

Scaling, Self-similarity, and Fractals

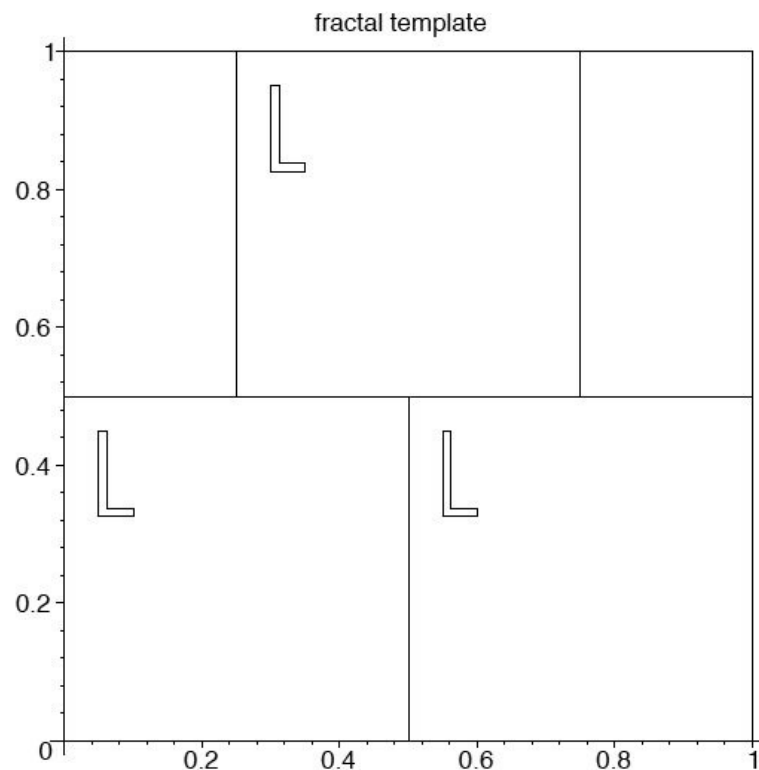
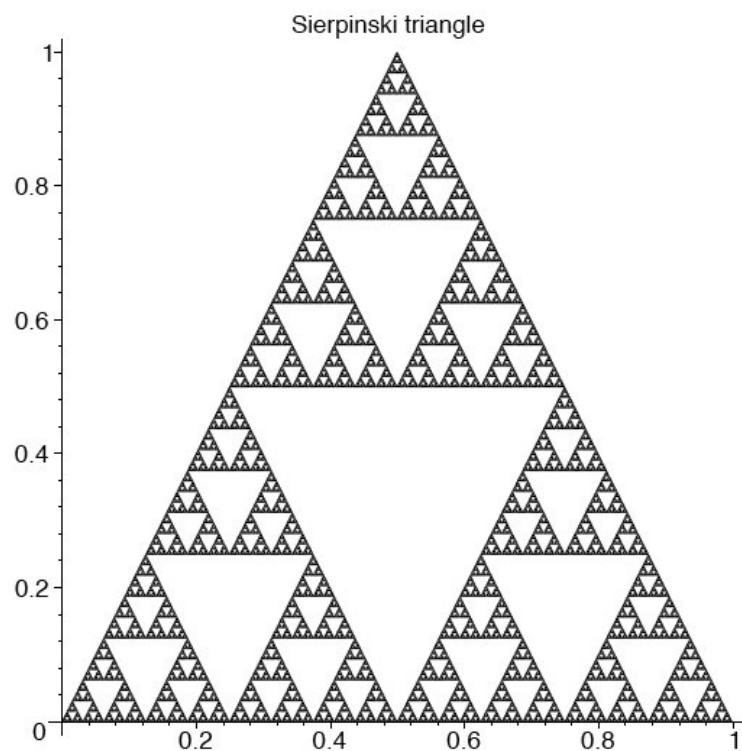
Access Math Week 2, July 2009



Scaling, Self-similarity, and Fractals

- “Scaling” an object means stretching or shrinking it, either uniformly or with distortion.
- An object is “self-similar” if it is congruent to a uniformly scaled piece of itself.
- According to Wikipedia, A “fractal” is generally “a rough or fragmented geometric shape that can be split into parts, each of which is (at least approximately) a reduced-size copy of the whole.”
- Benoit Mandelbrot came up with the name “fractal” in 1975, using the Latin root “fractus” (=fractured, or broken).
Mathematical fractals go back over one hundred years, but this mathematical field came of age with the advent of computers.
- Many natural objects have fractal-like structure.

Fractals in Math: Sierpinski's Triangle



<http://www.math.utah.edu/~korevaar/fractals/Sierpinski.pdf>

Fractals in Nature: Lightening



http://208.106.191.145/_media/imgs/articles/a302_f10.jpg

Fractals in Nature: Clouds



<http://wvs.toleftpixel.com/08/01/08/>

Fractals in Nature: Geographic Features



<http://fractalfoundation.org/wp-content/uploads/2009/03/efrac1.jpg>

Fractals in Nature: Broccoli Romanesco



http://tiger.towson.edu/~gstiff1/images/800px-Fractal_Broccoli.jpg

Fractals in Nature: Ferns



<http://stumbleupon.foresthippy.com/img/fractalfern.jpg>

Fractals in Nature: Kidneys

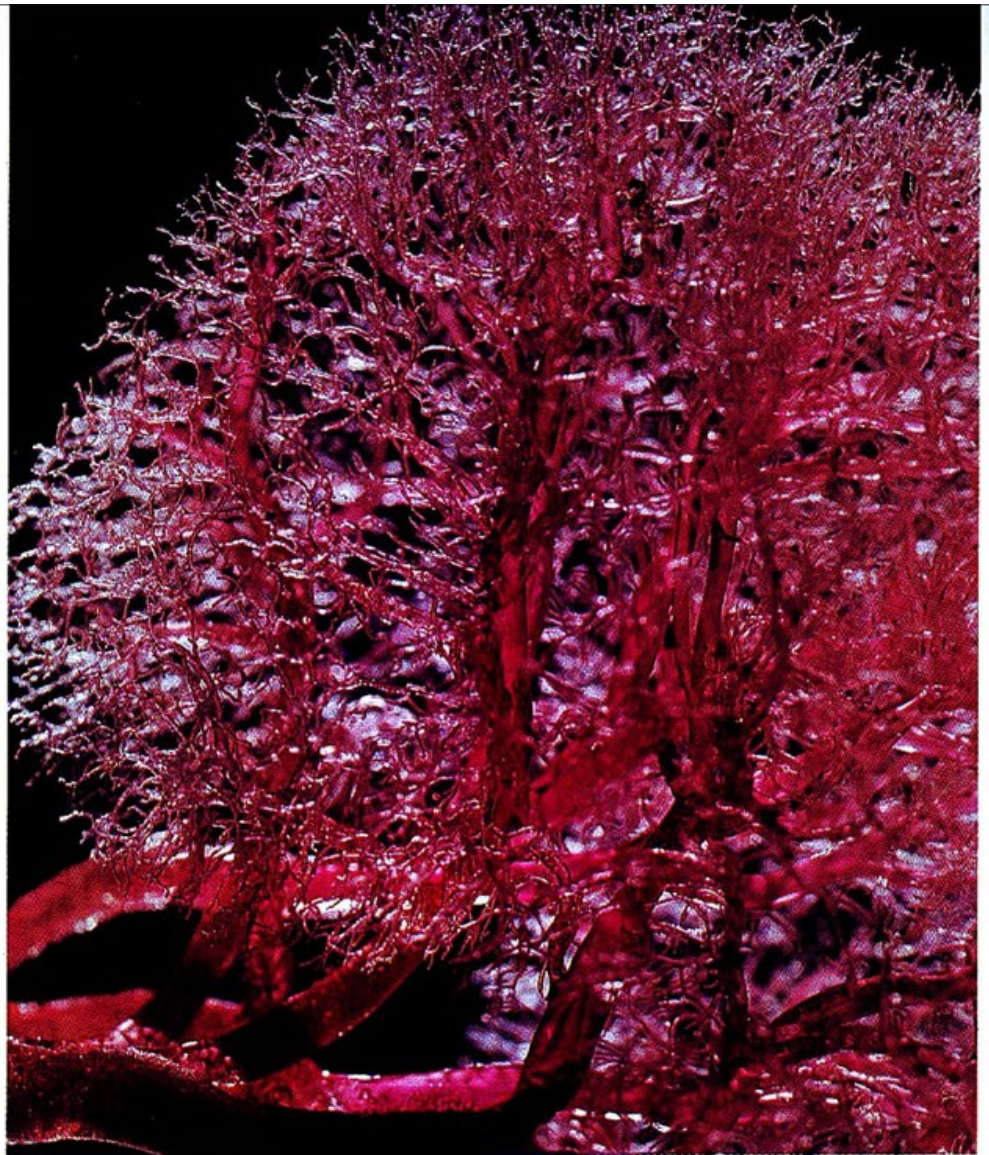
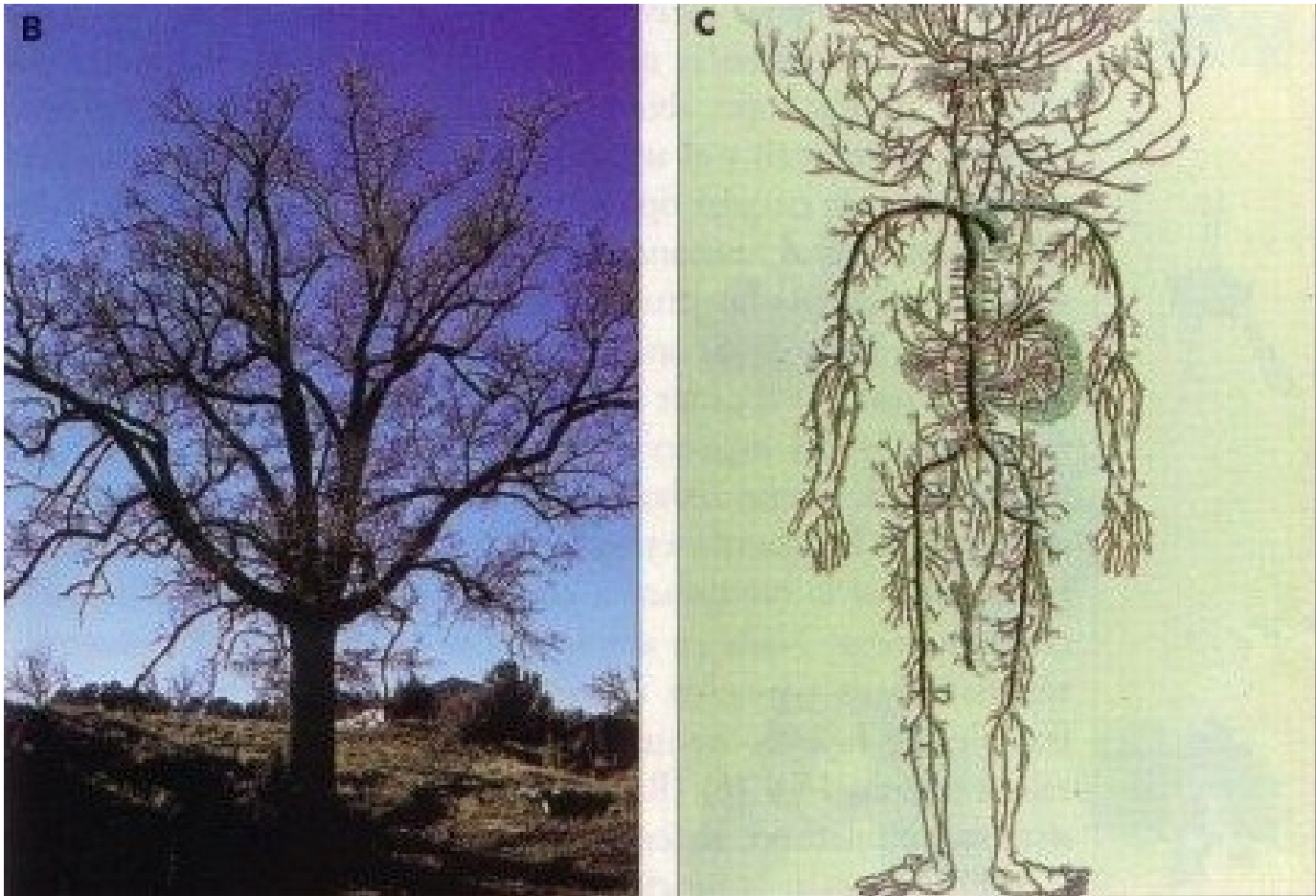


Plate 2: Cast of a child's kidney, venous and arterial system,
© Manfred Kage, Institut für wissenschaftliche Fotografie.

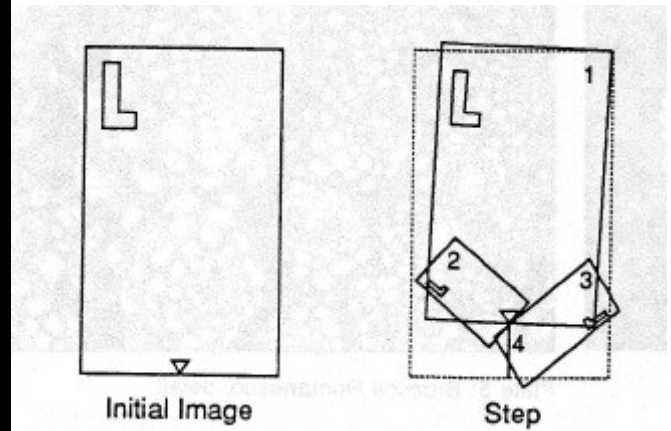
Peitgen, Jurgens and Saupe,
"Chaos and Fractals", p. 176
Springer-Verlag 1992.

Fractals in Nature: Tree structures



http://www.rogerolivella.net/imgs/imginsu/other_natural_frac_thumb.jpg

Fractals in Math: Barnsley Ferns, with iterated function systems



<http://bugman123.com/Fractals/Fern.gif>

Fractals in Math: 3-Dimensional Barnsley Ferns



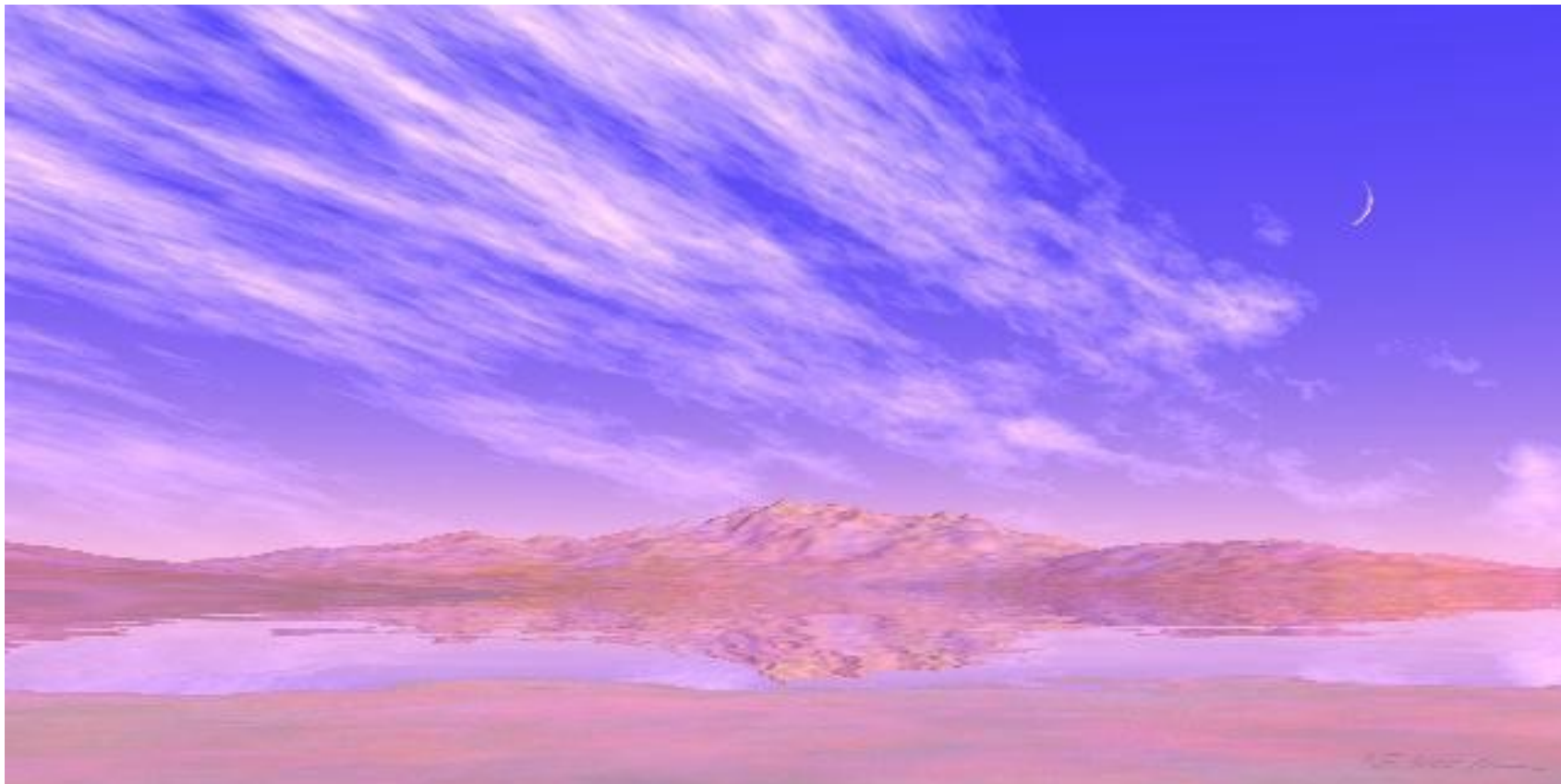
<http://www.popmath.org.uk/rpamaths/imagesrpam/bfern.jpg>

Fractals in Art: “Carolina”



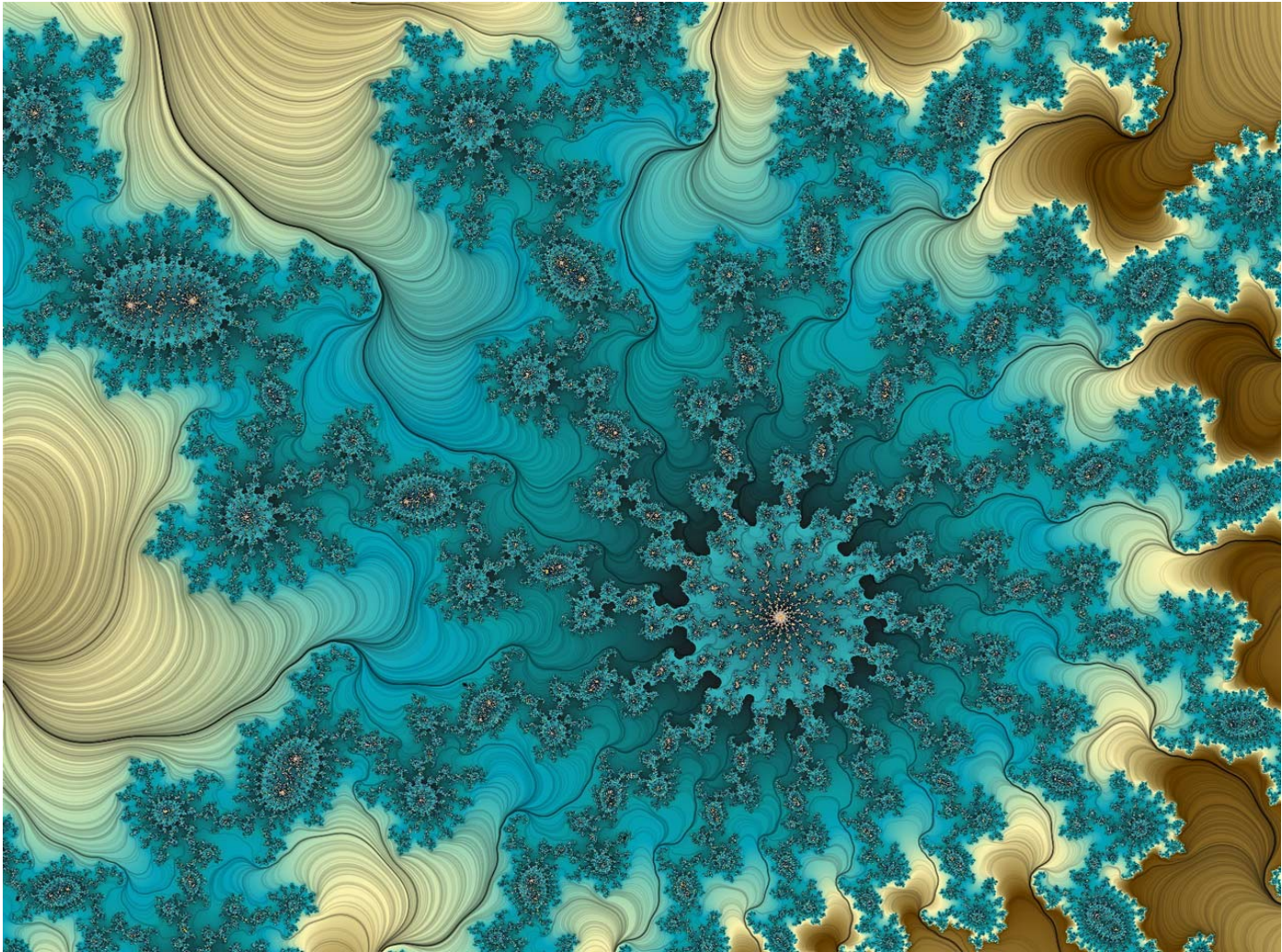
<http://www.kenmusgrave.com/carolina.jpg>

Fractals in Art: “Zabriski Point”



<http://www.kenmusgrave.com/mirage.jpg>

Fractals in Art: Mandelbrot-type sets



Google “fractal art”