Chemistry
**al-Mīzān: One of the Fundamentals of Chemical Science According to Ġābir b. Ḥaiyān**

His belief in a mathematical order of the material world and in the possibility of explaining the transformation of substances on a quantitative basis finds its clearest expression in his theory of the proportions of equilibrium which he calls ‟ilm al-mīzān. This, in Ġābir’s view, is “the fact that certain characteristics (ḥawāṣṣ) of substances, particularly in the field of chemistry, can be measured and are based on proportions which can be expressed in numbers. If, for example, vinegar loses its acidic taste when litharge is added, it shows that vinegar had originally a specific and quantifiable composition which is altered by the admixture of litharge that can likewise be represented numerically. The appearance of the specific characteristic, in this case the capability of litharge to alter vinegar, is not dependent on chance but on the internal constitution of the matter, and to change this arbitrarily is therefore the task of the chemical procedure (tadbīr). If the specific characteristics are based on a mathematical rationale, then the procedure also is justified, and its correctness, according to Ġābir, is established.”

“All the individual features of the natural sciences are enmeshed in a larger context and receive their significance and their justification only from this context. Here we have to do with a philosophical train of thought which is the actual starting point of the author and his strength throughout. Again and again he emphasizes that the application of technology and the practice of science (‟amal) leads nowhere if theory (‟ilm, qijās, burhān) is not given its proper place.” (P. Kraus 1930; see Catalogue IV, p. 100)

**Arab Alchemy as Basis of the Alchemy of the Latin West**

“It cannot be emphasized strongly enough that the alchemy of the Latin West owes practically nothing to the Greeks, but nearly everything to the Arabs. For decades, one fixed one’s sight at the fragments of the Greek alchemical works as if from these the content and the nature of Latin alchemy could be explained and, while doing so, missed the most obvious task of tracing the occidental literature back to its direct and immediate sources. It is not the Greek alchemists but the translations of original works from the Arabic which constituted the foundation of Latin alchemy; over and again it is the translations and adaptations of Arabic authors which determined the course of developments in the Occident.” (J. Ruska 1933; see Catalogue IV, p. 108)
Distilling plant for rose water from al-Mizza. The geographer Shams al-Din al-Dimashqi (13th c. CE) handed down a description and a delineation of a large multiple still for making rose petal extract commonly used in al-Mizza near Damascus. He tells us they were up to 1.5 times the size of a man. In the 16th century CE at the latest this type of device was introduced to Italy.

(Rose water still)

A type of distilling plant common in the Islamic world is described in the Kitab at-Tabrīf written by the famous physician Abu'l-Qasim al-Zahrawi, who lived in Arabic Spain during the 10th century CE. This sophisticated apparatus became known in Europe (outside Spain) later as “berchile.” Our model is based on al-Zahrawi’s description. (Cat. IV, 111; K 1.63)

(Alembic with beak and receiver)

(Cat. IV, 116; K 1.64)

Destilling furnace, gently and evenly heating the flasks in a steam bath. After a description by the cosmographer Shams al-Din al-Dimashqi (d. 1327 CE).

(Destilling furnace)

(Cat. IV, 117; K 1.65)

Alembic for the extraction of ethereal oils and alcohol.

(Alembic for the extraction of ethereal oils and alcohol)

(Cat. IV, 120; K 1.66)
The «blind» Alembic
(Cat. IV, 125; K 1.33, K 1.51)

The «Duplicated Gourd»
(Cat. IV, 129; K 1.52)

Alembic
(Cat. IV, 126; K 1.50)

Beaked Alembic
(Cat. IV, 128; K 1.68, K 1.68b)

Receptacle made up of two similar glasses.
(Cat. IV, 124; K 1.40, K 1.29)
Retort with markedly curved beak (Cat. IV, 130; K 1.57)

Flask with bent neck (Cat. IV, 131; K 1.35)

Flask with curved neck (Cat. IV, 131; K 1.37)

Flat-Bottomed Flask (Cat. IV, 132; K 1.34, K 1.42, K 1.54)

Round retort sheathed in clay (Cat. IV, 134; K 1.49)

Flask with rounded bottom (Cat. IV, 147; K 1.47, K 1.55)
Wide-necked receptacle (carafe) (Cat. IV, 135; K 1.31)

Clubbed Glass Container (Cat. IV, 136; K 1.36)

Device for «dissolving spirits» (Cat. IV, 138; K 1.39)

Receptacle for «dissolving spirits» (Cat. IV, 137; K 1.38)

Capillary filter cup (Cat. IV, 139; K 1.69)

Cornu (probably a funnel) (Cat. IV, 140; K 1.59b)

Sphere-shaped Vessel (Cat. IV, 136; K 1.44)
Breeding place
was very far spread particularly in Egypt in 15th c. The model shows the plant in Luxor, in which eggs were expenditure-bred. 100,000 chickens were hatched in the cycle of 10 days.

(K 1.04)

(L 1.01)
A spherical Apparatus for Dissolution
(Cat. IV, 140; K 1.60)

The «Self-Fanning Furnace»
(Cat. IV, 141; K 1.62)

Vas decoctionis mercuris
Kiln for heating mercury.
(Cat. IV, 142; K 1.23)

Aludel
Furnace for sublimation processes.
(Cat. IV, 143; K 1.70)

Furnace for heating solid matter
(Cat. IV, 145; K 1.10)

Stove with three flasks
(Cat. IV, 145; K 1.09)
Furnace for chemical processes
(Cat. IV, 144; K 1.07)

Furnace for heating a flask suspended over it.
(Cat. IV, 146; K 1.12)

Furnace with alembic
(Cat. IV, 146; K 1.14)

Kiln with a top piece of glass
(Cat. IV, 147; K 1.15)

Apparatus for unknown purpose
(Cat. IV, 150; K 1.11)

Vas decoctionis elixir
Flask for the preparation of the elixir.
(Cat. IV, 147; K 1.16)
Pot with lions paws (Cat. IV, 148; K 1.17)

Furnace with retort in helmet-form. (Cat. IV, 148; K 1.20)

Bipartite Furnace with flask (Cat. IV, 149; K 1.71)

Furnace shaped like a proboscis (Cat. IV, 149; K 1.19)

Furnace (Cat. IV, 151; K 1.21)
Kiln for the production of artificial gems. After a fragmentary manuscript entitled ٌاَوَاهِب ٌالْفَنُونَ ٍالْسُّنَانَِّ ٍفِي ٌغَرِيب ٌالْعَلَّمَ ٍوَالْبَدَايّ (Gotha 1347, fol. 55a, 57a). The author Muhammad b. Muhammad Aflātūn al-Harmasī al-ʿAbbāsī al-Bīšāmī is unknown so far.

(Fcat. IV, 152; K 1.06)

Zosimos' Kiln
After an illustration in the manuscript Gotha 1347. This apparatus, though ascribed here to Zosimos (4th or 5th c.), seems to be the result of a development in the construction of chemical apparatuses that took place only from the 11th c. in the Arabic-Islamic culture area.

(Fcat. IV, 153; K 1.05)
The Development of Botany by Philologists

An interesting example of this genre is the book of plants (Kitāb an-Nabāt) by Abū Ḥanīfa ad-Dīnawarī (d. ca 895). The surviving parts of this book, originally comprising 7 volumes, show clearly how far and how rapidly a branch of knowledge hitherto cultivated by the Greeks could already develop, in complete independence from the latter, amongst Arab philologists before the end of the 9th century. A study conducted in 1910–1911 by Bruno Silberberg exclusively on the basis of fragments of this book as cited in later dictionaries shows that Abū Ḥanīfa’s botanical descriptions are equal to those of the Materia medica by Dioscurides. The descriptions prepared by Dioscurides had a different motivation from those in the Kitāb an-Nabāt of Abū Ḥanīfa. The purpose of the former was to help the reader in the identification of herbs in the field, i.e. purely practical, while Abū Ḥanīfa’s presentation seems to have been inspired by a delight in the manifold varieties of plant morphology. In those days, Silberberg would still wonder: “How could the people of Islam reach in this respect the level of the brilliant Greeks or even surpass them at such an early period of their literature?” Abū Ḥanīfa’s book bears witness to the use of a scientific botanical terminology; “he knows a lot of specialised expressions for the diverse features of plants which in an unbiased reader evokes the impression that they were part of a scientific nomenclature created for the sake of greater precision.” He displays an advanced scientific–morphological attitude, is familiar with the observation and description of physiological aspects and illustrates “complicated shapes in plants by comparison with familiar types.” (Cat. I, 19)