

What is life?



People who know me well, know that I'm a bit of an armchair philosopher, and that I love to think about the big picture... And usually late at night over a bottle of scotch

Tonight, I'm going to address the not so simple question of What is life?



The point of this presentation isn't so much to answer this unanswerable question but to offer a series of rational thoughts and pose further questions around the subject that might lead to new perspectives...

I'm going to ignore the more spiritual aspects of this question...



Order / Disorder

Freeman Dyson, one of the great physicists of the 20th century once stated that.... “Life is a conspicuous example of a process involving an intimate mixture of order and disorder”



But why are some bits of physical matter, like this boy, more highly ordered and complex than others, such as this seedling that he's holding?

Now for the fun part let's look at some physics for some clues...



The Second Law of “Everything?” (Thermodynamics)

The 2'nd law of thermodynamics has sometimes been referred to as the second law of everything...

It is a universal law of physics which essentially states that:

Energy spontaneously tends to flow only from being concentrated in one place to becoming diffused, dispersed and spread out.

(Yet, this law of nature that must be seemingly countered to create the highly ordered structure of our physical reality here on earth.)



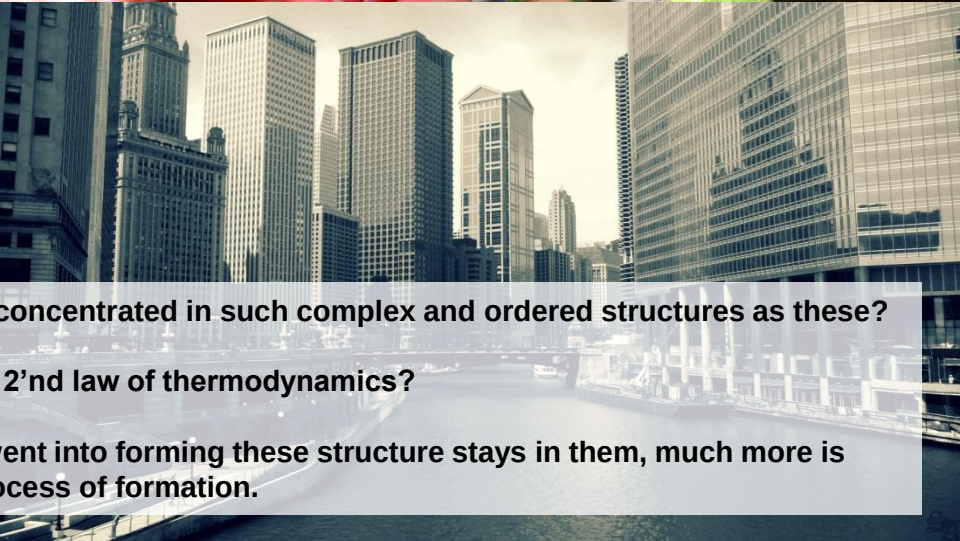
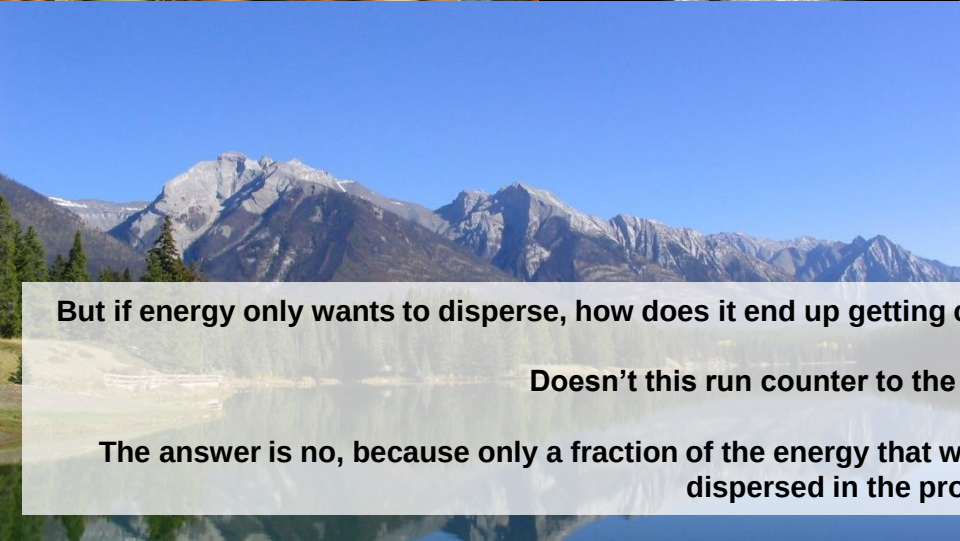
For example, the highly ordered matter of these trees and their embodied energy is being very rapidly dispersed into the environment through the catalyst of fire.

The end state is much more disorderly than the initial state.



Here, the concentrated energy embodied in the structure of this iron chain is gradually dispersing into the environment through the process oxidation and rust.

Eventually it will rust away completely as it's energy comes fully into equilibrium with the environment around it.



But if energy only wants to disperse, how does it end up getting concentrated in such complex and ordered structures as these?

Doesn't this run counter to the 2nd law of thermodynamics?

The answer is no, because only a fraction of the energy that went into forming these structure stays in them, much more is dispersed in the process of formation.

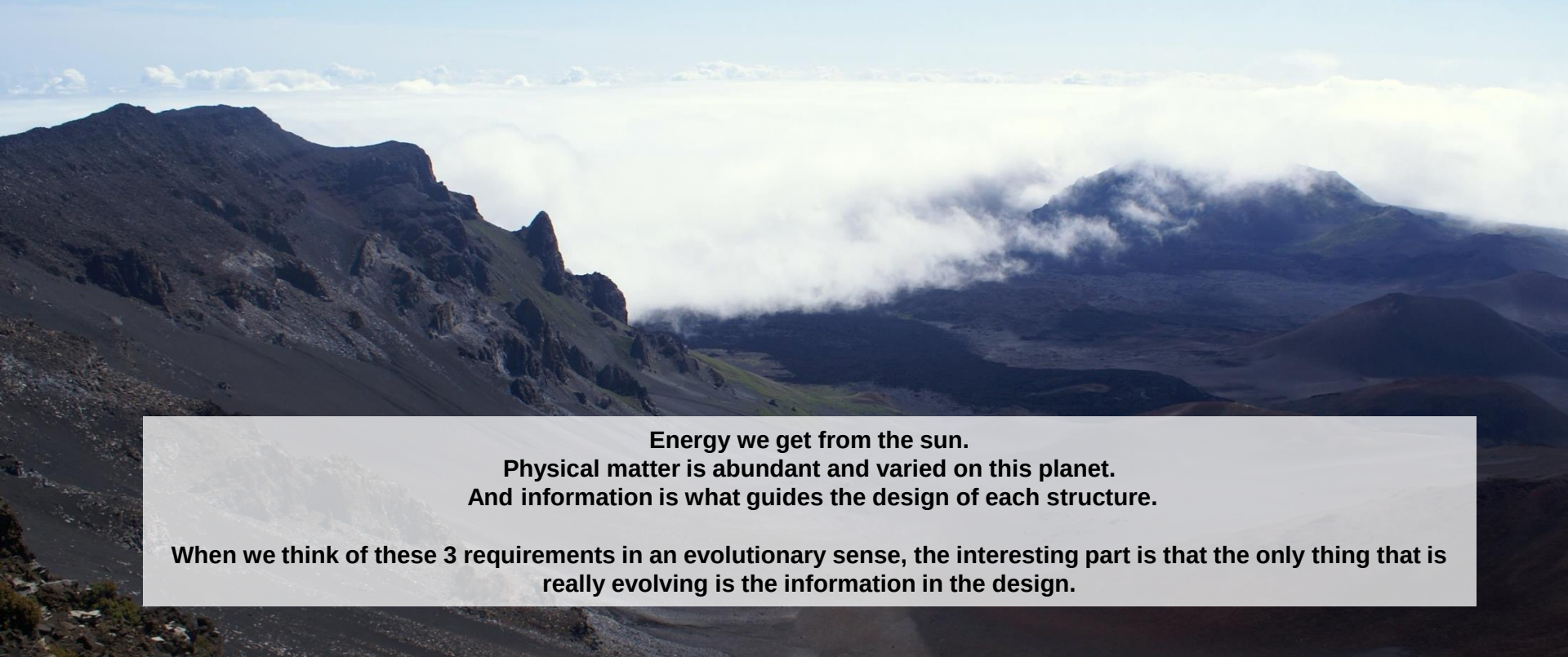


For example, this cliff of columnar volcanic basalt was once a field of molten lava that cooled and crystallized into these relatively orderly columns, but today it contains only a small fraction of the energy went into forming it.



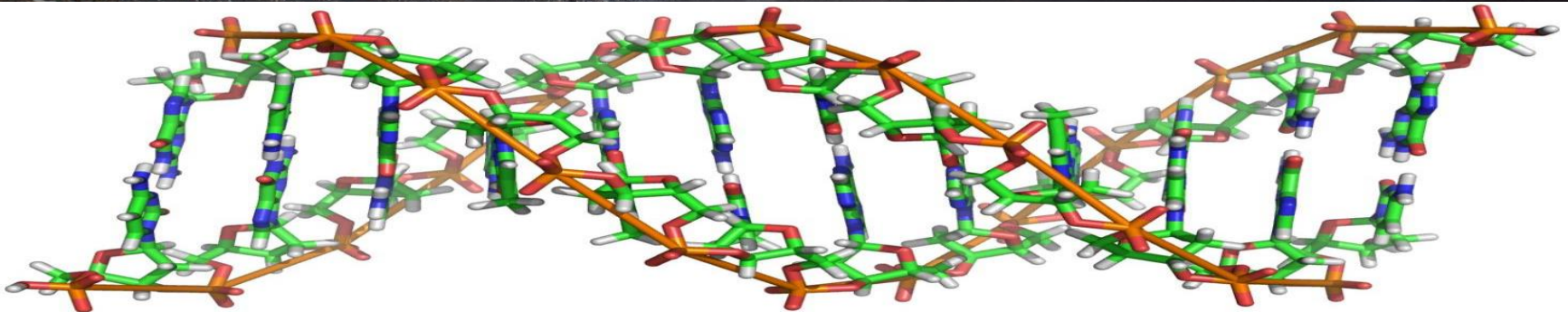
**But why is there an evolution of matter into more highly ordered and complex structures?
And what is required for this evolution to occur?**

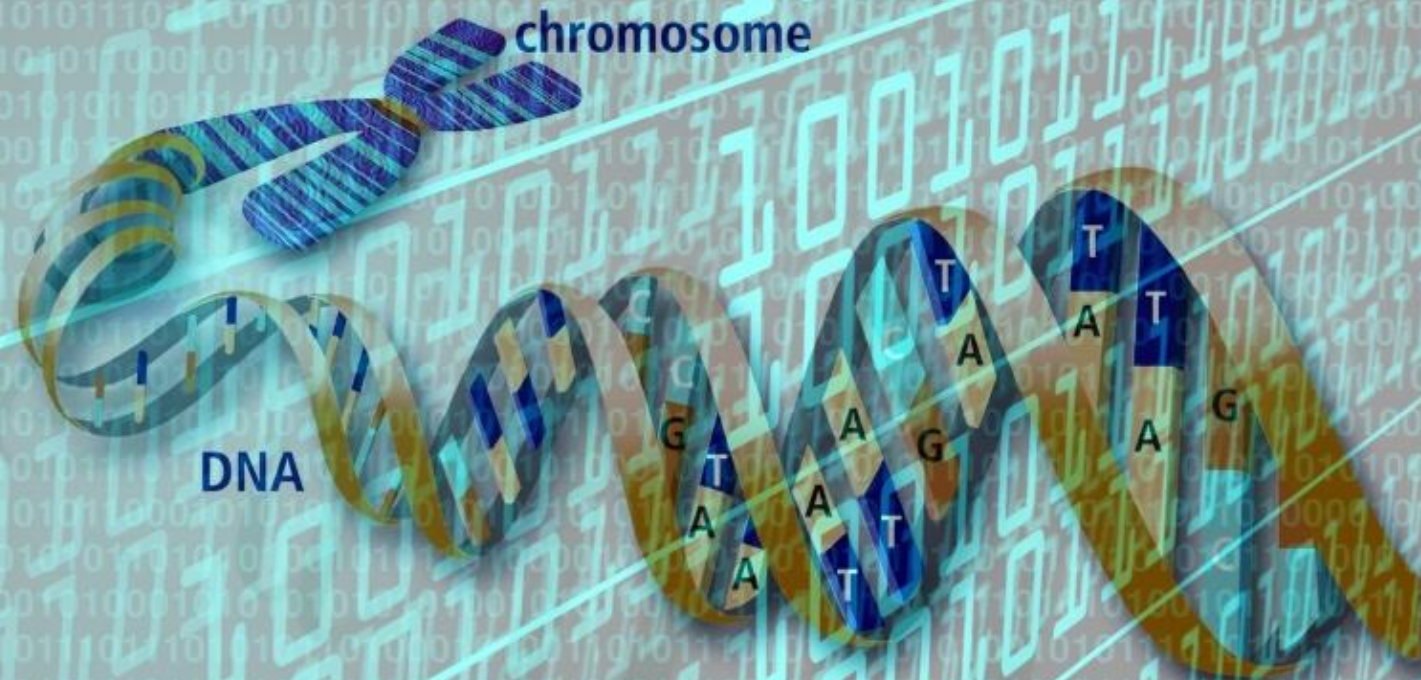
The most basic requirements would include energy, physical matter, and information (knowledge).



**Energy we get from the sun.
Physical matter is abundant and varied on this planet.
And information is what guides the design of each structure.**

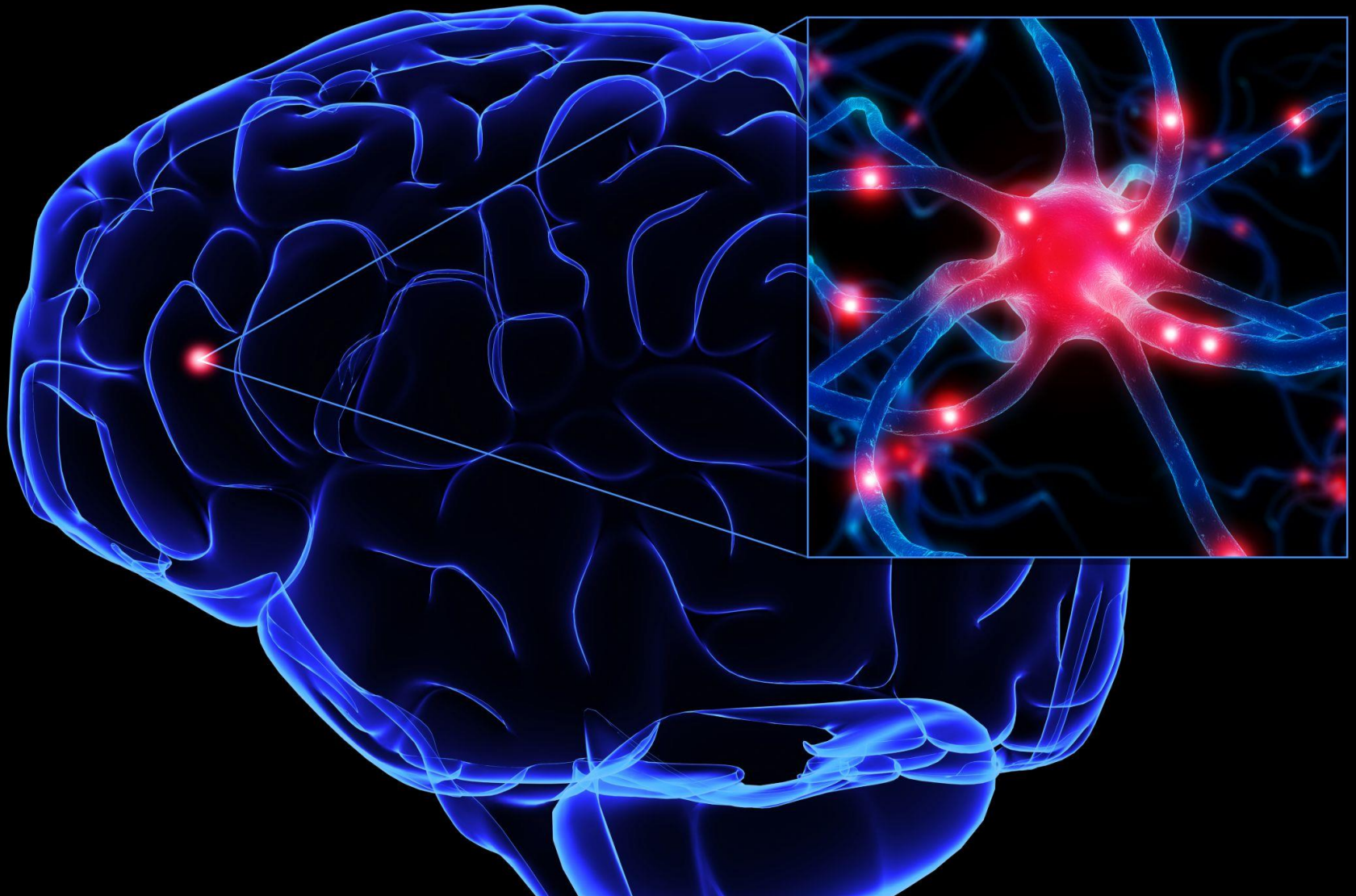
When we think of these 3 requirements in an evolutionary sense, the interesting part is that the only thing that is really evolving is the information in the design.





Could information be nothing more than the patterned arrangement of matter such as we find in the molecular structure of DNA in all life forms?...Patterns which can be decoded and saved digitally on the silicon substrate of a microchip?

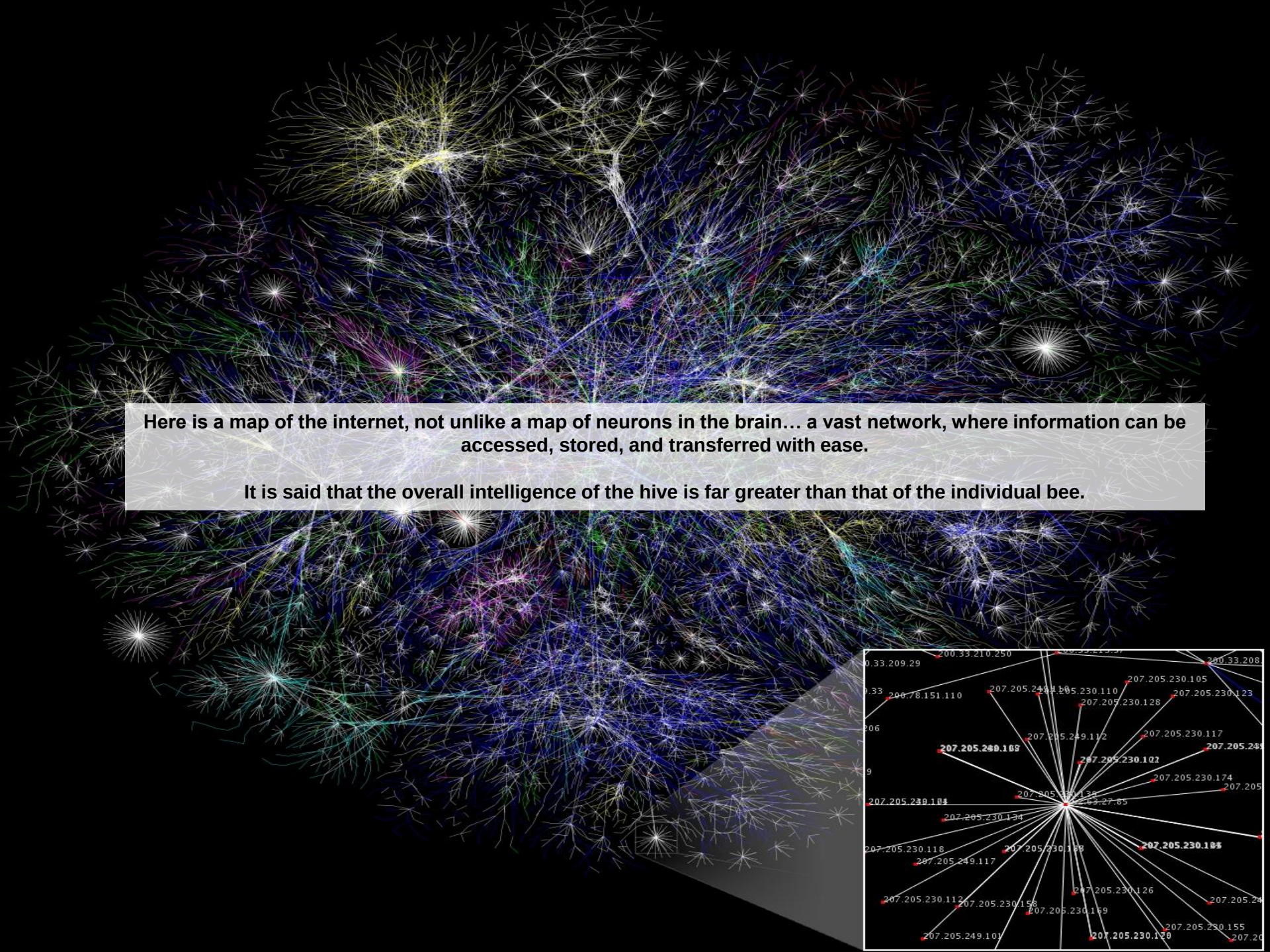
A type of pattern that influences the formation and transformation of other patterns?



How far can information evolve? Are there physical constraints that limit this?

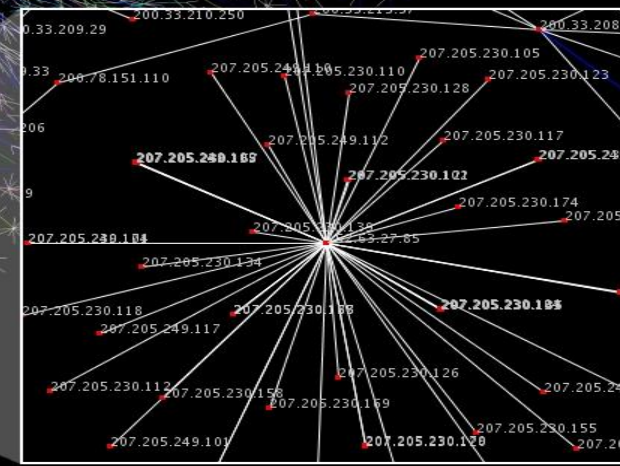
The human brain is arguably the most complexly structured piece of matter on Earth, but it's been postulated that it has reached its evolutionary limits.

Yet new information and knowledge is created daily...



Here is a map of the internet, not unlike a map of neurons in the brain... a vast network, where information can be accessed, stored, and transferred with ease.

It is said that the overall intelligence of the hive is far greater than that of the individual bee.



1 The accelerating pace of change ...

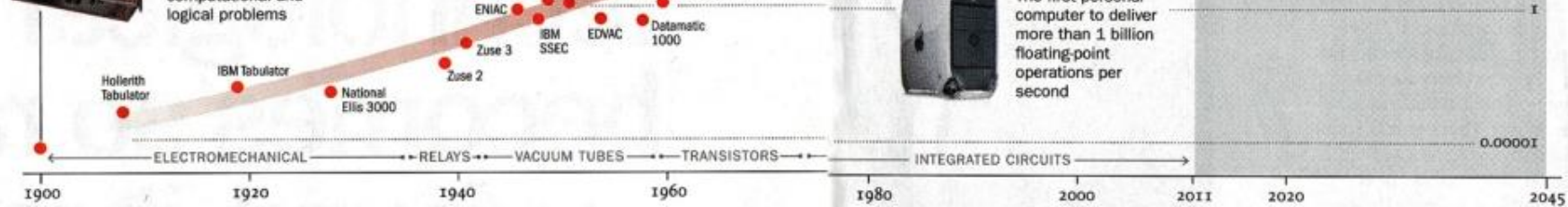
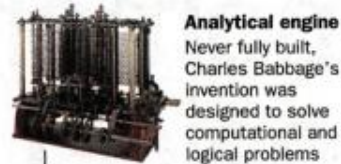


2 ... and exponential growth in computing power ...

Computer technology, shown here climbing dramatically by powers of 10, is now progressing more each hour than it did in its entire first 90 years

COMPUTER RANKINGS

By calculations per second per \$1,000



3 ... will lead to the Singularity



Futurists like Ray Kurzweil have extrapolated current growth rates in computing power, predicting that computer processing power will surpass human brainpower in about 12 years...(2023!) after that we're supposedly into science fiction territory where technology will begin to design itself and evolve on it's own as a sort of natural extension of biological evolution.

This is an intriguing proposition, but it does not address the fundamental epistemological questions of how knowledge is actually created in the human mind. The ultimate process will involve more than adding processing power and memory to current software systems.



Putting aside speculations for now, we're still left with the basic existential question.

Why are these evolutionary processes happening at all?

Basic thermodynamics tells us energy wants to disperse, as in the example of a hot cup of tea cooling down to room temperature.

But basic thermodynamics also tells us that energy will disperse by the fastest route possible... so if this was an insulated cup most the heat energy would be lost from the top rather than the sides.

Basically, the universe looks to destroy energy gradients by the fastest route possible...





And it turns out that life is one of the best ways to do this.. and the more complex the structure, perhaps the more energy that is dispersed in creating and maintaining it...

So perhaps life and evolution are inevitable given the right conditions...



But where does that leave us philosophically speaking...?

Could our very existence and evolution be the result of a universal law of nature which seeks to maximize energy dispersal?

Perhaps, but now that we humans are on the scene and creating new knowledge and information outside the bounds of the evolutionary process, we need no longer be led by the 2nd law of thermodynamics, even if we are still bound by it.