leonardo met Copernicus…

- Suppose the 2 had dinner with some friends and discussed astronomy. Who is more likely to influence whom? Leonardo would have been older, Copernicus a young student.
- Copernicus was “better educated” in astronomy.
- Leonardo was bolder, more willing to entertain unconventional ideas.
- Leonardo was already famous.

Commentariolus

- 1 May 1514 Matthias Miechow recorded the presence in the Cracow library of a “short treatise maintaining that the earth moves and the sun remains in a state of rest.”

1533 Papal Briefing

- 1533 Pope Clement VII requested a briefing on the heliocentric hypothesis.
- The papal secretary, Johann Albrecht Widmannstetter, gave a series of lectures on Copernicus' theories to Pope Clement VII and assembled company in the papal gardens.
- Favorably and enthusiastically received.
- Cardinal von Schoenberg of Capua encouraged Copernicus in a letter to promulgate the theory widely.

Leonardo,
St. John in the Wilderness,
“Bacchus,”
1510-15.
Oil on panel transferred to canvas.
177 x 115 cm.
Louvre, Paris.

Leonardo,
St. John the Baptist, 1513–16.
Oil on Panel
69 x 57 cm.
Louvre, Paris.

- rhombicuboctahedron (a convex solid consisting of 18 squares and 8 triangles).