Scientific Illustration

Digital Illustration

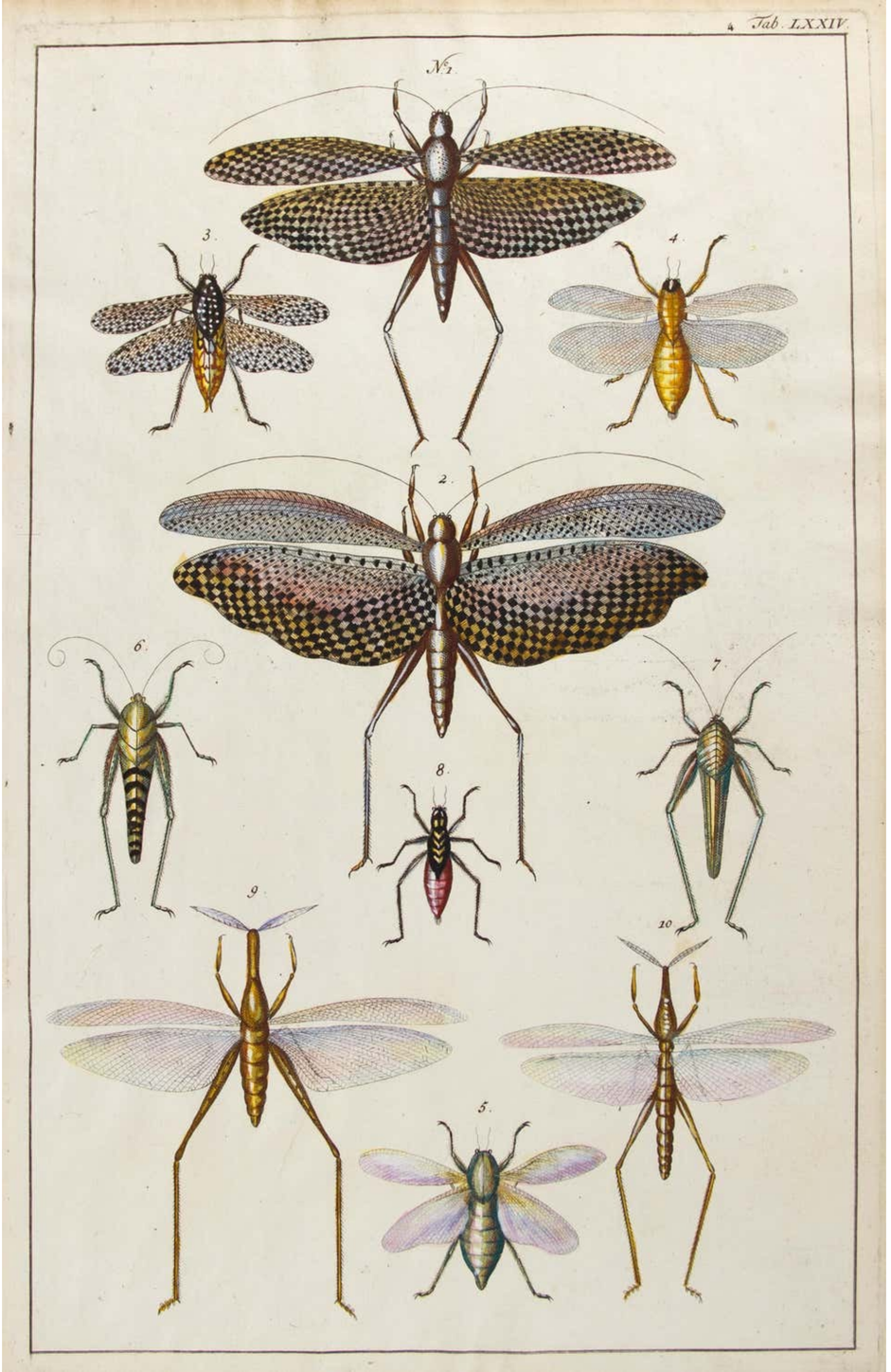
Fall 2023

Accuracy - Observation

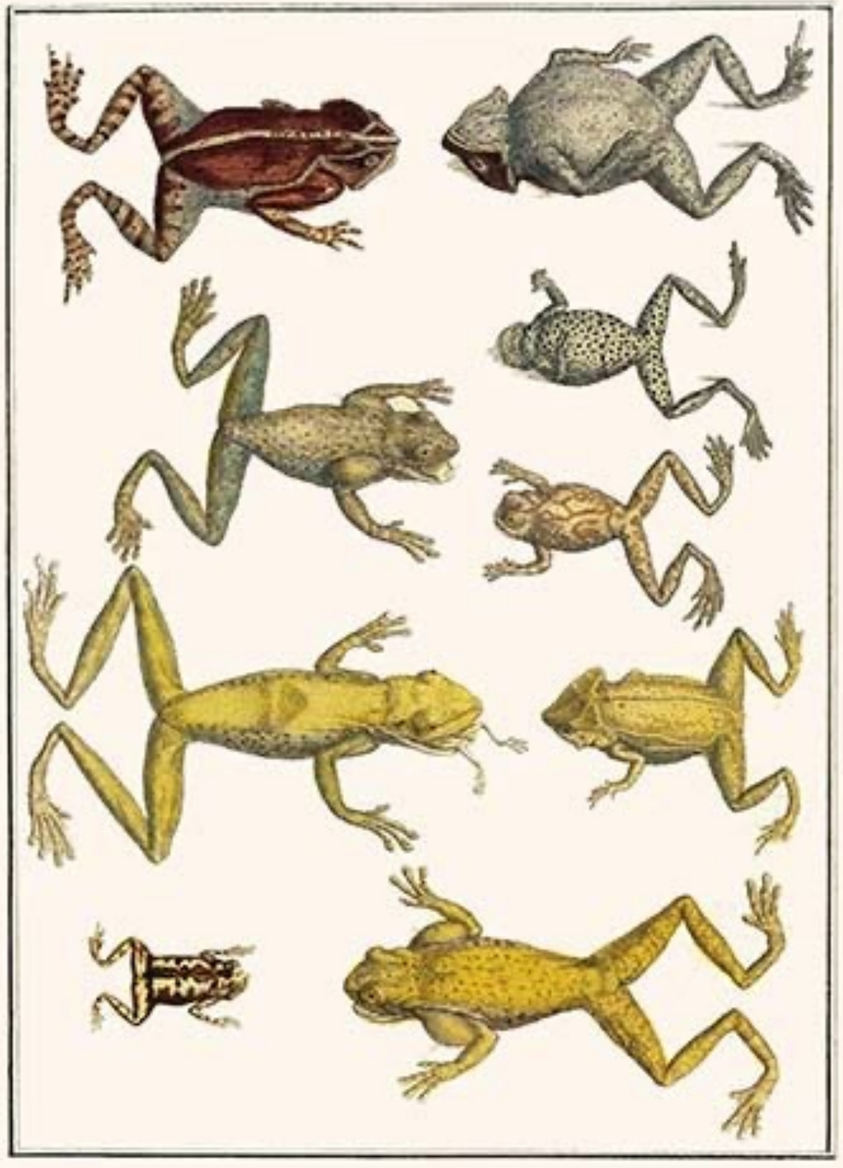
Albertus Seba

1665 - 1736

The Cabinet of Natural Curiosities


№1.
3.
4.
2.
6.
7.
8.
9.
10.
5.


N. 1.
N. 4.
N. 6.
N. 7.
N. 5.
N. 3.
N. 9.
N. 10.
N. 8.
N. 2.
N. 12.
N. 11.
N. 13.
N. 14.
N. 15.
N. 17.
a....
N. 18.
N. 19.
N. 16.
b....
a....

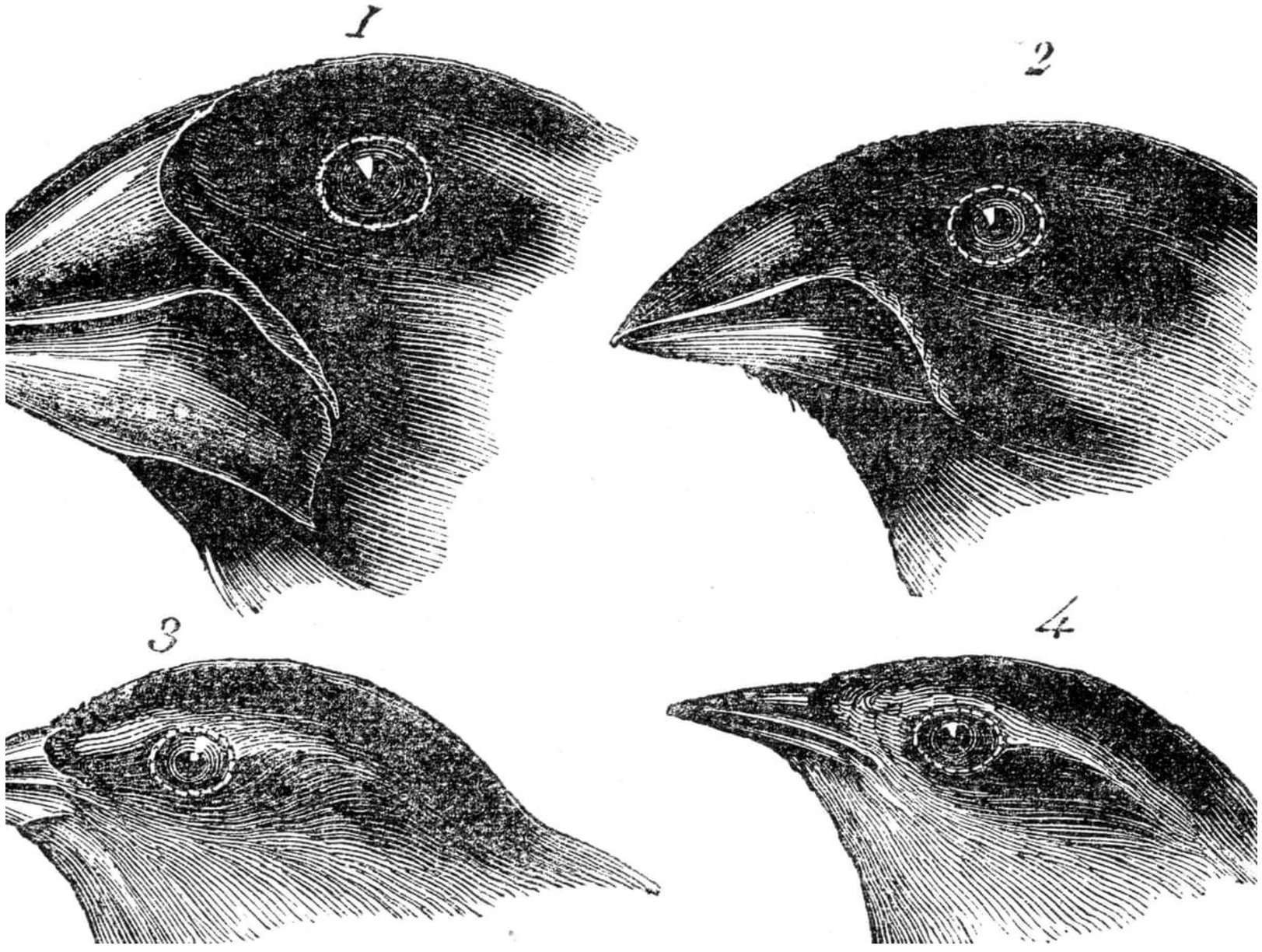


Charles Darwin

1809 - 1882

On the Origin of Species

Mimus parvulus.


1
2
3
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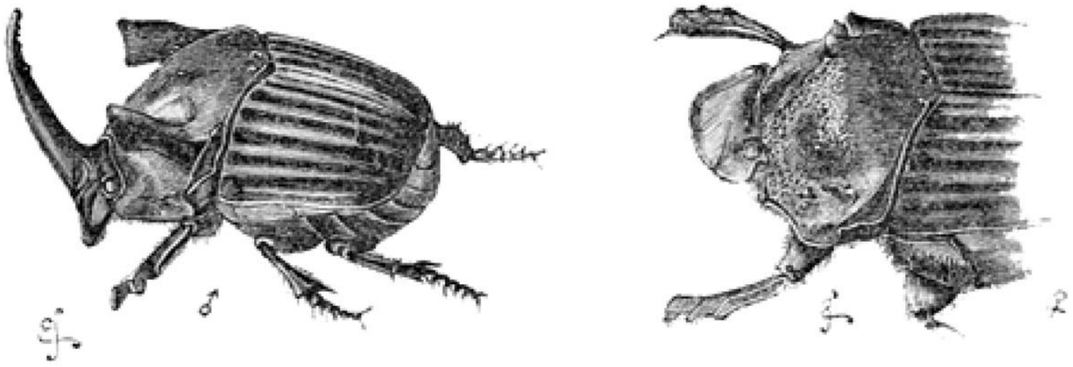


Fig. 17. Phanæus faunus.

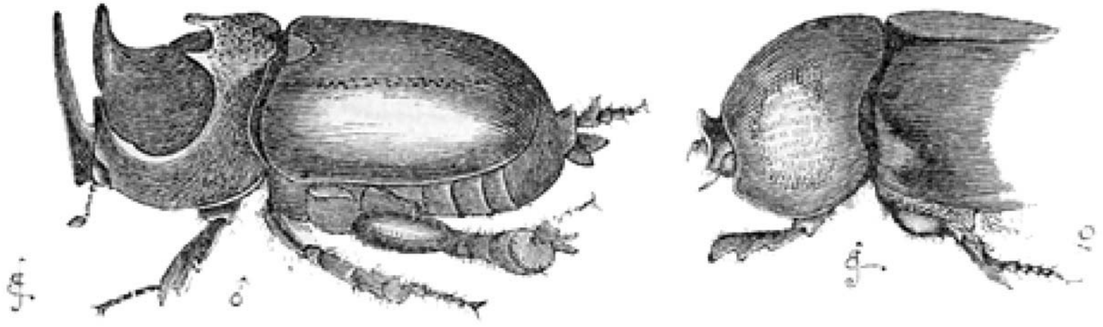


Fig. 18. Dipelicus cantori.


Birds Pl. 29
Ammodramus longicaudatus

Harriet & Helena Scott

1830 - 1907, 1832 - 1910

Australian Lepidoptera and their Transformations

PLATE XXXII.

Helena Scott Forde

Harpaneta nigrina. Dmc.

Vol II. pl. XVI

Harriet ~~Scott~~ Morgan
published

Danais Corinna. Macleay.

Engraved
[illegible]

PLATE XII.

Helena ~~Scott~~ Forde

~~Biblina~~ Diadema Lassinassa. ~~Stanley~~.

Unpublished

Harriet ~~Scott~~ Morgan

Antheraea Yamata


PLATE XXXIX.
Polia festiva
Harriet Morgan


PLATE XXXVI.
Chelepteryx Collesi. G. Gray.
Harriet Morgan

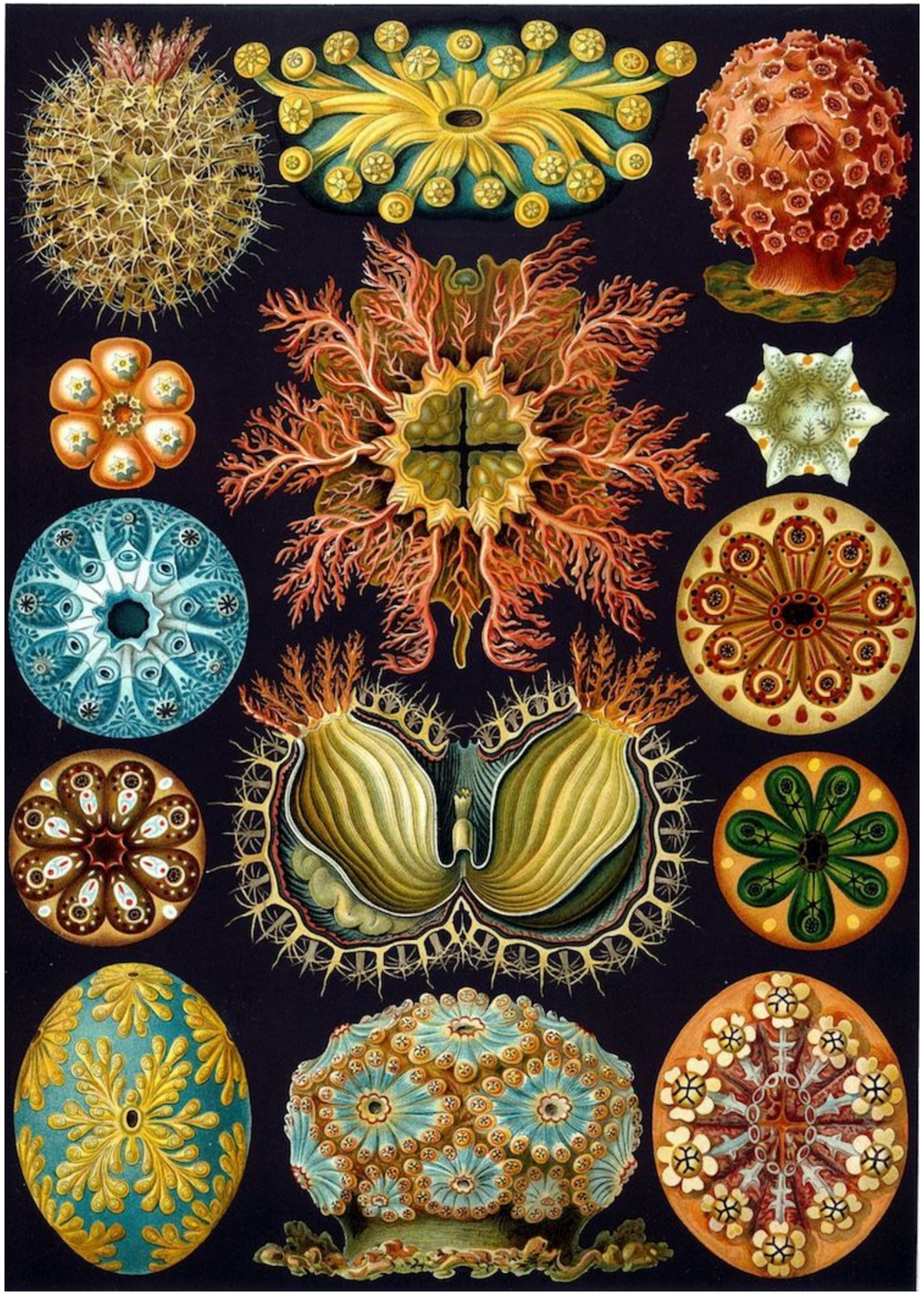
20 1.—Eriostemon salicifolius. Sydney. 2.—Actinolus helianthi. Sydney.

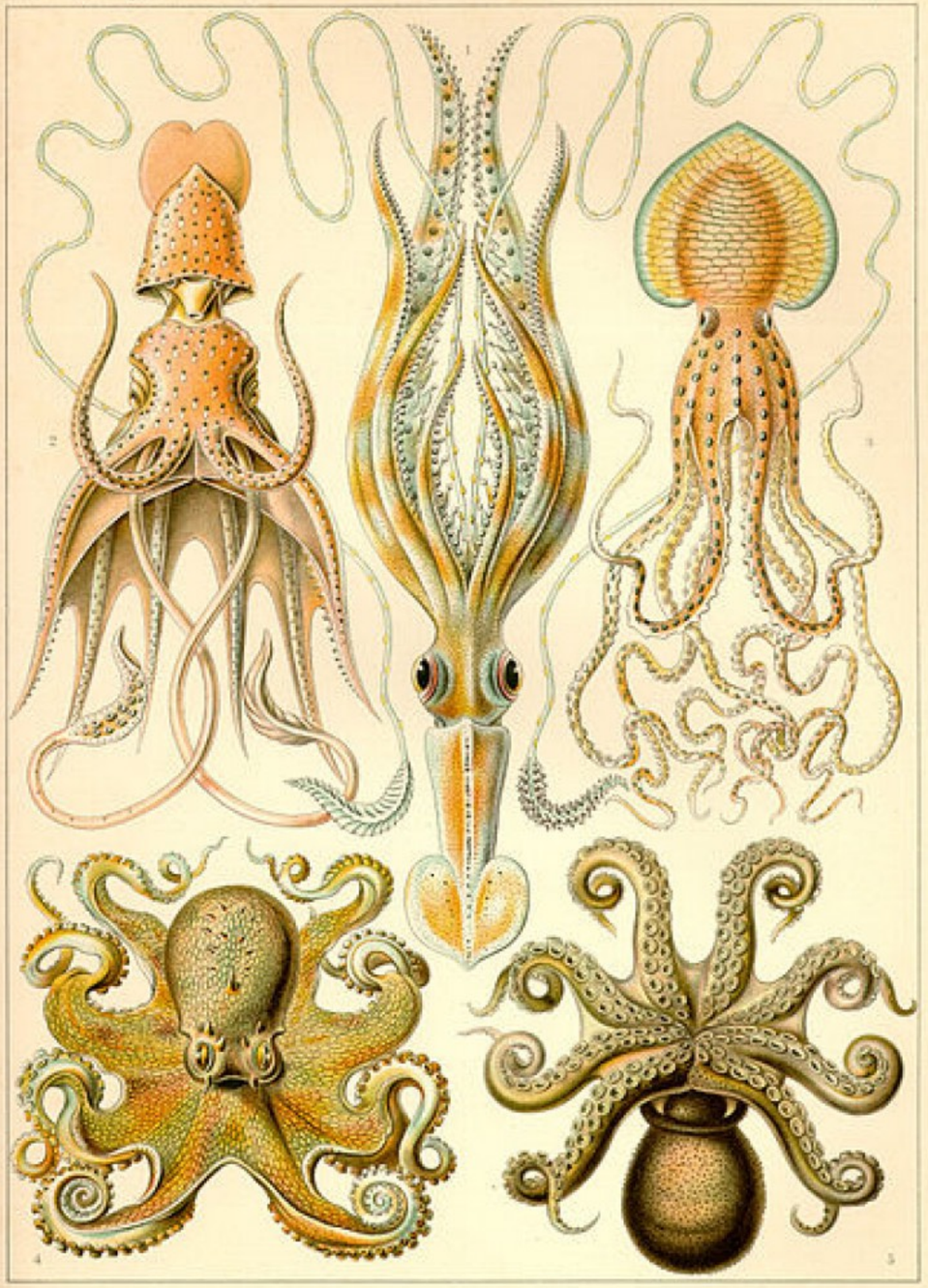
Australian Butterflies.

Ernst Haeckel

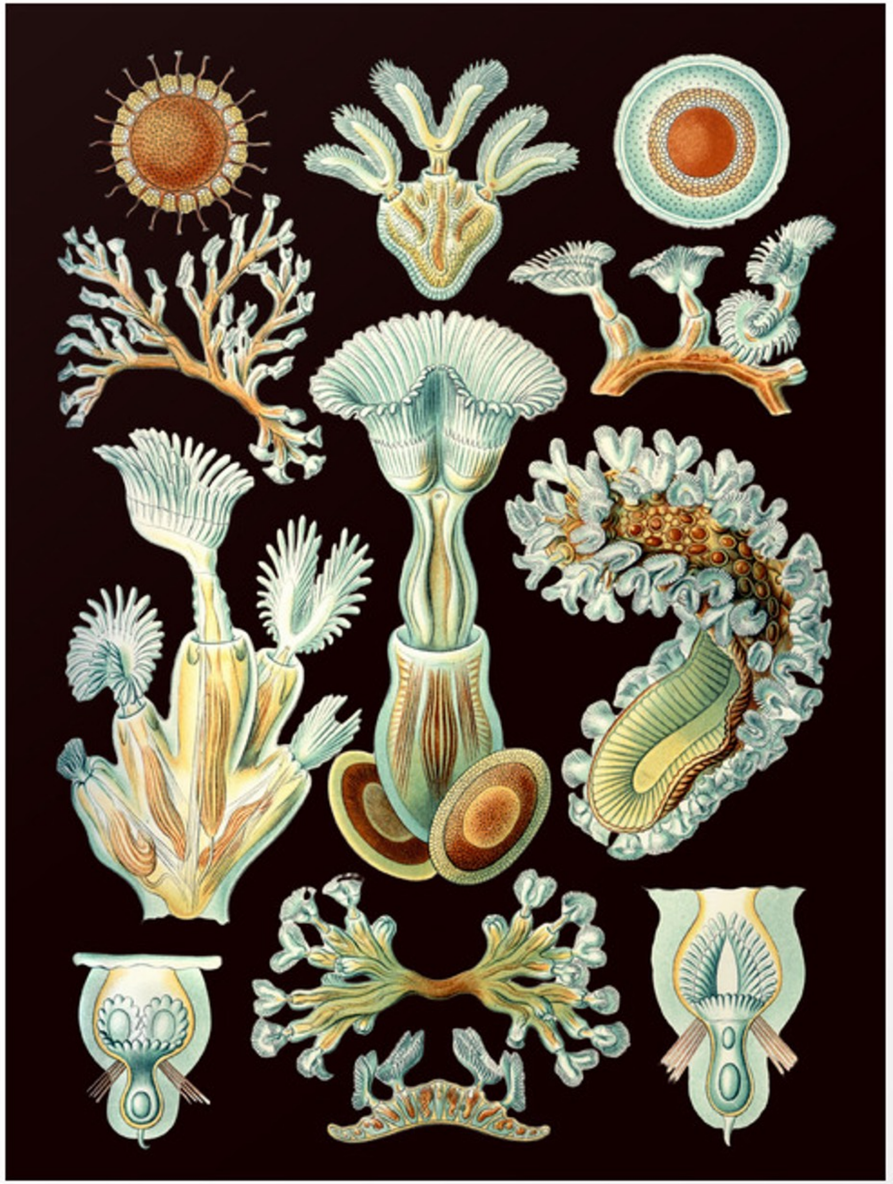
1834 - 1919

The Riddle of the Universe





Gamochonia. — Trichterstraßen.



Basimycetes. — Schwammpilze.

Decapoda. — Zehnfußkrebse.

My Current Work

2016 - present

Working title “An Eastern Fly Angler’s Collection”

GREEN DRAKE

Ephemera guttulata

Dun

Nymph

Spinner
Coffin Fly

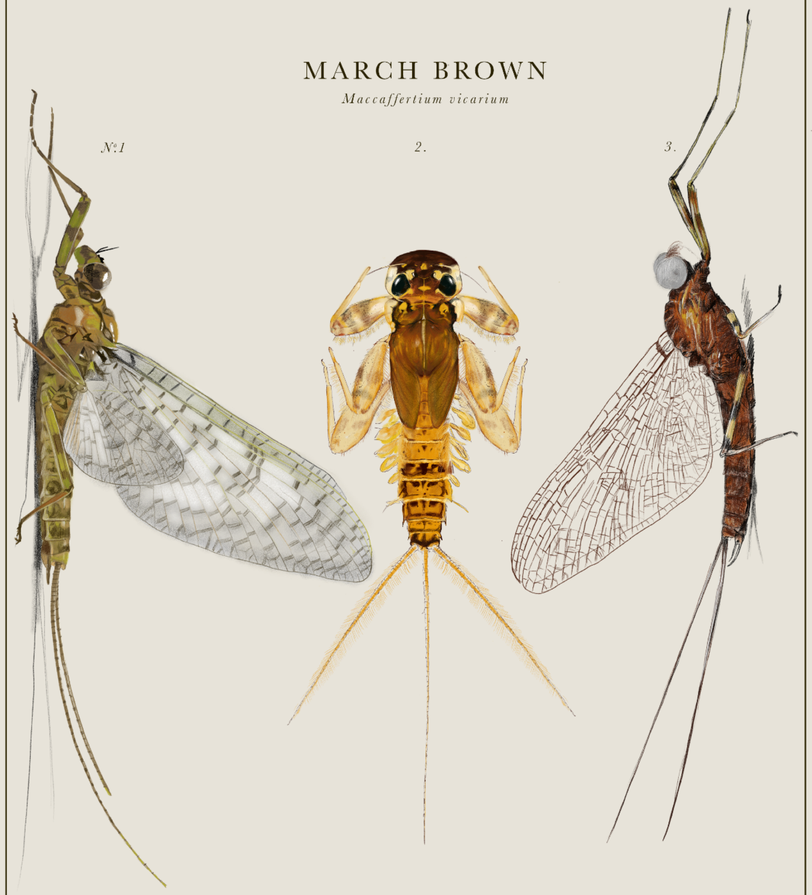
SLATE DRAKE

Isonychia bicolor

Dun *Nymph* *Spinner*

MARCH BROWN

Maccaffertium vicarium



Dun *Nymph* *Spinner*

LITTLE BLUE-WINGED OLIVE

Baetis tricaudatus

№1 *2.* *3.*

№1 *2.* *3.*

Dun *Nymph* *Spinner*

SULFUR

Ephemerella invaria

№1 *2.* *3.*

№1 *2.* *3.*

Dun *Nymph* *Spinner*

Geology, Astronomy, Biology, Chemistry and Anatomy

G. theklae harterti

G. theklae hilgerti

G. theklae deichleri

Berg. v. A. Pietsch, Berlin W.

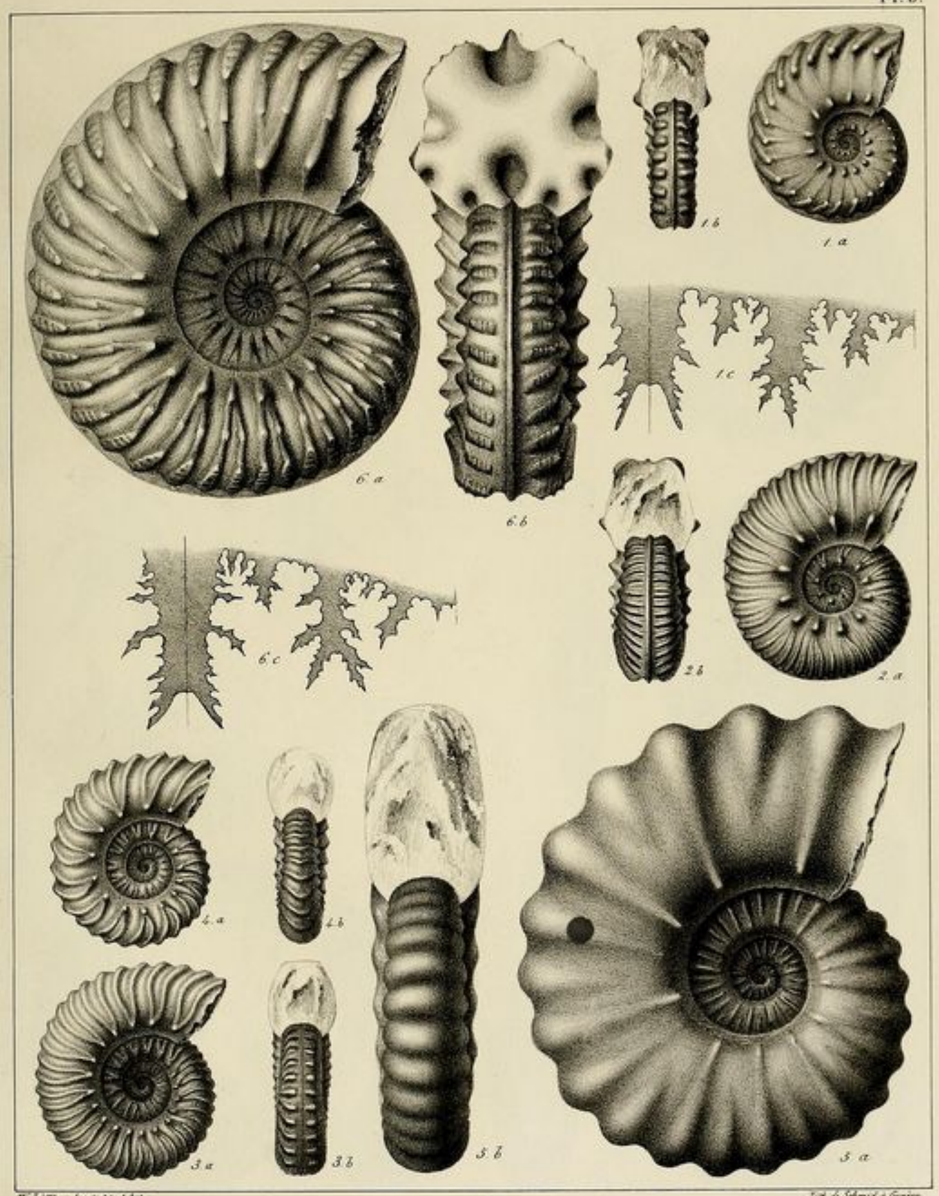


Fig. 1. Ammonites Balmatianus. — Fig. 2. A. Rouxianus.
Fig. 3, 4 et 5. A. varicosus. — Fig. 6. A. inflatus.

Fig. 79. Der kurzschnäbelige Nashornfisch (Naseus brevirostris).

Fig. 80. Der gemeine Schuppenfisch oder Windarzt (Acanthurus chirurgus).

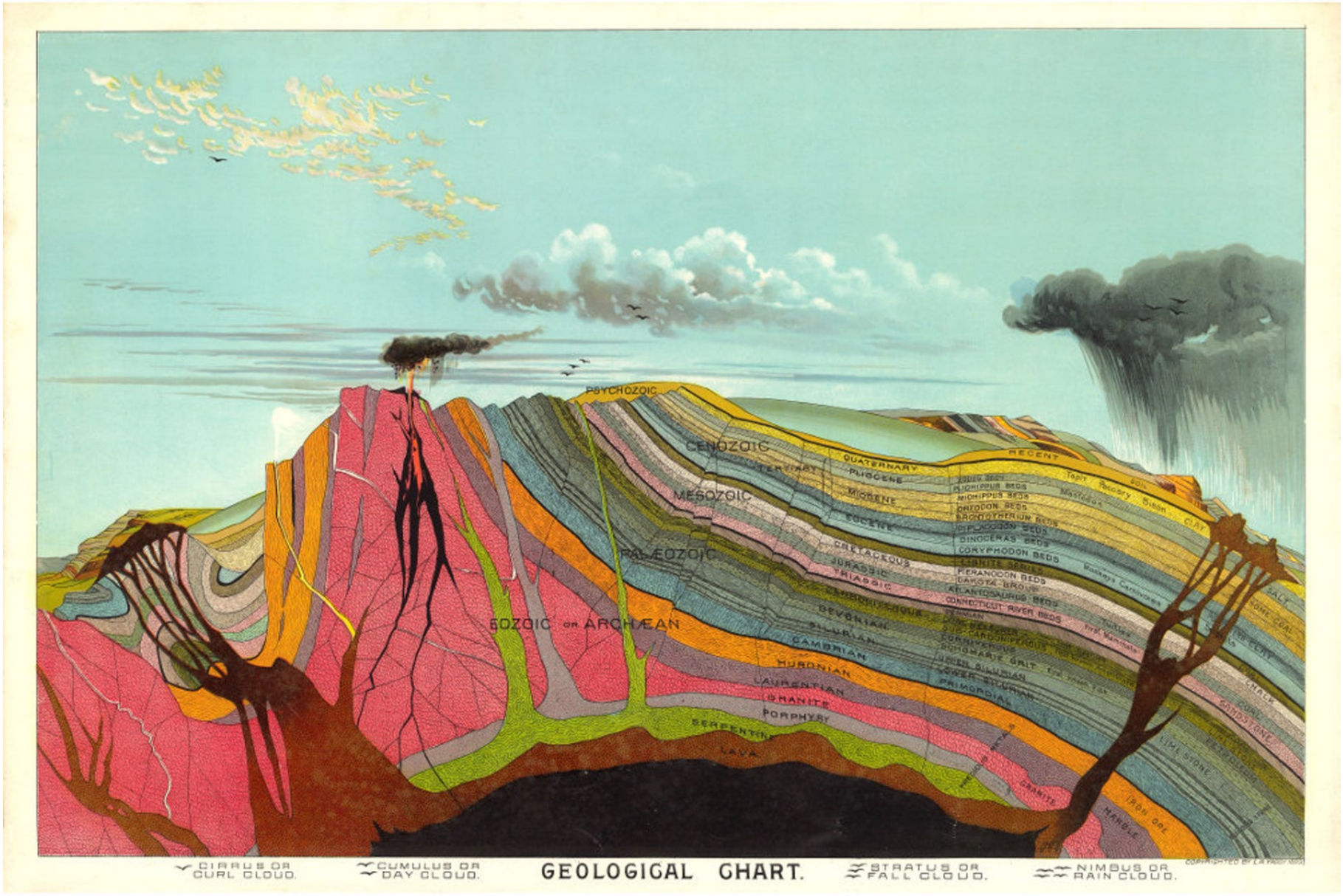
Fig. 81. Der rothe Lederfisch (Amphacanthus coralinus).

Tafel 64.

Echte Ringelblume, Calendula officinalis.

519.

Melissa officinalis L. **Gebräuchliche Melisse.**


PSYCHOZOIC
CENOZOIC
QUATERNARY
RECENT
TERTIARY
PLIOCENE
MIOCENE
EOCENE
MESOZOIC
CRETACEOUS
JURASSIC
TRIASSIC
PALÆOZOIC
PERMIAN
CARBONIFEROUS
DEVONIAN
SILURIAN
CAMBRIAN
EOZOIC or ARCHÆAN
HURONIAN
LAURENTIAN
GRANITE
PORPHYRY
SERPENTINE
LAVA
LIME STONE
IRON ORE
MARBLE
SALT
CHALK
FLINT
SANDSTONE
CLAY
CIRRUS OR CURL CLOUD.
CUMULUS OR DAY CLOUD.
GEOLOGICAL CHART.
STRATUS OR FALL CLOUD.
NIMBUS OR RAIN CLOUD.

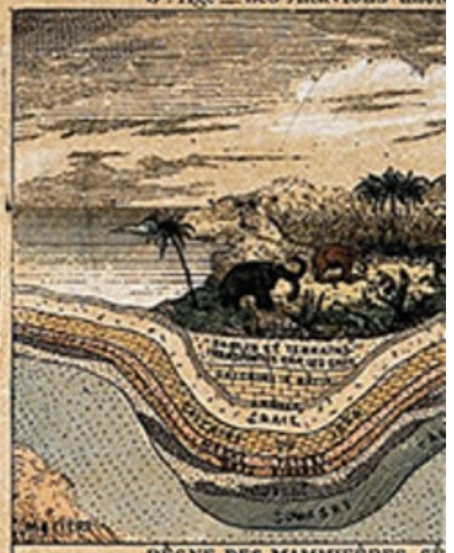
GÉOLOGIE

BASALTES. Grotte de Fingal

1. Grès. 2. Granit. 3. Marbre. 4. Calcaire à bâtir. 5. Calcaire du Jura. 6. Porphyre. 7. Schiste. 8. Argile. 9. Pierre à plâtre. 10. Craie. 11. Silex. 12. Houille. 13. Marne irisée.

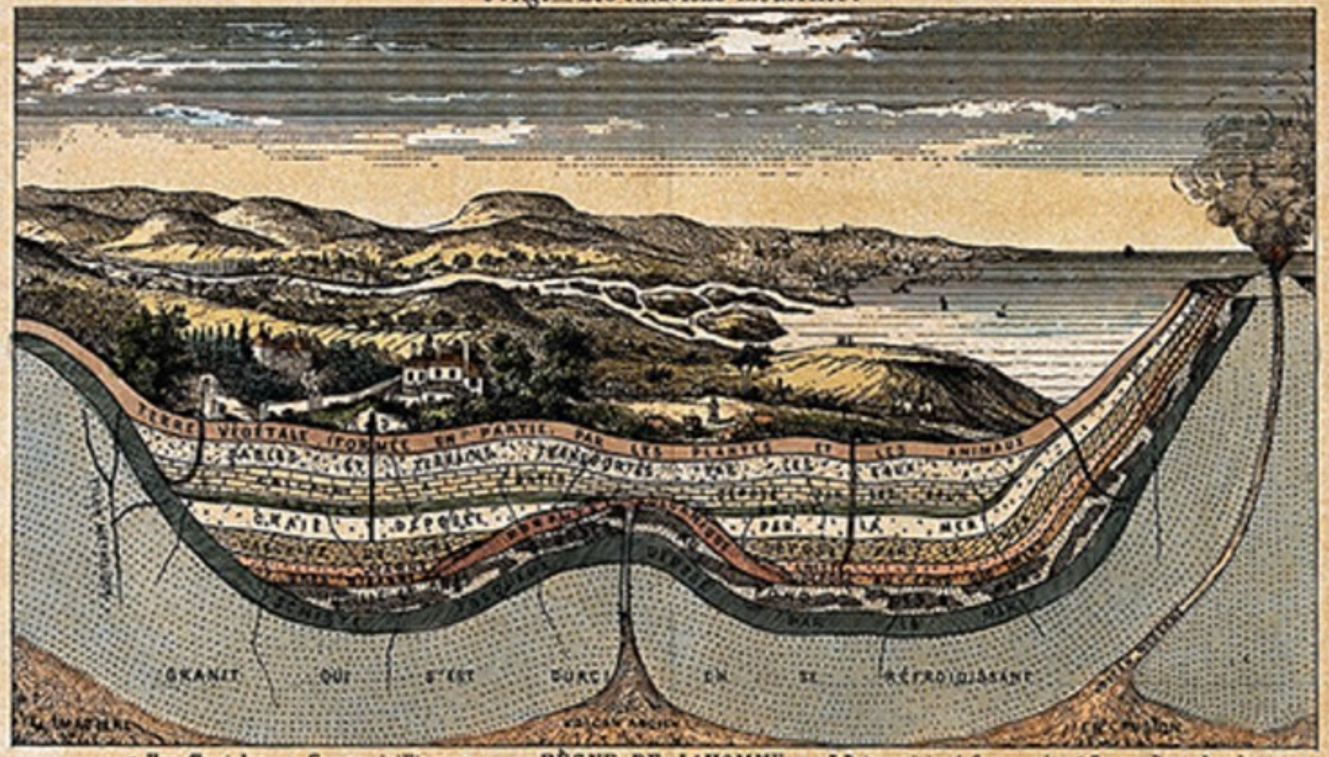
GEYSER DE L'ISLANDE.
Sources jaillissantes d'eau chaude.

8e Age. Les Alluvions anci



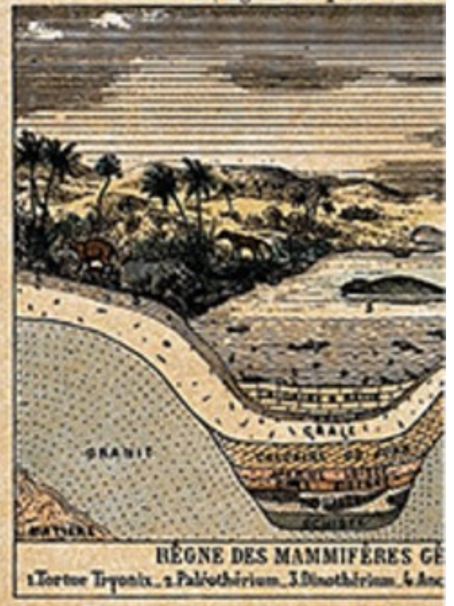
RÈGNE DES MAMMIFÈRES GÉ
1. Mastodonte. 2. Mammouth. 3. Hyène. 4. Singe. 5. Mégathérium. 6

9e Age. Les Alluvions modernes.



1. Iles fluviales. 2. Source jaillissante. RÈGNE DE L'HOMME 3. Puits artésien. 4. Source salée. 5. Source d'eau chaude

7e Age. La pierre à bât



RÈGNE DES MAMMIFÈRES GÉ
1. Tortue Tryonix. 2. Paléothérium. 3. Dinothérium. 4. An

6e Age. La Craie.

4e Age. Le Sel Gemme.

5e Age. Le Calcaire du Jura.

MINÉRALOGIE.

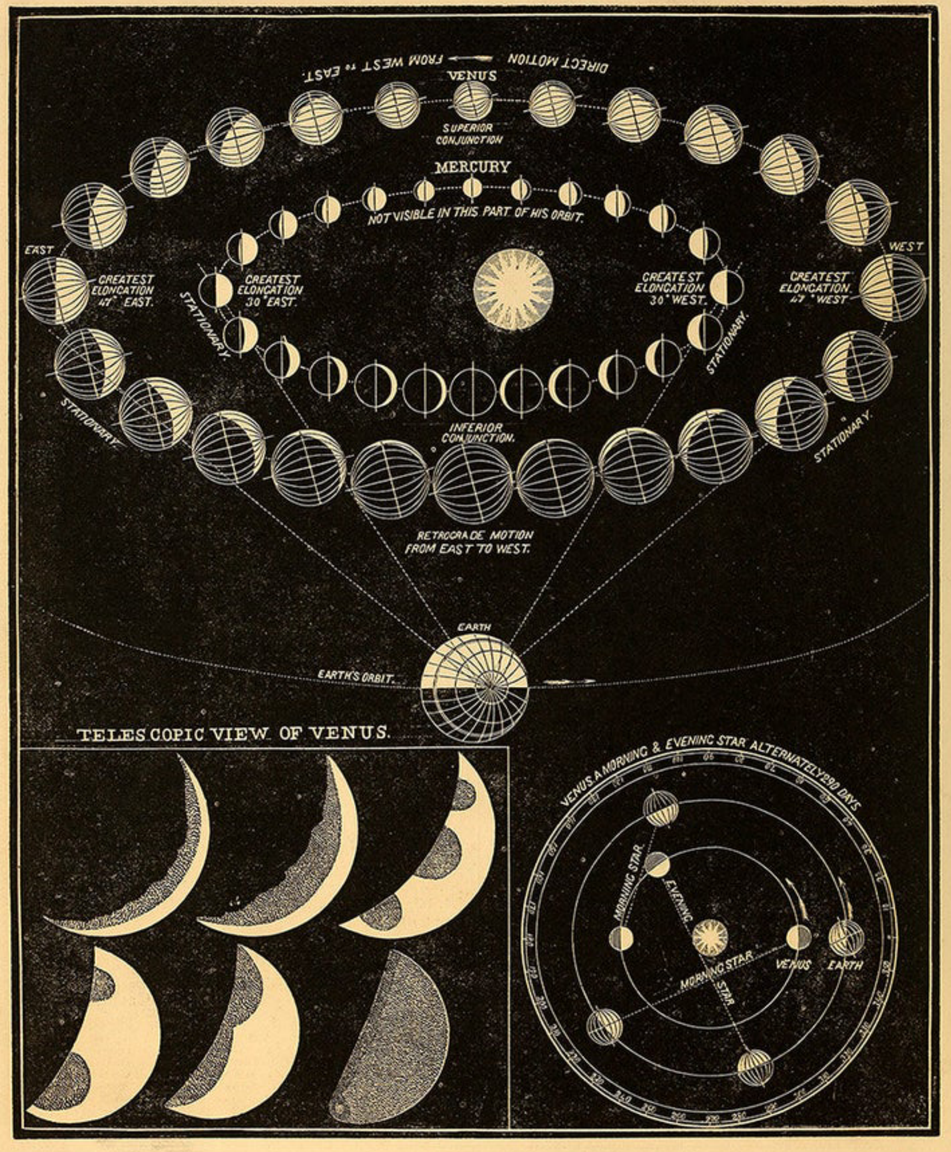

DIRECT MOTION
FROM WEST TO EAST.
VENUS
SUPERIOR CONJUNCTION
MERCURY
NOT VISIBLE IN THIS PART OF HIS ORBIT.
EAST
GREATEST ELONGATION 47° EAST.
GREATEST ELONGATION 30° EAST.
STATIONARY.
GREATEST ELONGATION 30° WEST.
STATIONARY.
GREATEST ELONGATION 47° WEST.
WEST
STATIONARY.
STATIONARY.
INFERIOR CONJUNCTION.
RETROGRADE MOTION FROM EAST TO WEST.
EARTH
EARTH'S ORBIT.
TELESCOPIC VIEW OF VENUS.
VENUS A MORNING & EVENING STAR ALTERNATELY 292 DAYS
MORNING STAR
EVENING STAR
MORNING STAR
VENUS
EARTH

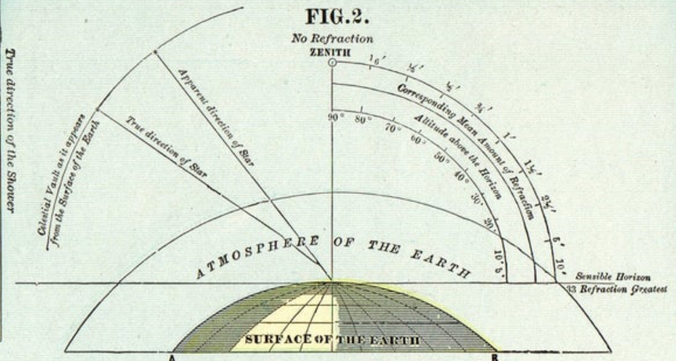
FIG. 1.

PLATE III

FIG.4.

ABERRATION

FIG.2.



REFRACTION

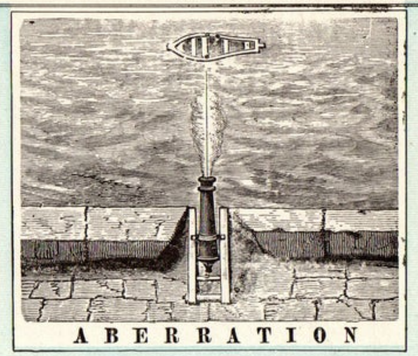
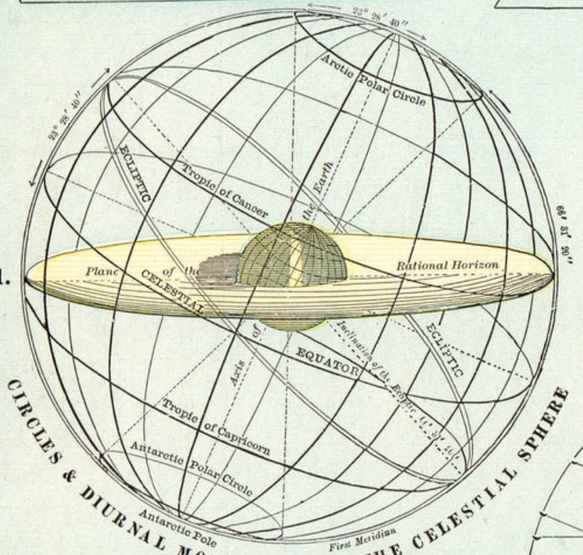


FIG.5.

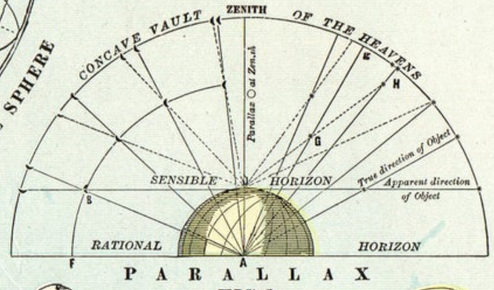
ABERRATION

FIG.1.



CIRCLES & DIURNAL MOVEMENTS OF THE CELESTIAL SPHERE

SUN



PARALLAX

FIG.3.

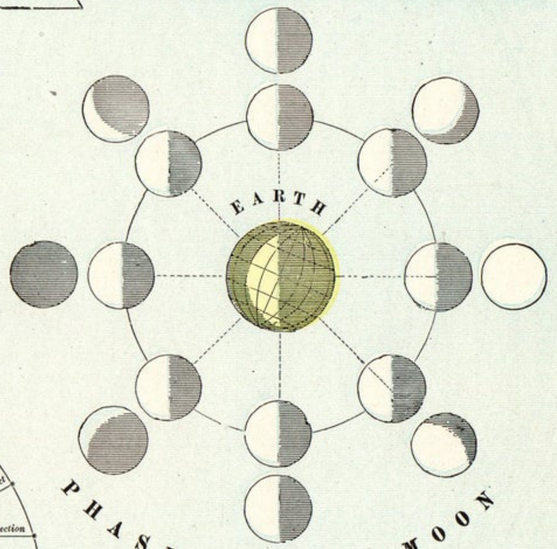


FIG.6.

PHASES OF THE MOON

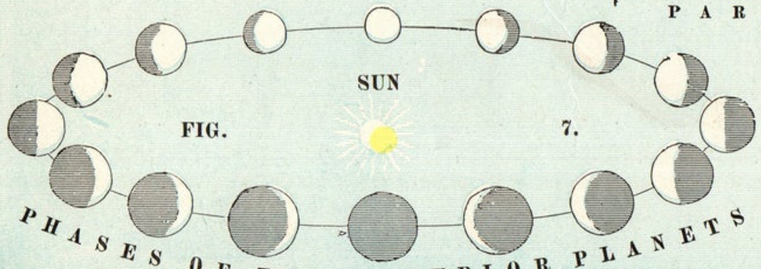


FIG. 7.

PHASES OF THE INFERIOR PLANETS

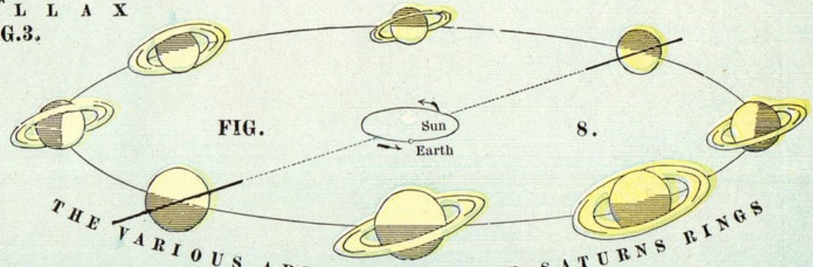
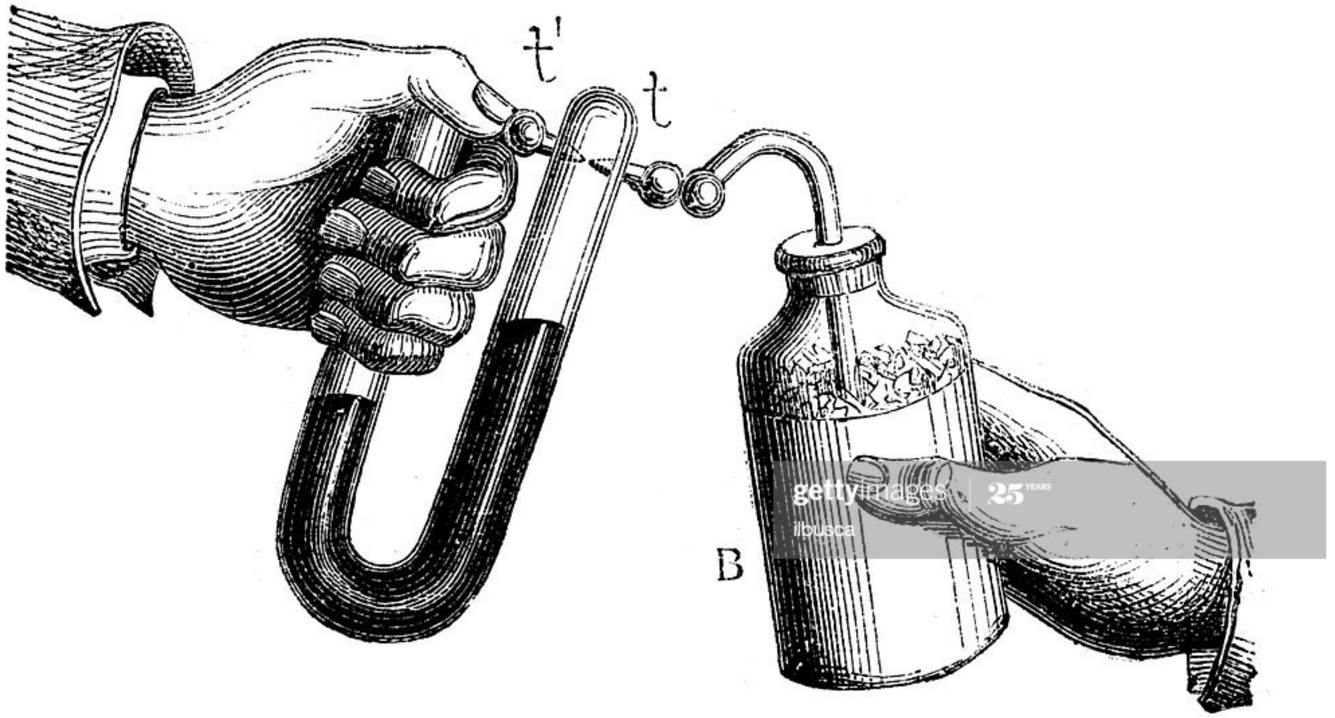
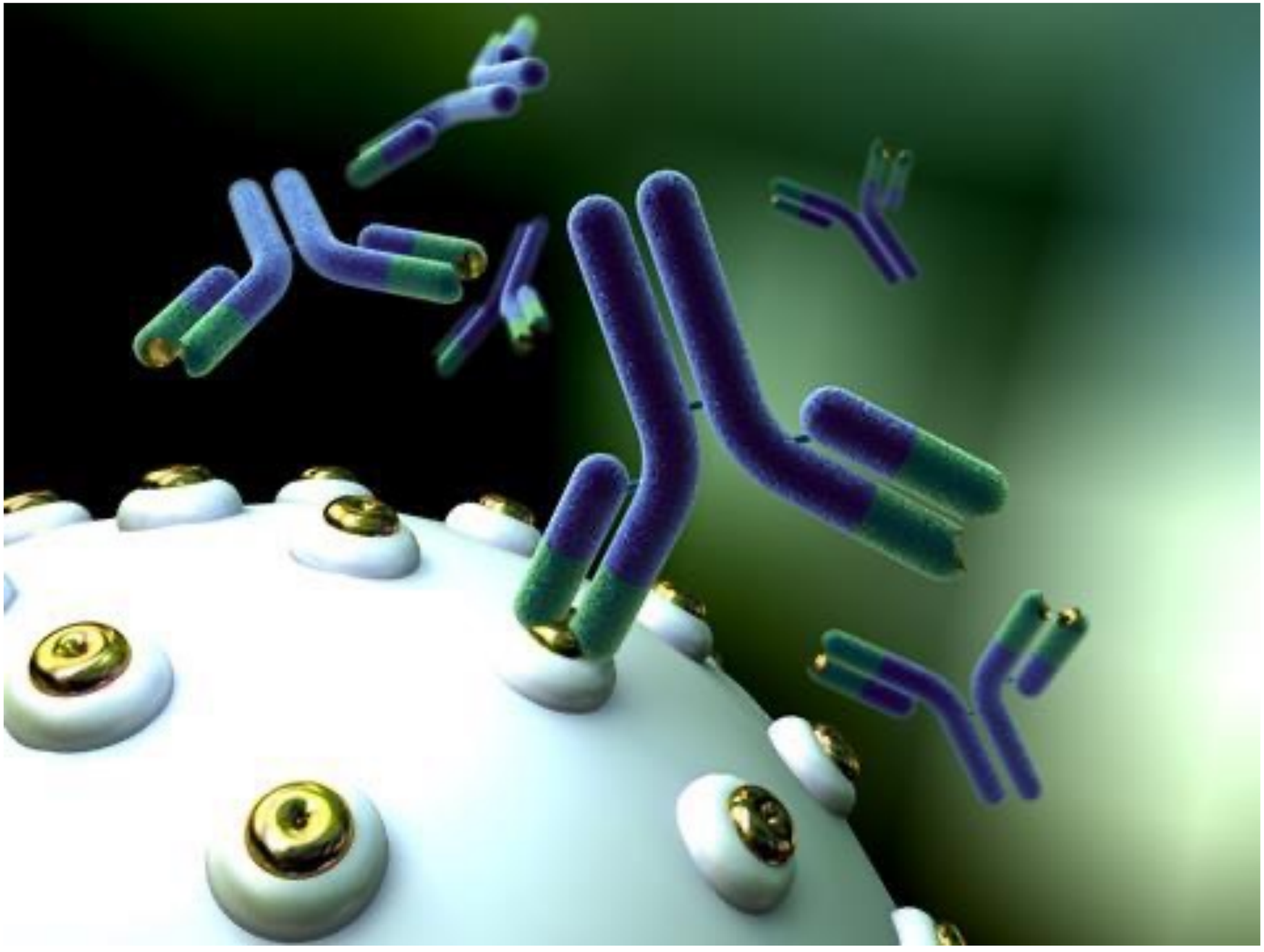
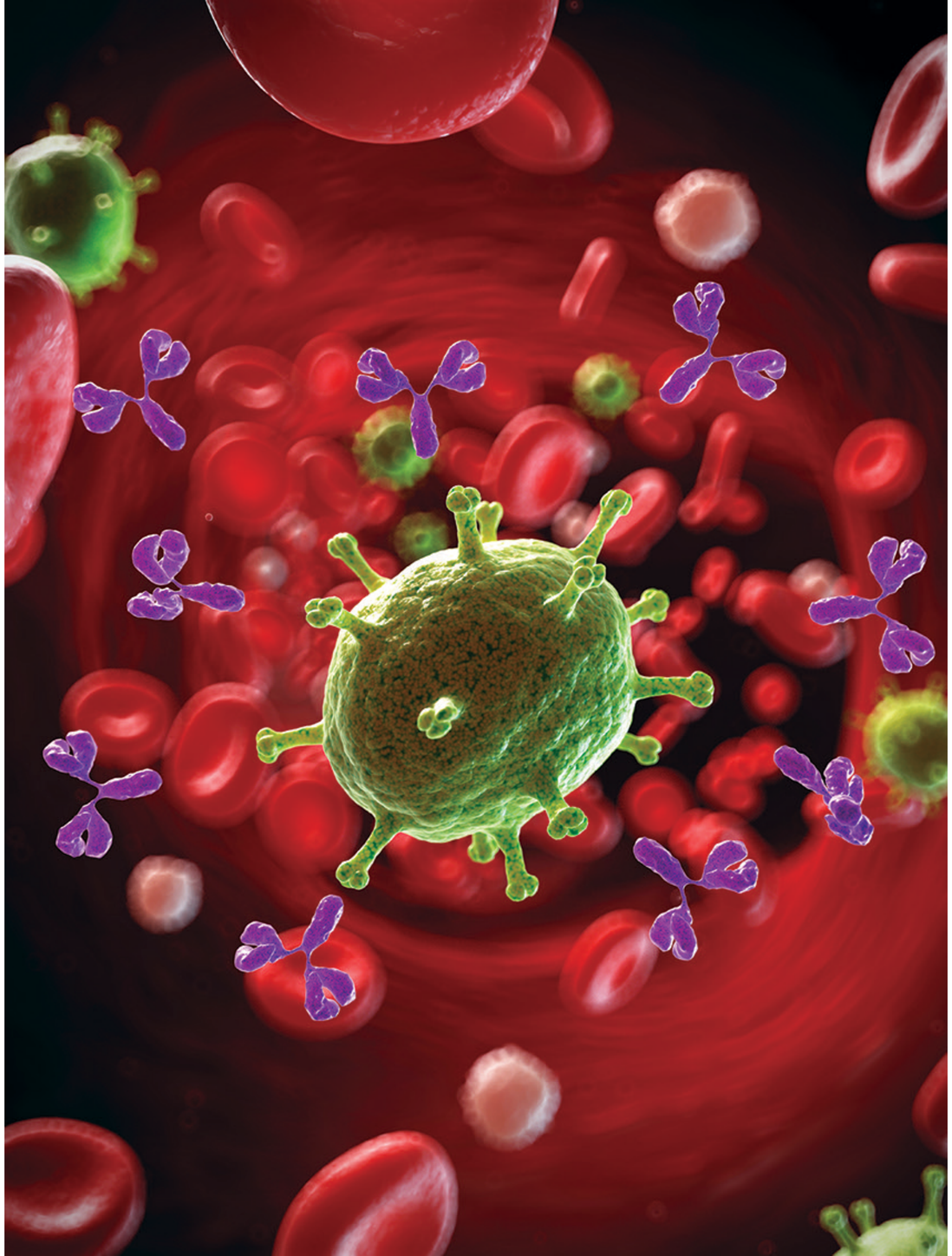


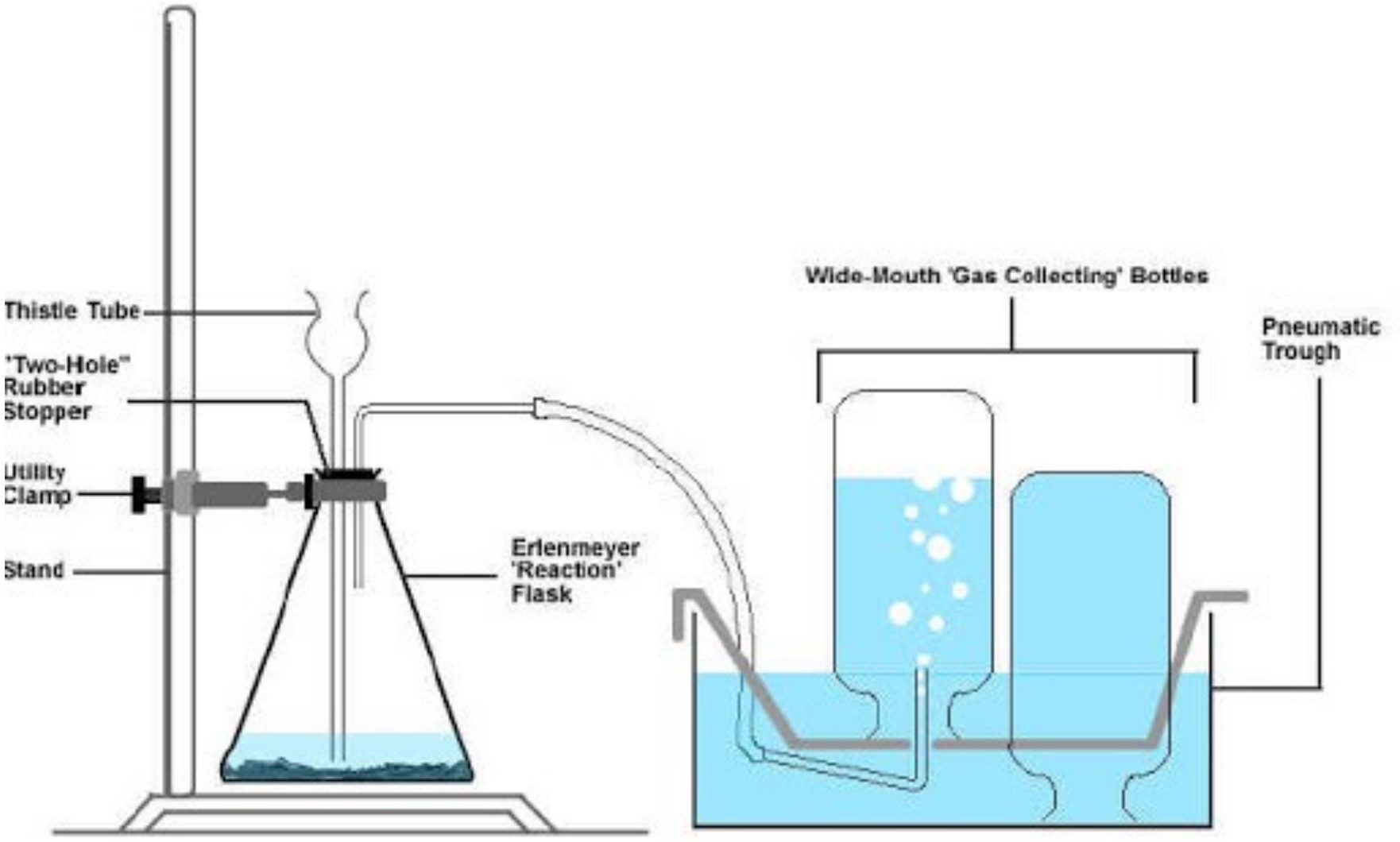
FIG. 8.

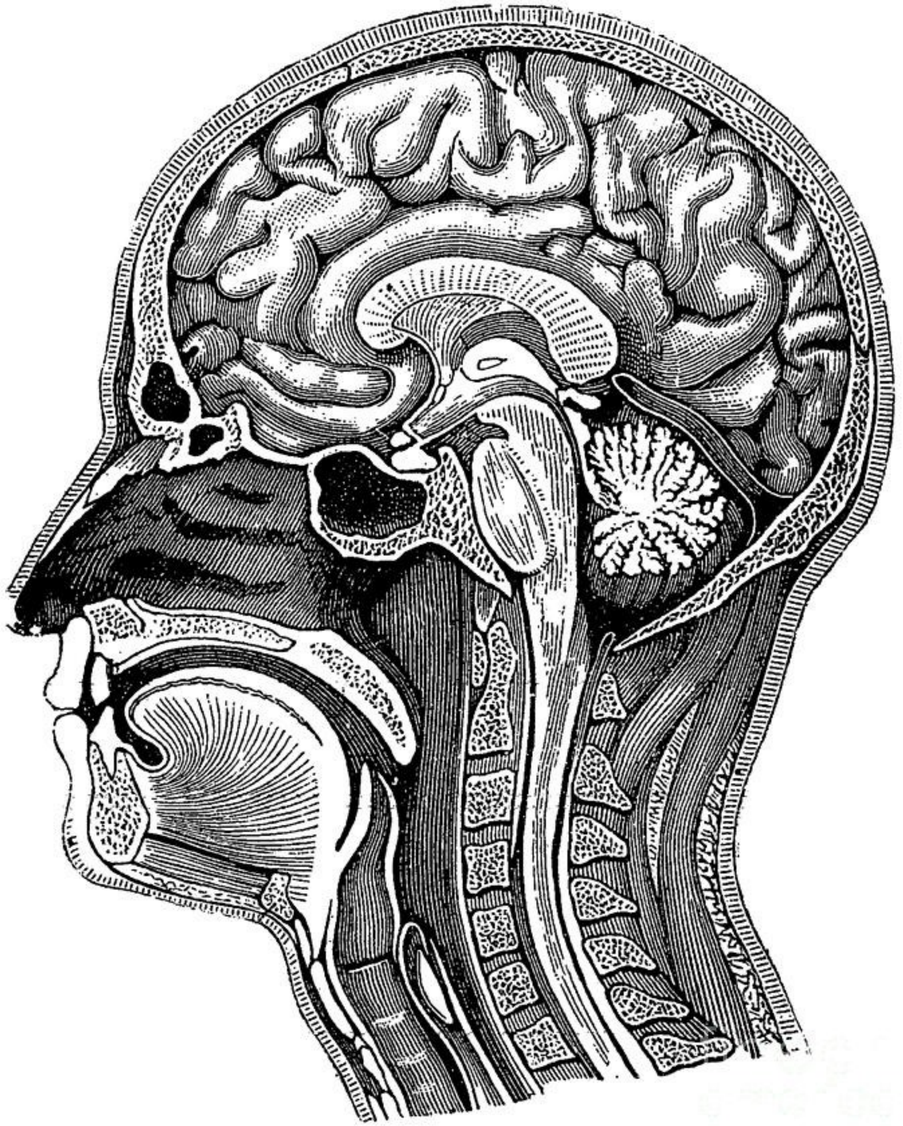
THE VARIOUS APPEARANCES OF SATURNS RINGS

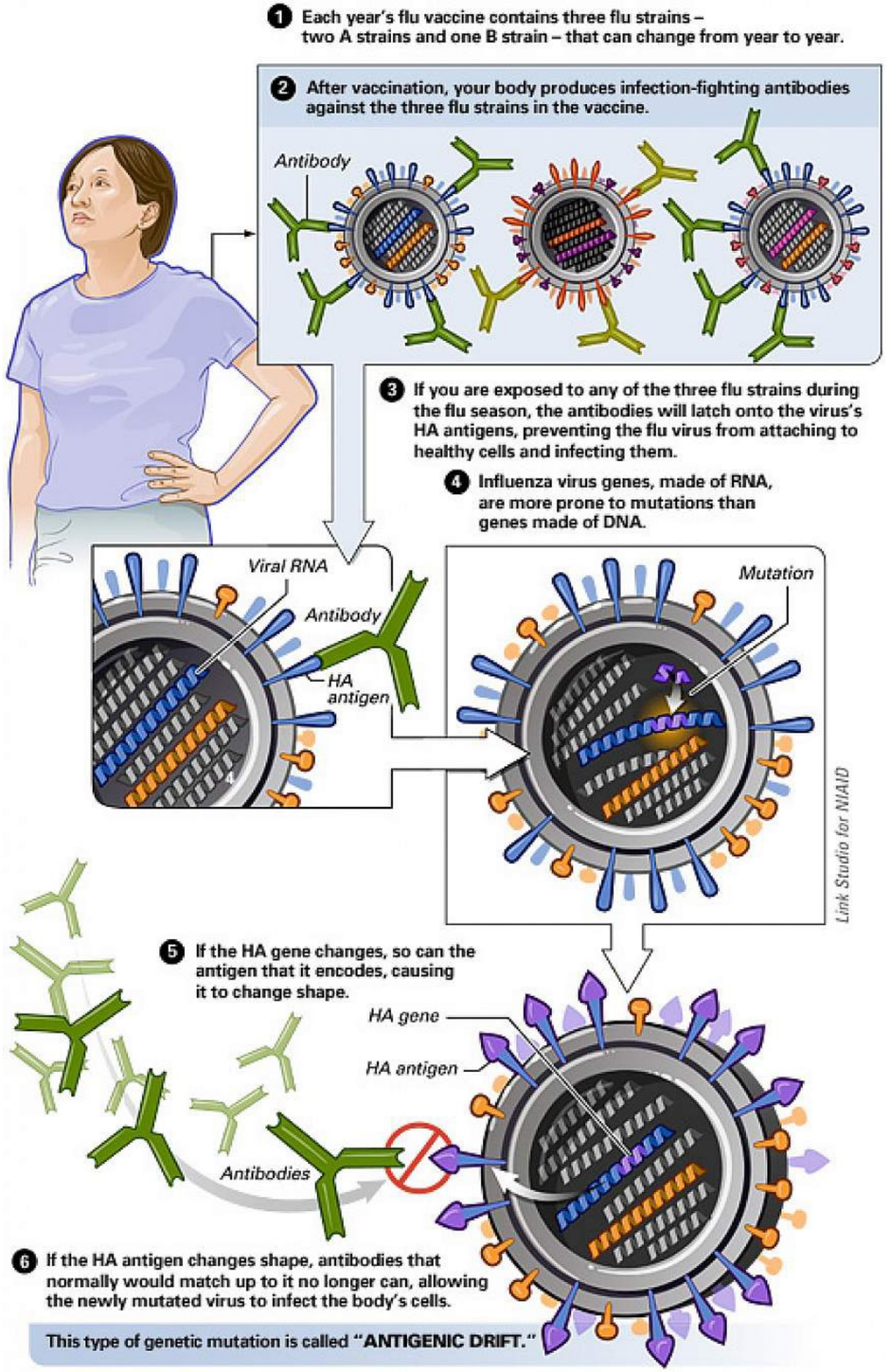







Thistle Tube
'Two-Hole'
Rubber
Stopper
Utility
Clamp
Stand
Erlenmeyer
'Reaction'
Flask
Wide-Mouth 'Gas Collecting' Bottles
Pneumatic
Trough

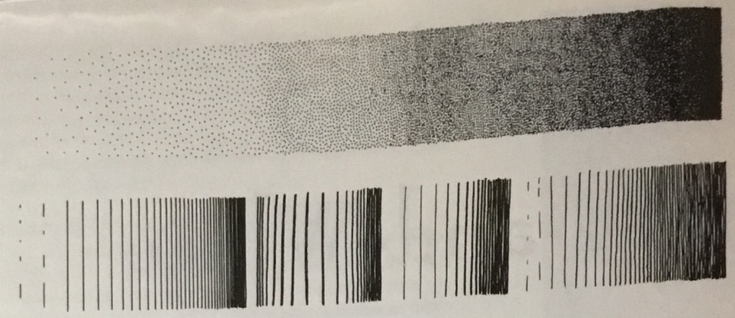



1 Each year's flu vaccine contains three flu strains – two A strains and one B strain – that can change from year to year.
2 After vaccination, your body produces infection-fighting antibodies against the three flu strains in the vaccine.
Antibody
3 If you are exposed to any of the three flu strains during the flu season, the antibodies will latch onto the virus's HA antigens, preventing the flu virus from attaching to healthy cells and infecting them.
4 Influenza virus genes, made of RNA, are more prone to mutations than genes made of DNA.
Viral RNA
Antibody
HA antigen
Mutation
Link Studio for NIAID
5 If the HA gene changes, so can the antigen that it encodes, causing it to change shape.
HA gene
HA antigen
Antibodies
6 If the HA antigen changes shape, antibodies that normally would match up to it no longer can, allowing the newly mutated virus to infect the body's cells.
This type of genetic mutation is called "ANTIGENIC DRIFT."

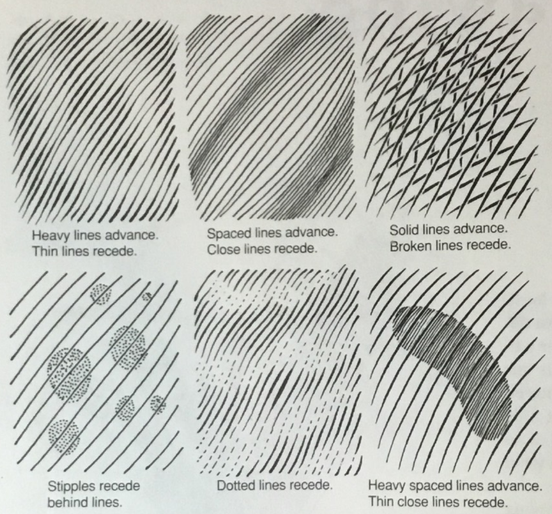
Line Quality considerations

Copies from ‘Scientific Illustration” Second Edition

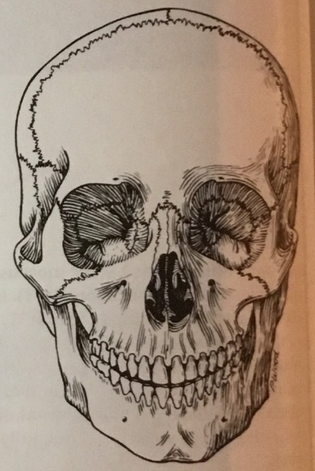
Phyllis Wood



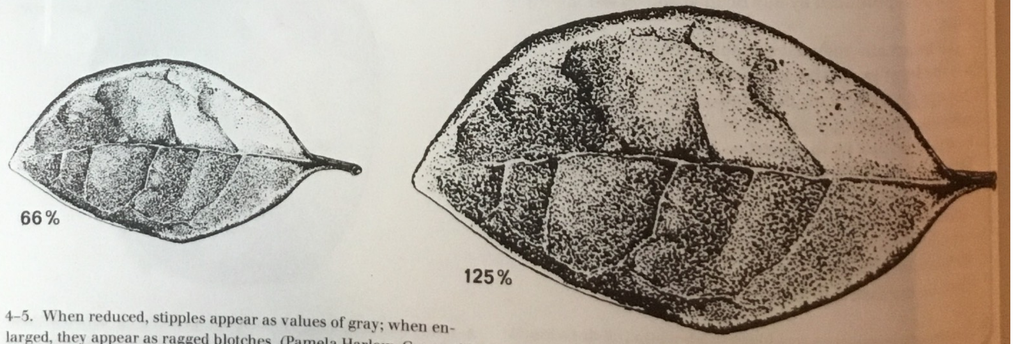
4–2. Stipples or lines mimic range of values on gray scale.



4–3. Create different effects with combinations of line and stipple.



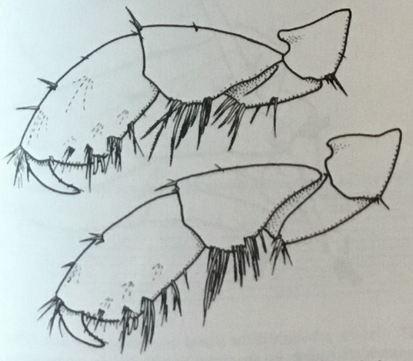
4–4. Reduced to 50%, line shading appears as values of gray. (Gillott 290 pen and ink on plate-finish paper.)



4–5. When reduced, stipples appear as values of gray; when enlarged, they appear as ragged blotches. (Pamela Harlow. Crowquill pen on plate-finish paper.)

4–10. Smooth, gradual contours and color variation rendered in stipple. (Sharon Feder. Gillott 290 pen on plate-finish paper.)

4–11. The bracts are stippled in contrast to the line-shaded scales of the Douglas fir cone. (Ramona Hammerly. Technical pen 0, 00 on plate-finish Bristol. From *Northwest Trees.* Arno and Hammerly. The Mountaineers, 1977.)



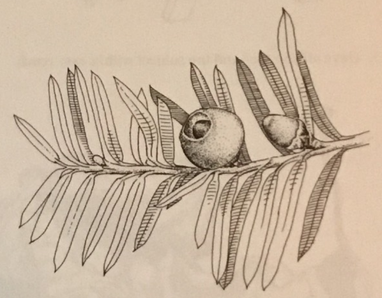
4–12. If an outline is all that is necessary, it is the best choice. (Craig Staude. Freshwater amphipod legs. Crowquill pen on plate-finish paper.)

sensitive outline can express a great deal about the shape, bulk, and texture of a subject.

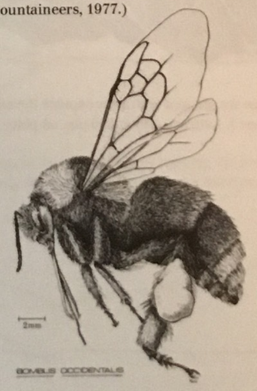
Interpreting the Subject

After becoming acquainted with the various ways of handling ink you must learn where, how, and how much of it to use. The tendency is to become so delighted with the rendering process that one embellishes on and on. One needs restraint and a knowledge of when to stop. The ink line or stipple should capture the essence of the subject without necessarily including every detail.

You must know not only your subject but also your audience. Don't draw the whole elephant if all you need is the trunk. The focal point of the drawing should be more fully rendered, with more detail than in the peripheral parts, which serve to relate to rather than to inform the viewer. It can be rewarding in terms of both design and information to combine a simple outline with tightly detailed line and stipple (4–14).



4–13. The focal point of the drawing (the fruit of the Pacific Yew) is rendered in detail, the rest is simplified. (Ramona Hammerly. Technical pen 000 on plate-finish. From *Northwest Trees.* Arno and Hammerly. The Mountaineers, 1977.)



4–14. A combination of line and stipple describe these transparent and hairy surfaces. (Patricia Veno. Pen, brush, and ink on scratchboard.)

Weighted Line

By letting the pen glide over the paper with no pressure other than the weight of the pen, you can draw a very fine line. Varying pressures produce varying lines, from very fine to very wide. Greater variation is possible with more flexible pens. Weighted-line drawings can have much vitality and character. Practice many variations. Each line may be made in several steps, doing the thin parts first and then adding the heavier part (4–22).

When joining two lines or continuing a natural contour that has been interrupted, start the new line inside the end of the previous line in order to prevent a jerky appearance.

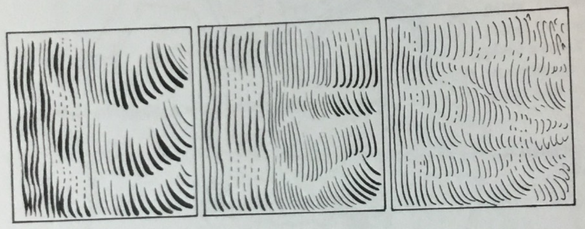
Find a drawing that you like, enlarge it and trace it line for line. Tracing other artists' work is very helpful in training your "hand." There is no danger of copying another's style, as it is similar to handwriting; after you learn the basics, you will develop your own signature or personal style.

Unweighted Line

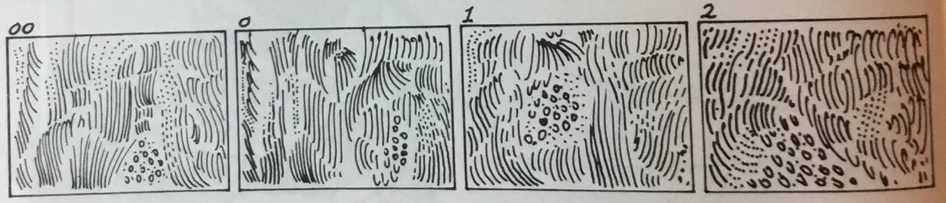
An unweighted line is made by exerting an even pressure, using a flexible pen or a technical pen. The technical pen should be held almost vertically to produce an even, steady ink flow. It will produce a constant line with the width dependent on the pen size. Sizes 00 to 2 are the usual range used for drawing (4–23, 4–24). Technical pens must be kept scrupulously clean and filled with the recommended brand of ink. If the pen becomes clogged, disassemble it, wash thoroughly in warm soapy water, dry, and reassemble.

Crosshatching

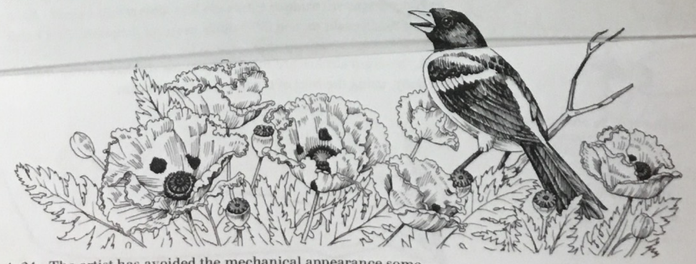
In crosshatching, opposing directions of lines are at oblique angles to one another. Right-angled crosshatching produces a wire-screen effect and should be avoided. Two, three, or four directions of lines may be used as the shadow becomes darker. Dots may be placed in the centers of the little parallelograms (4–25).



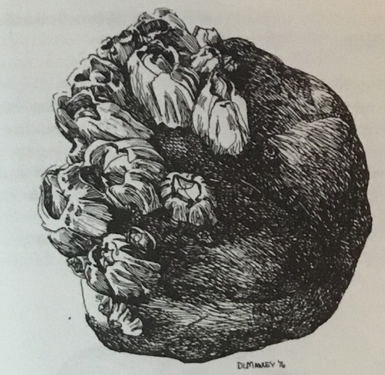
4–22. Strokes. Using (from left) Hunt 107, Gillott 290, Crowquill.



4–23. Technical pens offer two options for variety: the number of lines and their distance from each other.



4–24. The artist has avoided the mechanical appearance sometimes associated with the technical pen. (Jean Emmons. Rotring pen .18 on 1-ply plate-finish paper. From *Organic Gardening Guide.* Heidi Stonehill. Rodale Press, 1992.)



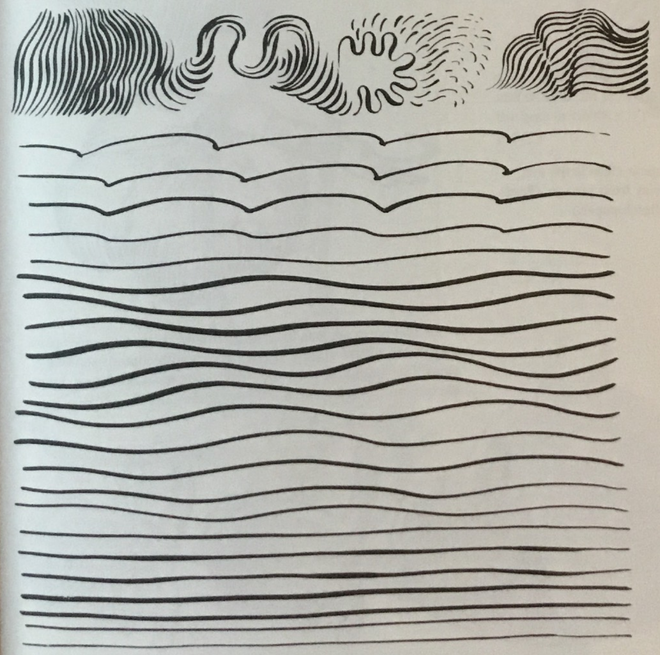
4–25. Crosshatching uses thin lines at about 60° from each other to create texture and contour. (Deanna Manley. Gillott 290 and ink on plate-finish paper.)

Brush Line

The brush is handled in much the same way as the flexible pen. It especially shines when long smooth or heavily weighted lines are needed. The ink flow can be precisely controlled to make very heavy to very fine lines (4–26).

First dip the brush in water to see that it comes to a perfect point when partially dried. Then dip the brush only part way into the ink and release some of the ink on the neck of the bottle. Check again for the perfect point. For greatest control, hold the brush almost vertically to the paper.

Rinse and dry the brush often as you work. Do not leave a brush with the bristles resting in the water jug, as they will become permanently bent and separated and will never again give a controlled line. After the brushes have been washed gently in mild soap and warm water and then rinsed, they should be left to air-dry in a pointed position (4–27). It is necessary to invest in good brushes for this kind of precision work. They will last for years if treated with respect.



4–26. Any slight variation in the way the brush is held produces a change in the weight and character of the line. Practice drawing long, smooth, varied brush lines.

4–27. When packing them, tie brushes together to protect the tips.

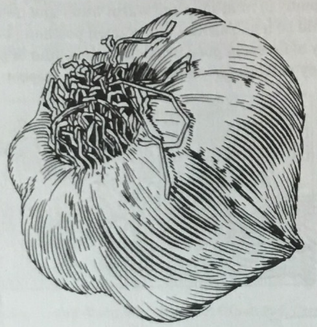
Line-Shaded Drawing

It is a good idea to pencil in the general direction of the shading lines on your preliminary sketch, but it is not necessary to trace each line laboriously in pencil before doing your ink drawing (4–28). With practice you will become adept at determining the width of the lines and the distance between them.

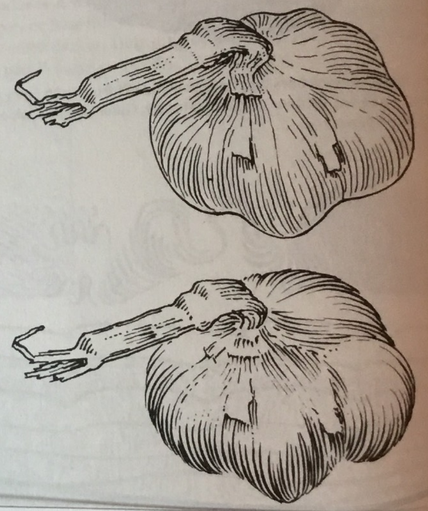
A good way to determine the most appropriate way to line-shade a drawing is to start with a continuous-tone pencil sketch and experiment (4–29). If the direction of the line shading is difficult to decide on, place a piece of tracing paper over the trouble spot and try several directions until one seems right.

Outline or No Outline

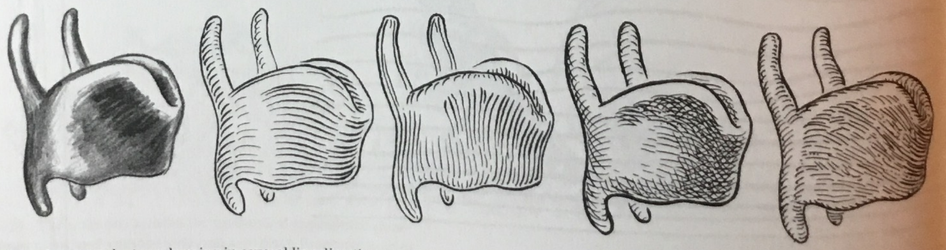
The inclusion or omission of an outline should be considered when rendering a line-shaded drawing. An outline will emphasize the edges of the subject, setting off positive and negative space concisely. Line-shading without an outline will emphasize the shape or contour of the subject, the shading lines creating the edges more subtly (4–30).



4–28. Heavy lines that are farther apart appear close to the eye. Thin lines that are close together recede away from the eye. (Paula Richards. Gillott 290 pen and ink on plate-finish paper.)



4–30. Flat parts, such as the stem, demand outlines. Curved parts, such as the spherical bulb, can be drawn with contour shading alone. Use an outline if the boundaries are most important. Omit the outline if the contour is the most important.

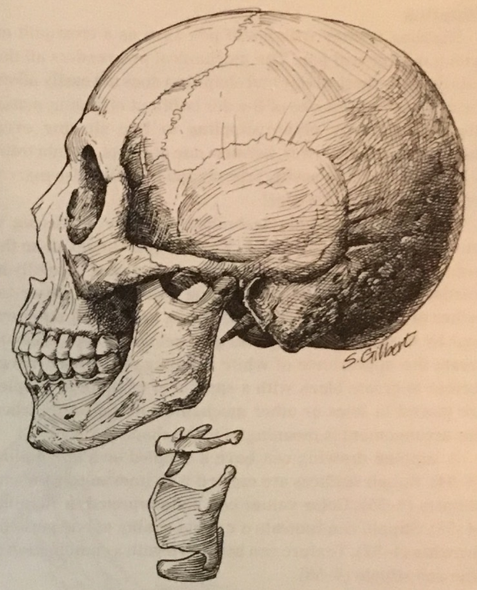


4–29. Interpret the tone drawing in several line directions and weights. Select the rendering that seems to best reflect the natural contour and character of the subject.

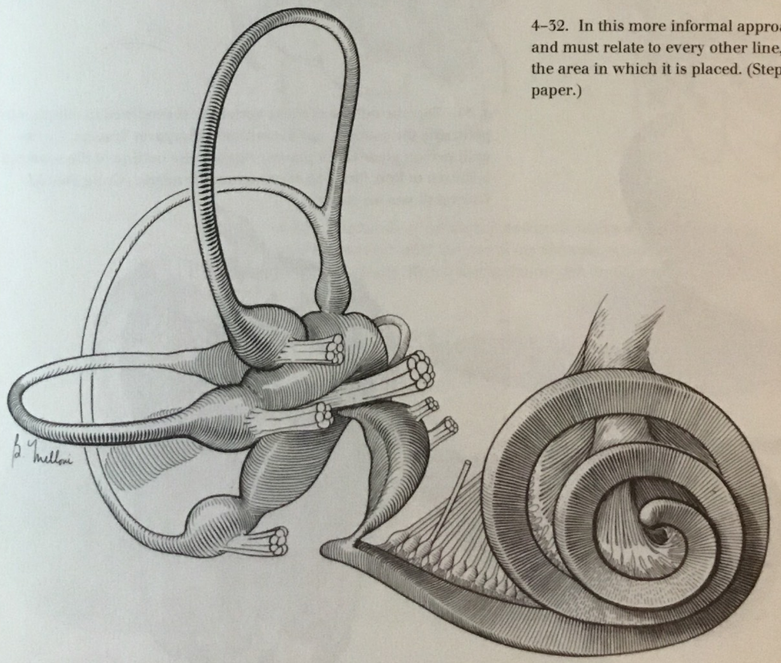
Controlled and Relaxed Treatments

The choice between a tightly controlled and a looser, more relaxed rendering is most apparent with ink-line shading. In the tightly controlled treatment, each line must be perfect, but a mechanical look must be avoided (4–31).

At the opposite end of the spectrum is a loose, more informal approach (4–32). Every artist who draws in this style will interpret the subject differently. This seemingly light-hearted expressiveness does not mean that it is any less difficult to achieve. There is a danger of producing a sketchy drawing, inappropriate for a scientific illustration. Most pen-and-ink drawings fall somewhere between these two examples.



4–32. In this more informal approach, each line is still important and must relate to every other line, the shape of the subject, and the area in which it is placed. (Stephen G. Gilbert. Pen and ink on paper.)



Finishing

After rendering an illustration in wash, look at it with a critical eye. There may be something that can be improved. The deep dark may need to be enhanced with paint in a dry-brush technique. A sparkle of white paint in the darkest area may add depth. An edge may need a sparkly highlight of white water color or opaque paint. Ink or a carbon or graphite pencil may be used to make details crisp or darker. A knife blade can be used to scratch highlights. A Pink Pearl eraser can be used to soften and lighten certain areas. An electric eraser may be helpful in removing darks or in lightening the value. An eraser, however, cannot remove particles of pigment that have settled in the roughness of cold-press board, so the erasures will not be smooth. Many of these techniques will mar the surface of the board, so they should be done only after all the rendering is complete. White paint must not be disturbed after it has been applied, as it will turn muddy.

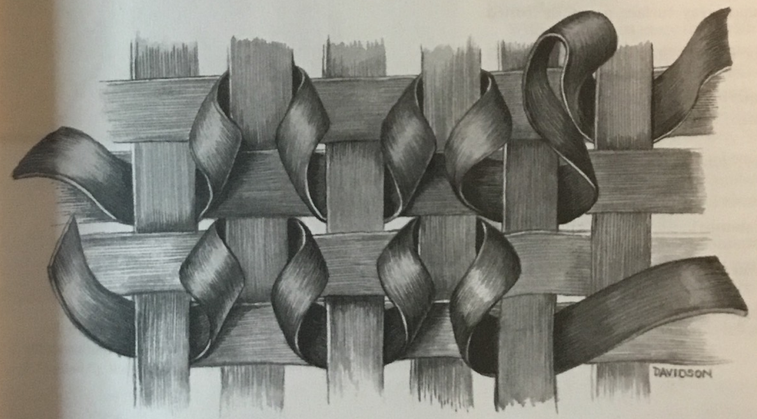
Dry-Brush Technique

In wet-on-dry rendering, the preliminary clear wash is not applied. The values are built up gradually with the brush not fully loaded (5–10).

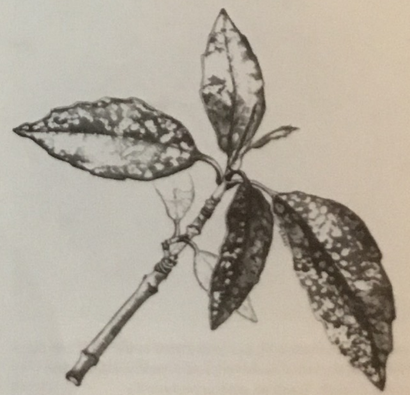
Resists

Masking fluids or resists (Maskoid, Miskit) block the absorption of the pigment on the board. You can also use thinned rubber cement. Some resists are colored so they are easier to see on the white board.

Dip your brush in liquid soap before dipping it in the resist, and it will be easier to clean. Apply the resist to the area that you wish to leave white. Lay the washes on and, when they are dry, remove the resist by gently rubbing the surface with a finger or rubber-cement "pickup." This leaves a white surface, which can then be left white or painted. A resist can be applied between washes, leaving one part of an area lighter than another. This method of isolating white areas produces crisp edges (5–11).



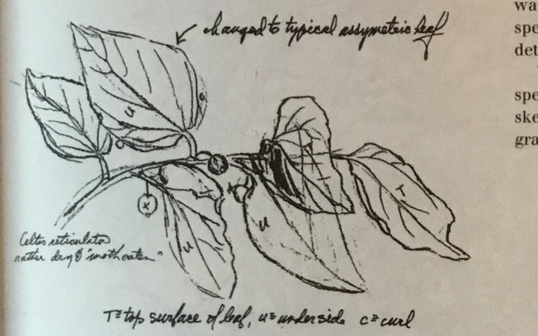
5–10. The pigment-water mixture was applied to the dry surface of three-ply, medium-finish Strathmore. The layers of pigment are applied progressively drier. (Margaret Davidson. Mohawk basket detail.)

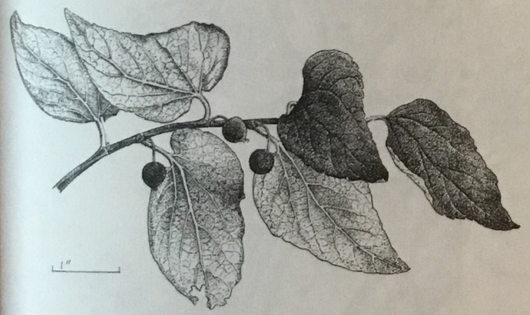


5–11. Resist is applied on the light areas of the leaf pattern; and wash is applied over the whole leaf. The resist is removed, leaving a white pattern. Subsequent washes are layered over the entire area. (Jane Rady. Wash on cold-press board.)

DOCUMENTATION

Each sketching session should be documented with field notes. Include the scientific and common names, the date and the time of day, and the site. Note the colors and their variations. Note an animal's age and sex, its actions, both generally and specifically, alone and interacting with other animals (7–3, 7–4). If the animal is not alive, note its condition: freshly killed or preserved. If it is a preserved specimen, write down the information in the collection. This documentation, while interesting in itself, also will prove valuable as reference material.





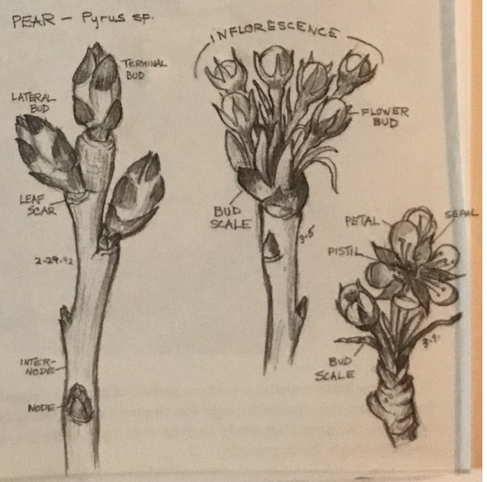
7–11. The sketch of the foliage and documentary notes were done in the field; the twig was brought to the studio for the final drawing. Line and stipple were used for the sandpapery texture of the leaves. (Ramona Hammerly. *Celtis reticulata*, netleaf hackberry. Pencil on medium-rough, 70-lb. sketch paper; and technical pen 0, 00 on 2-ply, plate-finish Bristol. From *Northwest Trees*, Arno and Hammerly. The Mountaineers, 1987.)

BOTANICAL DRAWING

Each foliage specimen and each tree is unique. The artist must select one that is characteristic of the species and also has variety in its composition (7–11 through 7–15). The artist has the option of manipulating the elements of the subject, being careful not to change the anatomy. Drawings are usually a combination of field sketching, photography, and studio drawing. A good exercise to familiarize yourself with a botanical subject is to draw a twig or bud in a series of growth stages (7–12).

Foliage specimens put in a ziplock bag with a few drops of water will last several days in the refrigerator. Preserved specimens and photocopies of the specimens will document details and proportions.

When drawing trees, look for unique characteristics of the species, and include variety in the composition. When sketching trees, concentrate on the silhouette and take photographs to augment that information (7–13, 7–14, 7–15).



7–12. A greater understanding of plants can be gained by drawing and identifying the stages in their development. (Pencil on ledger paper.)