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Idaho Falls, ID  
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The astronomer and cosmologist, Carl Sagan, is reported to have said “If you wish to make an apple pie from scratch, you must first invent the universe.”

That’s just a little food for thought as we proceed to invent the universe starting with the Big Bang theory—which I like to refer to as the scientific creation myth. I use ‘myth’ in the sense of a story which explains our understanding of how things came to be as they are. I will traverse the stream of evolution using as stepping stones the major processes that science has identified were involved in cosmic as well as biological evolution. But first a bit of Big Bang lore.

When asked what existed before the Big Bang (BB) physicist Steven Hawking responded “the question is meaningless since there was no ‘before’—time began with the BB” (my paraphrase). Former astronaut, Edgar Mitchell, disagreed with Hawking when he said that ‘the *potential* for the BB was preexistent’. I’ll have more on ‘potential’ later.

The approach I have taken is philosophical rather than scientific and the processes I have selected are not all-inclusive so I’m sure a review by professional cosmologists and evolutionary biologists would most likely come up with a different set but here goes.

In roughly the order of occurrence the processes are:

EMERGENCE, GROWTH, TRANSFORMATION, SEED FORMATION, SELF-ORGANIZATION, AGEING, DEATH, TRANSFORMATION-DISPERSION, REPEAT.

**EMERGENCE:** From nothing (science calls it a singularity, a super-massive point of zero extent; in common parlance a mystery), emerged a blast of pure energy.

**GROWTH:** The energy field grew rapidly to humungous size creating space and time as it expanded.

**TRANSFORMATION:** As the energy cloud expanded it began to cool until metaphorically it eventually reached the equivalent of a dew point temperature and it starting raining hydrogen.

**SEED FORMATION:** Via some mysterious process, perhaps turbulence in the hydrogen cloud, or some quantum disturbance or maybe miniature black holes emitted with the blast of energy, gravitational seeds or centers of gravity formed.

**SELF-ORGANIZATION:** The gravitational attraction of the seed(s) caused the nearby hydrogen to begin collapsing until a spherical ball of hydrogen was formed. The collapsing mass became denser and hotter until a fusion reaction was triggered and a star was born. This process was repeated throughout the gigantic hydrogen cloud creating millions nay even billions of stars. After a few billion years stars began to self-organize into structures we call galaxies the spiral shape being the most noteworthy.

**AGEING:** As some of these stars aged they consumed their central supply of hydrogen and imploded.

**DEATH AND DISPERSION:** The implosion of the star resulted in a spectacular explosion, a super nova, scattering its material including the heavier elements created in the star's interior throughout the nearby space.

**SELF-ORGANIZATION:** After a few billion years the debris from a series of super nova explosions self-organized into our solar system with its central star and orbiting planets with moons, asteroids, comets, meteors and miscellaneous debris.

**EMERGENCE:** After a billion years or so single cell living organisms emerged on earth.

#### **GROWTH AND TRANSFORMATION**

These single cell organisms grew in number and transformed into many different types with different characteristics including self-replication.

**SELF-ORGANIZATION:** Single cells began to self-organize into multiple cell organisms beginning the long chain of evolution leading to the present ecosphere of great diversity in which we live.

**TRANSFORMATION VIA MUTATION:** Charles Darwin's theory of evolution tells a story of cell mutation leading to variation in species with those variants with the greatest ability to survive passing on their genes to future generations. This is the process of natural selection. The history of this billion year process is recorded in the molecular structure within living cells we call genetic material the heart of which is DNA—the blueprint of life.

**THE HUMAN FACTOR:** It is very intriguing to compare individual human pro-creation and growth with the cosmic story just outlined.

We humans begin as a very tiny single cell organism called a zygote or fertilized egg cell—what we might call a human singularity. These early cells are all alike and divide and multiply for a few weeks when transformation sets in and the cells begin to change into specific types which self-organize into various organs and tissues in accordance with the information encoded in each cell's DNA. In about 9 months a fully formed human baby emerges from its mother's womb into the outside world.

The universe is characterized as expanding from the BB to its present size with the rate of expansion approaching the speed of light the farther we look into space. A human singularity expands, slowly at first with increasing speed near delivery, from a single cell to about 500 billion cells in 9 months, an average expansion rate of 22,400 new cells per second, which could be called a mini-bang. The baby grows as it ages until it becomes a fully grown adult embodying according to various estimates 10 trillion to 100 trillion cells (the estimated number of stars in several thousand milky way galaxies). Aging goes on with increasing deterioration of structure ending in death and ultimate dispersion of the remains into the environment. The processes included in this story are conception, growth, transformation, self-organization, emergence, ageing, death and dispersion. In summary, the developmental life span of we humans parallels the origin and development of the entire universe. An interesting observation from this scenario is that life does not begin at conception. The sperm and egg cells that form the zygote each come from living donors who came from living donors who came from living donors all the way back to the very beginning of life itself

**POTENTIAL:** At the beginning of this talk I mentioned former astronaut Edgar Mitchell's comment that the potential for the Big Bang preceded the BB itself. The potential or necessary set of pre-conditions for any event,

always precedes that event. We could speculate that the singularity from which the BB emerged contained all the necessary information or cosmic DNA for the creation of the entire universe and everything that has evolved within it. This idea of evolutionary potential has given rise to the concept that everything that exists, living or inert matter, has an inside and an outside. The outside is the objective reality that science studies. It is our physical body. The inside can be and has been characterized in many ways as spirit, soul, mind, innate nature, physical and chemical properties, and more recently as evolutionary potential. We think of the inside of ourselves as our subjective nature-our thoughts, emotions, and aspirations. Religion, psychology and philosophy focus on our inside nature. One spiritual teacher calls the creative potential we all feel in our very bones as the *evolutionary impulse* and refers to his students as evolutionaries.

The Hindu genesis holds that creation emerges from the ground of being with two interconnected principles, the material energy principle (the outside) and the spiritual energy principle (the inside) which devolve into the living universe. These principles propel the devolution into the densest state of materiality when evolution takes over and begins the journey back to the source via evolving states of higher consciousness.

If you trace the development of consciousness-the way we think and perceive the world-of each individual as we age you will find that it mimics the processes of consciousness development through human history as chronicled by many scholars.

Today we seem to be at the turning point where religion, spirituality and science have reached a crossroads or, more appropriately, a chaotic mixing ground. Humanity has now become aware of its evolutionary history and in effect we are now conscious of and therefore in charge of our future evolution. Physicist John Wheeler has postulated that we live in a 'participatory universe', a universe in which the human mind participates in the creative process. We know we are made of star stuff, the very atoms making up our cells having been forged in the fusion fires in the heart of stars. Human consciousness has evolved along with our biology and in effect We are the universe becoming aware of itself.

So now that we have invented the universe lets make that apple pie.

