APPROACHING THE HISTORY OF SCIENCE THROUGH ITS IMAGES IN SCIENCE TEACHER EDUCATION.

THE CASE OF THE PNEUMATIC TROUGH

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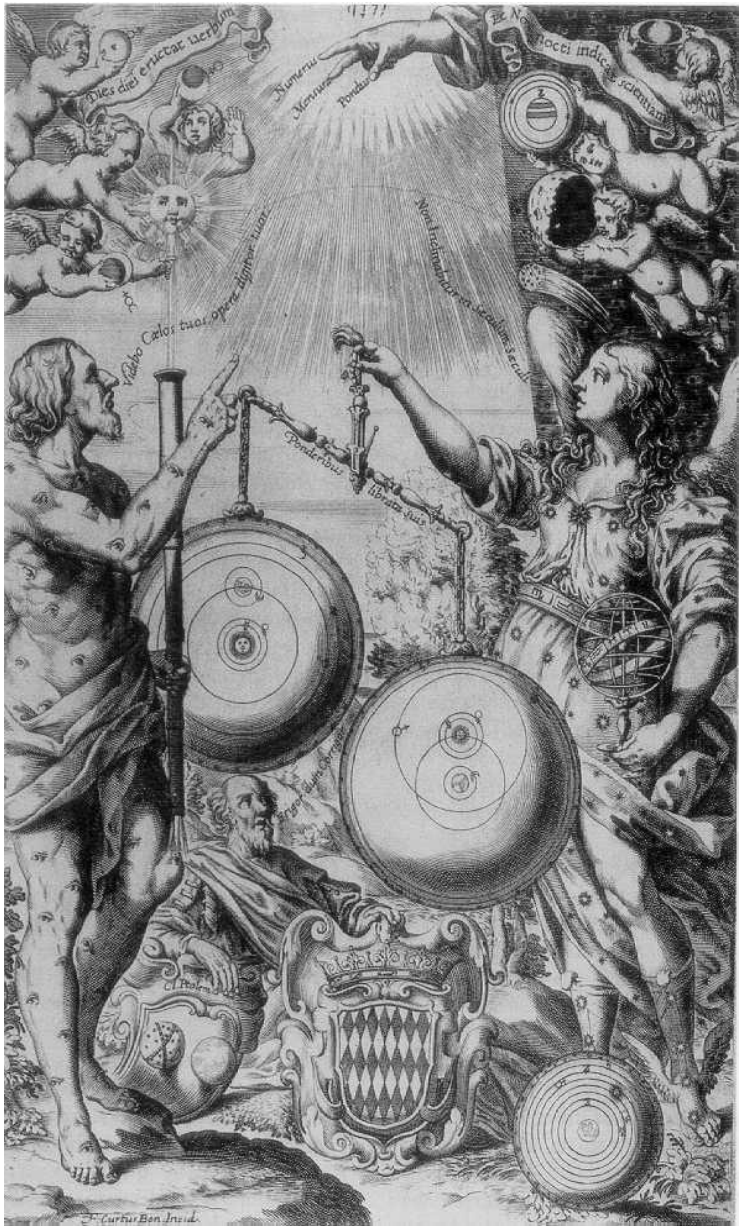
Histoires et philosophies de la chimie
Quels apports pour son enseignement?
Paris, 18 January 2017

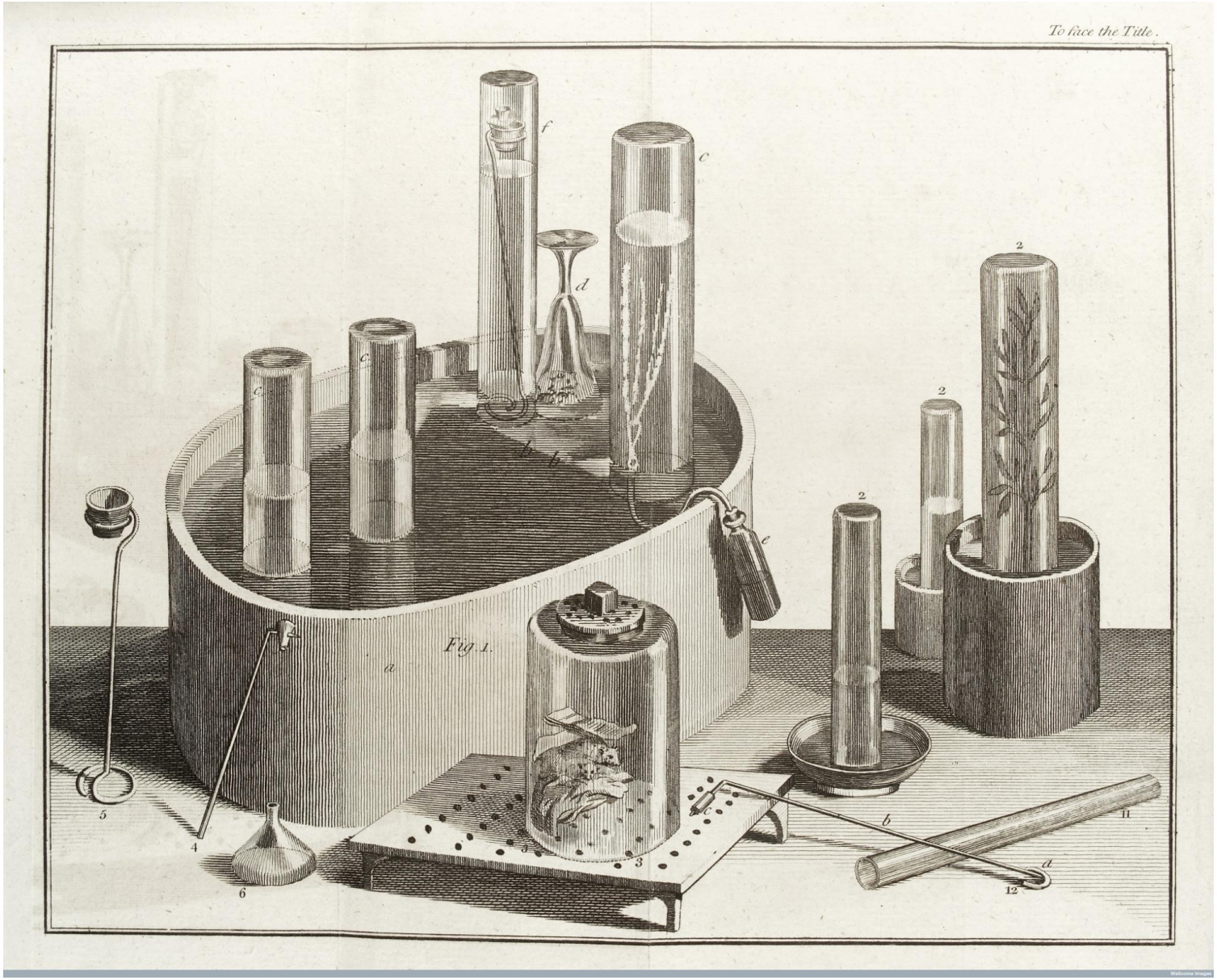
Didactical approach

To **use** the **history of science** by means of **historical images** rather than to **teach** the **history of science** throughout its **academic contents**.



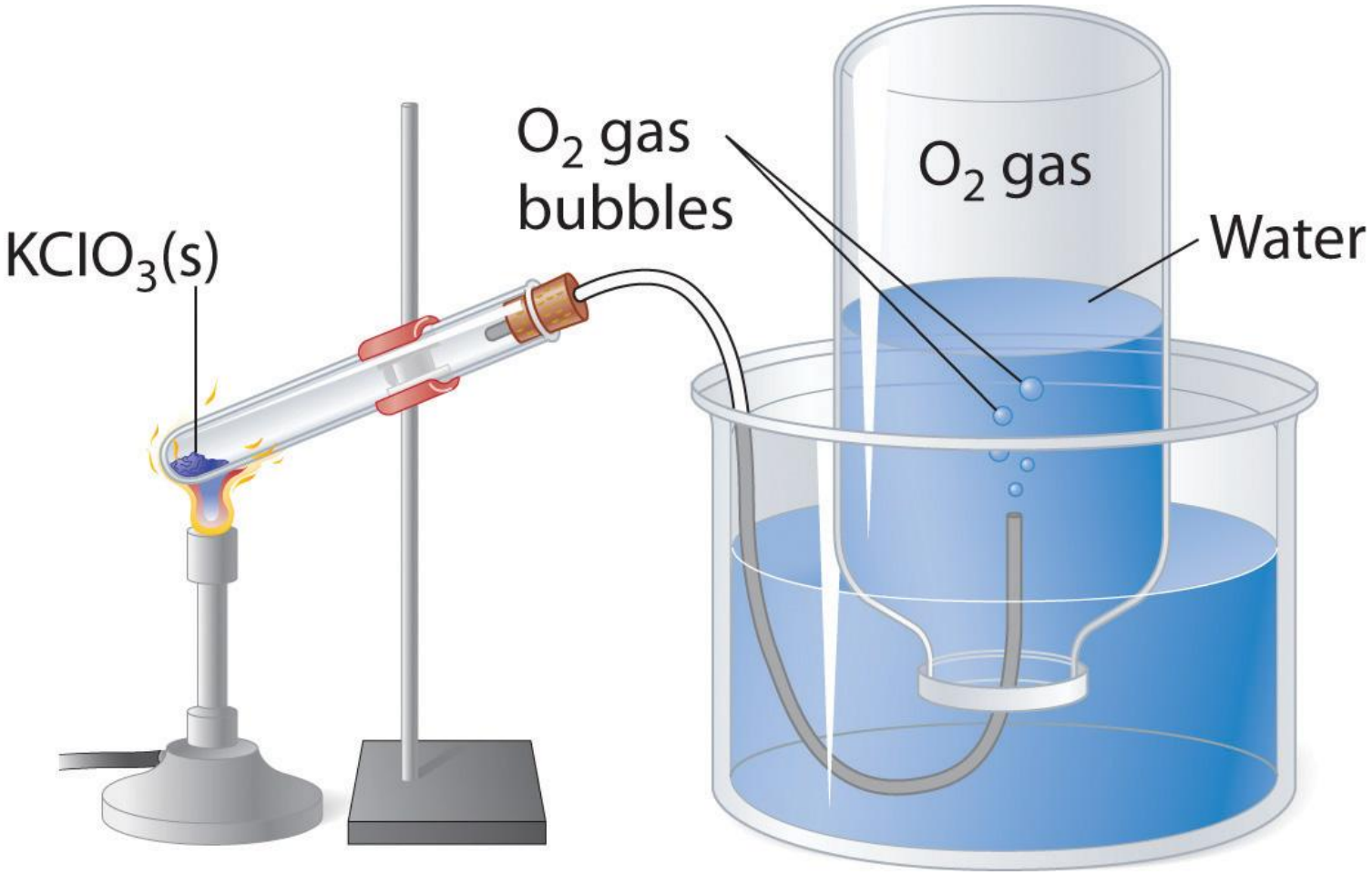
From Giovanni Batista Riccioli's *Alamgestu Nostrum*, 1651

Two drawings by Marie-Anne Paulze (Madame Lavoisier), c. 1790

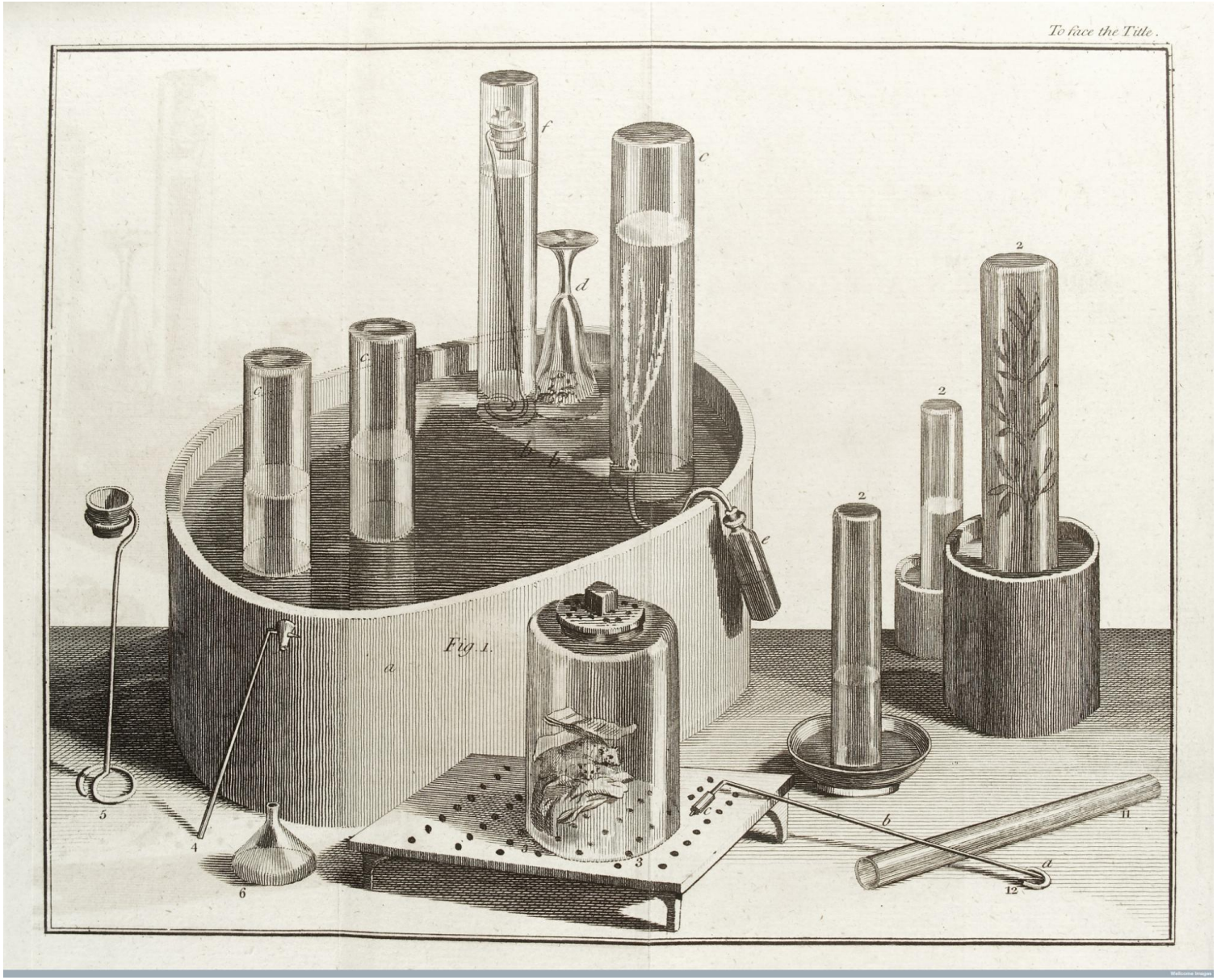


From Joseph Priestley's *Experiments and Observations of Different Kinds of Air*, 1774.

From *Beautiful Chemistry* (http://www.beautifulchemistry.net/history/)



From *Principles of General Chemistry*
(http://2012books.lardbucket.org/books/principles-of-general-chemistry-v1.0/)



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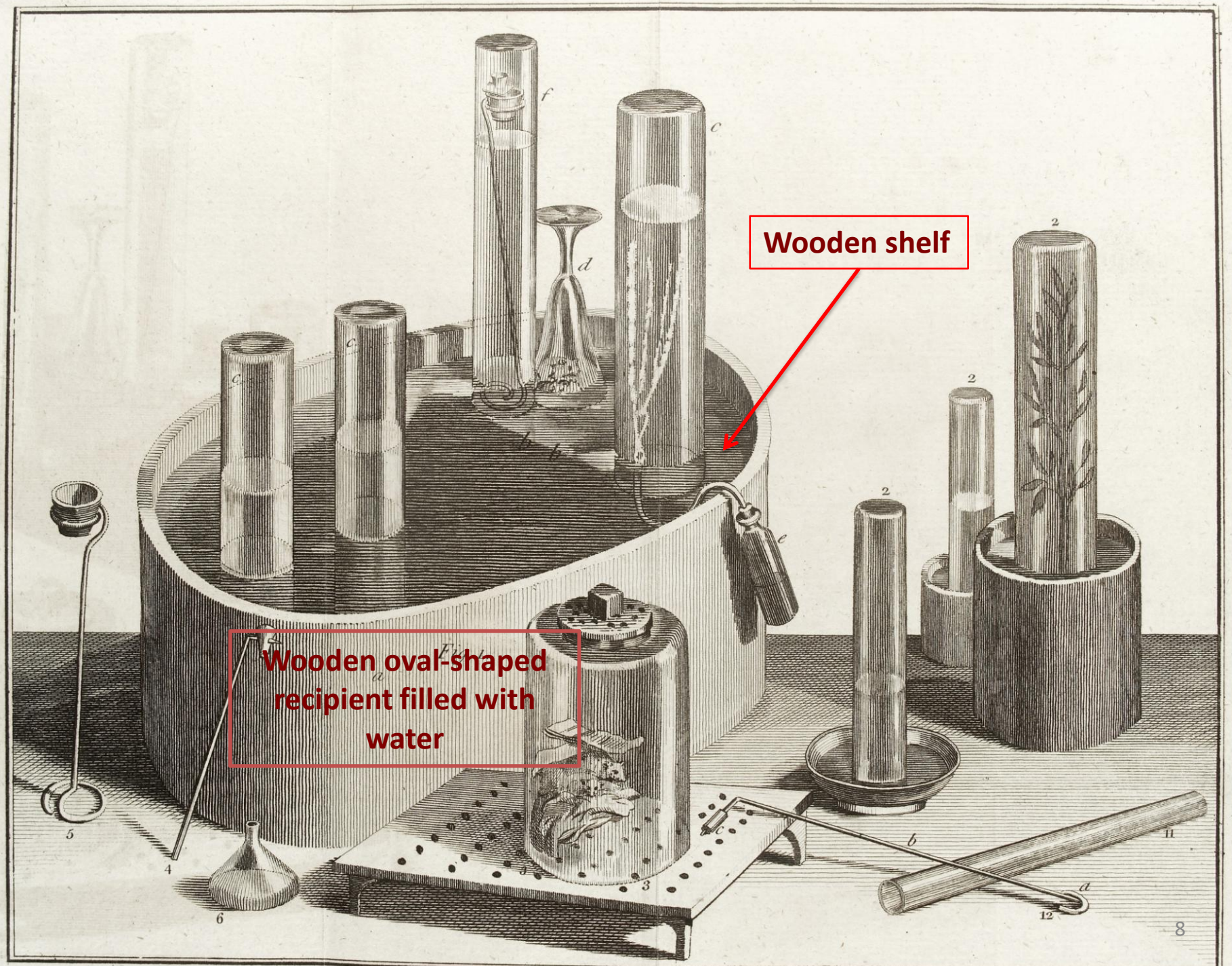
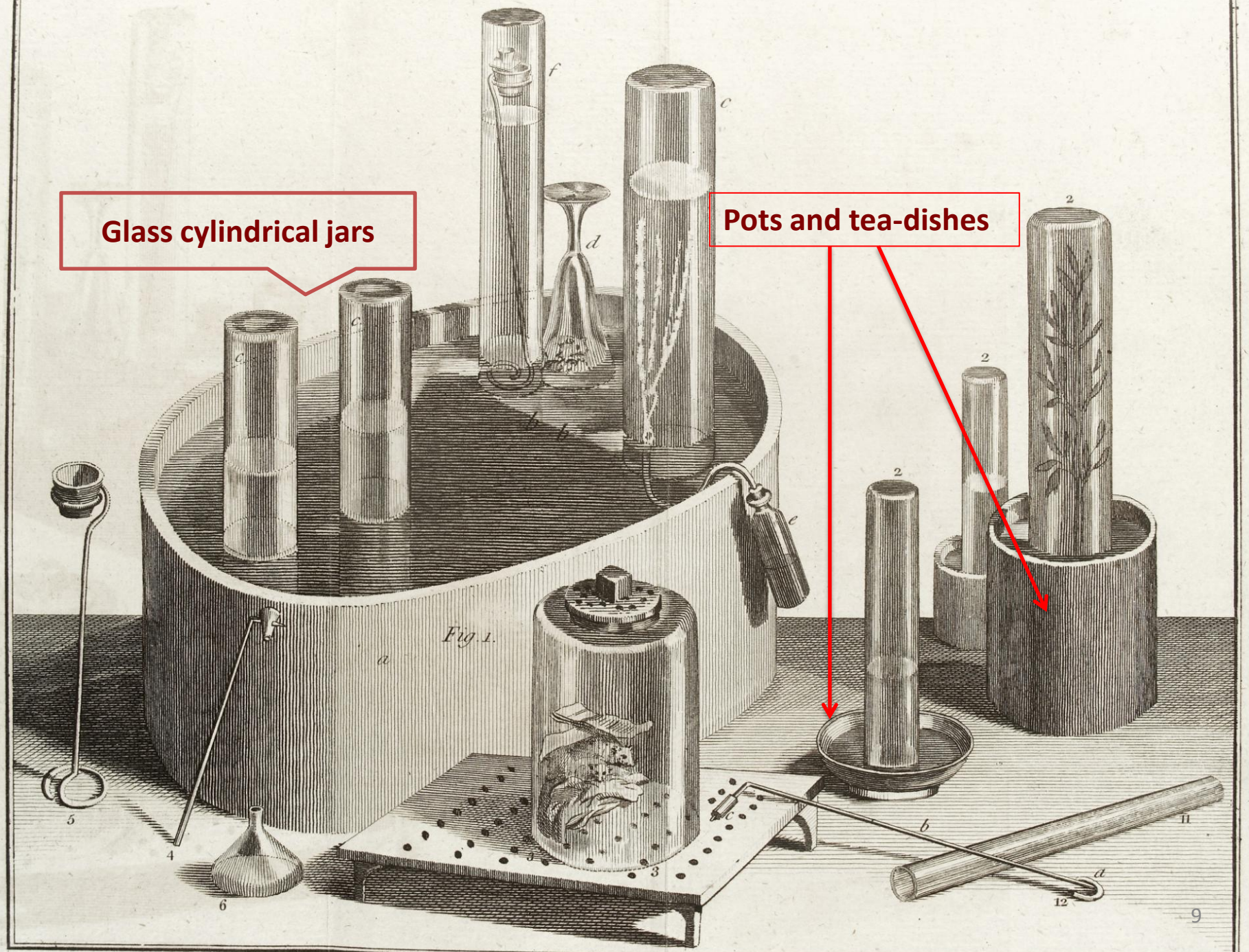
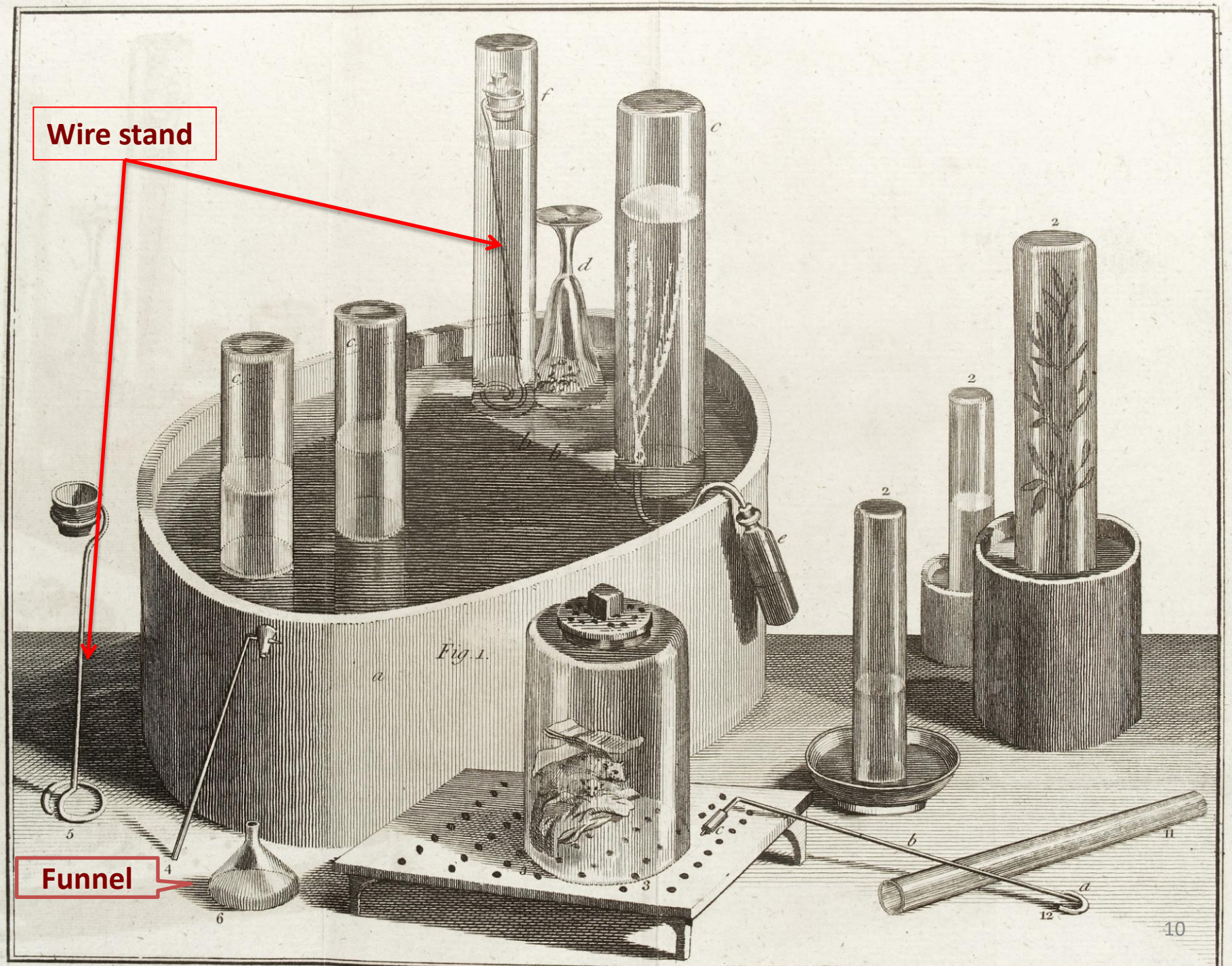
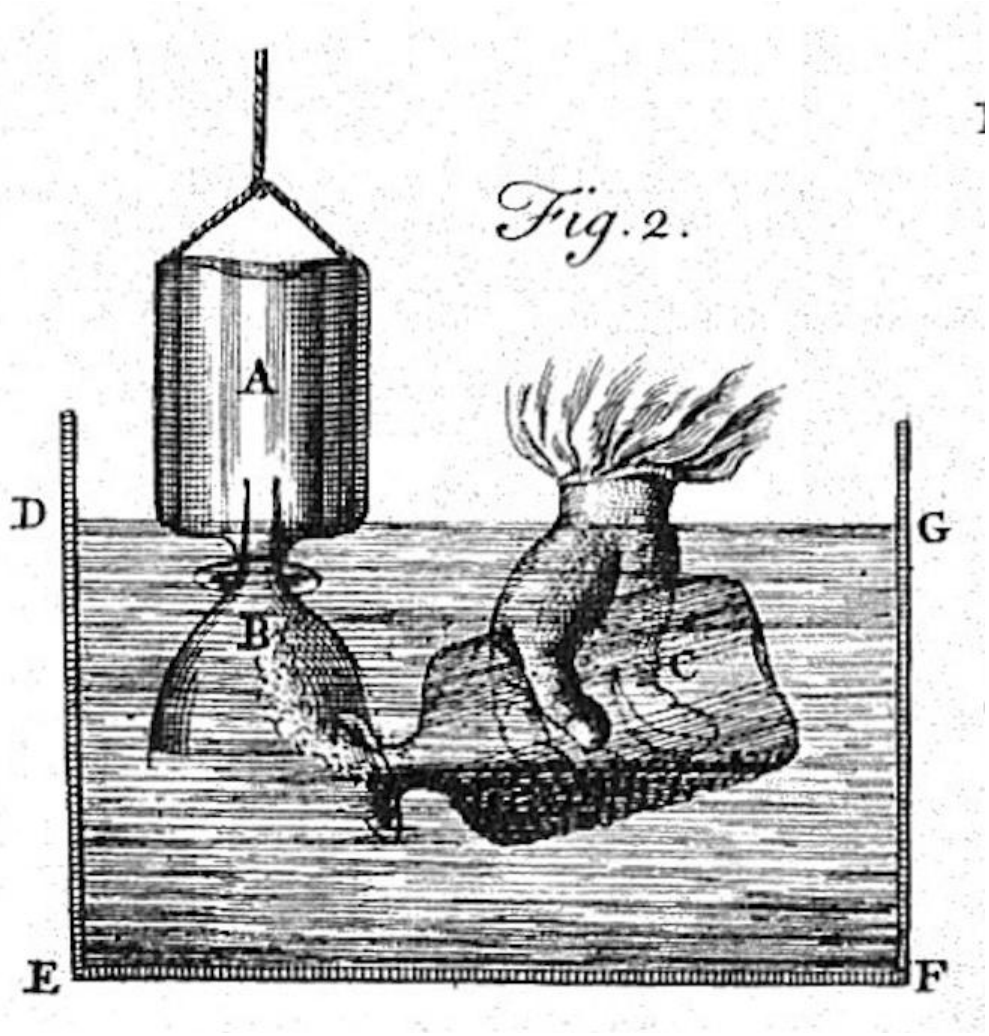
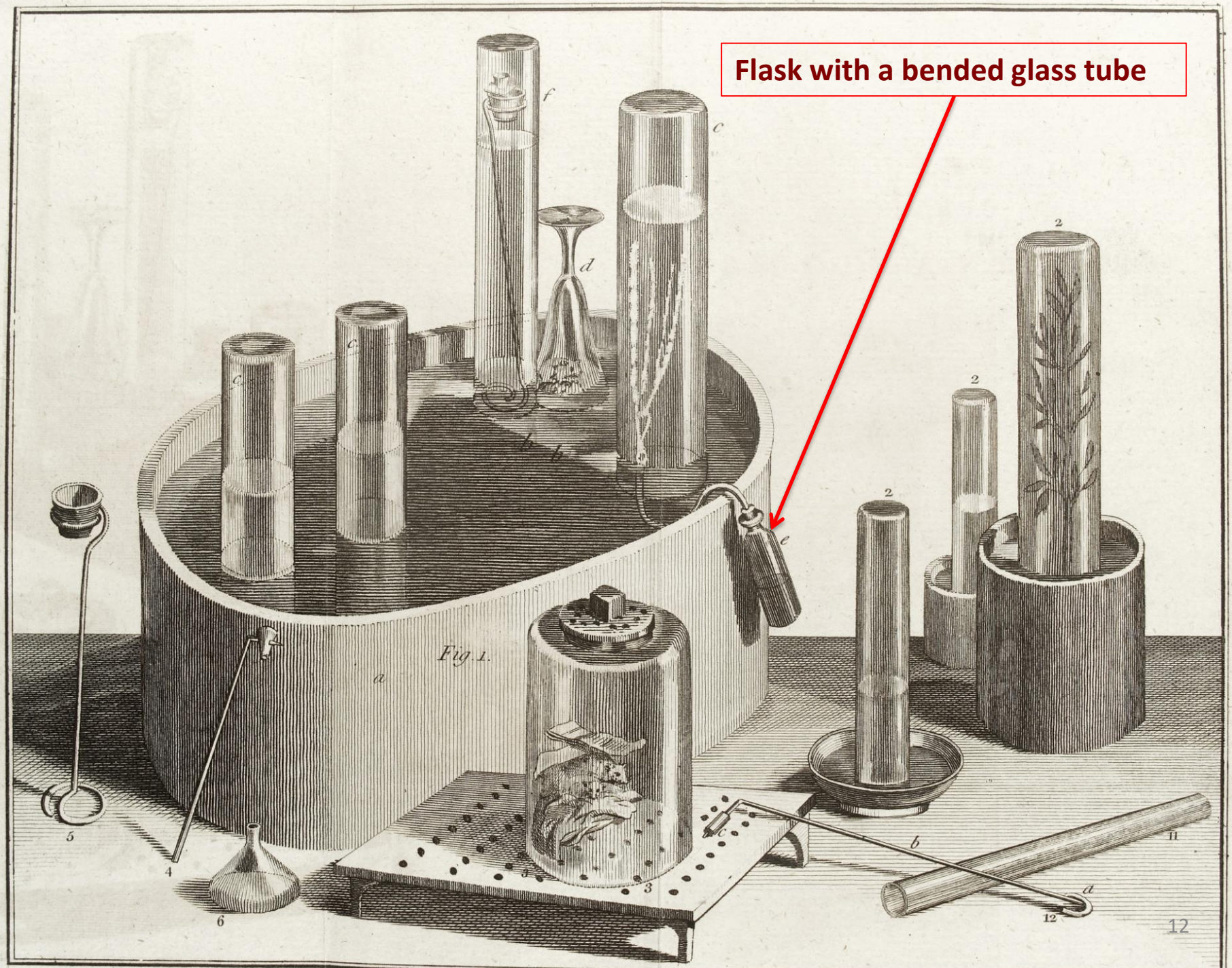

Wooden shelf
Wooden oval-shaped recipient filled with water

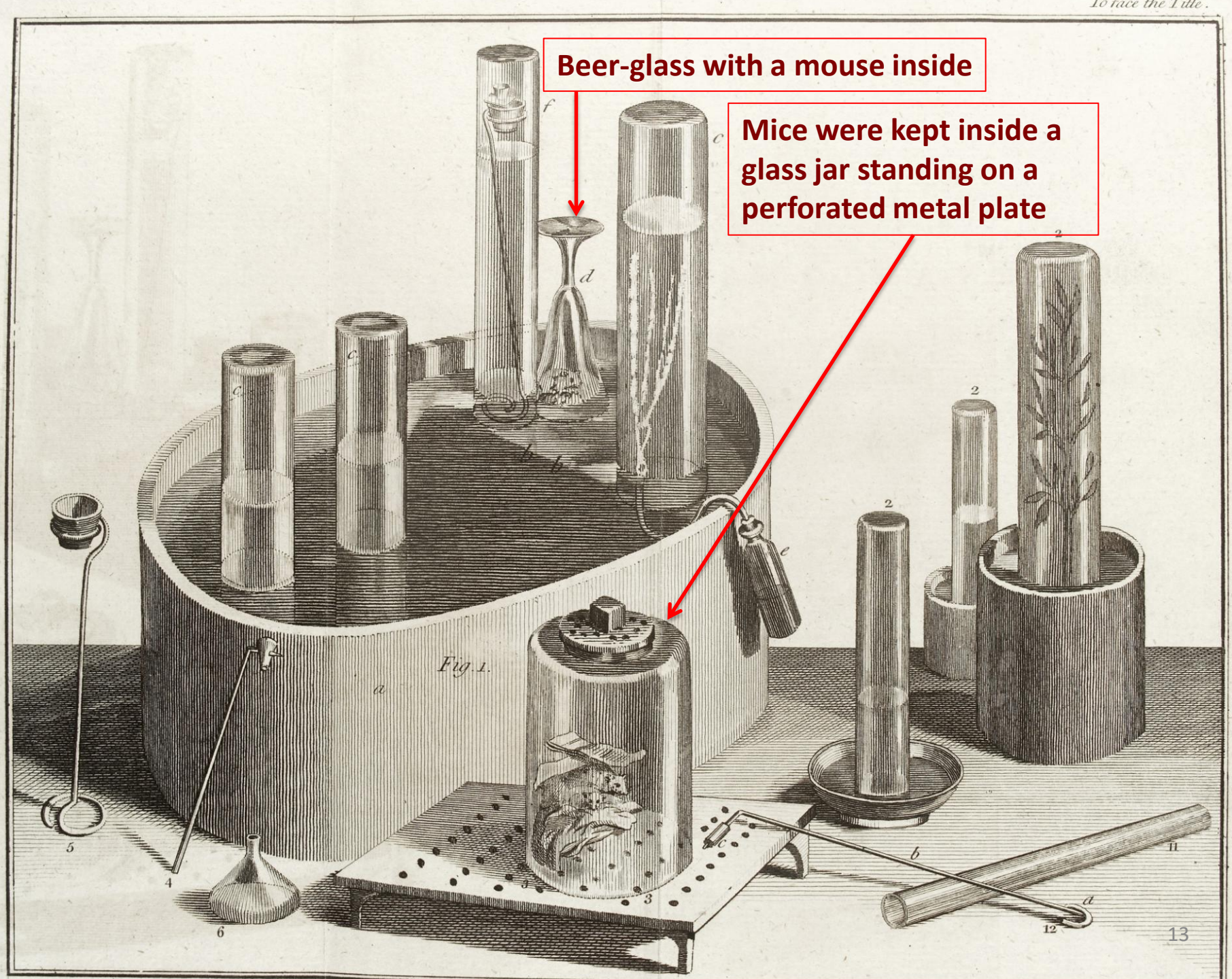

Glass cylindrical jars
Pots and tea-dishes
Fig. 1.


Wire stand
Funnel
Fig. 1.



Cavendish device for transferring gases. From *Philosophical Transactions,* 1766.


Flask with a bended glass tube
Fig. 1.


Beer-glass with a mouse inside
Mice were kept inside a glass jar standing on a perforated metal plate
Fig. 1.

SOME GENERAL ISSUES INTENDED FOR DISCUSSION

- The interaction between theoretical views and the design of experimental devices.
- The versatility of an experimental device.
- Materials used in the making of apparatuses: constraints and risks.
- The use of animals for experimentation.
- The tacit knowledge in the practice of chemistry.

THE INTERACTION BETWEEN THEORETICAL VIEWS AND THE DESIGN OF EXPERIMENTAL DEVICES

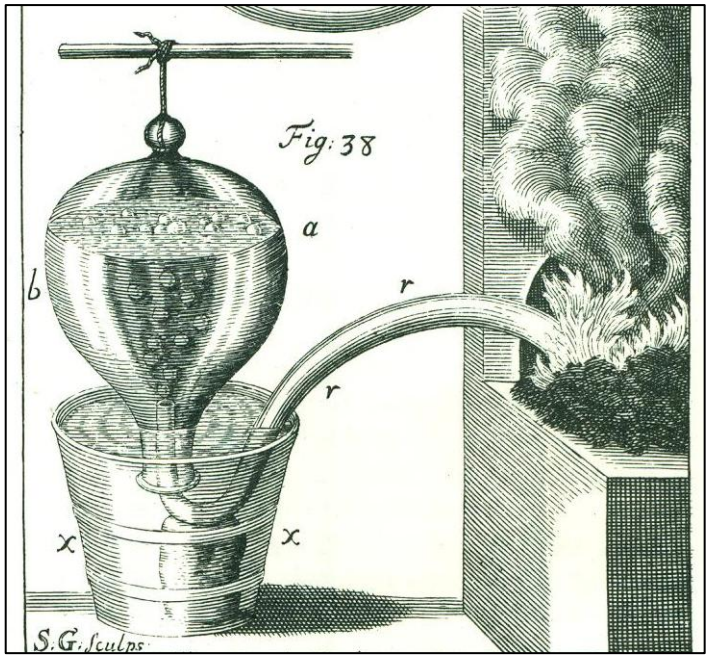
Trigger question:

Have you noticed in this description the absence of the term “gas”

concerning the gaseous substances?

- The absence of the term ***gas***. The pneumatic trough was an apparatus intended to generate and collect different ***kinds of air***.
- Chemistry as a two dimensional discipline.
- Common air was an elemental substance rather than a mixture of gases.
- The different kinds of air (inflammable, fixed, respirable,..) were atmospheric air in varying degrees of purity.

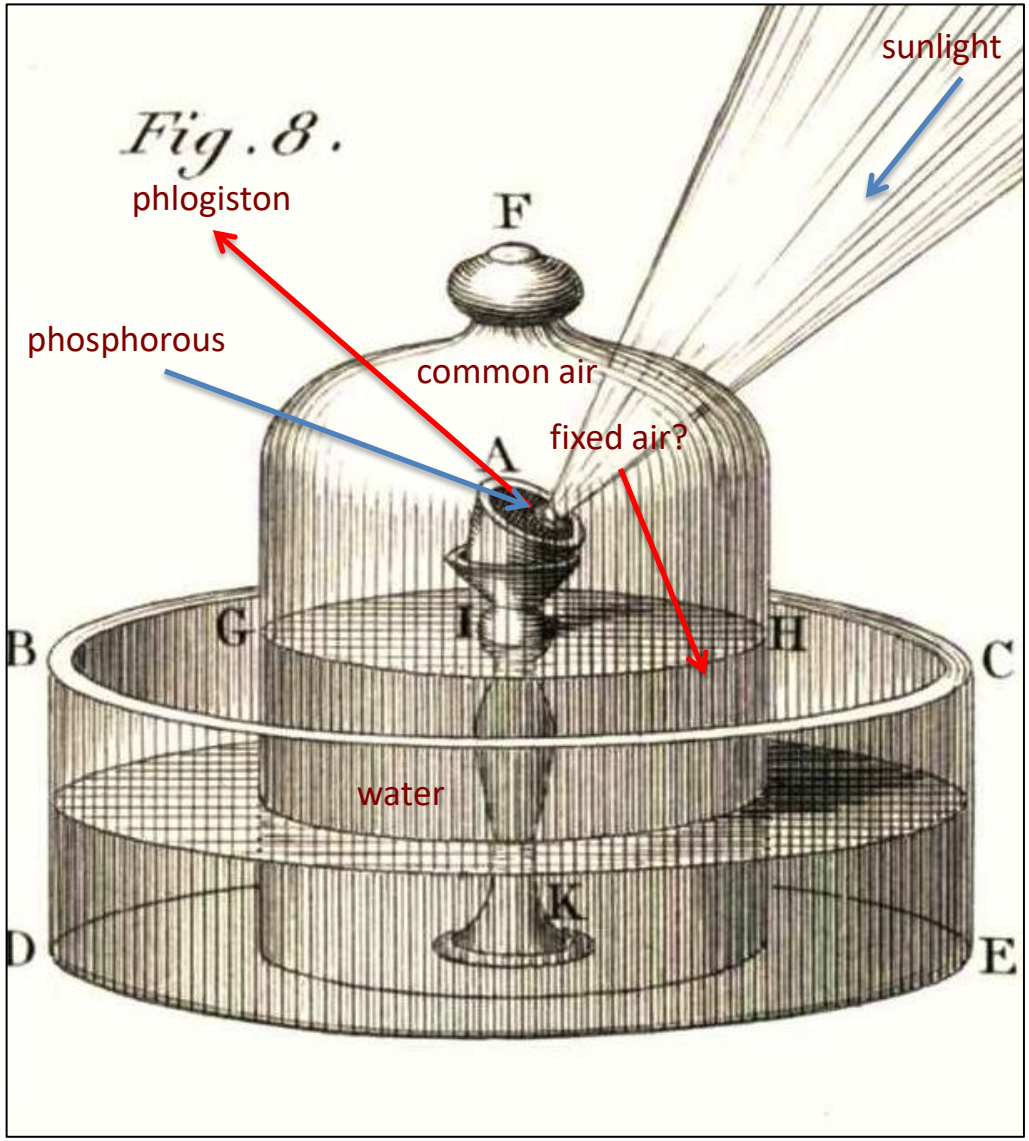
THE PROTOTYPE OF THE PNEUMATIC TROUGH AS AN EXAMPLE OF A THEORY-LADEN DESIGN



Stephen Hales' collection of "air" by the displacement of water.
From *Vegetable Staticks* , 1727

- Hales device was designed to "wash" airs rather than to "collect" them.
- The idea was to purify airs by intercepting their impurities in the water.
- To isolate water-soluble gases water was replaced by mercury or by water covered by a layer of oil.

MODIFICATIONS OF THE PNEUMATIC TROUGH BECAUSE OF DIFFERENT INTERPRETATIONS OF COMBUSTION

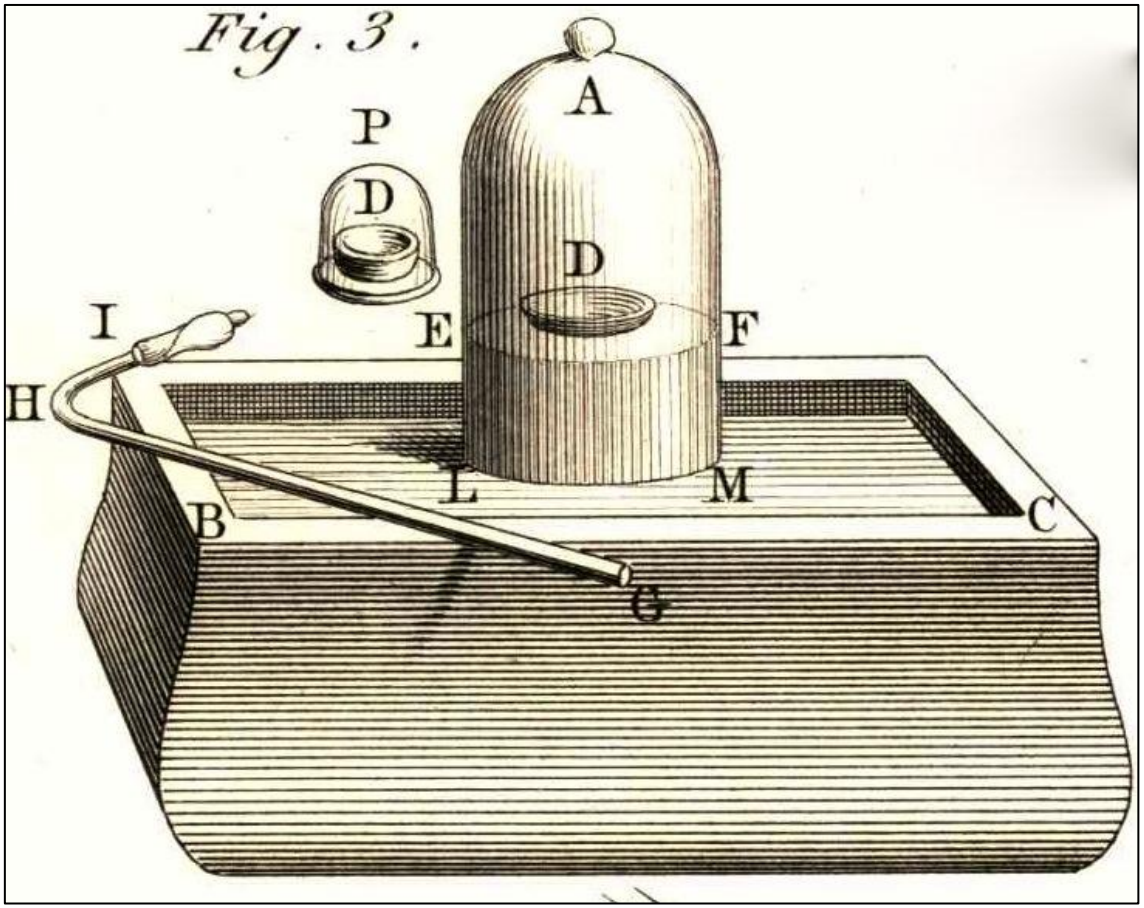


Water was used again instead of mercury. Why?

Because it was believed that a hypothetical fixed air flowing from the atmospheric air was absorbed by the water.

From Lavoisier's *Opuscules physiques et chimiques*, 1774

When the existence of any fixed air in the common air was discarded, mercury was restored in experiments on combustion in the pneumatic trough.



From Lavoisier's *Traité élémentaire de chimie*, 1789

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TABLEAU de dix espèces d'affinités doubles qui ont lieu entre divers sels neutres, & qui sont exprimés par des nombres pris du tableau précédent.

PREMIER EXEMPLE.

nitre.

sulfate de potasse. — potasse. 7 — acide nitrique. — nitrate calcaire.

8 affinités — aff. divellen. — quiescentes 4 { 12 * — 6 | 13

acide sulfurique. — chaux.

sulfate calcaire.

SECOND EXEMPLE.

muriate de potasse.

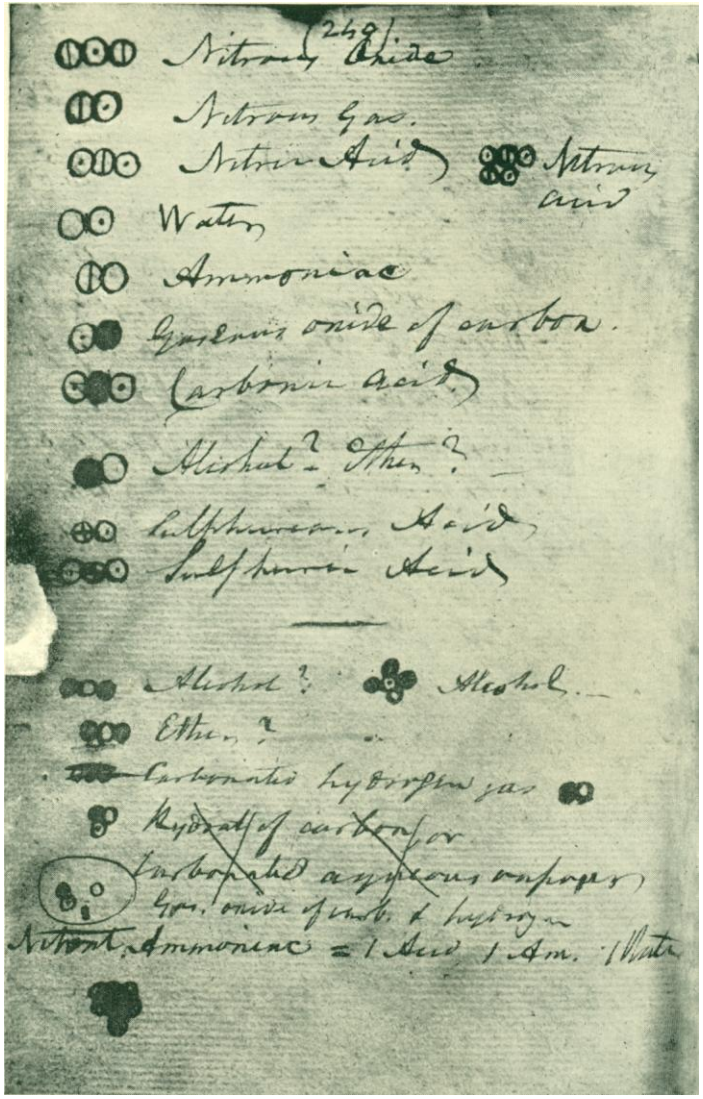
sulfate de potasse. — potasse. 6 — acide muriatique. — muriate calcaire.

8 affinités — aff. divellen. — quiescentes 3 { 11 — 5 | 12

acide sulfurique. — chaux.

sulfate calcaire.

From Fourcroy's *Élémens d'Histoire Naturelle et de Chimie*, 1789



Dalton's notebook, September 1803.
From *A New View of the Origin of Dalton's Atomic Theory*, 1896

The Lavoisier’s
Jacques-Louis David, 1788, Metropolitan Museum of New York