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Formal technical text

Astronomers and cosmologists seek to understand how the universe evolved from a smooth, nearly uniform state just after the Big Bang into the **complex web of galaxies, clusters, and filaments** we see today. Tiny "seeds" of dark matter in the early universe grew over billions of years by gravitational attraction into larger structures. Large elliptical galaxies may have formed either through **rapid collapse of gas and dark matter** ("top-down" scenario) or through **mergers of smaller galaxies** that had already formed stars ("bottom-up" scenario). Observations suggest that while some giant elliptical galaxies began forming very early, most matured only after many mergers over time. Spiral galaxies, by contrast, appear to have developed more complex structures in multiple phases, with disks forming later and still containing gas and dust for ongoing star formation.

Initially, matter in the universe was nearly uniform, but slight variations in density served as the **seeds of all cosmic structure**. Regions with slightly higher density exerted a stronger gravitational pull, drawing in more material and eventually collapsing to form irregular clumps and elongated filaments. These structures acted as scaffolding for the formation of galaxies, galaxy clusters, and superclusters. Over cosmic time, smaller structures formed first and merged to build larger ones — a process akin to assembling a giant framework piece by piece. The oldest and densest regions collapsed earliest, forming the first galaxies and clusters. In some cases, galaxy-galaxy collisions triggered bursts of star formation and the growth of supermassive black holes at galactic centers

As small galaxy fragments assembled under gravity, they gradually built up the **larger systems** we observe today. Tiny clumps of matter that were once the size of star clusters or dwarf galaxies merged into larger galaxies and eventually into clusters and superclusters. Observations indicate that these processes continue to shape the universe: galaxy clusters are still gathering members, and gas continues to flow along cosmic filaments into existing structures. This hierarchical growth — from small to large — under the influence of dark matter and gravity illustrates how cosmic structure evolves across billions of years

These passages are adapted from:

Informal technical text

The price of this simplicity was that an Autoverse bacterium didn't necessarily behave like its real-world counterparts. A. lamberti had a habit of confounding traditional expectations in bizarre and unpredictable ways—and for most serious microbi-ologists, mat was enough to render it worthless. For Autoverse junkies, though, that was the whole point.

Maria brushed aside the diagrams concealing her view of the Petri dishes, then zoomed in on one thriving culture, until a single bacterium filled the workspace. Color-coded by "health," it was a featureless blue blob; but even when she switched to a standard chemical map there was no real structure visible, apart from the cell wall—no nucleus, no organelles, no flagella; A. lamberti wasn't much more than a sac of protoplasm. She played with the representation, making the fine strands of the unraveled chromosomes appear; highlighting regions where protein synthesis was taking place< rendering visible the concentration gradients of nutrose and its immediate metabolites. Computationally expensive views; she cursed herself (as always) for wasting money, but failed (as ..always) to shut down everything but the essential analysis software (and the Autoverse itself), failed to sit gazing into thin air, waiting patiently for a result.

Instead, she zoomed in closer, switched to atomic colors (but left the pervasive aqua molecules invisible), temporarily halted time to freeze the blur of thermal motion, then zoomed in still further until the vague specks scattered throughout the workspace sharpened into the intricate tangles of long-chain lipids, polysaccharides, peptidoglycans. Names stolen unmodified from their real-world analogues— but screw it, who wanted to spend their life devising a whole new biochemical nomenclature? Maria was sufficiently impressed that Lambert had come up with distinguishable colors for all thirty-two Autoverse atoms, and unambiguous names to match.

She tracked through the sea of elaborate molecules—all of them synthesized by A. lamberti from nothing but nutrose, aqua, pneuma, and a few trace elements. Unable to spot any mutose molecules, she invoked Maxwell's Demon and asked it to find one. The perceptible delay before the program responded always drove home to her the sheer quantity of information she was playing with—and the way in which it was organized. A traditional biochemical simulation would have been keeping track of every molecule, and could have told her the exact location of the nearest altered sugar almost instantaneously. For a traditional simulation, this catalogue of molecules would have been the "ultimate truth"—nothing would have "existed," except by virtue of an entry in the Big List. In contrast, the "ultimate truth" of the Autoverse was a vast array of cubic cells of subatomic dimensions—and the primary software dealt only with these cells, oblivious to any larger structures. Atoms in the Autoverse were like hurricanes in an atmospheric model (only far more stable); they arose from the simple rules governing the smallest elements of the system. There was no need to explicitly calculate their behavior; the laws governing individual cells drove everything that happened at higher levels. Of course, a swarm of demons could have been used to compile and maintain a kind of census of atoms and molecules—at great computational expense, rather defeating the point. And the Autoverse itself would have churned on, regardless

(an excerpt from Greg Egan’s book: *A permutation city*)