

Additional Notes from Dr. Regina Valluzzi

Complex Fluid - This piece represents a very imaginary nanostructure, with little hints and allusions to surfactancy, cell membranes, and complex fluids in general. What do microstructures and nanostructures really do when we're not looking?

Learning Circuit - "Learning Circuit" refers to early ideas in A.I., expert systems, and heuristic neural networks. The colored drawing is reminiscent of circuitry patterns. The line tracers are overlaid like wispy ideas and connections beginning to form - the emergent "learned" circuit connections.

Tunneling Regime - Quantum Mechanical tunneling happens when, According to Classical Mechanics there is a barrier or wall. The energy to hop over the wall is more than is possessed by any of the particles blocked by the wall (or barrier). So in Classical Terms, those particles should be stuck on their side of the wall. In Quantum Mechanics, there is also an Uncertainty factor, which tend to soften up Classical Walls, allowing some of the particles to leak or "tunnel" through the barrier. This idea was used to create the Scanning Tunneling Microscope, which could attain atomic resolution on atomically flat conductive samples.

In the painting "Tunneling Regime", mica and other textural materials are used to create a granular space for the quantum tunneling particles, and the particle waves tunneling through are swirling helicoids. To be accurate, the Planck length granularity of space time is much much smaller than particles that can tunnel, and the waveforms are not accurate either. It is after all Art, and not a Physics illustration.

Entropic Repulsion - Entropy relates to the number of distinct states a molecule can access. There are different flavors of entropy, depending on the different properties that can vary. For long floppy shoestring shapes molecules, something called "configurational entropy" is fairly important. These molecules favor states and environments where they can flop around in the largest possible variety of twisted shapes and configurations - high configurational entropy.

When a floppy shoestring molecule is held close to a solid surface, there are a number of shapes that are no longer accessible because the molecule would collide with the surface. If a bunch of floppy molecules are affixed to particles at one end only (the other end is free), the particles will repel because the attached floppy molecules can't move as freely. The configurational entropy decreases, which is unfavorable. This is a phenomenon called "entropic repulsion".

Transition to Chaos - Chaos is often heralded by increased complexity and fine granularity in condensed matter. I think of this process as the "machinery" of matter dividing itself into ever smaller and more loosely related units. These ever smaller units retain a fractal similarity to the larger originals right up to the point where they disintegrate and disappear into the formless field.