

Was Leonardo a “Copernican”?



Richard L Poss
University of Arizona

Leonardo da Vinci:

“Il sole no si move.”

“The sun does not move.”

~1510

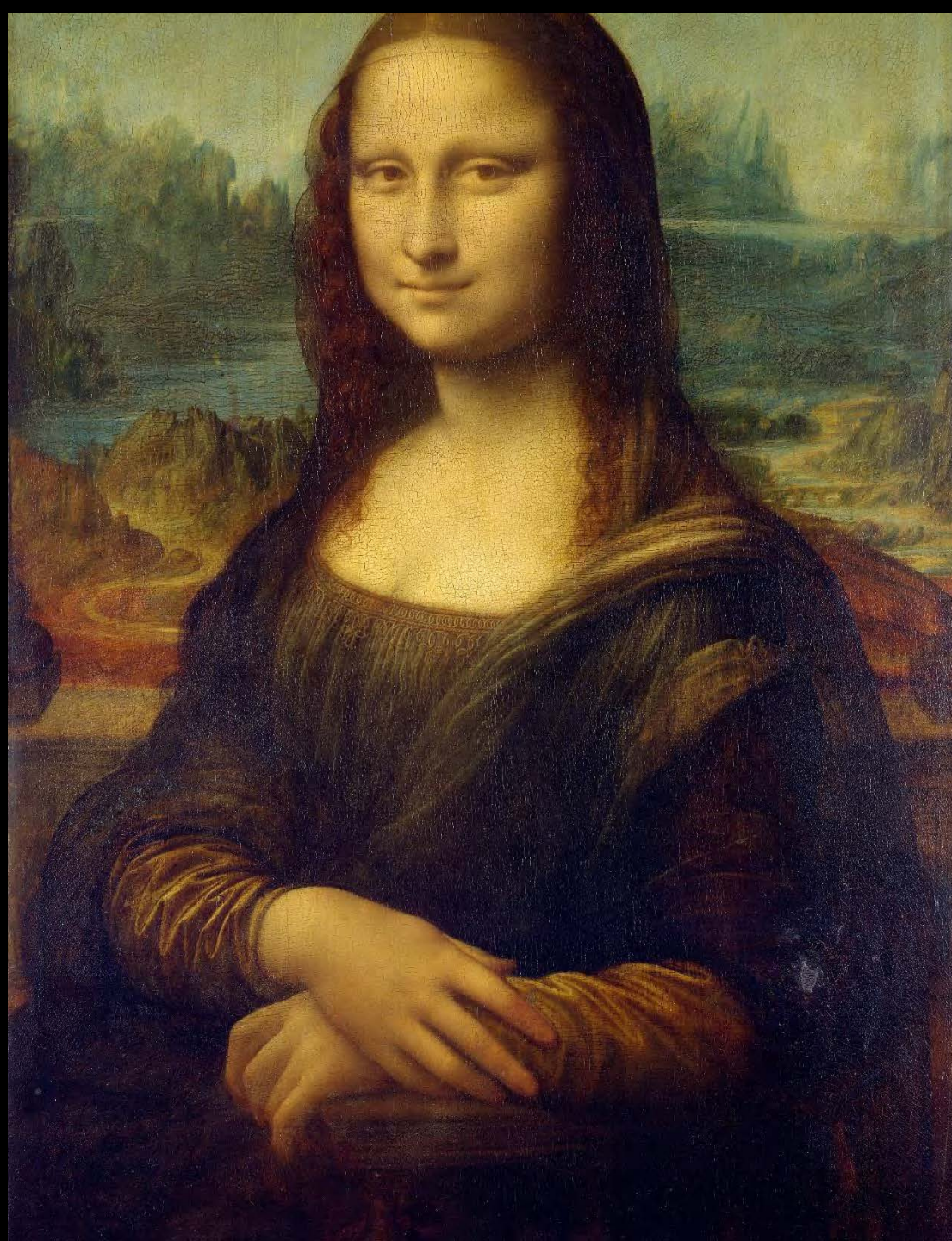
“The sun does not move.”

“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.

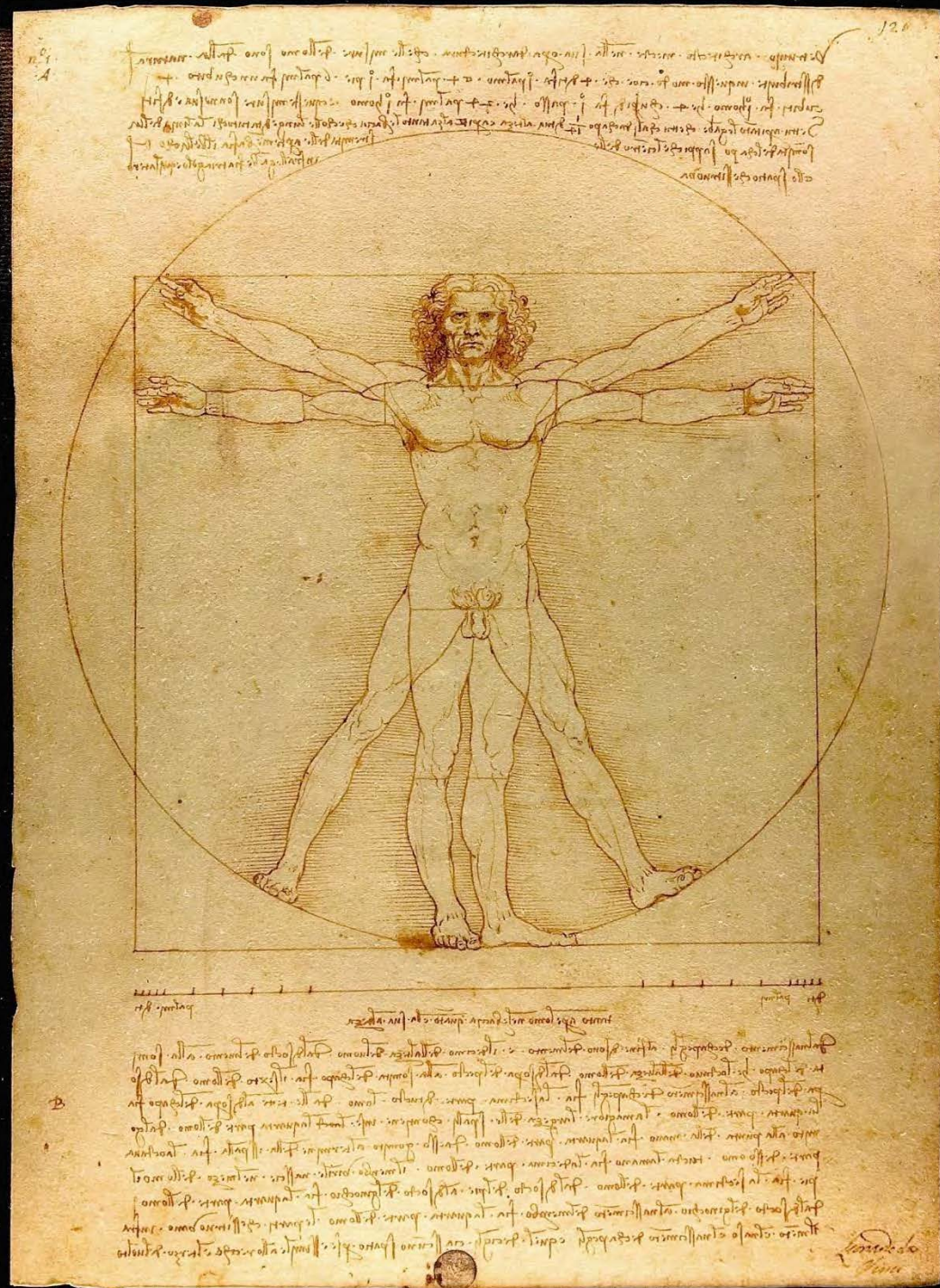
Louvre

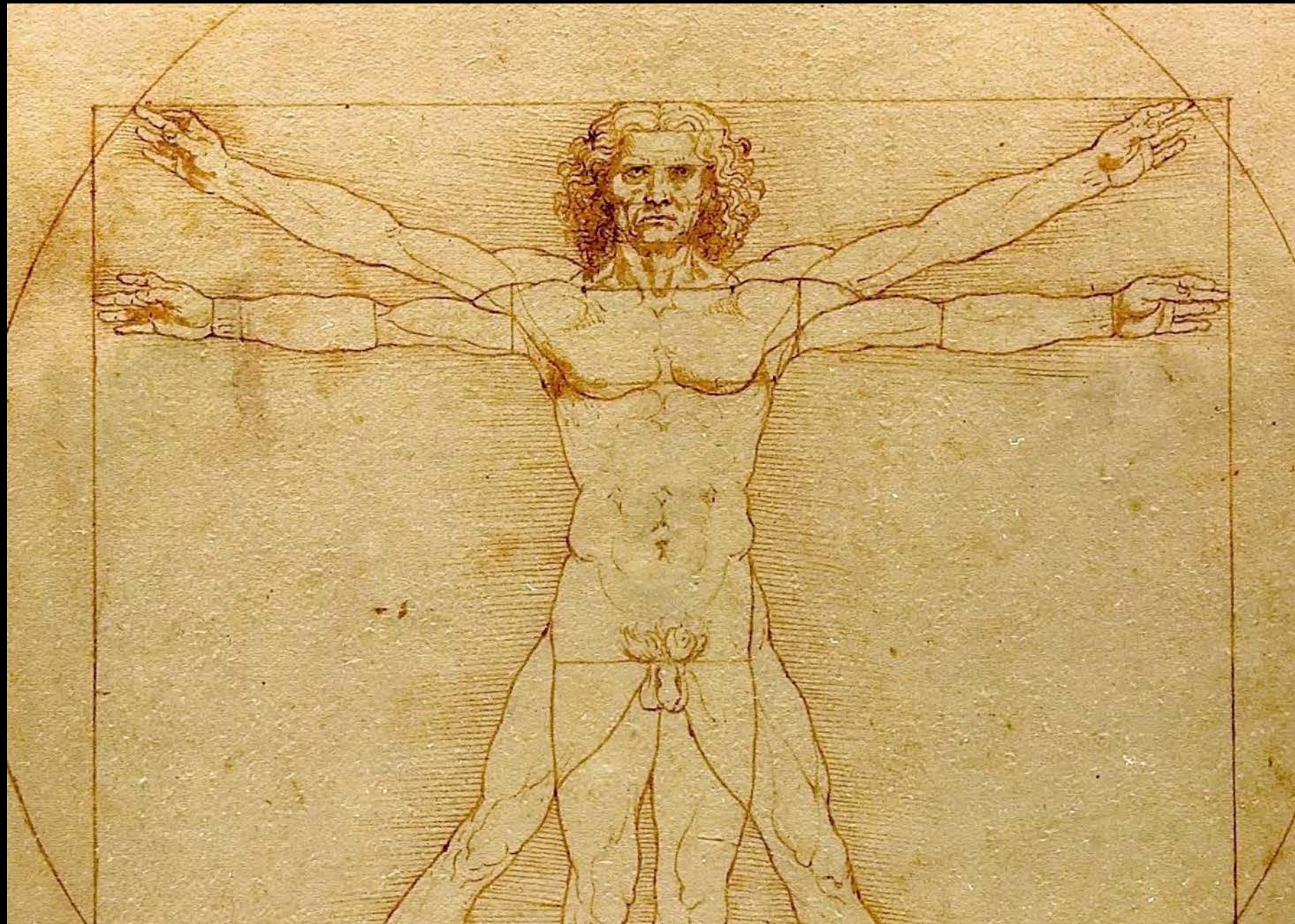


Leonardo,
"Vitruvian Man" 1490

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.

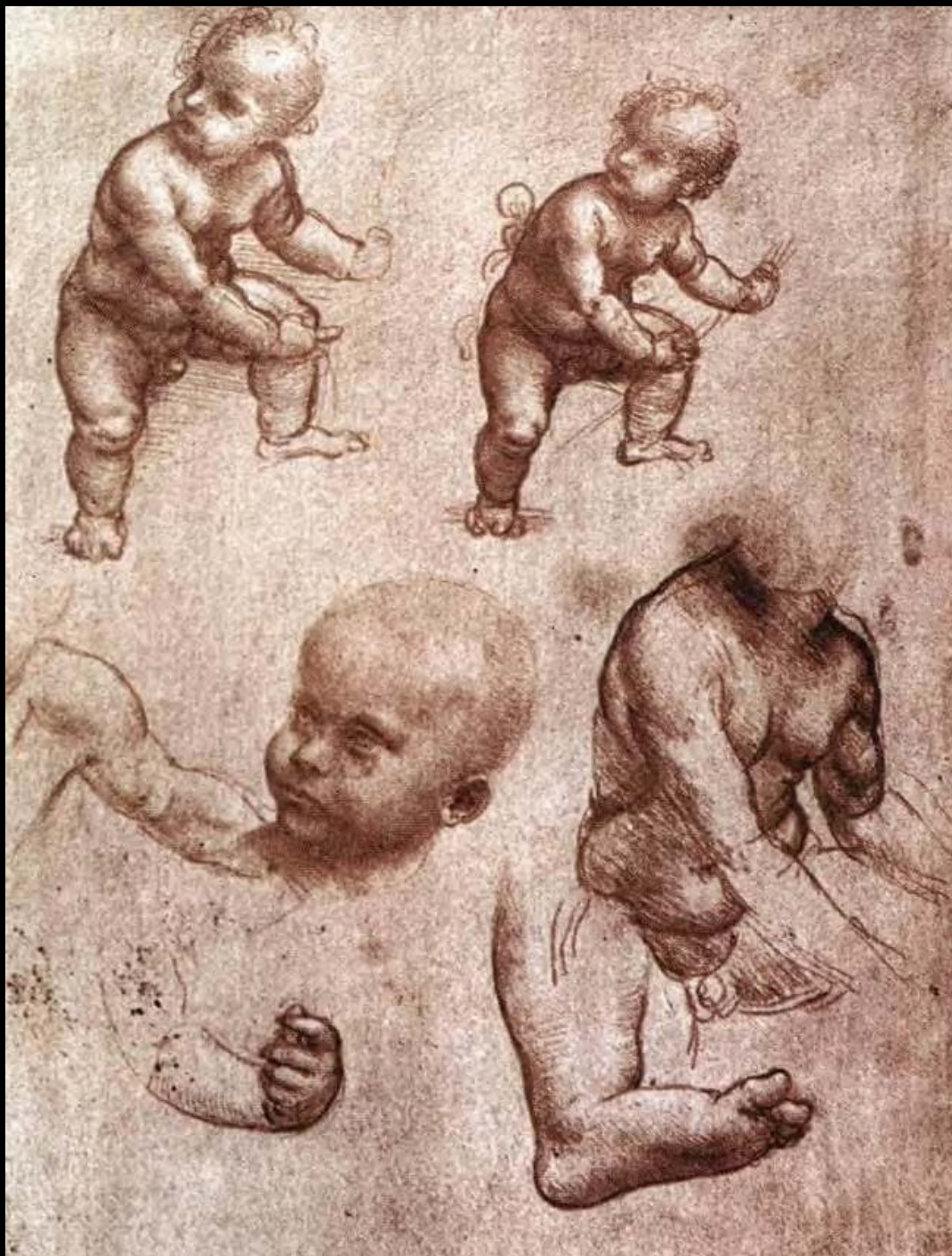
Collections:

- 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)

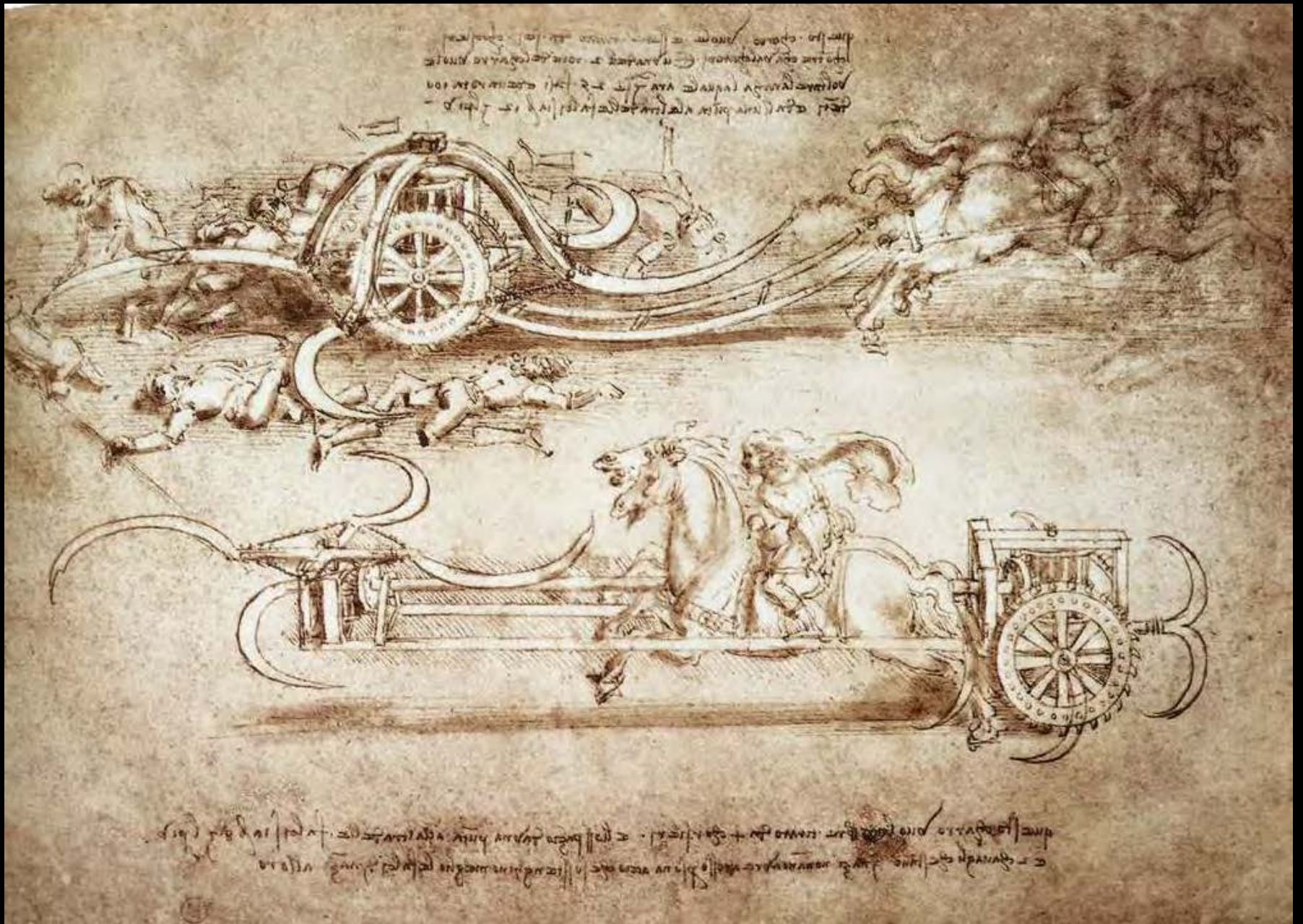
Collections, cont.

- 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)



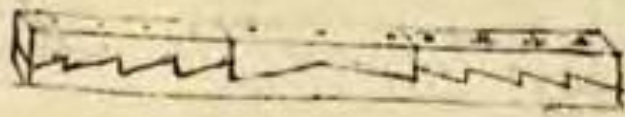
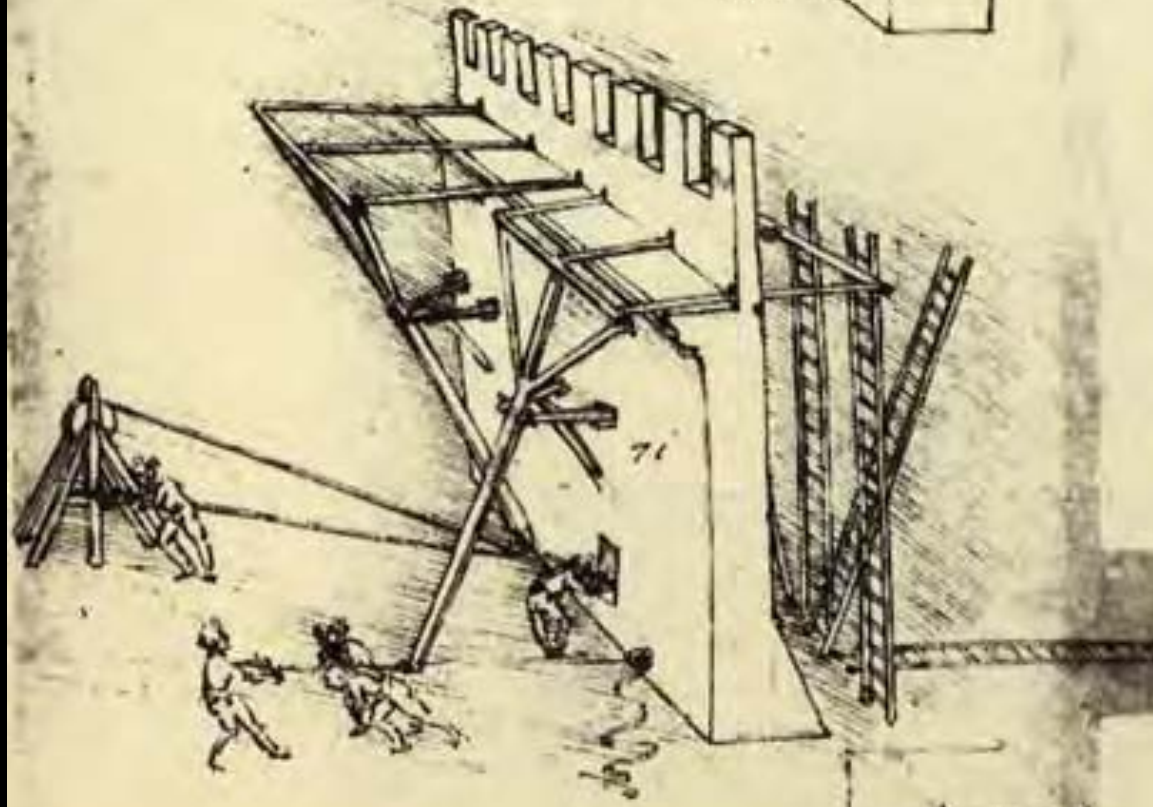
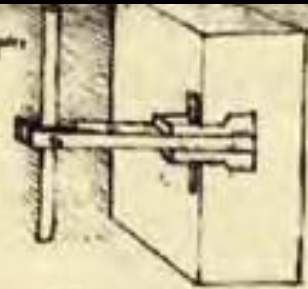


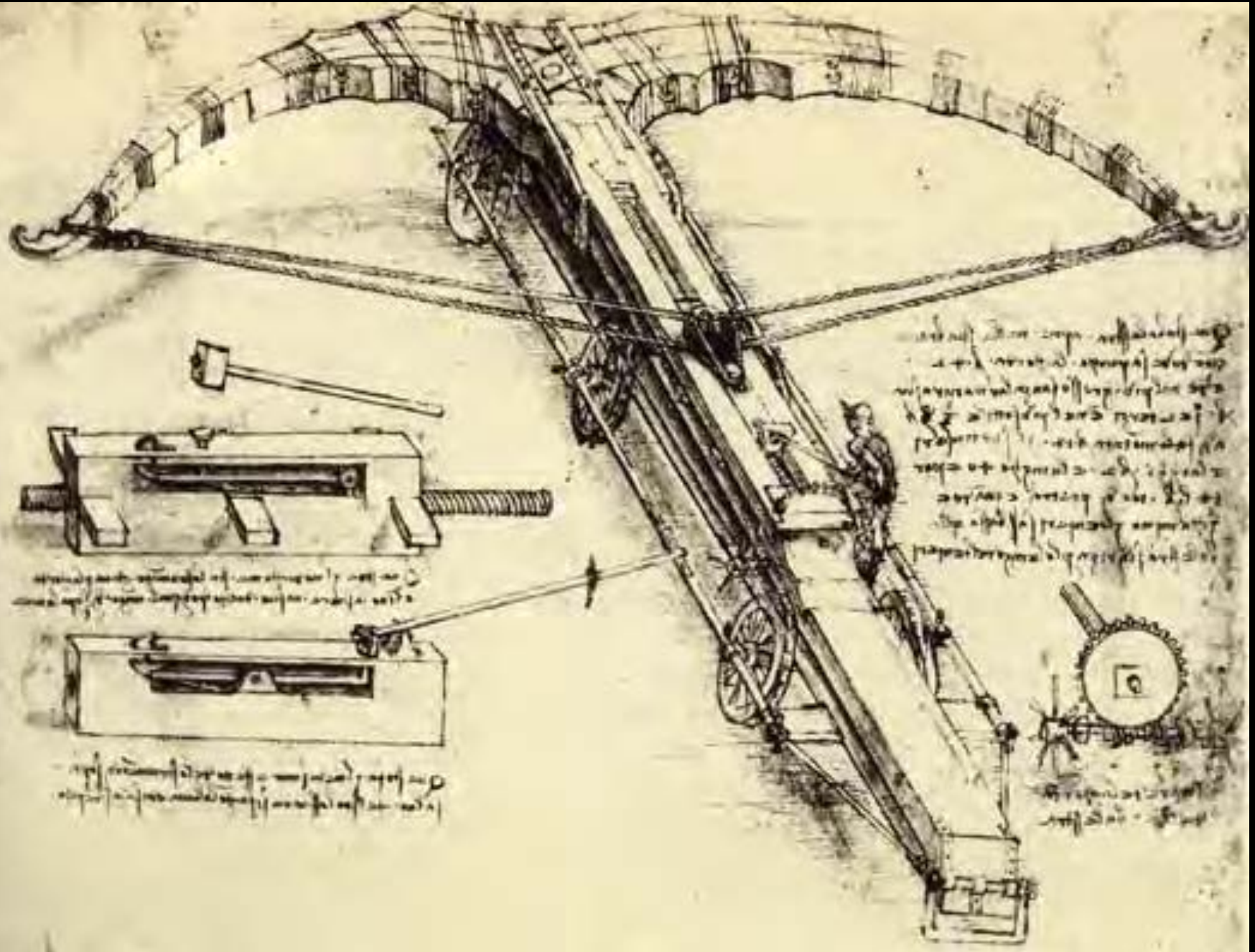




The Human Scythe.

Handwritten text in a historical script, likely Arabic or Persian, located at the top of the page. The text is arranged in two lines and appears to be a technical description or instruction related to the mechanical diagrams.





Ein solches Instrument ist in der Natur
ein solches Instrument ist in der Natur

Ein solches Instrument ist in der Natur
ein solches Instrument ist in der Natur

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Ein solches Instrument ist in der Natur
ein solches Instrument ist in der Natur

Handwritten text at the top of the page, likely a title or description of the machinery.



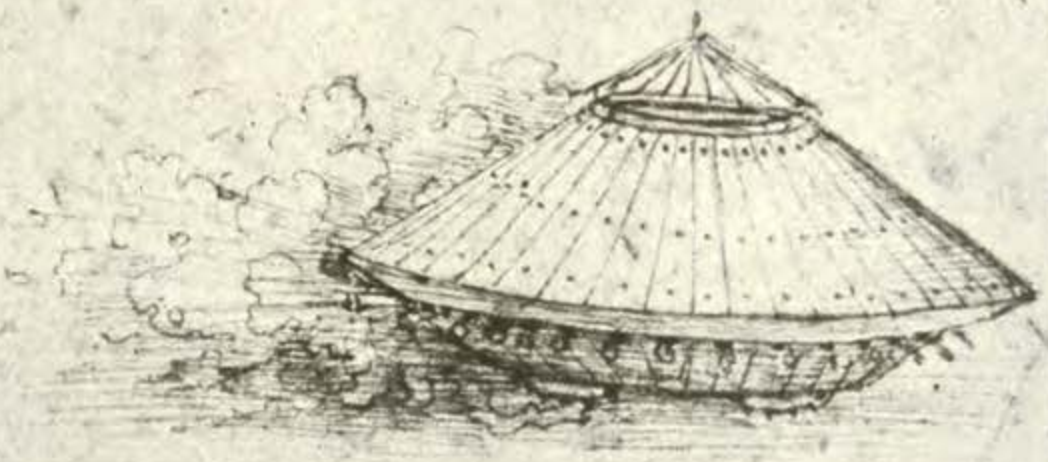
Handwritten text in the middle of the page, providing further details or instructions related to the machinery.



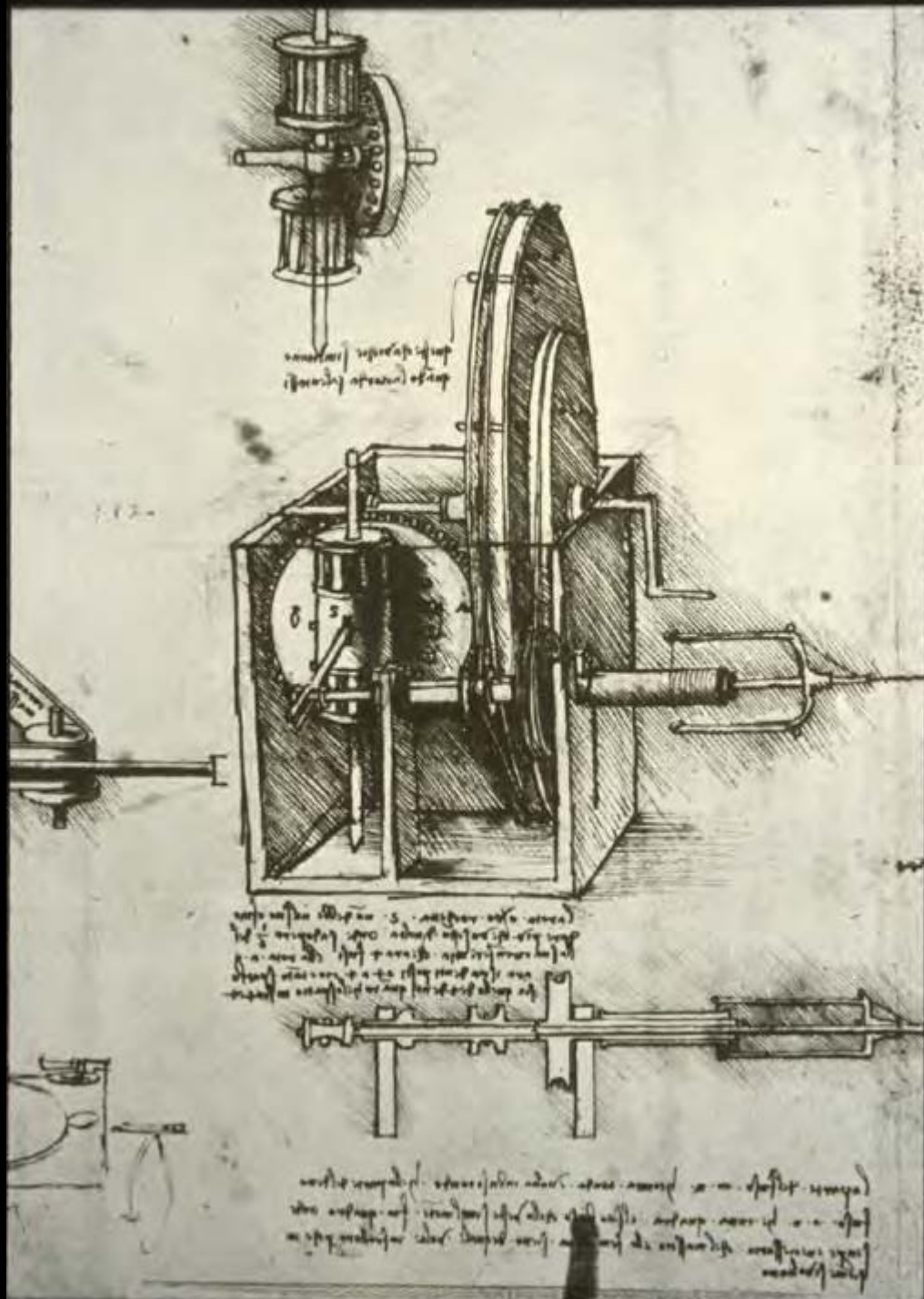
Handwritten text in a cursive script, likely a title or description, located above the left drawing.

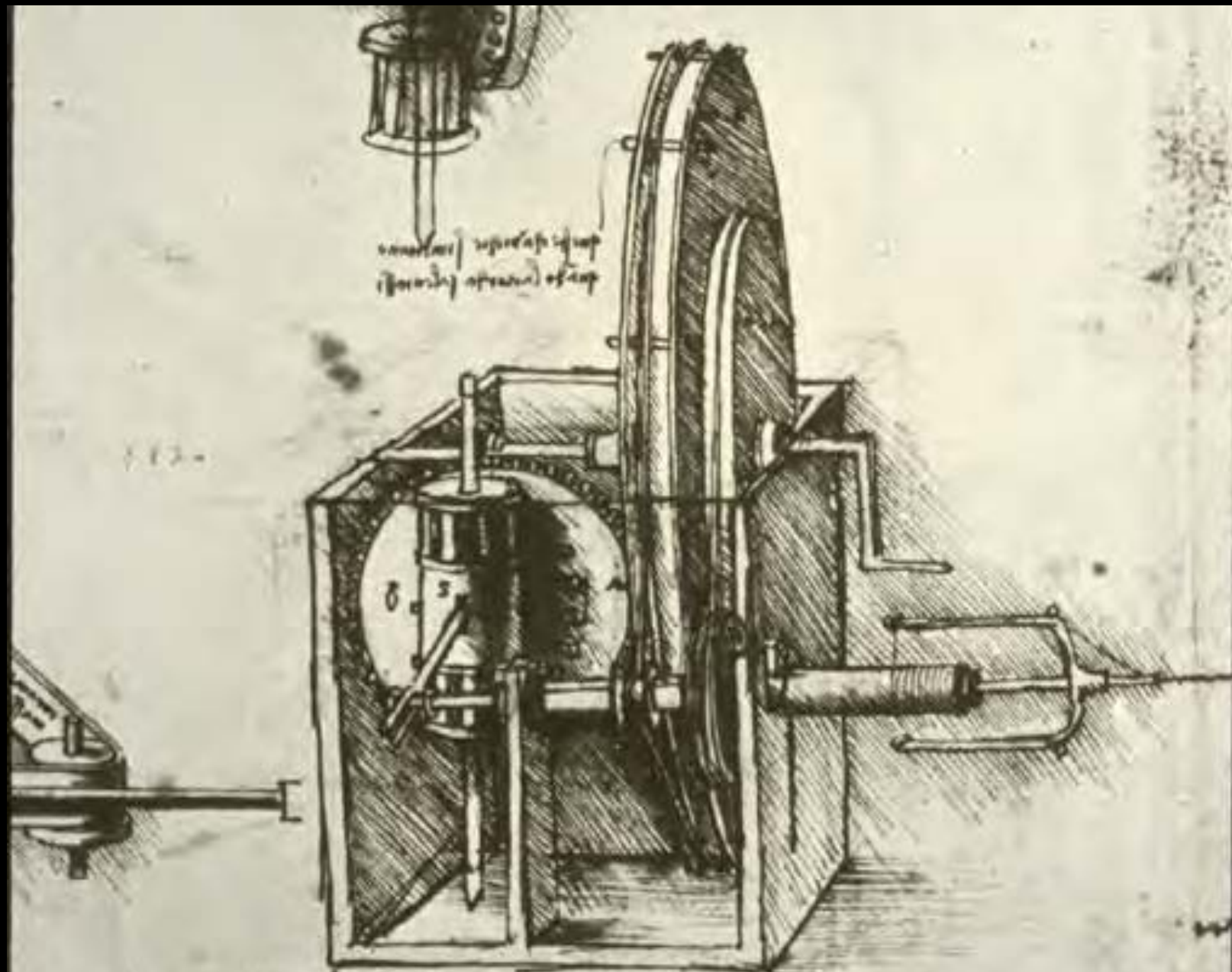


Handwritten text in a cursive script, likely a title or description, located below the left drawing.



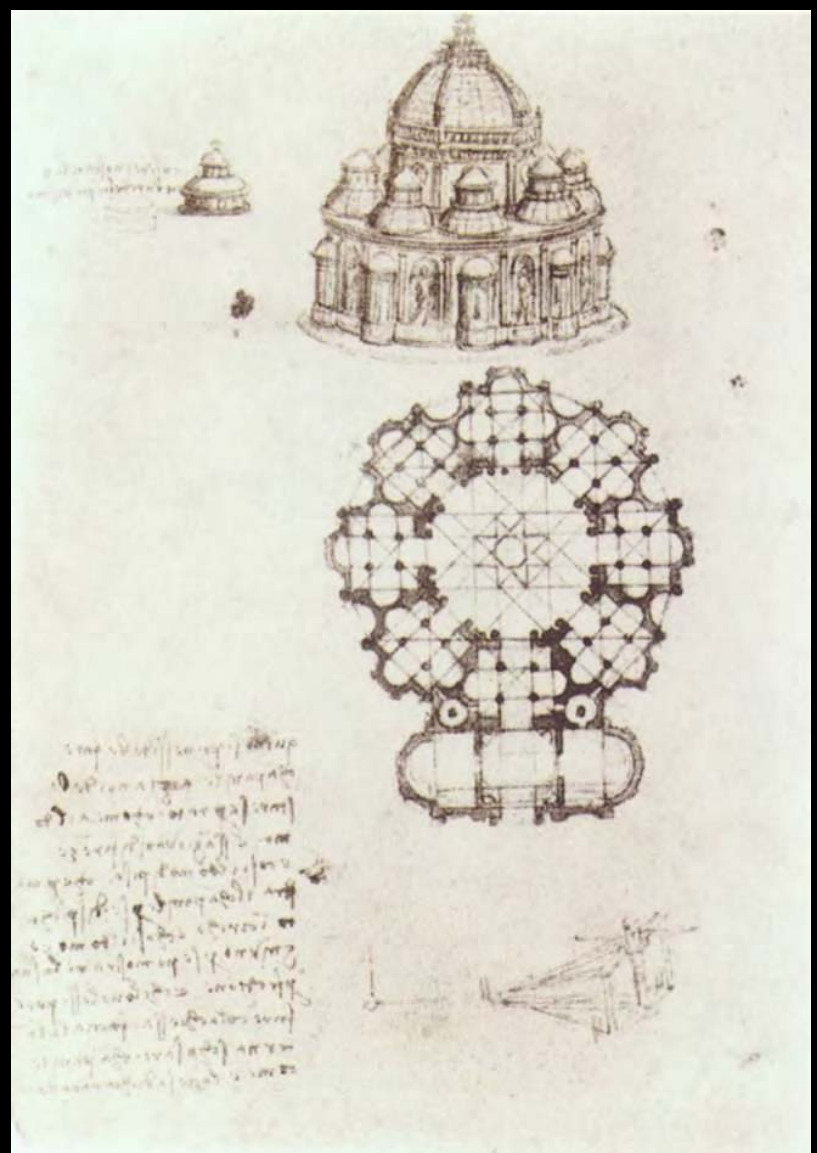
Handwritten text in a cursive script, likely a title or description, located below the right drawing.

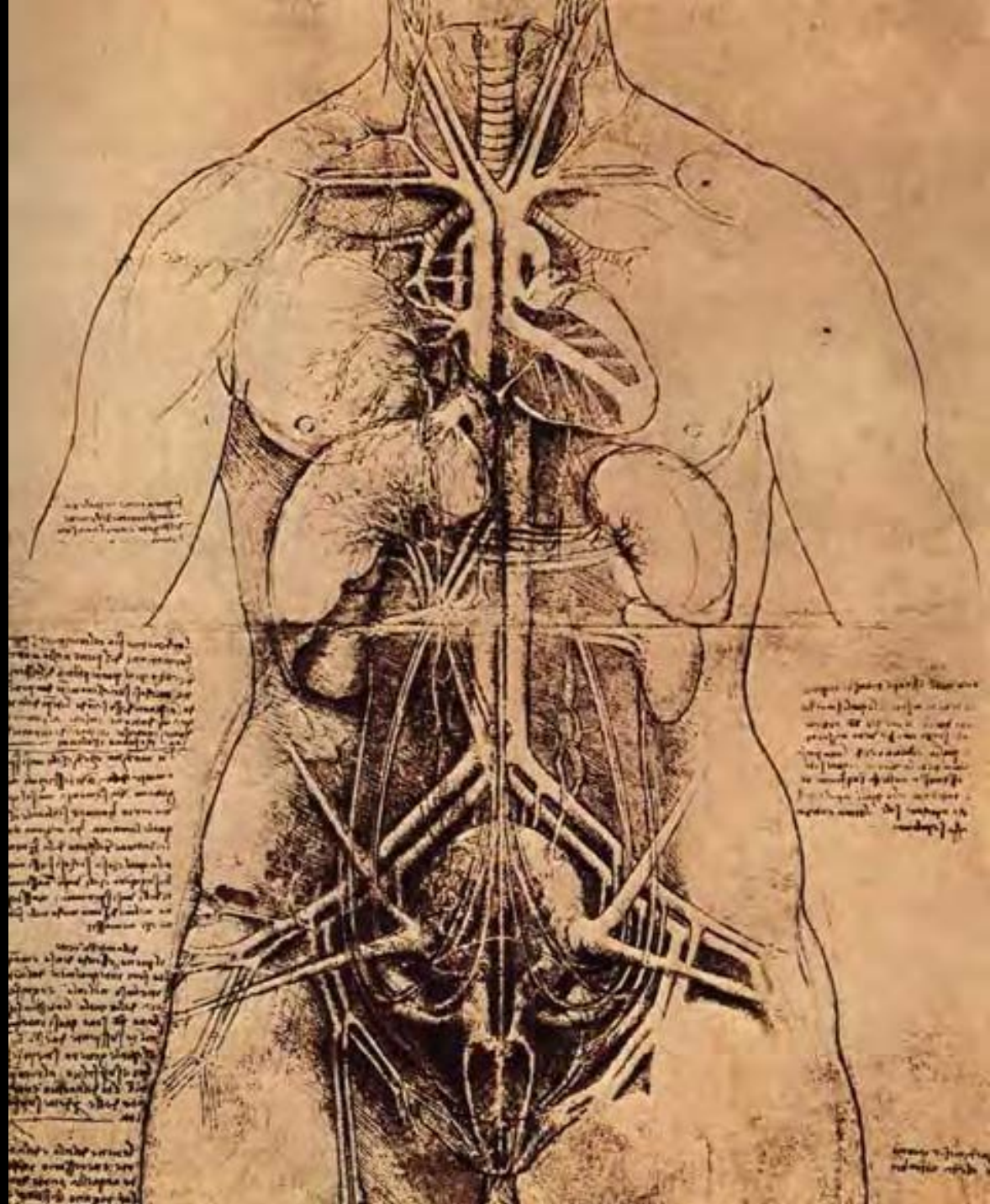




Handwritten text in a cursive script, likely a historical language, located above the main mechanical drawing.

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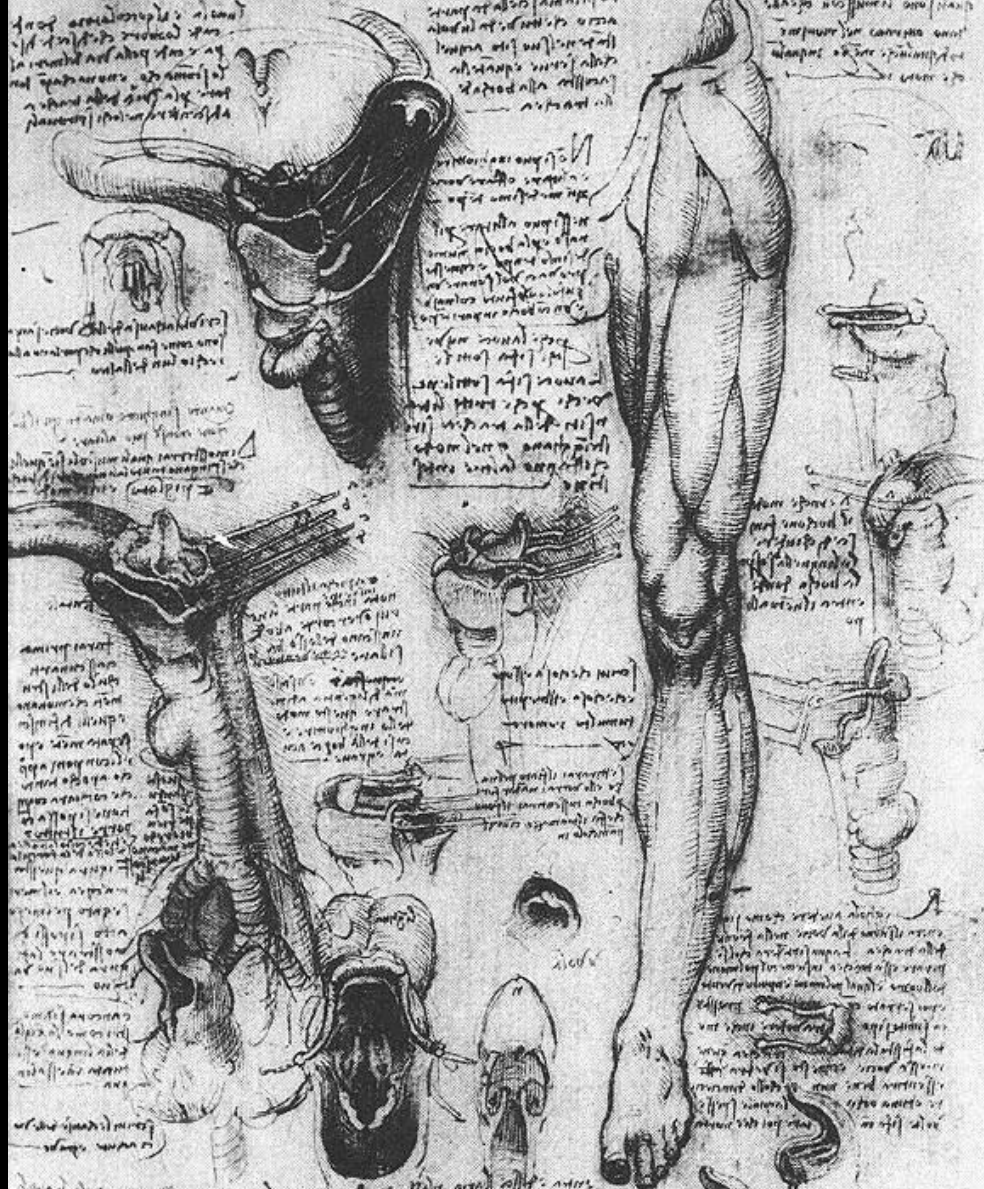




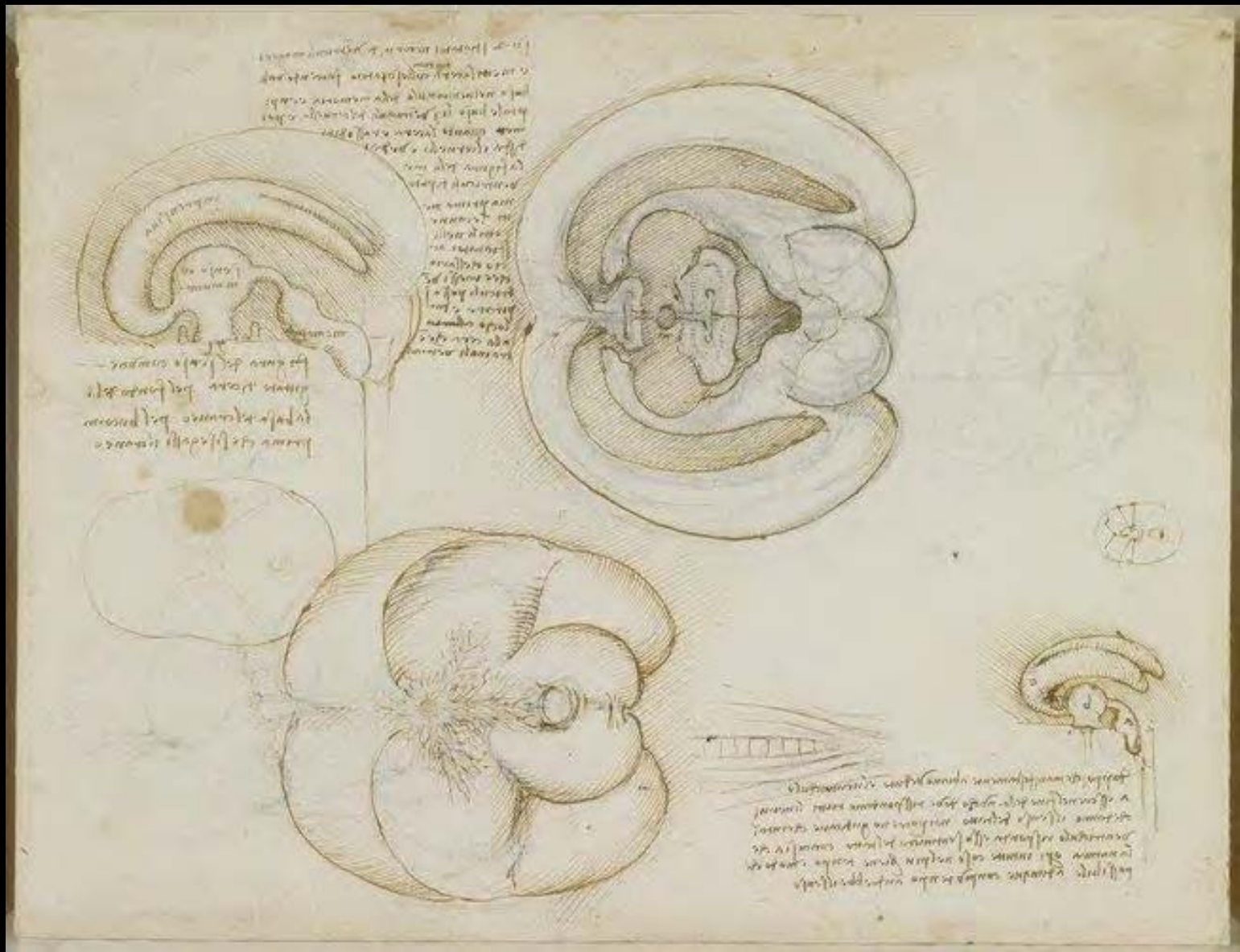
Marcantonio della Torre

- 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.

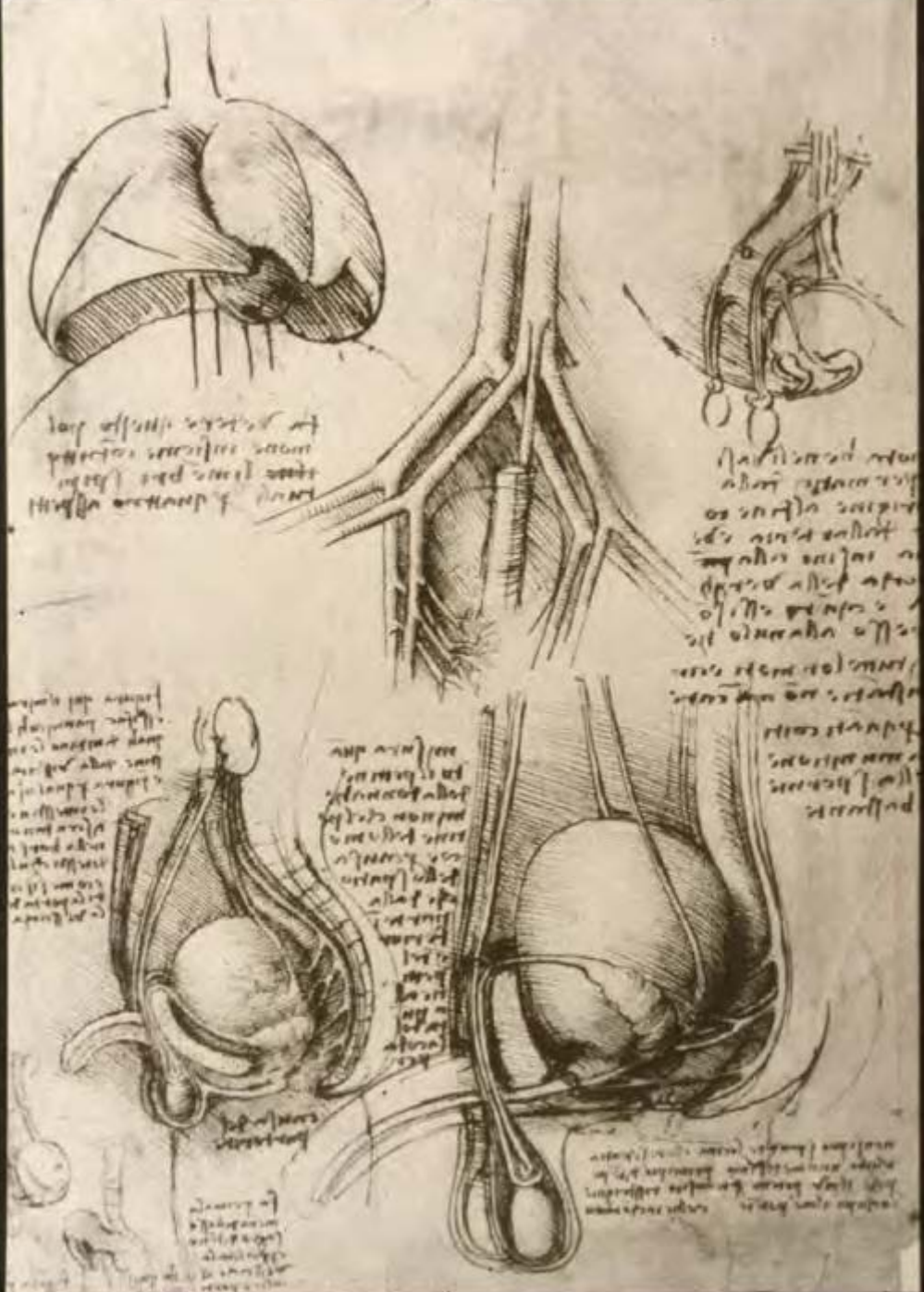
Handwritten text at the top of the page, likely a title or introductory notes, written in a cursive script.



Handwritten text at the bottom of the page, continuing the annotations or providing a conclusion to the anatomical study.



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



Handwritten text in a cursive script, likely Latin or Italian, describing anatomical features. The text is oriented vertically and appears to be a list of labels or descriptions for the structures shown in the sketches.

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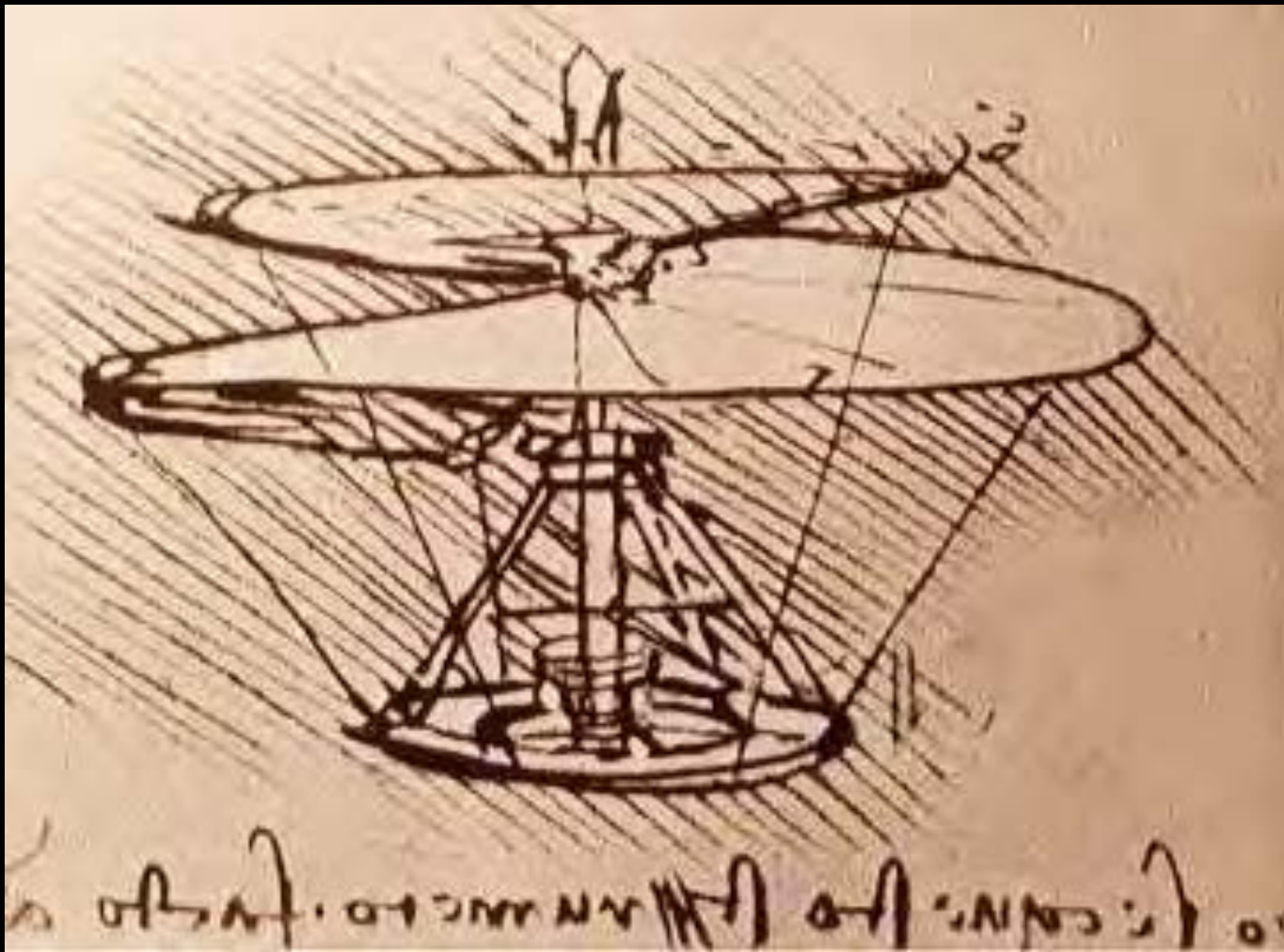


Handwritten text in a cursive script, likely a legend or title, located on the right side of the map.

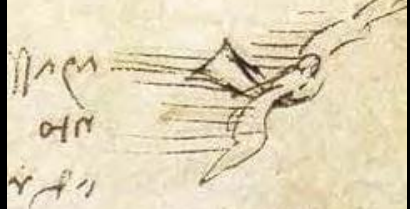
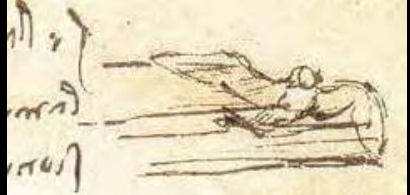


Handwritten text in a cursive script, possibly a list or notes, located to the left of the drawing.





Leonardo's design: a proto-helicopter.



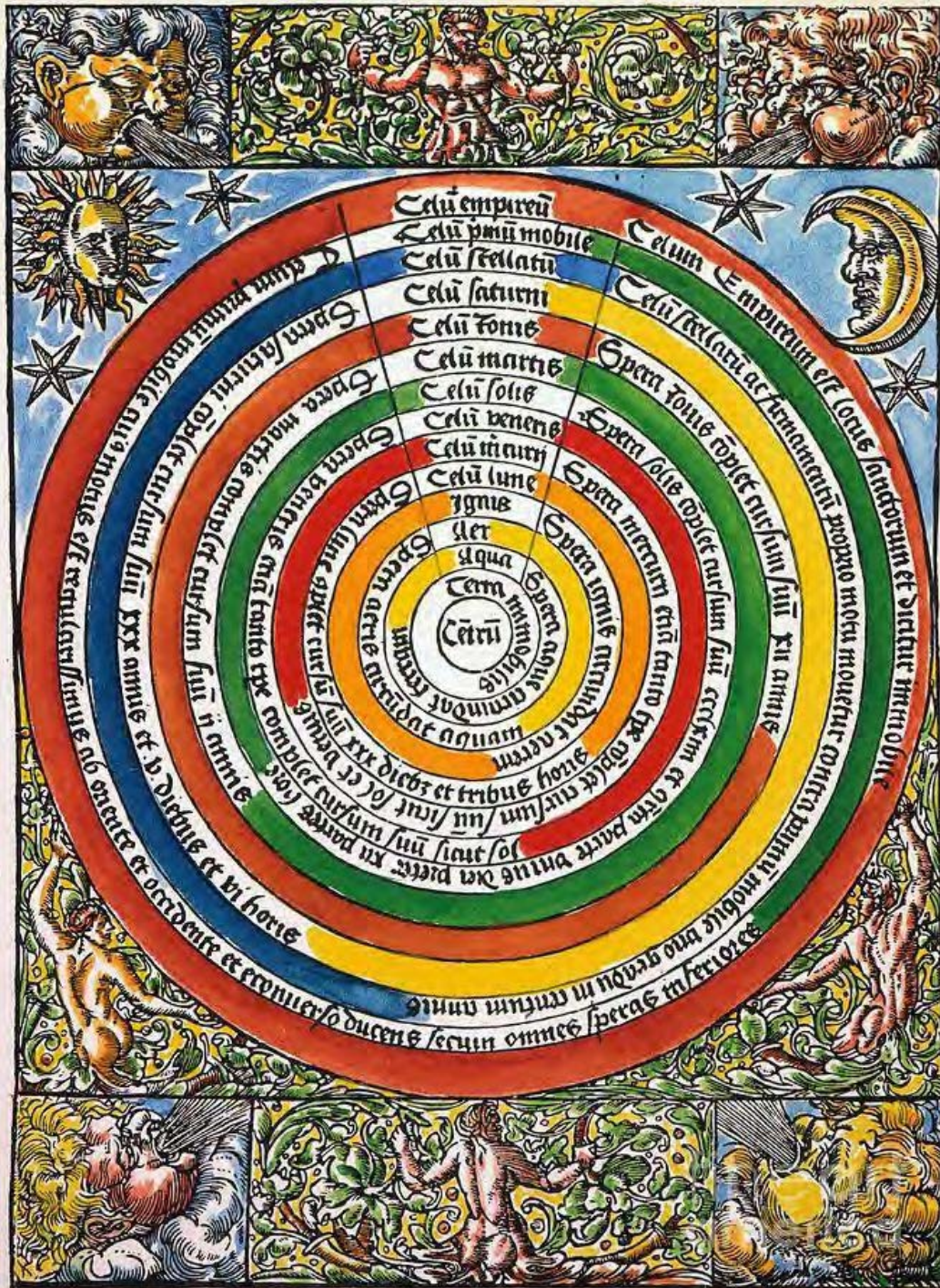


- Costume designs for a theatrical entertainment at court.



Allegory of boat, dog, and eagle.

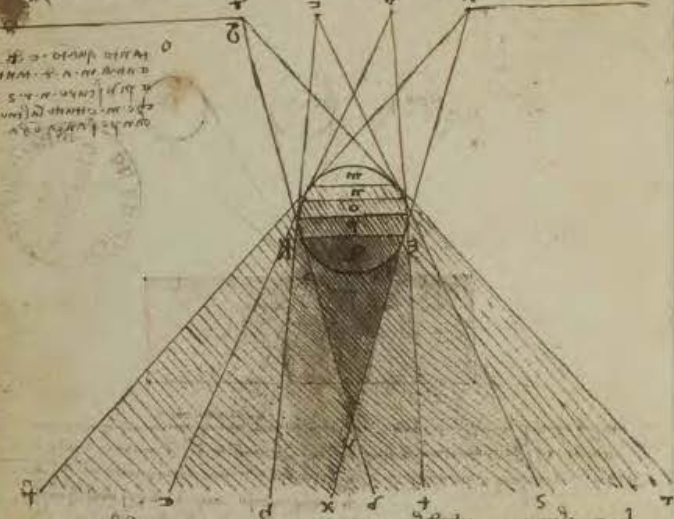
Cornelius
Cornipolitanus,
"Chronographia",
1537.



Leonardo's questions:

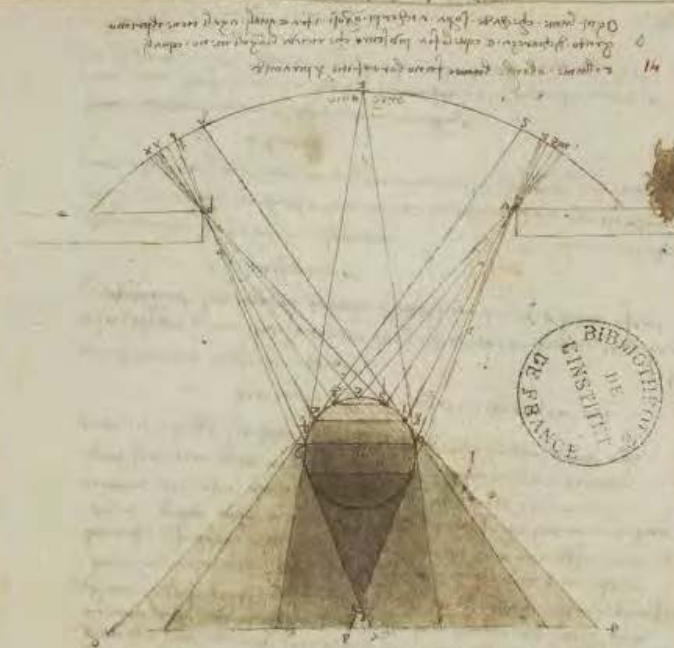
- Is the Earth covered more with earth or water?
- What is the interior of the Earth like?
- How to measure the size of the Sun?
- How do you get fossils on mountain tops?
- Does the Moon have oceans?
- Does the Moon give off any light of its own?

Handwritten text in a cursive script, likely a preface or introduction to the diagram. The text is arranged in several lines, with some words appearing to be in a different script or dialect.



Handwritten text in a cursive script, likely a continuation of the text from the top of the page. The text is arranged in several lines, with some words appearing to be in a different script or dialect.

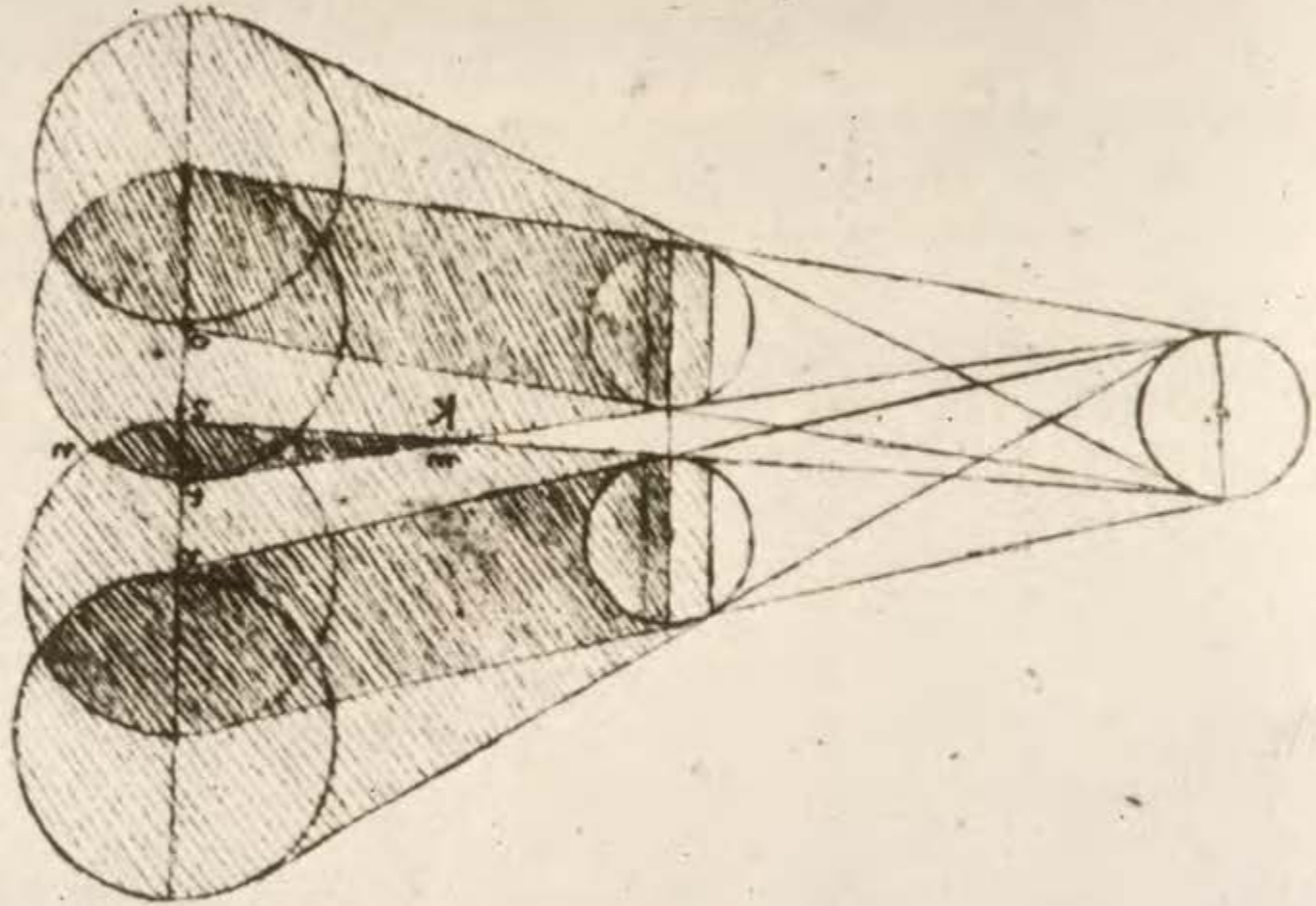
Handwritten text in a cursive script, likely a preface or introduction to the diagram. The text is arranged in several lines, with some words appearing to be in a different script or dialect.

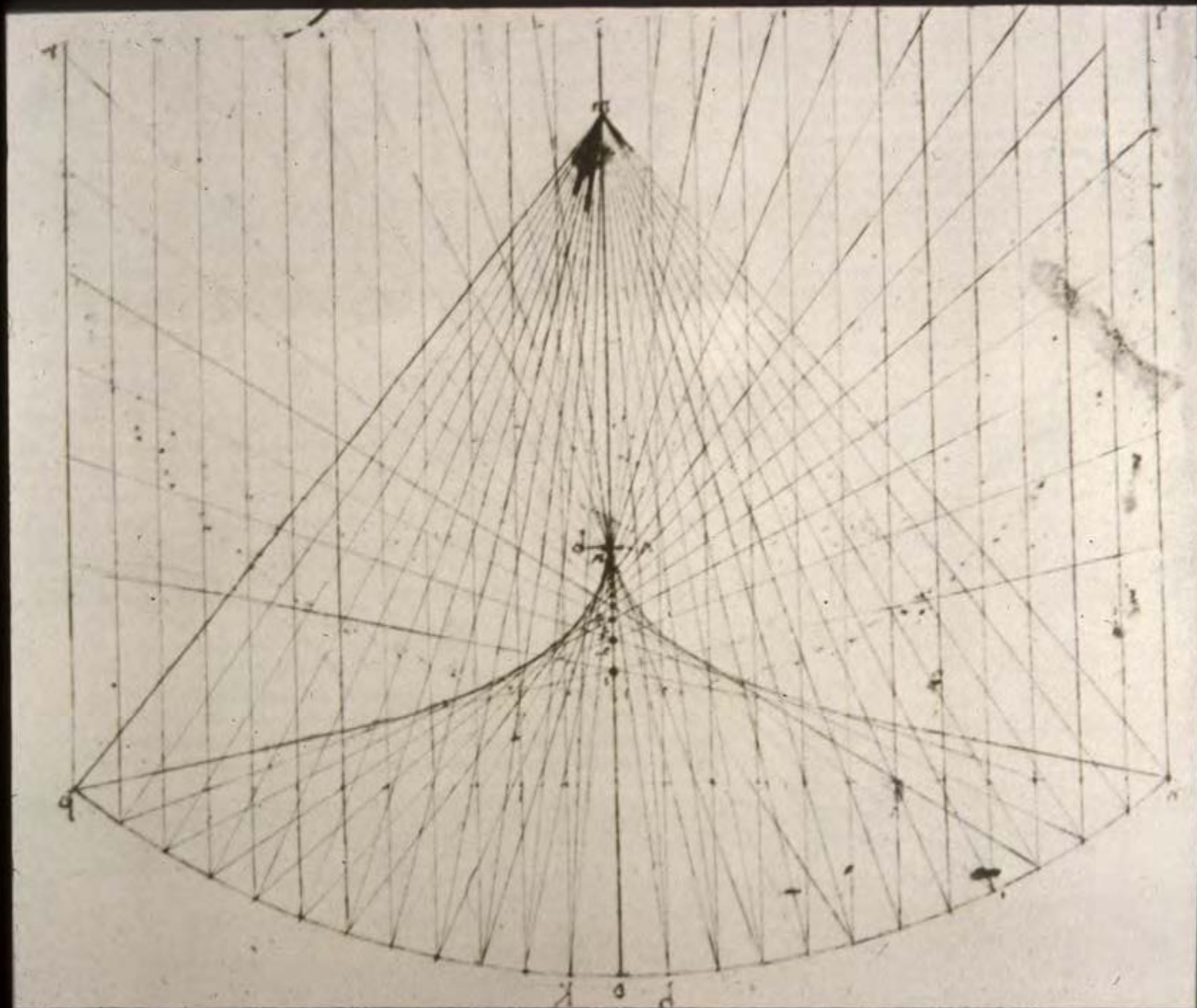


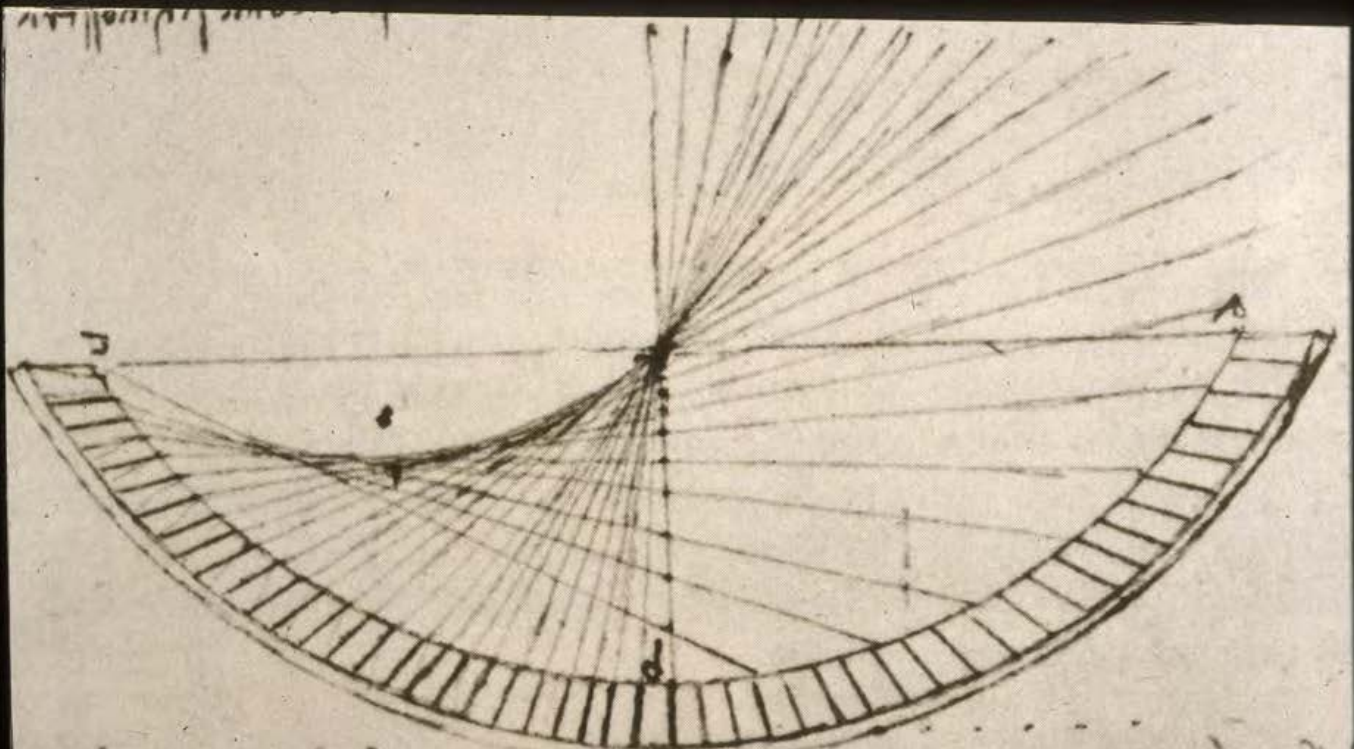
Handwritten text in a cursive script, likely a continuation of the text from the top of the page. The text is arranged in several lines, with some words appearing to be in a different script or dialect.

Manuscript A, Paris.

Die Abbildung zeigt
 die Projektion eines
 Gegenstandes durch
 ein System von
 zwei Linsen.







Handwritten text in a script, likely a historical or scientific manuscript, located below the diagram. The text is written in a cursive style and appears to be in a non-Latin script, possibly Arabic or Persian. It is partially obscured by the diagram above it.

Leonardo da Vinci
Codex Atlanticus 674v

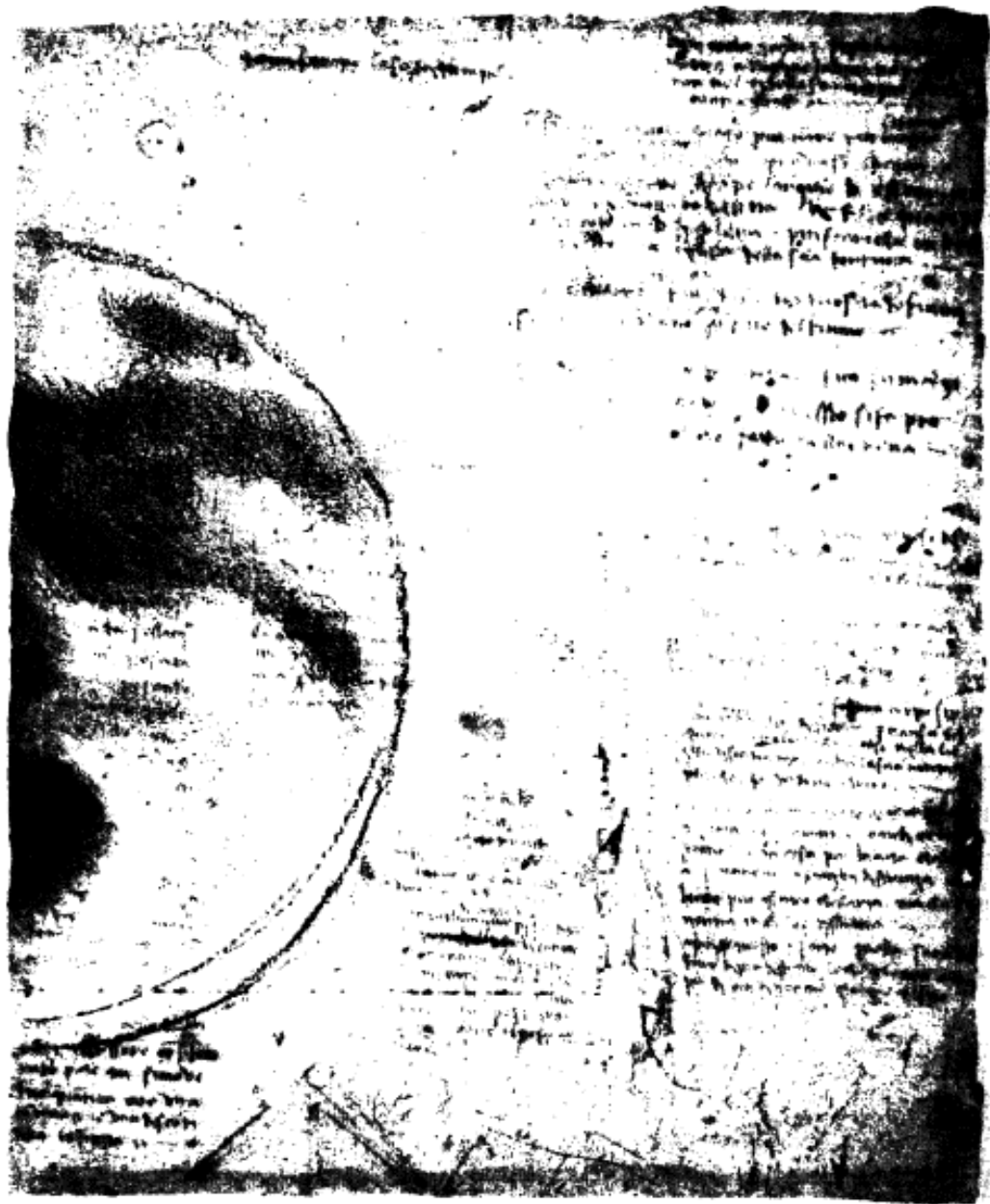
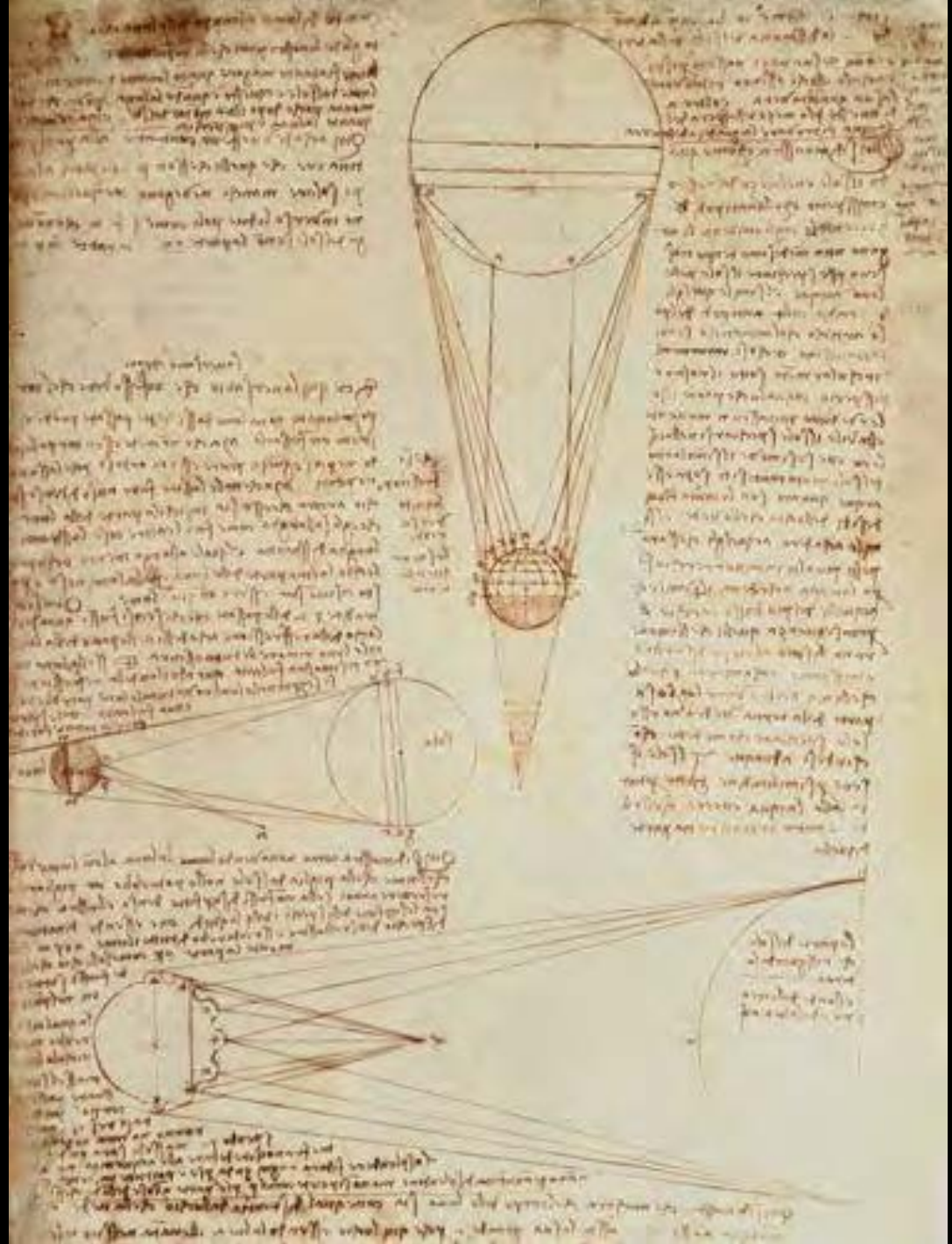


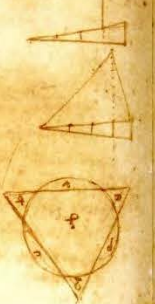
FIG 2. Drawing of the western half of the Moon by Leonardo da Vinci: Codex Atlanticus 674 verso (reproduced with the kind permission of Giunti Barbèra, Florence).



Codes Leicester,
Sheet 1A, folio 1y.

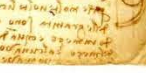
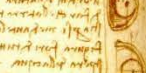
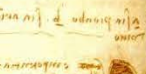


Handwritten text in Italian script, likely discussing optics and the rainbow. It begins with 'Sopra l'arcobaleno' and describes the formation of the rainbow through the refraction and reflection of light in water droplets.



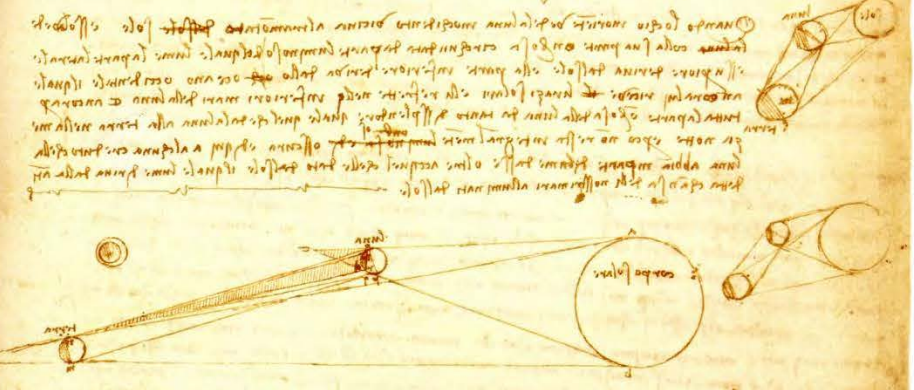
Handwritten text in Italian script, continuing the discussion on optics and the rainbow. It includes the phrase 'Sopra l'arcobaleno' and describes the colors of the rainbow.

Handwritten text in Italian script, discussing the rainbow and the colors of the spectrum. It includes the phrase 'Sopra l'arcobaleno' and describes the colors of the rainbow.



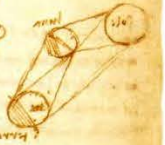
Handwritten text in Italian script, continuing the discussion on optics and the rainbow. It includes the phrase 'Sopra l'arcobaleno' and describes the colors of the rainbow.

Handwritten text in Italian script, discussing optics and the rainbow. It includes the phrase 'Sopra l'arcobaleno' and describes the colors of the rainbow.



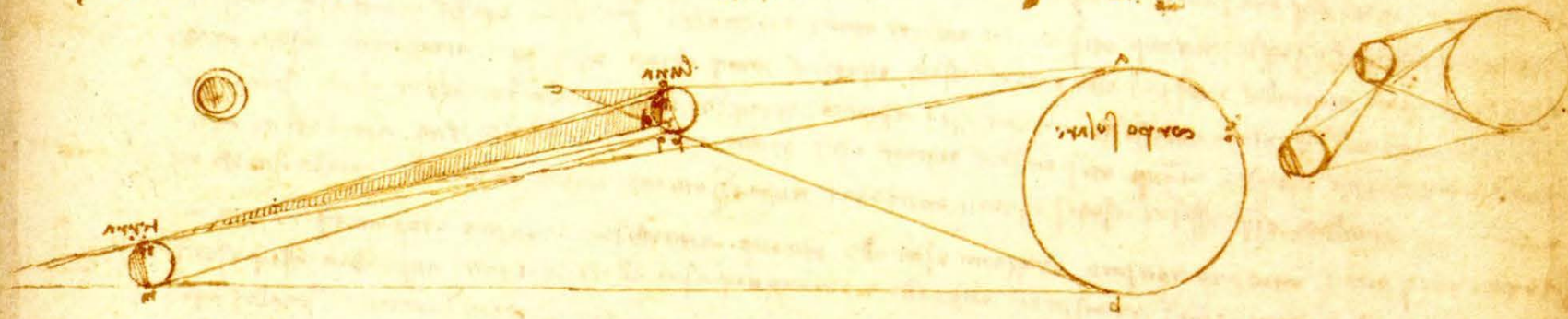
Handwritten text in Italian script, discussing optics and the rainbow. It includes the phrase 'Sopra l'arcobaleno' and describes the colors of the rainbow.

Handwritten text in Italian script, discussing optics and the rainbow. It includes the phrase 'Sopra l'arcobaleno' and describes the colors of the rainbow.



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

Handwritten text at the top of the page, likely a preface or introduction, written in a cursive script.



Handwritten text block below the diagram, starting with a large initial 'A'. The text is written in a cursive script and appears to be a detailed explanation or commentary on the diagram above.

Handwritten text block below the first paragraph, starting with a large initial 'A'. This block continues the text from the previous paragraph.

Main body of handwritten text at the bottom of the page, starting with a large initial 'A'. This block contains the majority of the text on the page and is written in a cursive script.



Handwritten text on the right margin, written in a cursive script, likely a continuation of the main text or a separate note.

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.)

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

Handwritten text at the top of the page, possibly a title or introductory paragraph.



Main body of handwritten text, consisting of several paragraphs. The text is dense and appears to be a detailed account or report.

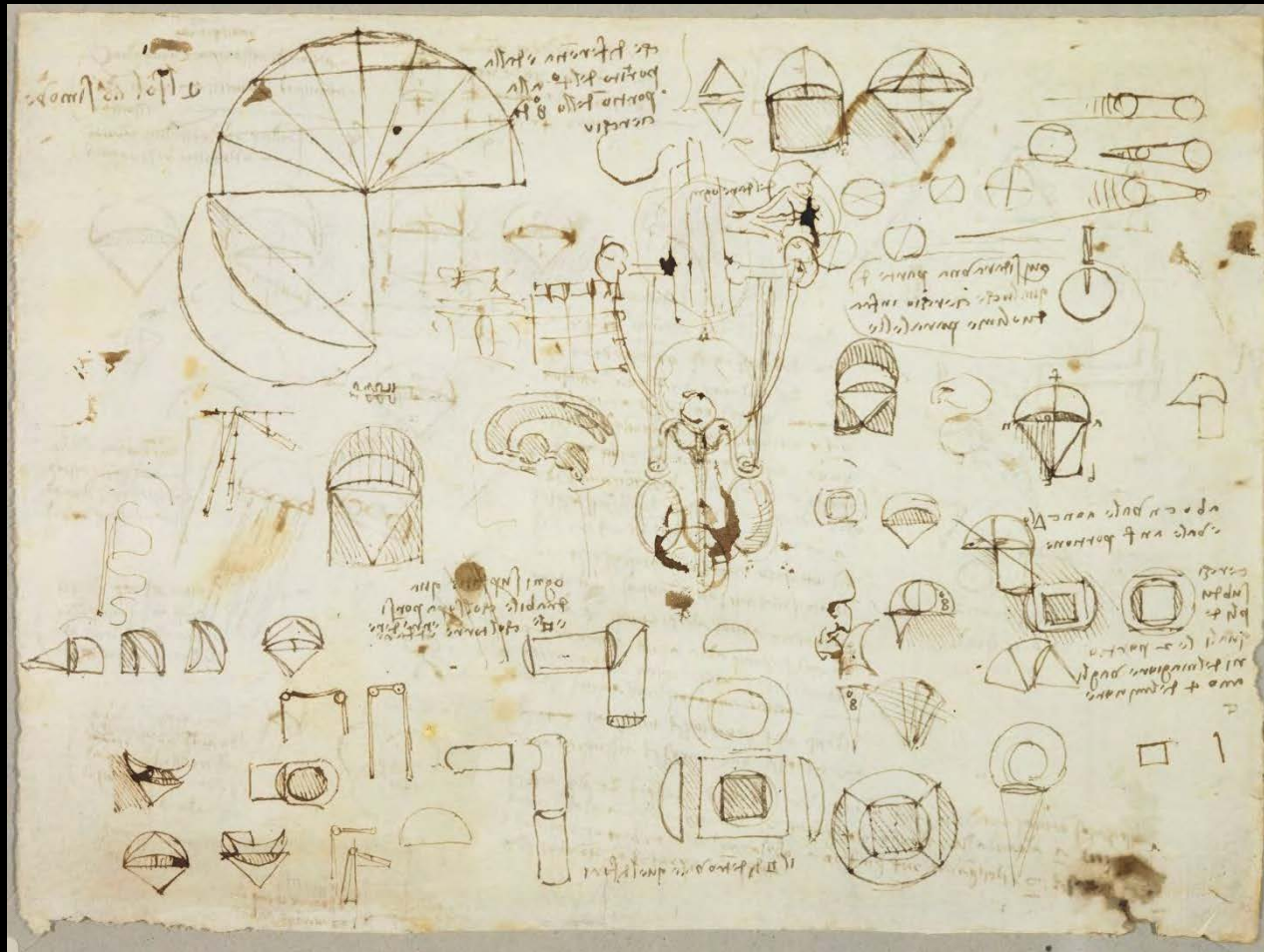
A section of handwritten text, possibly a sub-section or a specific note within the main body.

Another section of handwritten text, continuing the narrative or providing further details.

Final lines of handwritten text at the bottom of the page.

Fragments:

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



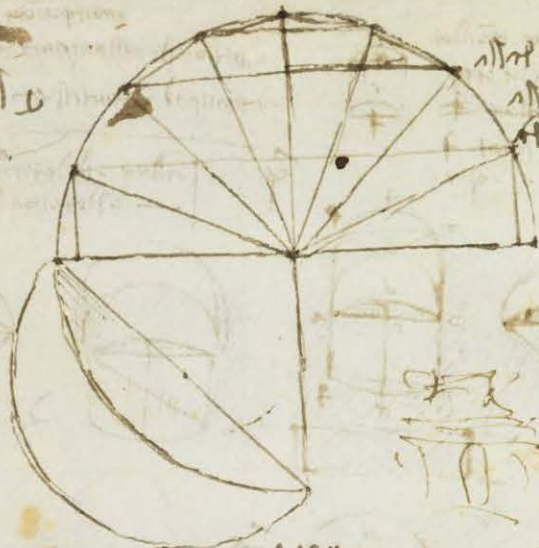
Leonardo da Vinci, drawing. 1510-11.

Windsor Castle, Royal Collection. RCIN 912669v.

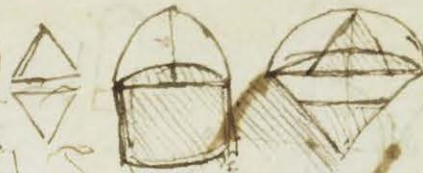
RCIN 912669v.

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

Handwritten text at the top left, possibly a title or reference.



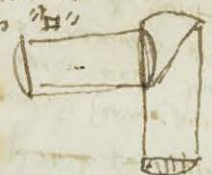
Handwritten text in the upper right quadrant, oriented vertically.



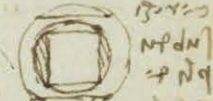
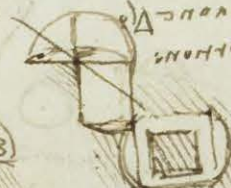
Handwritten text in a circular arrangement, possibly describing a component.



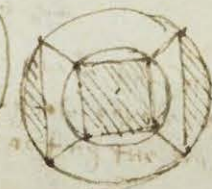
Handwritten text in the lower middle section, oriented vertically.



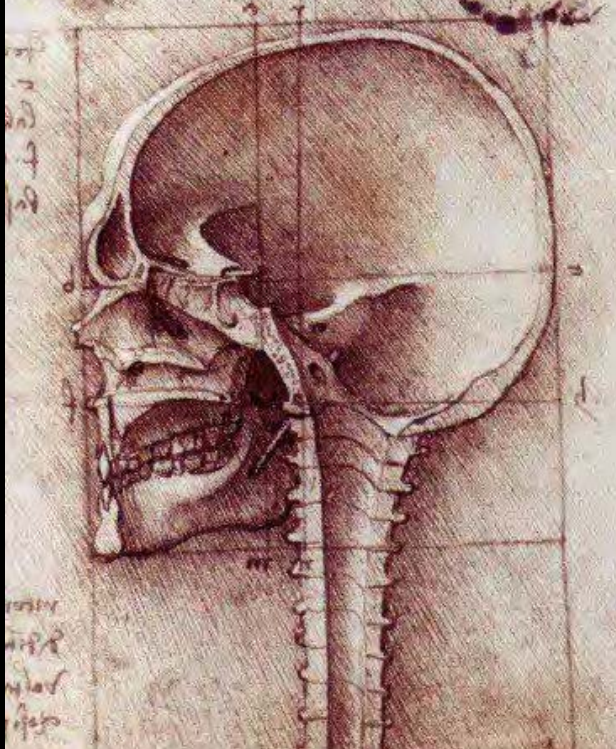
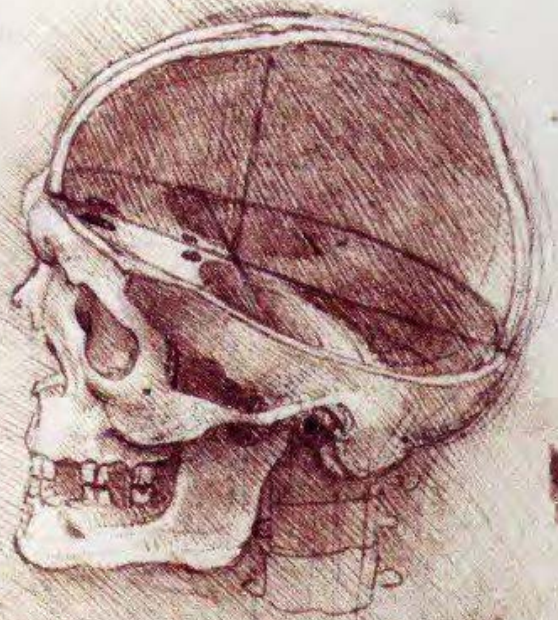
Handwritten text in the lower right quadrant, oriented vertically.



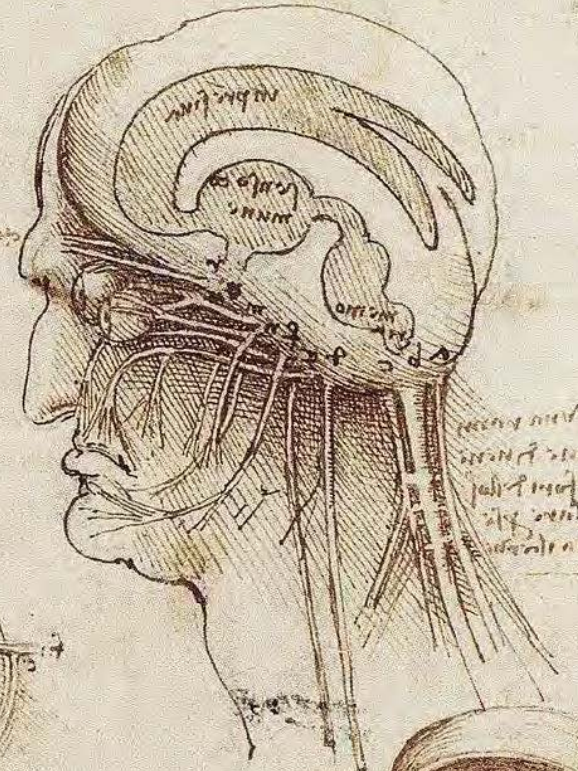
Handwritten text at the bottom center, oriented vertically.



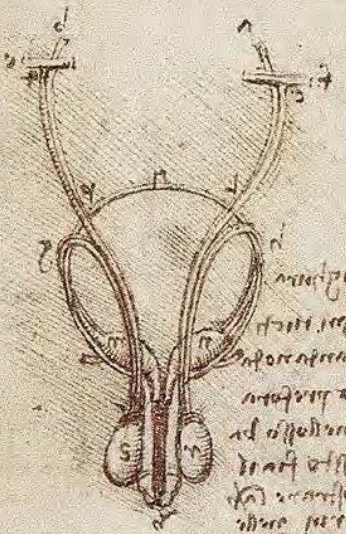
A small handwritten mark or character at the bottom right.



Handwritten text in a cursive script, likely Latin, located at the top left of the page.



Handwritten text in a cursive script, likely Latin, located to the right of the head drawing.



Handwritten text in a cursive script, likely Latin, located at the bottom left of the page.

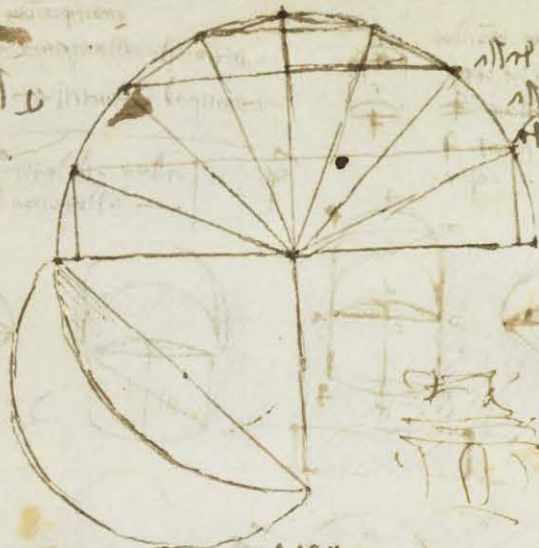
Handwritten text in a cursive script, likely Latin, located in the middle of the page.

Handwritten text in a cursive script, likely Latin, located at the bottom middle of the page.

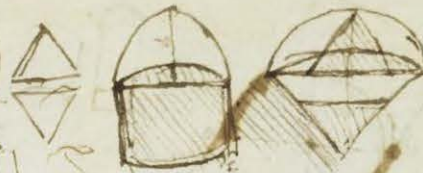


Handwritten text in a cursive script, likely Latin, located to the right of the head drawing.

Handwritten text at the top left, possibly a title or reference.



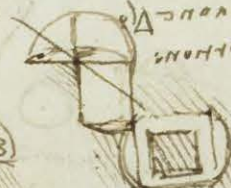
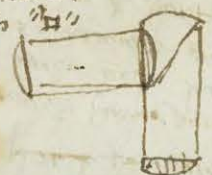
Handwritten text describing the dome structure, possibly mentioning 'geodesic' or 'dome'.



Handwritten text describing the central mechanism, possibly mentioning 'pump' or 'lifting'.



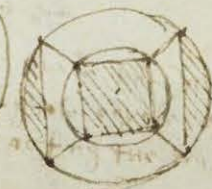
Handwritten text describing a component, possibly a 'cylinder' or 'shaft'.



Handwritten text describing a component, possibly mentioning 'square' or 'hole'.



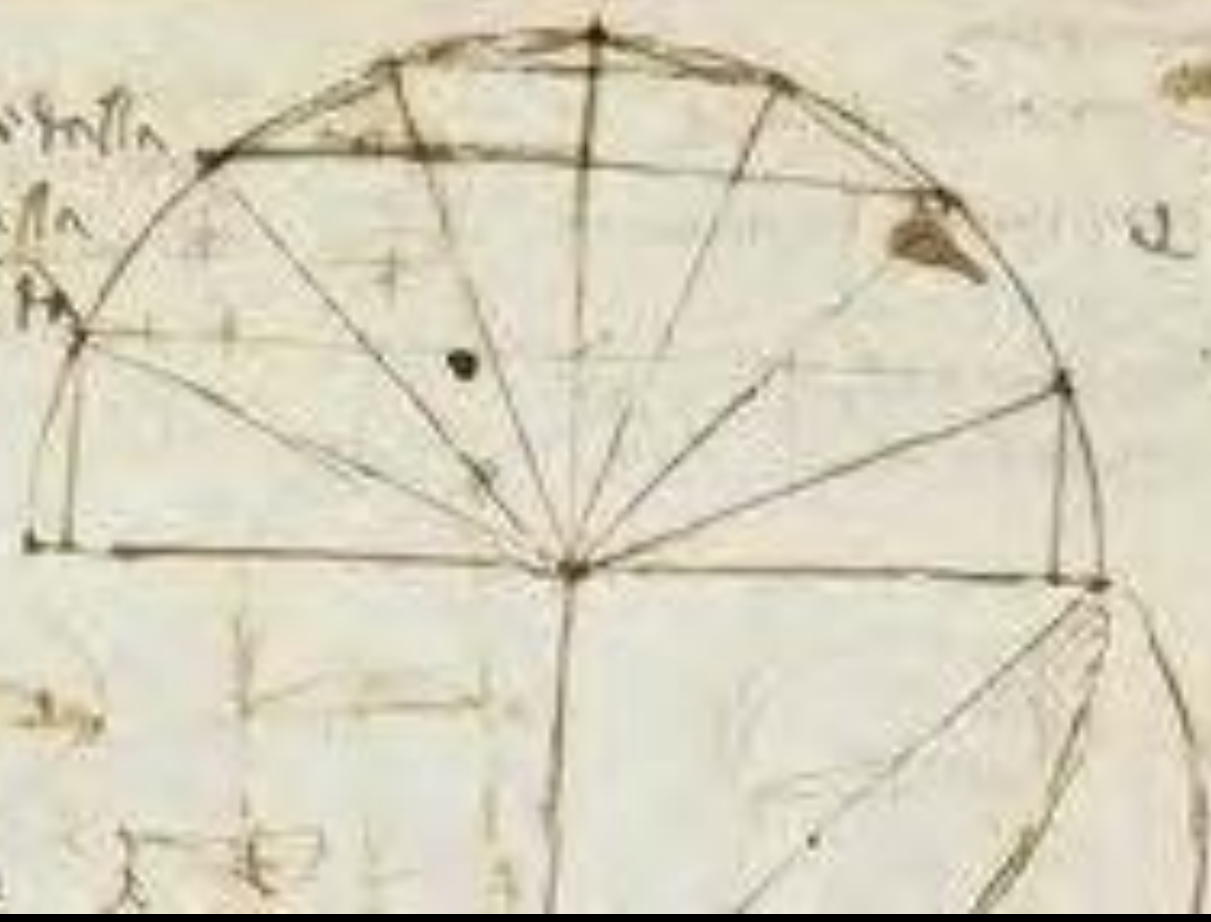
Handwritten text at the bottom center, possibly a title or reference.



A small handwritten mark or symbol at the bottom right.

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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)

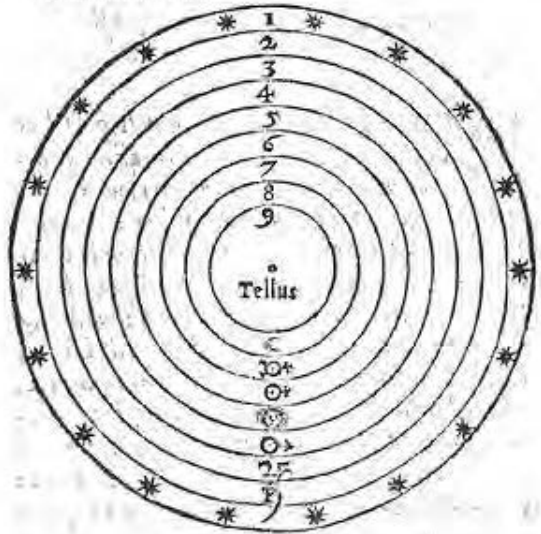
- Early 5th century Neoplatonist.
- “On the Marriage of Philology and Mercury”
- Enormously influential.
- Theory of 7 Liberal Arts.



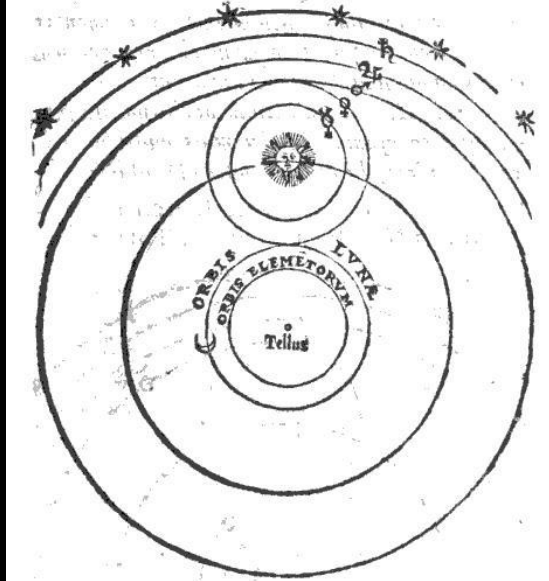
Martianus Capella's "Marriage of Philology and Mercury." (~420)

- 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*.

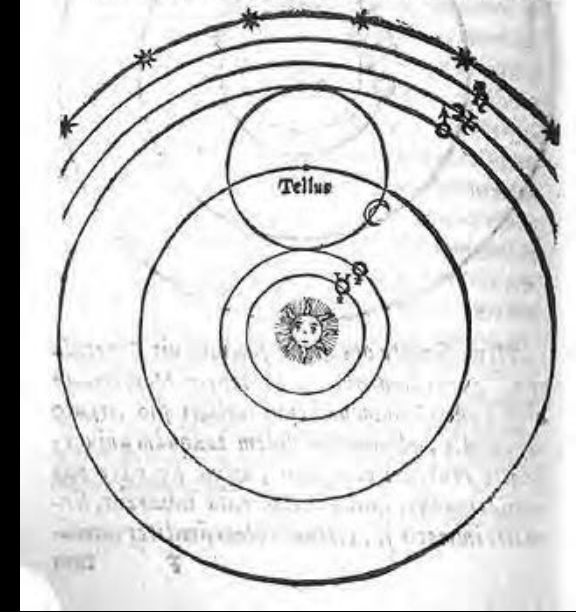
Systema maximarum mundi partium,
quibus totam rerum vniuersitatem
connexam esse tradiderunt communi-
ter authores.



Systema maximarum vniuersitatis
partium ex sententia Martiani
Capellæ.



Systema vniuersitatis de sententia sum-
mi viri Nicolai Copernici Torinensis.



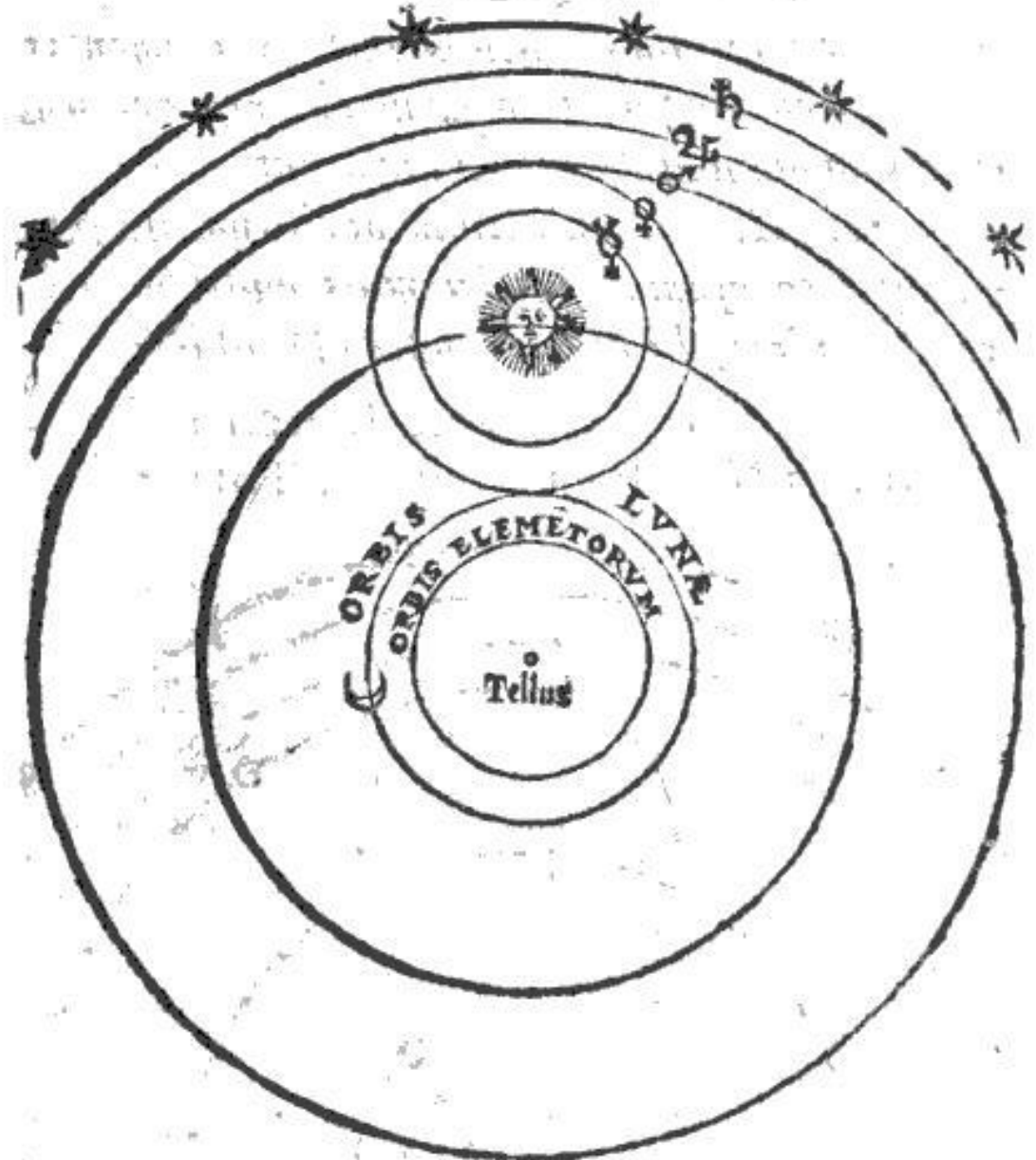
Aristotle,

Martianus Capella,

Copernicus

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

Systema maximarum vniuersitatis
partium ex sententia Martiani
Capellæ.



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.





Satur nus!

Jupit

Mars

Sol

Venus

Mercurius

II

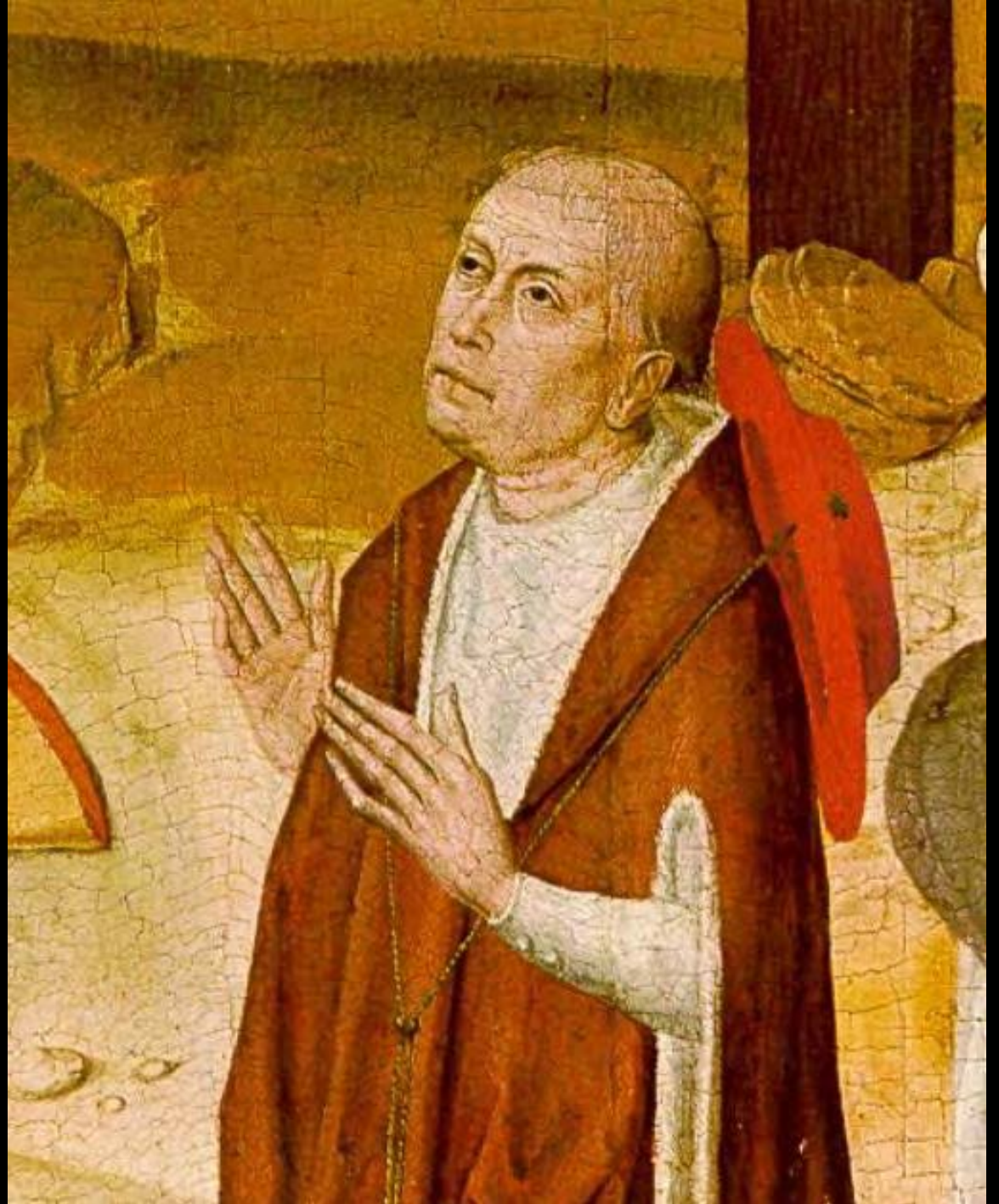


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Nicholas of Cusa

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).



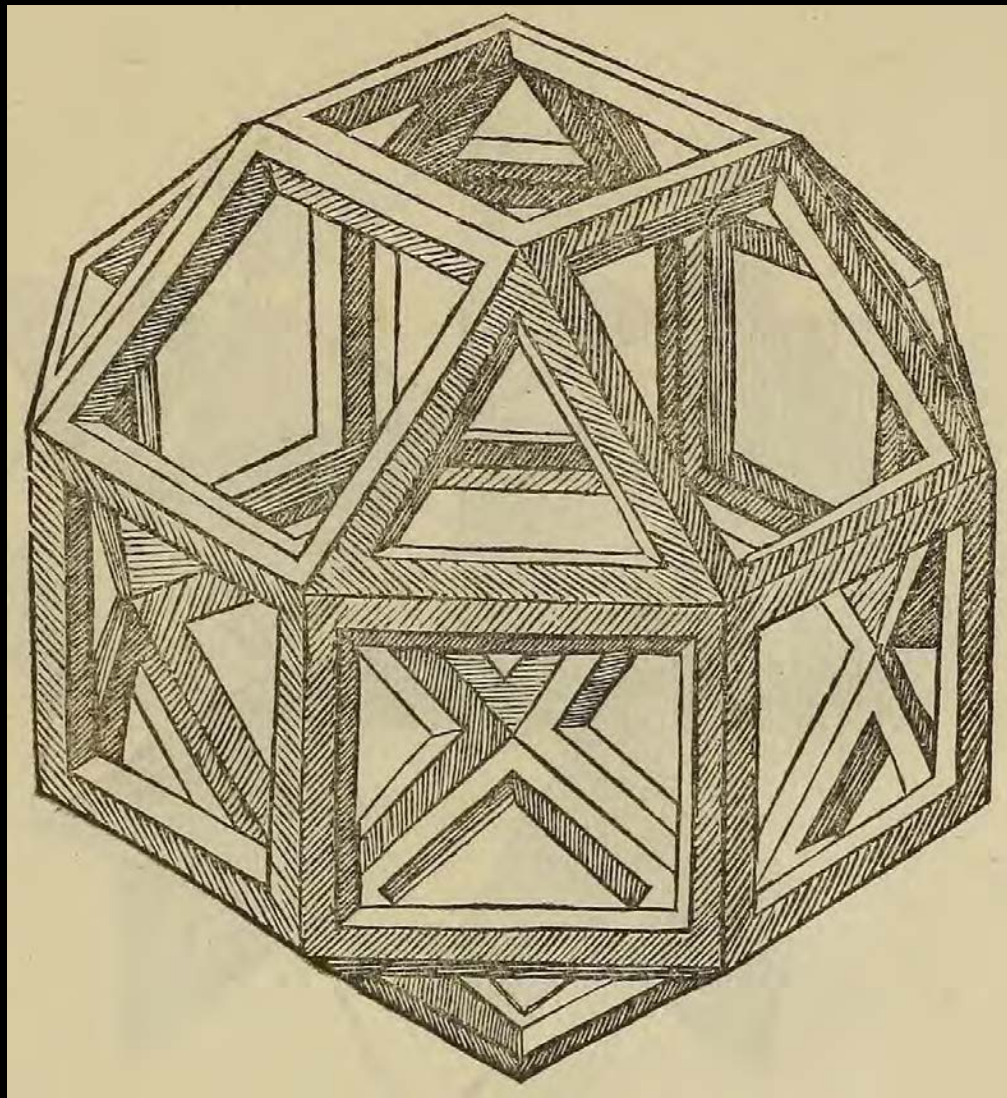
Regiomontanus (1436-1476)

- Peurbach 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 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 Halley's 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).