February 1, 2019

J O U R N E Y O F T H E U N I V E R S E

By Peter C. Goldmark, Jr.

This poem was inspired by, and is intentionally derivative of, Journey of the Universe.
So in that sense Brian Thomas Swimme and Mary Evelyn Tucker are the "god - parents" of the poem, as well as authors of the original, powerful work which inspired it.

If in the snow you found an acorn

And you had never seen an oak,

Is there any way you might

Imagine what that knobbed and rounded

Small nut might become in time?

There is not.

And so it is

With a bigger mystery

That has the same ingredients:

Become, imagine, time – and you.

There is no way that you and I

Can imagine what preceded

The earliest thing we've learned about:

The big explosion, that huge bang,

Measured to be more than fourteen

Billion years –those tiny units

We use every day - before

Our moment now and here.

* * * *

And if we conceive fourteen

Billion years as just one year,

Then we curious *homo sapiens* –

Galloping on the wide savannah;

Sailing around the globe in ships;

Building machines that think a lot

Faster than our small brains can;

Going to the moon; and heating

Our earth beyond what we can live with -

Then we curious, self-describing

Animals have been around

For just seven minutes of it.

And in those few minutes since man

Appeared, we - our generation –

Learned to understand the grandeur,

To explore the origins,

Physics and complexity of

That deep unfathomed harmony --

The universe in which we live.

* * * *

Our planet orbits round our sun,

Itself one of trillions of stars

Strewn in billions of galaxies

Across an unfinished universe.

The universe is more than space;

The universe is a story –

A story we learned in the last

Seconds of seven minutes here.

The Milky Way is the universe

In the form of a galaxy;

An orchid is the universe

In the form of a single flower.

And when we look in the dark night

And reflect on its deep beauty,

We also are the universe,

Reflecting in peace on itself.

* * * *

From a central intensity

Whose strength we cannot comprehend

Flared forth oceans of light, plasma

And energy. And at that single

Moment began also time as

We learned to know and measure it,

As well as luminous matter

And dark matter, hurled across

The pulsing chaos we call space.

Some matter became galaxies

And stars; some matter still unseen

Stayed invisible but helped

No less to shape the universe.

And like the two related forms of

Matter, there were two related

Forces operating as one

In space: explosive expansion

Driving the unseen edges of

The universe out and away;

And gravity and compression

Creating in the same force field

Stars and galaxies - and our sun,

On one of whose spinning planets

We became creative sparks,

Small sensate nanonanimals

In fourteen billion years of time.

* * * *

How could it happen that the pace

Of expansion of the new-born

Universe attained exactly

A speed just slow enough to keep

From flying apart but also just fast

Enough to keep from collapsing

And compressing itself to death?

It means the speed of expansion

Did not by chance sneak in between

Other speeds with potentially

Destructive results. It means a

Single system was unfolding

Toward a unified destiny

With only one path and one speed,

And no others possible.

The universe did not slip through

A crack between two speeds either

Of which would have been fatal.

As tree limbs grow out from a trunk,

Those two speeds came to exist,

Resembling possible options,

Only after the universe

Had already begun to spread

Along the one pre-destined course

Contained within, unfolding from

That primordial explosion.

* * * *

After half a million years

(Twice the length of time that we

Have been here as *homo sapiens*)

The universe consisted of

A thick, jelly-like, opaque plasma -

A molten red-hot collection

Of nuclei and unattached

Electrons floating in the soup,

The whole aglow with all the light

Trapped inside, and clumped in chunks

By the presence of dark matter.

The expansion and the cooling

Caused a phase-based rearrangement,

And the protons and electrons

Came together to form the first

Simple atomic elements.

And this is when the universe

Transformed itself from plasmic soup

To billowing clouds of larger atoms.

And still today we do not know:

Why do protons and electrons

Attract and balance each other?

We know that then the universe

Became transparent and photons

Of light could travel in straight lines

For enormous distances.

* * * *

From the earliest moments when

We roamed the plains of Africa,

We imagined ourselves to be

Always at the center of

Whatever universe we thought

We occupied at that moment.

All sensation, instinct and thought,

All song and all observation

Came from within that universe.

Thus when the limits of whatever

World we knew grew by ten miles

Or by billions of light years,

The center of the universe

Remained, by definition, us.

The speed at which all this learning

Happened in the last century

Was enough to make us feel

Small and perhaps temporary.

The first voices who suggested

That our planet rotates around

The sun were quickly brushed aside

And silenced – for a little while.

Then we learned that we were part

Of a solar system strung out

Neatly around our special star.

And next our scientists found that

Our sun was in the Milky Way,

A spiral galaxy that can

Give birth to other stars and thus

Even to other galaxies.

Then we learned there were a hundred

Billion galaxies, and that

Ours belongs, like others, to

A cluster of galaxies that forms

A small part of a supercluster.

Mirroring our experience

Each galactic supercluster

Lies at a centerpoint around

Which the universe expands.

The idea of center has now

Totally changed. And we remain,

Knowing we are not the center,

Feeling and living as if we are

Because we think, and sense, and sing.

* * * *

Forms and patterns of creative

Disequilibrium are found

Scattered throughout the universe.

And the phases of the life

Of each individual star

Gave birth to planets as ours did.

* * * *

Gravitational attraction

Between atomic particles

Drives the mass of each new star

To collapse on itself. And there

Nuclear fusion, where the protons

And neutrons melt and thus release

Energy, explodes the matter

That gravity sought to compress.

If either force predominates

The star's life then comes to an end.

The creative tension between

These two fundamental forces

May last for billions of years. And in

That cycle a sequence occurs

That can lay the basis for life.

Nuclei repel each other,

But if gravitational force

Is stronger than this resistance,

Protons and neutrons in adjacent

Nuclei are forced so close

That they will fuse into the stable

Form of a different nucleus.

And so hydrogen nuclei

Fuse into helium nuclei;

And then the helium nuclei

Combine as carbon nuclei,

And the carbon nuclei

Can then fuse into oxygen.

And the process continues on

To form more complex elements

Until iron is formed, at which

Point the process changes because

Iron releases no energy

When iron's atomic centers fuse.

The energy of implosion

Then becomes so powerful that

Protons and electrons are

Crushed together to form neutrons.

This sets off a great reversal:

A supernova explosion.

The hyper-concentrated dot

Of neutrons now explodes outward

With the brilliance of a hundred

Billion stars, which in turn triggers

A new and dominating cycle

Of sustained nucleosynthesis,

Forging the nuclei of all

The universe's elements.

* * *

The newly fused elements

Cooled into dust and were hurled or

Drifted through the universe.

And these planetesimals

Collided and accreted, grew

Until planets like ours were formed.

And when we watch a meteor

Shearing through the starlit sky,

We see that the process which

Made the earth continues still.

* * * *

As the planetesimals

In our solar system went through

The hail of pebble accretion,

Two planets emerged with the same

Structure –but different outcomes.

Mars froze – but Earth did not. Its core,

Largely molten metals like

Iron and nickel, was surrounded

First by a soft mantle, and then

On the surface a thin, hard crust.

Intense pressure of gravity

In the core, and heat produced by

Radioactive decay

Gave rise to flows of hot magma,

Some of which broke through the crust

As plumes of molten, flowing lava.

As it cooled and solidified

The magma descended back to

The center of the planet in

A cycle that moves continents

And continues to this day.

* * * *

When the earth collided with

Another large emerging planet,

The moon was ejected and cooled

Into rugged, frozen terrain.

At that time the moon was closer

To the earth, which was rotating

At a speed that made a day

Only five hours long. Since then

The earth has been slowing down, the

Moon drifting further out in space.

* * * *

The sun converts its hydrogen

Into energy and helium.

A sliver of the shining wave

Of light and energy pouring

Out from the sun reaches the earth –

And enables everything

The earth has become: the early

Phase of life in the form of plants;

The planetesimals crashing

Into our planet, bringing with

Them water and new elements;

The diurnal cycle of light

That allows the earth to heat and

Cool within a narrow band that

Favors complex forms of life.

* * * *

Earth's early days were chaotic.

Oceans boiled up into steam.

Dust raised by crashing asteroids

Blocked out the sun and oceans froze.

After millions of years more stable

Conditions emerged at last

For rock, water and air. Great seas

Encircled the globe, held by a

Thin layer of atmosphere. And in

This precarious, double embrace

The earth brought forth a living cell.

* * * *

One-cell beings have existed

On earth for several billion years;

Multicellular creatures for

Several hundred million years.

The first cells were a simple kind

Of bacteria living by

Heat vents on the ocean floor.

Some of them developed into

More complex but still unicell

Organisms with nuclei -

And suddenly the race was on.

The vast profusion sped and widened

And soon there were different kinds

Of algae – some that “swam”, others

Became fish, then lizards on shore,

Wolves in the forest and primates

Running and hunting on the plains.

Why on earth? We don't really know.

* * * *

Patterns are key. And in the physics

Of our universe basic

Patterns can occur anywhere.

Take the whirlpool - - a basic pattern

That can appear anywhere that

There is a flow and a barrier.

Some of these self-organizing

Patterns appear in nested form:

Perhaps the largest dynamic

Structure in the universe is

That of a galaxy. Within

A galactic structure we can

Find self-organizing stars, and

Within their spheres self-assembling

Planets such as Earth with its own

Organizing substructures like

Hurricanes or whirlpools. And in

The framework of these patterns lay

The possibility of other

Self-organizing systems that

"Lived" to regenerate themselves.

The universe began with a

Great outpouring of cosmic breath

That refined and complexified

Into differentiated

Substreams that could cohere and burst

Forth as meadows and forests with

Nesting doves and fireflies.

What leads to such complex swirlstreams

Of energy? Is it random?

Is it natural? Or is it

Miraculous? Is there between

These three words any difference?

* * * *

After the development of

Simple cells, the most powerful

Step of interconnectedness

Was the emergence of molecules

That could resonate with sunlight.

Like tuning forks shaped to vibrate

In the presence of certain music,

Chlorophyll molecules glow when

Sunlight falls upon them. Did life

Find a way of growing stronger

By harnessing the sun's photons?

Did sunlight's energy pattern

Open up a path for life?

We will probably never know

How many still-born molecules

The earth tossed forth before there came

Chlorophyll molecules now in

The leaves of every tree on earth.

Chance and differentiation;

Accident and need, coherence,

Chaos of winners and losers.

* * * *

As it expanded life became

More than epiphenomenal

On the earth. It slowly became

A serious partner in the

Evolution of the planet.

The earth is not just a big ball

On which living things come and go.

Living things and the atmosphere,

The oceans, the crust, the mantle

And the cores are all part of

A creative community

That has the chance age after age

To reorganize itself

Through its crucial capacity

To adapt and then remember.

* * * *

Our food, for example, is composed

Of many complex different parts.

When we ingest they need to be

Broken down and then rewoven

Within our body in different ways

To give us energy to live.

This complex physiological

Process was worked out by trial

And error over hundreds of

Millions of years by multicellular

Ancestors that have disappeared.

But their accomplishments are etched

In our cells and genes, and so grain

Can feed us only because life

Remembers its own achievements.

Genetic coding in our cells

Handed down through generations

Allows us to transform the grain

Of our fields into flesh and blood.

* * * *

The energy of our lives comes

From the original flaring

Forth at the universe's birth.

The atoms of our bodies were

Made when ancient stars exploded;

And the patterns of our lives come

From many ancestors over

Billions of years. Life remembers,

Life adapts; our consciousness

Is a tool through which life learns.

* * * *

As we discover old patterns

And organize new ones across

The generations, we try to

Cope with violence and destruction.

What is the violence of the hawk

That plummets down from the blue sky

And kills the lizard on the rock?

What is the violence of the state

That sends an airplane filled with bombs

To destroy an entire city?

Who are winners? Who are losers?

Patterns are by definition

Equilibria of forces,

Stable or unstable, spreading

Or deteriorating. What is

Progress? What is decay? What is

The difference? And how could one

Short-lived animal decide such

Questions in the blink of an eye?

* * * *

We live in a universe

Where choices must be made. Some things

Are better than others and are

Preferred, which always causes strife.

The male bowerbird tries to build

A beautiful nest; the female bird

Decides if he has succeeded.

The male stickleback fish dances;

The female stickleback decides

If his dance offers the quality

She needs to raise a family.

* * * *

Our human odyssey began

Six or maybe seven million

Years ago with a few hundred

Thousand chimplike monkeys living

In the center of Africa.

The forests, with abundant foods,

Were drying out. One group of apes

Stayed in the forests; but another

Moved to the growing savannah.

Their developed skills for swinging

Through the trees were of no use

Under the blazing sun, where they

Were hunted by new predators.

Our ancestors adapted in

Two key ways: bipedalism

And a brain that grew much bigger.

Six million years after their move

Onto the great savannahs, human

Brains had grown to more than three times

The size of those of forest apes.

And from this strange new starting point

A new adventure would unfold.

* * * *

A few hundred people out of

A tribe of five or ten thousand

Moved out of Africa completely.

They crossed the Red Sea. Some moved down

Around the coast to India.

Some stopped in the mid-East; others

Continued to Europe. And some

Spread across the Eurasian steppes

And even crossed the Bering Straits

Down into the Americas.

We will never know the complete

History of that exodus.

What we do know is that a few

Hundred men, women and children

Spread and multiplied down through the

Centuries until this species

Populated every biome

And continent upon the planet.

* * * *

Beyond bipedalism and

Tripling the volume of our brains,

The ability to adapt

And learn meant humans had acquired

Behavioral flexibility.

Like the offspring of all mammals

Human children play. And humans

Improvise and experiment.

But then – all roughly in the same

Geological instant, humans

Learned to record outside themselves

What they found and what it might mean.

An early notched deer antler shows

The stages of the moon – humans

Learned to mark, keep and transmit

Facts, perceptions and feelings, and

Make a transgenerational

Base on which future humans could

Build new flexibility.

* * * *

Humanity's great invention,

Symbolic language, led to a

Whole new level of consciousness.

The universe reached a fever

Pitch in humanity that boiled

Over into words, art, numbers.

And so humans began to build

In different forms their legacy.

Listen to the words of Zhang Zai:[1]

"Heaven is my father and earth

Is my mother and even such

A small creature as I can find

An intimate place in their midst.

Therefore that which extends throughout

The universe I regard as

My body and that which directs

The universe I consider

As my nature. All people are

[1] From the *Western Inscription* by Zhang Zai, 11th century

My brothers and sisters, and all

Things too are my companions.”

* * * *

Humans became a planetary

Presence, and because the planet

Is a sphere there came a moment

When the most successful humans

Folded back upon themselves,

Meeting the one being that could

Match them – their faraway cousins.

After two hundred thousand years

Of life in hunter-gatherer bands

Humans then built fixed settlements

Near the richest river deltas.

When the universe folds back

On itself, it complexifies:

The birth of a star through compression

Forced simple atoms to produce

A hundred elements; lone cells

Close together learned slowly

To merge and then to specialize.

The first cities became cauldrons

For human creativity.

* * * *

When Newton wrote his formulae
For motion and for gravity
Around half a billion people
Were living on the earth. Today
There are fifteen times that number
And we have crossed over into
An earth whose atmosphere and whose
Biosphere are shaped by human
Decisions, thought and behavior.
The world of numbers and machines
And extraction and combustion
Is hostile to the natural world
And threatens to destabilize
The climate equilibrium
That has fed and sheltered us
Through the growth of civilization.

* * * *

Somewhere along the way we came
To the belief that matter and

The universe were passive, and

We were the only centers of

Creativity and willful,

Active interventionism.

And so modern society

Began to dismantle the earth's

Fragile, living ecosystems.

* * * *

We sense we are in a dark night.

How, with what, shall we navigate?

Now that we are changing the way

That the earth as a whole functions,

Can we change our path to one

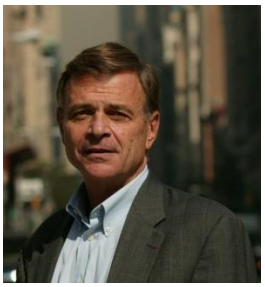
That on an Earth-wide scale will mesh

In harmony with the patterns

Of the universe that gave us

Birth, meaning, and consciousness?

* * *



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Peter Goldmark currently works as an independent consultant in the areas of philanthropy, environmental policy, international affairs and development, and organizational development in the social change field. He directed the Climate and Air program for Environmental Defense from 2003 through 2010. Prior to joining Environmental Defense, he was Chairman and CEO of the International Herald Tribune. Peter has had exceptional careers in both the public and private sectors. His public service was highlighted by his tenure as Budget Director for the State of New York during the 1970s city- and state-wide fiscal crisis where he was an architect of its rescue; and as Executive Director of the Port Authority of New York and New Jersey through to 1983.

He served as president of the Rockefeller Foundation from 1988 through 1997, encouraging its involvement in environmental issues, particularly as they related to energy.