

Emergence and Evolution

Parked

Quantum mechanics

- Properties
 - Superconductivity
 - Superfluidity
 - Ferromagnetism
 - Crystals
 - Lasers
 - Non-local connectedness
 - Symmetry-breaking

A Career in Theoretical Physics -- Phillip Anderson

Hierarchy levels

- Elementary particle
 - Quarks
- Nucleus
- Atom
- Periodic table
- Proteins
- Life
- Communication
- Family
- Government

Speciation

- Open areas
 - Many new species
- Migration
 - Sub species
- Two aspects
 - Genes that code for traits
 - Genes that control development
 - DNA contains a large past history
- Galapagos finches
- Variation > unexpected changes
- Selection > most fit reproduce

Curt McNamara, P.E. 2021
The Origins of Evolutionary Innovations by Wagner

Types

- Stable forms
 - Land masses
 - Weather patterns
 - Cells > organs > species
- Behavior
 - Useful
 - Social insects
 - Memes
 - Destructive
 - System of system
 - Combination of many elements
- Classic examples
 - Slime mold
 - Biological clocks
 - Flocks
 - Ants
 - Scales
 - Flexible
 - Waterproof
 - Interesting at level of fish
 - School of fish
 - Community
 - Water
 - Atmosphere
- Building blocks
 - Watchmaker
 - Proteins
 - Letters

Behavior

- Self-organizing behavior
 - Emerges unpredictably
 - At different levels of system
 - Make intelligible by relating to lower level properties
 - Don't reduce a whole to its parts and interactions
 - Causal gap between one level of description and the next
- Properties at one level
 - Subsumed by behavior at the next
 - Hierarchy
 - Alternate methods of description
 - Emergent properties don't influence lower level behavior