

## Scientific Illustration: A Picture's Worth a Thousand Words

### References:

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### Slide 1 - Title

Scientific illustration has its roots in the earliest endeavors of humans. The Paleolithic cave paintings recorded the careful observation of early humans as well as their mythology. So carefully observed were various animals, that scientists studying the images now can distinguish particular species, and whether they display winter or summer coats and markings. In early cultures it's difficult to distinguish art, science and religion. They did not begin to be thought of or taught as separate disciplines until centuries later.

### **I. The Realism of Antiquity**

#### Slide 2- Bird Hunter of Ancient Egypt

This beautifully observed wall painting for 1400 BC shows a government official from Thebes, named Nebamun, hunting Birds in marshland, accompanied by his wife and daughter, with a trained retriever cat.

#### Slide 3 – Mosaic showing marine fishes, an octopus , etc. Pompeii, 1<sup>st</sup> century BC

Artists in the early cultures around the Mediterranean, depicted the natural world with great accuracy and attention to detail. The tale is told that in the 5<sup>th</sup> c. BC in Greece, a competition was held between Zeuxis of Heracleia and Parrhasius of Ephesus, to determine who could represent nature most accurately. When the time came to unveil the two pictures, Zeuxis revealed an illustration of his *Vitis vinifera* so vivid that birds flew down to pluck the grapes. Thinking he had certainly won, he turned to Parrhasius and asked him to draw aside the curtains to show his own painting. But Parrhasius had no curtains; they were painted images. Zeuxis conceded he had lost: "I deceived the birds," he said, "but you deceived the artist." No paintings or illustrations have survived from ancient Greece, but we have some indication of what they were like from the art of the Romans, who absorbed and copied wholesale the Greek arts, both painting and sculpture. And we know that studies by the Greek artist Crateuas, for example, from the 1<sup>st</sup> c BC, were later added to the manuscript copies of the writings of Dioscorides , a century later, who wrote a famous treatise on medicinal plants that was copied for centuries. So we know that the works of early Greek and Roman artists/naturalists certainly influenced

illustration for centuries on, though they quickly became degraded in the process of being copied numerous times.

Slide 4 – Roman mural from Villa of Publius Fannius Sinistor

These artworks that Roman artists had solved problems of depicting three-dimensional space and shading.

Slide 5 – Glazed Ceramic Horse, T'ang Dynasty , c. 600-900 AD

In AD 105 and event of momentous importance to the development of the graphic (2D) arts occurred in China: paper was invented. Likewise no paintings on paper survive from this early Han period, but some preserved on damask were very well observed. So we have to get some indication, as with the Greeks and Romans, from their sculpture. In China ceramics developed to a high art very early. This is an example of the skill in accurate observation and in modeling in ceramics that was characteristic of Chinese art from c. 600 AD onward.

## **II. The Middle Ages- The Early Illustrated Books: Mixture of Fact and Fantasy**

Slide 6 –Page from Herbarium of 1484, based on a 5<sup>th</sup> c. AD illustration of Plantain by Apuleius Barbarus

In the Middle Ages, after the collapse of the Roman Empire, rather than observing nature first-hand, many artists copied “iconic” models in illustrating texts. Artists drew from surviving models from Antiquity, such as in this illustration of plantain. Certain key bestiaries and herbals were freely plagiarized and copied repeatedly for centuries and whole model books existed of animals and plants for use by illustrators. The accuracy of the illustrations was gradually degraded through copying. Unintentional mistakes were perpetuated and accentuated.

Slide 7 – Depiction of Elephants based on description by Pliny, c. 1230

Medieval illustrations were also based on written surviving ancient Roman texts, such as that of Pliny the Elder, a Roman naturalist and writer who lived from 23-79 AD. Pliny created a phenomenal work, his *Natural History*, describing plants and animals – an attempt to describe all the plants and animals of the known (Roman) world.

Illustrators worked for centuries from his written descriptions, but often had never seen the animals of plants themselves, which gave rise to odd depictions such as this elephant.

Slide 8 - Monstrous Races –12<sup>th</sup> c. Medieval Illustration based on Pliny’s Natural History

Much of Pliny’s work is concrete and factual, but it also was quite generously populated with the curious and fantastic from ancient myths and legends, which made Medieval illustrations an interesting mix of fact and fantasy.

Slide 9 –V. Early Italian Renaissance, landscape as prop for Biblical stories

In fact, however, descriptions such as Pliny’s accorded well with Biblical descriptions of demons and devils. So the fact that people could not observe them first-hand was not an obstacle to belief. The prevailing world- view put little emphasis on accurate observation of the natural world. emphasis in art gradually shifted away from realism. The Middle

Ages in Europe were very rich in artistic production, but it was understood to be a transitory stage in one's spiritual journey. Landscape was not depicted for its own sake as a subject in art, and the conventions of realism and the accurate depiction of scale, perspective, light and shade, were abandoned in favor of hieratic space. Spiritual realities were more considered more important, and thus were given more emphasis.

Slide 10 –Manuscript herbal, c. 1450.

In the Middle Ages the world was seen as divinely created and ordered by God. Nature was studied in order to discern God's purposes, which were revealed in signs and miracles. The "Doctrine of Signatures" was the idea that God had stamped his signature on the natural world, so that the shape of a particular plant would indicate its usefulness. For example, lungwort, a plant with a spotted lung-shaped leaf, was thought to be useful in treating diseases of the lungs. Illustrators would often distort plant and animal shapes in copying them to make them more symmetrical and decorative. The illustrations in herbals, for example, often were not used to make actual identifications of plants in the field, but simply as mnemonic devices to aid memory regarding the uses of the plant. The herbalists would know the plants well by sight, and the poor accuracy of the illustrations may even have served as a means of excluding the uninitiated.

Slide 11 – Three Versions of a Hyena: (top left) Woodcut from Conrad Gessner's *Icones Animalium*, 1560; (top right) Edward Topsell's *History of Four-Footed Beasts and Serpents*, 1658; (bottom) Gaspar Schott's *Physica Curiosa*, 1693.

In addition to a world-view that de-emphasized the importance of observing accurately the natural world, illustrations from the Middle Ages and the early Renaissance show evidence of rampant plagiarism and sometimes intentional fraud. This slide shows three versions of an illustration of a hyena; the second two are clearly plagiarized from Gessner's well-known work.

Slide 12 - The Tree Bearing Geese, from Gerard's *Historie of Plants* (1597)

A persistent legend was that the goose barnacle gave birth to adult geese, and was itself the fruit of a land plant. Gerard's book perpetuated the legend, with a full description of the plant and its life history. Gerard added that he had seen it all and handled them with his own hands. This account persisted in herbals until the late 1700's.

### **III. The Age of Exploration and the Birth of Modern Scientific Inquiry**

Slide 13 – Sea Monsters, Woodcuts from Conrad Gessner's *Icones Animalium*, 1560

Beginning in the 1500's, there were numerous voyages of exploration to the New World and other lands. Sailors, having been steeped in myths and legends of monsters sea serpents were quite prepared to see them when they encountered new species. We see what we expect to see. Travelers brought back verbal accounts of monsters and of exotic fishes, which were then liberally interpreted by artists and then by the engravers who printed the artists' drawings.

Exotic Fishes supposedly found in Indonesian waters. Copper engravings from Francois Valentijn's *Oud en Nieuw Oost-Indien*, 1726.

Slide 14 – Olfert Dapper, scene from *Description de l’Afrique* (1686)

Often the authors of natural history texts did not travel. Rather they relied on the accounts of explorers, combining them with information taken from earlier works. Olfert Dapper, for example, wrote his *Description de l’Afrique* (1686) without ever having traveled there. His book was very successful and translated into several languages. He commissioned artists to illustrate the book.

Slide 15, Gregor Reisch, earthquake, from *Margaita Philosophica Nova* (1503)

In the 1500’s there began to be greater latitude, and gradual interest in inquiry into the nature of the physical world. This image of an earthquake in progress was from Reisch’s book, which was a pioneering attempt to account for the behavior of the earth.

Slide 16, Study of Human Anatomy, Da Vinci, C. 1515, and Albrecht Durer, study of a Roller’s wing, 1512.

Individual artists, such as Da Vinci and Albrecht Durer were artist/scientists, interested in studying and portraying the natural world with great accuracy. They were fore-runners of a large number of artist-naturalists in the 17<sup>th</sup>, 18<sup>th</sup> and 19<sup>th</sup> centuries.

Slide 17 , Albrecht Durer, woodcut showing his perspective device, 1525.

In the 1500’s, a system of geometric perspective was gradually developed which enabled artists to achieve the illusion of normal perspective.

Slide 18– Galileo’s study of the phases of the moon, watercolor (1609)

Throughout the 16<sup>th</sup> and 17<sup>th</sup> centuries, there was a progressive interest in the natural world, partly as a result of the weakened hold of the Catholic church; partly due to the rise of a new, affluent Middle class in Holland that enjoyed its affluence and wanted it documented in realistic portraits, domestic scenes and landscapes; partly stimulated by the exploration of new lands. This interest led to the development of new scientific instruments such as telescope and to a new realism in illustrations and fine art.

Slide 19 Robert Hooke, drawing of flea, *Micrographia* (1665)

The microscope was developed in the 1600’s and opened a new world for investigation and illustration. This magnificent drawing of a flea is by Robert Hooke, famous for his book *Micrographia*, a folio of drawings of insects and objects seen in the microscope. Hooke made his study by building up a picture of the whole insect through a minute examination of its separate regions. The compound microscope he used would have given an image something like this reconstruction.

Slide 20 What Hooke probably saw through the microscope

Slide 21 – Robert Hooke – the concept of molecular alignment in crystals

Hooke was also the first to describe, in *Micrographia*, the idea that the angles of the facets of crystals are related to their molecular alignment. This engraving shows a series of what we might now call “molecular models” relating their orientation to crystal facets.

Slide 22 – Franz Messmer and Jacob Kohl, “The Emperor Francis I of Austria, Creator of Natural History Collections, in his Cabinet with his Collaborators.

The 17 and 18<sup>th</sup> centuries, the enlightenment, saw the real blossoming of natural history. People at all levels of European society became “collectors,” creating natural history cabinets of their collections. The wealthy could afford to commission explorers to bring back specimens. The search for fossils, minerals, plants and animal specimens became an obsession. Some collections, such as those of Emperor Francis I of Austria were famous. This painting shows the emperor and his collaborators. On the table are samples of quartz, a sectioned ammonite and a tray of tiny shells, fossils and minerals.

Slide 23 – Nehemiah Grew, from his “Catalog of the Natural and Artificial Rarities belonging to the Royal Society,” 1681. Grew was curator of the Royal Society’s collections.

Slide 24 – Madeleine Bassporte, “Study of Fossilized Teeth: c. 1750

In the 18<sup>th</sup> century philosophers and intellectuals became interested in the origins of the world and of man. Scientists began studying the remains of skeletons of prehistoric animals as well as fossils, laying the foundations of paleontology and the beginning of man’s sense of his own past.

Slide 25 –Alexandre Leroy de Barde, “Minerals in Crystallization” 1813, gouache and watercolor. Minerals occupied an important place in collections and in scientific study.

Slide 26- Maria-Sybilla Merian, Four Dead Chaffinches from the Ardennes, c. 1700

As an aside, one should note that some of the best illustrators of the 1700’s were women, such as Madeleine Bassporte. Illustration, particularly botanical illustration was considered a genteel profession and was one of the few scientific professions open to women. The 1700’s were the great age of botanical and exploration, though few artists were yet going along on expeditions. Maria-Sybilla Merian was an exception to that; she was intrepid and eccentric, traveled to the new world several times, even taking her daughter. She had cabinets of tropical butterflies brought back from Surinam and made hundreds of beautiful drawings and paintings on vellum. She was the first naturalist to observe the development of certain insects from egg through the stages to butterfly.

Slide 27, Jean-Jacques de Boissieu, “Pereneire Rock”, 1766

A transformation took place in the second half of the 18<sup>th</sup> century in scientists’ and artists’ approach to nature. Scientists, instead of working in their studies from books and specimens brought by explorers, started traveling, often accompanied by one or more artists. The artists had to be as objective and precise as possible.

Slide 28, Balin, late 18<sup>th</sup> c, “View of the Sassenage Rocks,” black chalk and watercolor.

Slide 29 –Pierre Jacques Volaire, “Eruption of Vesuvius” 1774

An interest in volcanoes was sparked by several successive eruption. Mt. Vesuvius erupted in 1737, 1754 and 1757 and became an obligatory subject for painters. Artists specialized in day and night views of Vesuvius that were bought by art lovers as

souvenirs of the Italy trips. The demand was so great that artists copied their own pictures.

Slide 30 – Illustration from Cuvier and Brongniart’s *Essai sur la Geographie Mineralogique des environs de Paris*, 1811.

At the start of the 19<sup>th</sup> century, a prolific French scientist, Cuvier recognized large bones found in an excavation near Paris as being from an elephant. This caused him to begin studying geology with help from Alexander Brongniart, a professor at the Museum of Natural History in Paris. Their joint report of 1811 laid out the idea that the study of fossils could be used to place geographical strata in chronological sequence. It was a landmark in the emergence of geology as a science.

Slide 31– Agassiz Explores the nature of Glaciation, 1840

Artists’ illustrations from the 19<sup>th</sup> century record other landmark ideas in the development of geology. The idea that glaciers were moving and were the remains of an earlier ice-age was discovered by Louis Agassiz during a summer vacation in the Alps. (He later became a professor at Harvard)

Slide 32 –Titian Peale, study of moose from life, from Long expedition to Rocky Mountains, c. 1820 and drawings by J.H. Richard for *Report on the U.S. and Mexican Boundary*, 1858.

In the United States, likewise, artists were traveling with expeditions to map, study and record the continental U.S. Note the measurements of dimensions on the sketch.

Slide 33 – Albert Bierstadt, “Among the Sierra Nevadas”, 1868, 6’x10’

Artists were also commissioned to help popularize migration westward. Albert Bierstadt is one among the most famous. He was commissioned by the railroad company to paint scenes that would encourage westward travel. His enormous paintings were taken from city to city on the east coast and exhibited. People would pay an admission fee to view a painting, much as we now go to see a movie. Though not technically scientific illustrations, Bierstadt’s paintings helped shape our enduring vision of the west.

Slide 34 –Illustration of Plate Tectonics – Alfred Lothar Wegener 1924

By the start of the 20<sup>th</sup> century both the science of geology and the techniques of scientific illustration were well developed. This illustration by Wegener, from 1924, is part of his book describing the movement of tectonic plates, that sparked a storm of interest when they appeared.

Slide 35 – Illustration of the core of the earth

Slide 36 – SEM image of mineral under polarized light

Now we are capable of studying and representing phenomena we’ve never seen/will never see ourselves, from the size of the universe to that of the atom. The future of scientific illustration could include holographic images and other technologies we can only imagine.

