

Cosmology & Culture

Lecture 10

Wednesday May 27, 2009

Taking our Extraordinary Place in the Cosmos

UCSC Physics 80C

Cosmic Waterfalls

Gravity separates from other 3 forces?

Grand Unified Theory? Strong, weak, and electromagnetic forces separate.

End of cosmic inflation

Matter-Antimatter asymmetry generated

Great Annihilations

Big Bang Nucleosynthesis – most of the fusion happens then

Atoms form, cosmic background radiation emitted

First galaxies form; their stars and quasars ionize the universe

First stars make first heavy atoms

Mature galaxies form, with enough metals to have rocky planets

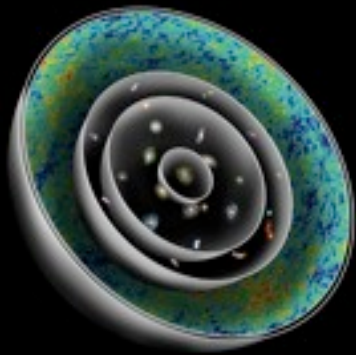
Life begins on rocky planets, creates oxygen atmosphere and sex

Big creatures evolve

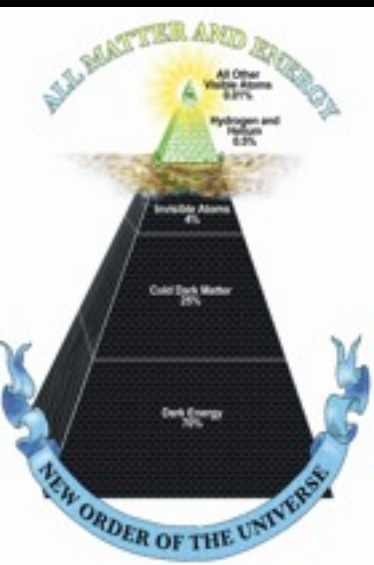
Intelligent life evolves, takes control of Earth

Next? Discovery of extraterrestrial intelligent life?

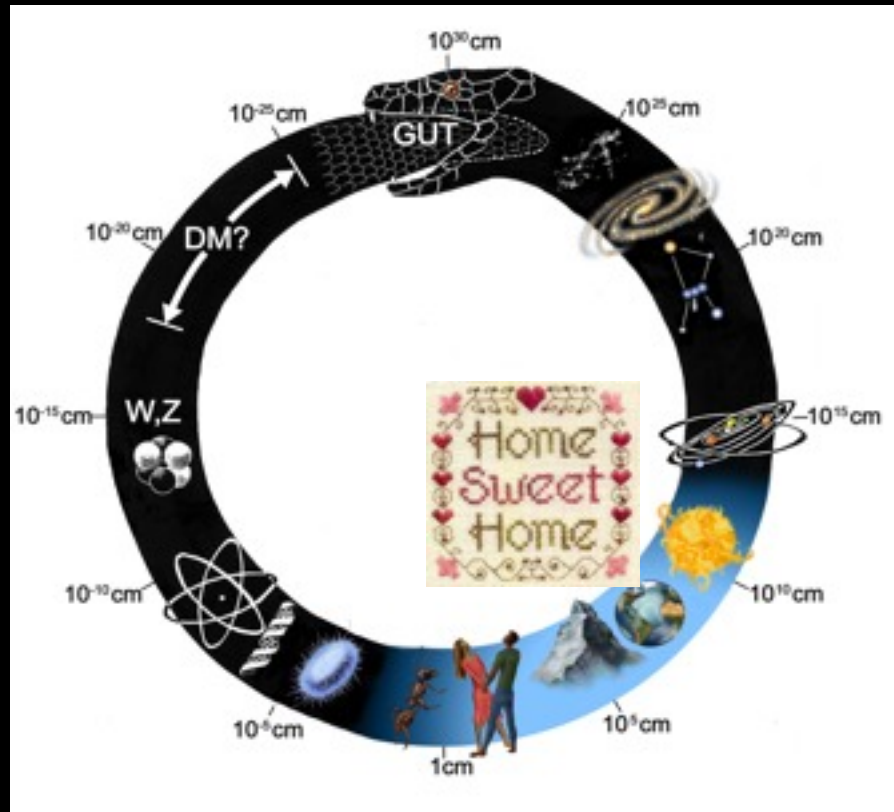
Human beings are central to the Universe not in a simple geographic sense but in at least seven different ways all of which follow directly from astronomy and physics.



1) We live at the center of our Cosmic Spheres of Time. The finite speed of light makes this inevitable.



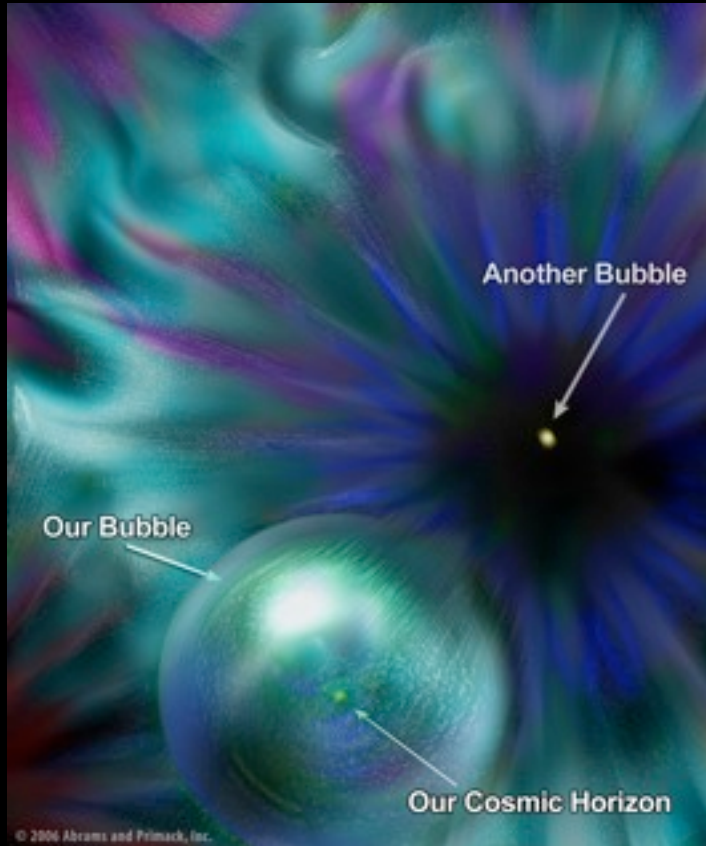
2) We are made of the rarest stuff in the universe: stardust.



3) We live at the middle of all possible sizes – in Midgard, where the possibility of tremendous variety and complexity coming in small packages keeps life interesting. Life of our complexity could bloom nowhere else on the Cosmic Uroboros.

4) We live in a universe that may be a rare bubble of spacetime in the infinite, seething cauldron of the eternal superuniverse.

Outside our unique and isolated bubble, which we call the Big Bang, there is neither space nor time as we know it. But here inside there is time for evolution and history, and there is space across which connections can form and structures can develop.



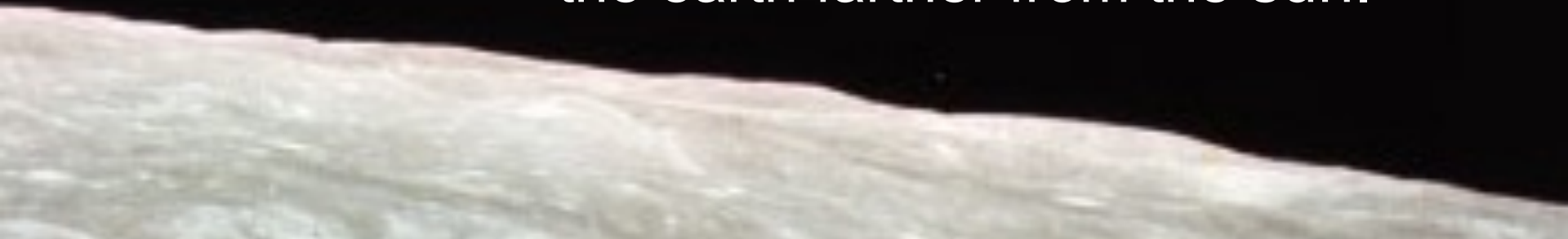
5) We live at the midpoint of time, which is also the peak moment in the entire evolution of the universe for astronomical observation. The most distant galaxies – which we have *just* acquired the ability to see – are beginning to disappear over the cosmic horizon now that the expansion of the universe has begun to accelerate.



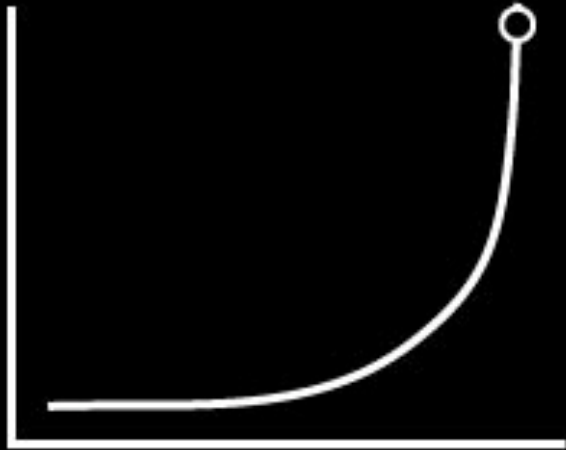
6) We live at the midpoint in the life of our planet. It formed, along with the sun and the other planets,

about four and a half billion years ago. It has about six billion years to go before it is roasted when our sun swells into a red giant star. Complex life evolved about half a billion years ago, and has about half a billion years to go until the warming sun overheats the earth.

Or billions of years if our descendants move the earth farther from the sun.



A Human Turning Point



7) From the point of view of our species, today is late enough to have evolved to our present abilities while early enough to have a multi-billion year potential future. For the generations alive at this moment, it is late enough that we are sobering up to the scale of our problems, but not so late that we have lost all chance to solve them. This is a very special time that will never come again.

Lynn White, Jr.: “The Historical Roots of Our Ecologic Crisis”

The leadership of the West, both in technology and in science, is far older than the so-called Scientific Revolution of the 17th century or the so-called Industrial Revolution of the 18th century. By A.D. 1000 at the latest...the West began to apply water power to industrial processes other than milling grain. This was followed in the late 12th century by the harnessing of wind power. From simple beginnings, but with remarkable consistency of style, the West rapidly expanded its skills in the development of power machinery, labor-saving devices, and automation....By the end of the 15th century the technological superiority of Europe was such that its small, mutually hostile nations could spill out all over the rest of the world, conquering, looting, and colonizing. The distinctive Western tradition in science...began in the late 11th century with a massive movement of translation of Arabic and Greek scientific works into Latin....By the late 13th century Europe had seized global scientific leadership from the faltering hands of Islam.

Human ecology is deeply conditioned by beliefs about our nature and destiny – that is, by religion. Christianity inherited from Judaism not only a concept of time as nonrepetitive and linear but also a striking story of creation: no item in the physical creation had any purpose save to serve man’s purposes.

Christianity is the most anthropocentric religion the world has seen. It insisted that it is God’s will that man exploit nature for his proper ends. The victory of Christianity over paganism was the greatest psychic revolution in the history of our culture. ...**In antiquity every tree, every spring, every stream, every hill had its guardian spirit. By destroying pagan animism, Christianity made it possible to exploit nature in a mood of indifference to the feelings of natural objects.**

I personally doubt that disastrous ecologic backlash can be avoided simply by applying to our problems more science and more technology. Perhaps we should ponder the **greatest radical in Christian history since Christ: Saint Francis of Assisi**. The present increasing disruption of the global environment is the product of a dynamic technology and science which were originating in the Western medieval world against which Saint Francis was rebelling in so original a way. Saint Francis proposed what he thought was an alternative Christian view of nature and man's relation to it: he tried to substitute the idea of the equality of all creatures, including man, for the idea of man's limitless rule of creation. We must rethink and refeel our nature and destiny. I propose Francis as a patron saint for ecologists.

Canticle of Brother Sun by St. Francis:

*Most High, all-powerful, all-good Lord,
All praise is Yours, all glory, all honour and all blessings.*

*To you alone, Most High, do they belong,
and no mortal lips are worthy to pronounce Your Name.
Praised be You my Lord with all Your creatures,
especially Sir Brother Sun,
Who is the day through whom You give us light.
And he is beautiful and radiant with great splendour,
Of You Most High, he bears the likeness.
Praised be You, my Lord, through Sister Moon and the stars,
In the heavens you have made them bright, precious and fair.
Praised be You, my Lord, through Brothers Wind and Air,
And fair and stormy, all weather's moods,
by which You cherish all that You have made.
Praised be You my Lord through Sister Water,
So useful, humble, precious and pure.
Praised be You my Lord through Brother Fire,
through whom You light the night
and he is beautiful and playful and robust and strong.
Praised be You my Lord through our Sister,
Mother Earth, who sustains and governs us,
producing varied fruits with coloured flowers and herbs.
Praise be You my Lord through those who grant pardon
for love of You and bear sickness and trial.
Blessed are those who endure in peace,
By You Most High, they will be crowned.
Praised be You, my Lord through Sister Death,
from whom no-one living can escape.
Woe to those who die in mortal sin!
Blessed are they She finds doing Your Will.
No second death can do them harm.
Praise and bless my Lord and give Him thanks,
And serve Him with great humility.*

Original Sin and Final Sin

Once a technological species embarks on space flight in a determined way, only a few million years would be required to explore and perhaps colonize an entire galaxy. The great physicist Enrico Fermi therefore argued that if alien intelligences exist, we should know about them, but “Where are they?”

It is possible that the conditions that led to the appearance of intelligent life on earth are so rare that we are the only intelligent creatures on all the planets around the hundred billion stars in the Milky Way galaxy – perhaps even in the entire visible universe. If we are alone, then we are the first creatures who have begun to understand the cosmos, and we are significant in an almost terrifying way.

St. Augustine enunciated the Christian doctrine, “the deliberate sin of the first man is the cause of *original sin*.” To fail to take adequate care of the earth and thereby destroy the only intelligence in the universe would surely be a *final sin*. How insane and cosmically tragic to wipe ourselves out over trivia!

Question: Does the modern scientific story of the origin and nature of the universe allow moral actions to help repair the imperfections of our world?

Maybe not in scientific cosmology itself. But in our interpretation of it, yes.

Modern science is one of our main sources of novel ideas, which can become powerful, even inspirational, metaphors.

Consider using the **Inflation-to-expansion** transition made by the universe as a model for what we could accomplish on earth.

This model resurrects the physical-moral link found in ancient cosmologies. For example, in Kabbalah through moral actions (Tikkun Olam) humans can help repair the imperfections of creation.

We are taking a physical understanding of the universe and saying, this shows us **how** we can be moral on a larger scale. Moral behavior in our complex global society is no longer a matter of good instincts or following a tradition. It requires knowledge! Without knowledge, the moral course might seem to be, to encourage third world people to follow the same technological path we have. But that would be disastrous to the planet.

Dangers of Scientific Myths

Darwin's idea of evolution was good science. But some of its consequences for society were terrible. Here are two examples.

I. **Social Darwinism** (created by Herbert Spencer 1820-1903) provided an excuse for the worst excesses of the Industrial Revolution.

In England, people who had lived on the land, paying taxes to the landowners, for generations, were thrown off the land when all England was fenced. They had nowhere to go but the cities, where they became cheap labor. Child labor was rampant in the factories.

Then Darwin burst onto the scene with the theory that evolution proceeds through competition "red in tooth and claw."

This became a justification for exploitation. Forests were cut down, coal smoke filled the cities. The urban poor were forced to compete at the lowest levels.

II. **Eugenics** (term coined by Sir Francis Galton 1822-1911)

Basic idea: according to Darwin, people are not sacred. They are just animals like other animals. Humans have thousands of years experience with breeding animals: you have to weed out the weak and undesirable ones so that they don't reproduce.

Hitler justified the genocide of Jews and Gypsies by saying he was improving the race by weeding out the bad. What we call concentration camps were called by the Nazis *Rassenhygiene* (race hygiene) camps.

III. **Conclusion:** good science does not necessarily make good contributions to society, because once out in the world it is interpreted in light of social and political factors.

Science and Myth, John Maynard Smith

Smith was presented this argument: Gay people are persecuted because the theory of evolution implies they are unfit because they don't reproduce and thus do not contribute to evolution. Gays can be protected if they can be shown to play an essential part in evolution.

Smith: this argument is wrong, because evolution says nothing about the relative worth of human beings. No one has to justify their existence. [Not to mention that the people most apt to persecute gays don't believe in evolution.]

Smith's argument: People such as the writer about gays do not understand that scientific theories do not have to be myths. **The purpose of myth is to justify meaning, morality, and values. Scientific theories only need to explain experience or phenomena. A scientific theory must never be evaluated on the basis of its social implications.** There are objective criteria by which scientists can choose between rival theories, and do.

Conclusion: myth is useful as an explanation of our values, but it must not be confused with scientific theory.

Some Requirements of a New Mythology

(in addition to the scientific cosmology)

I. *An ethic to guide the relationships of cultures to cultures.* No culture has had such an ethic, but a global cosmology must.

II. *A goal.* We teach our children today to value growth, to expect constant change, to see it as meaning freedom, and to fear any slowing down. But the increasingly fast pace of change over the 20th century is inflationary – it must end. What is less obvious is that humans would be far better off in a more stable culture. Our goal must be **sustainability**, stability on the material level: we can have the opportunity to be endlessly creative in thought and spirit but not in use of physical resources. Only a stable culture can undertake a long-term project like space travel. Or like building the pyramids or the great cathedrals.

III. ***A conviction that today matters.*** The next decades – the active lifetimes of the students in this class – are the Hokhmah of the future earth. This period is the end of inflation and the transition to something different, we cannot say what. The short period of Cosmic Inflation created the patterns that were then established for the long term. However earth's future turns out, the roots of what becomes accepted will lie in today. This is a “once in all of life's time” opportunity. We occupy a unique place in time as well as size, and this statement is not anthropomorphic but a scientific fact.

IV. ***Heroes:*** both spiritual and historical. Here are three examples, but many others could be suggested:

Einstein, who showed that the world is not as it seems, and who challenged us to make it better

St. Francis of Assisi, who contributed the idea to Christianity of a kind of brotherhood with animals, rather than indifference to them as living beings or domination in practice.

Chief Oren Lyons, Faithkeeper of the Onandaga Nation, who through art and mythology is reinterpreting his people's traditions in light of present day realities and who communicates the wisdom of that tradition to the world.

V. ***Art in service of a higher goal than art for its own sake.***

Chief Oren Lyons

Born in 1930 to a traditional Native American family, grew up on the Onandoga and Seneca reservations in upstate New York.

All-American lacrosse player (lacrosse was invented by the Iroquois). Graduated from Syracuse University College of Fine Arts, became a very successful commercial artist in New York City.

Returned to the Onandoga reservation in 1970 and took up his responsibility as "Faith Keeper of the Turtle Clan of the Onandoga Nation".

Professor of Native American Studies at the State University of New York in Buffalo.

Has addressed the United Nations and other gatherings of leaders around the world, concentrating on world peace and Earth's environmental problems. Organized a delegation from the Iroquois Confederacy to attend the U.N. Conference on the environment in Rio in 1992.

Using Shamanism to Help Understand the Potential of a Functional Cosmology

Goal of a functional cosmology: not only to understand the modern cosmological picture intellectually but to feel truly a part of it – to realize that its implications affect *us*. New scientific ideas merely tacked into our minds like notes on a bulletin board are not going to change anything. New ideas need to be integrated into all we know, and that can change the whole picture.

The universe of empty space with stars and other celestial bodies in it – the Newtonian universe we Westerners have all been brought up in – is not organic; it is mechanical. We understand its parts to work together in certain ways, but those parts are objects. They are defined by us. They are inanimate. Even the animals are thought of as property or natural resources or our heritage, rather than as our ancestors and fellow inhabitants of Midgard.

The Huichol experience is that the universe itself is alive, and because of that human beings can relate to it with the same emotions Westerners reserve for individuals. Clearly their cosmology about how animals helped create the universe is not a story about physical reality *independent of human beings*. It is a story about human beings and how by using animals as symbols of freedom, wisdom, etc., we can experience a connection to the larger universe. Huichol cosmology cultivates, through time-tested methods we call rituals, the *experience* of a blood kinship with the wind, water, fire, earth and sun. These forces are to the Huichols our Grandmother, Grandfather, Mother and Father. They are our ancestors because we came from them.

The Huichol universe is *organic*.

The deep irony is that in the West, science required a clean separation from religion in order to develop freely enough to create scientific cosmology. But the meaning for human beings of the scientific cosmology now emerging may only be graspable through the experience of personal connection to this cosmos – an experience which has traditionally been considered part of religion.

Huichol shamanism cannot tell us how to live in the modern world, in a global culture where no matter what you believe, most people will disagree, and where tolerance of each other's views is the best we can hope for and rarely fully achieve. We modern people are a combination of our evolution, for which perhaps shamanism would suffice, and modern culture, for which it will not. Both dimensions of ourselves must be recognized and supported by any cosmology that hopes to be functional.

The link between the expanding universe and 21st culture will not be grasped by people trapped in a clockwork universe. Liberation from this mental prison, whether through shamanism or other methods, may encourage the openness of mind and heart necessary to appreciate the breakthrough that modern cosmology is in the process of making.

QUOTES from OREN LYONS

It seems to me that we are living in a time of prophecy, a time of definitions and decisions. We are the generation with the responsibilities and the option to choose the Path of Life for the future of our children, or the life and path which defies the Laws of Regeneration.

Although we are in different boats you in your boat and we in our canoe we share the same river of life.

"The environment isn't over here. The environment isn't over there. You are the environment."

"The young generation can influence their elders and can make them understand the environmental problems that are faced by us today. The youth can make them see that our environment is deteriorating day by day."

...global warming is real. It is imminent. It is upon us. It's a lot closer than you think, and I don't think we're ready for what's coming. We're not instructing our people, we're not instructing our children, we're not preparing for what is coming. And it surely is coming. We've pulled the trigger, and there is nothing we can do now to stop it. The event is underway.

The chiefs, and I personally, feel that we have not passed the point of no return. Not yet, but we're approaching it. And the day when we do pass that point, there will be no boom, no sonic sound. It will be just like any other day.

**Contemplation:
No Cosmology**

Welcome

Home	Who We Are	Your Ancestry	DNA Connections
What We Offer	Your Opinion	What Others Say	More Information



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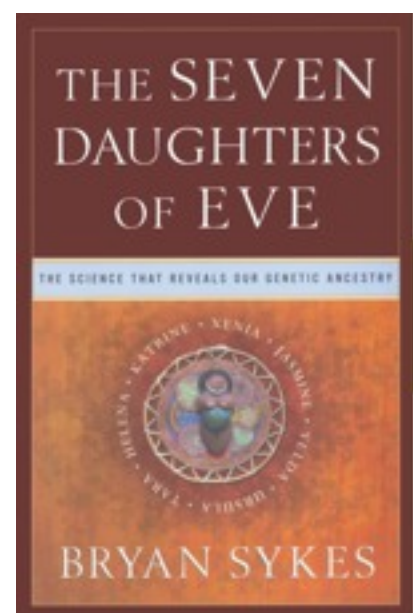
"Human Evolutionary Genetics"

Oxford Ancestors has sponsored two full-colour illustrations showing the geographic distribution of the major mitochondrial and Y-chromosome clades, in this new text book by Dr Mark Jobling, Dr Matthew Hurles and Dr Chris Tyler-Smith. The book is highly detailed and informative, and includes chapters on human genetics, evolution and the migration of our ancestors. For further details go to www.garlandscience.com



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Dear Nancy Ellen Abrams:

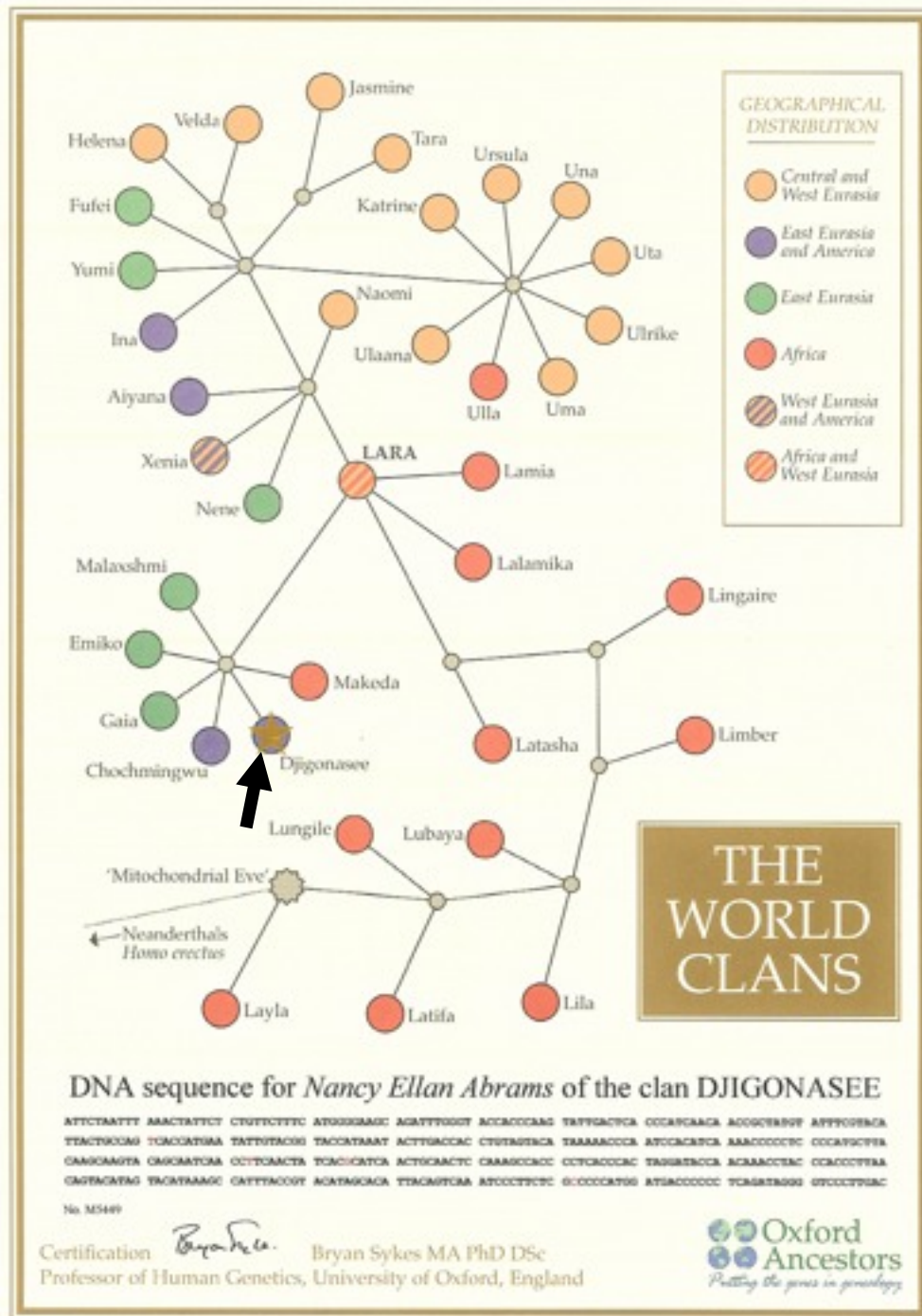
We have pleasure in enclosing your MatriLine™ chart. Your DNA sequence shows you to be a direct maternal descendent of Djigonasee.

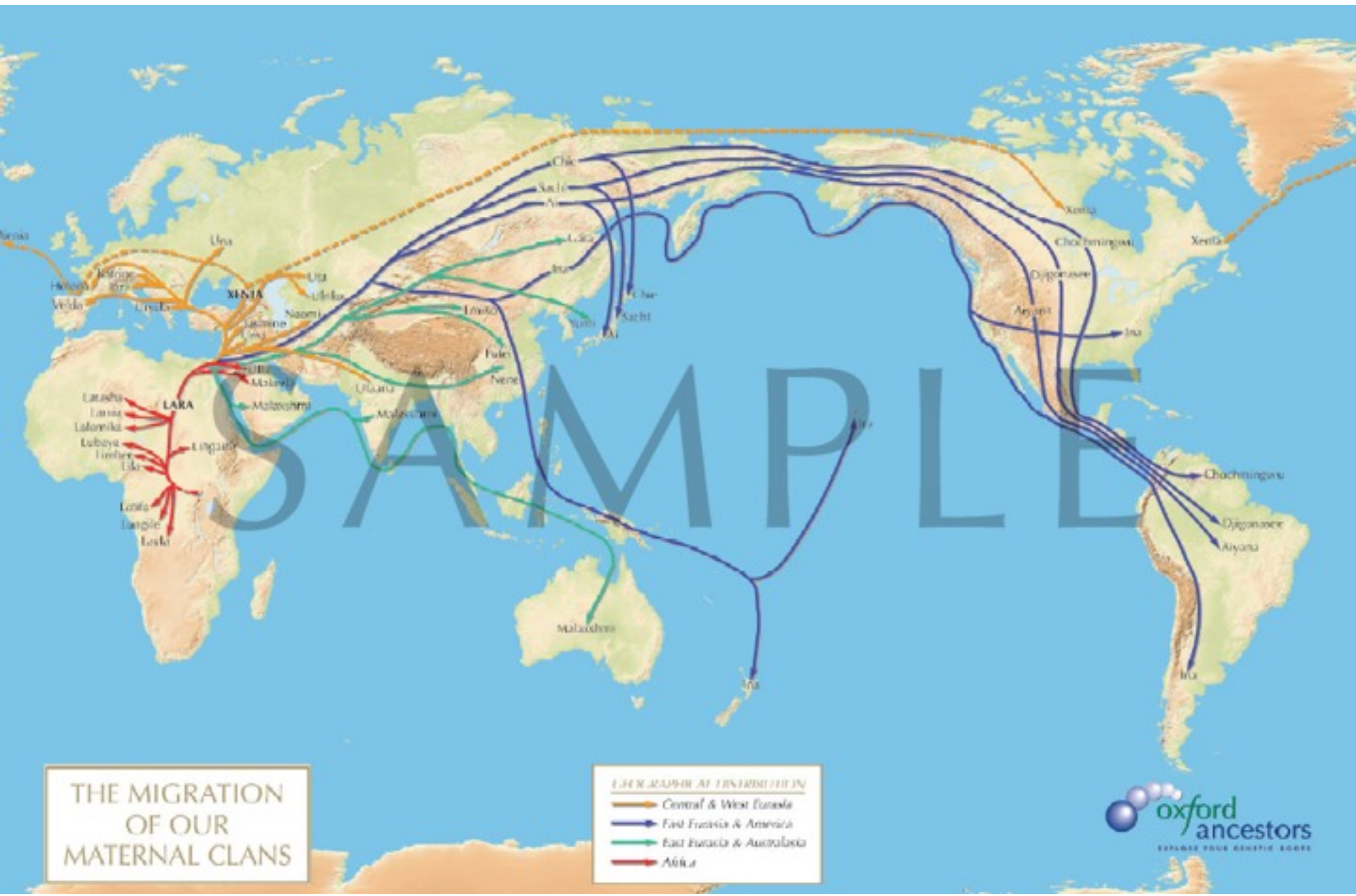
Yours is a DNA sequence which is very rare among native Europeans. It belongs to a clan which is found only occasionally within Europe and, because it is so rare, is not among the seven clans which appear on our web site.

You are a direct maternal descendant of Djigonasee. The name is taken from a heroine of the Ontario Hurons, Djigonasee was the mother of the peacebringer Deganiwada, founder of the Six Nations: Seneca, Cayuga, Onondaga, Oneida, Mohawk, and Tuscarora. Like many mothers of heroes, Djigonasee was a virgin when her son was born. A herald from beyond this world announced the birth.

She is the founder of one of the four major clans which colonised both North and South America from Eastern Asia about twelve thousand years ago. Moving across the Bering Land Bridge which joined what is now Alaska and Siberia, her descendants fought extreme conditions of cold and ice to reach the Great Plains. From there they spread out to reach all parts of North America and, within only a thousand years, all of Central and South America as well. Her evolutionary relationship to other clans from around the world is shown on your chart.

We think Djigonasee herself lived in North-Eastern Asia but we are not yet sure exactly when or where. We will make further information available to our customers about Djigonasee as more is revealed by further research.





Why Cosmology Matters

1. It is the truest story of our time without claiming to be more
2. It establishes our identity in the universe.
3. It gives our lives a larger context and thus larger meaning.
4. It expands the mind to think on multiple size scales.
5. It may be the perspective necessary to find solutions to earth's endemic problems.
6. It nourishes the spiritual imagination.

Some empowering concepts from cosmology:

Powers of Ten - a language in which to think, so that size alone, whether large or small, cannot intimidate or confuse you.

The Cosmic Uroboros - how everything fits into a larger scheme of being.

Expanding spacetime - an image of reality so counterintuitive that it creates a new level of humility.

The essential commonality between spirituality and cosmology

Virtually all cultures have believed that

1. There is a Beyond that cannot be seen.
2. The Beyond is in some way more important than what is right before us.
3. The Beyond determines the meaning of the here and now.

(Some cultures have also claimed that the Beyond determines right and wrong, but this idea is neither essential nor universal.)

How cosmology shares this essence

The ***meaning*** of something is ***by definition*** its significance ***in a larger context***. Thus the deepest possible meaning of anything in our world can only be understood in the widest possible context, the cosmic context.

Let Beyond mean not simply “over-there” or somehow “outside the physical universe” (a meaningless concept) but rather “on a larger scale of thought.”

What lies beyond the scale of our planet determines the evolution and nature of the universe. Cosmology and spirituality share the certainty that what lies beyond appearances determines why we are here and how we fit into the universe.

A centering cosmology based on science would ...

Explain what religions cannot explain:

- A. *The origin and nature of the universe*
- B. *The evolution of the universe into us and all we see*
- C. *The deep genetic connections among all human beings*
- D. *The deep genetic connections among all living things*
- E. *The constraints physical laws place on the concept of God*
- F. *The complex ideas that a God today should encompass*
- G. *How spiritual understanding can grow with new knowledge*

Be respectful and exclude no one

Religions are about something real in the connection between the universe and humans

Not even attempt to encompass the metaphors of religions

It is self-defeating to argue that Genesis tells the modern creation story. Must use new and exciting metaphors that inspire deeper ways of thinking about religion

ROLE OF ART IN GIVING UNDERSTANDABLE FORM TO COSMOLOGY

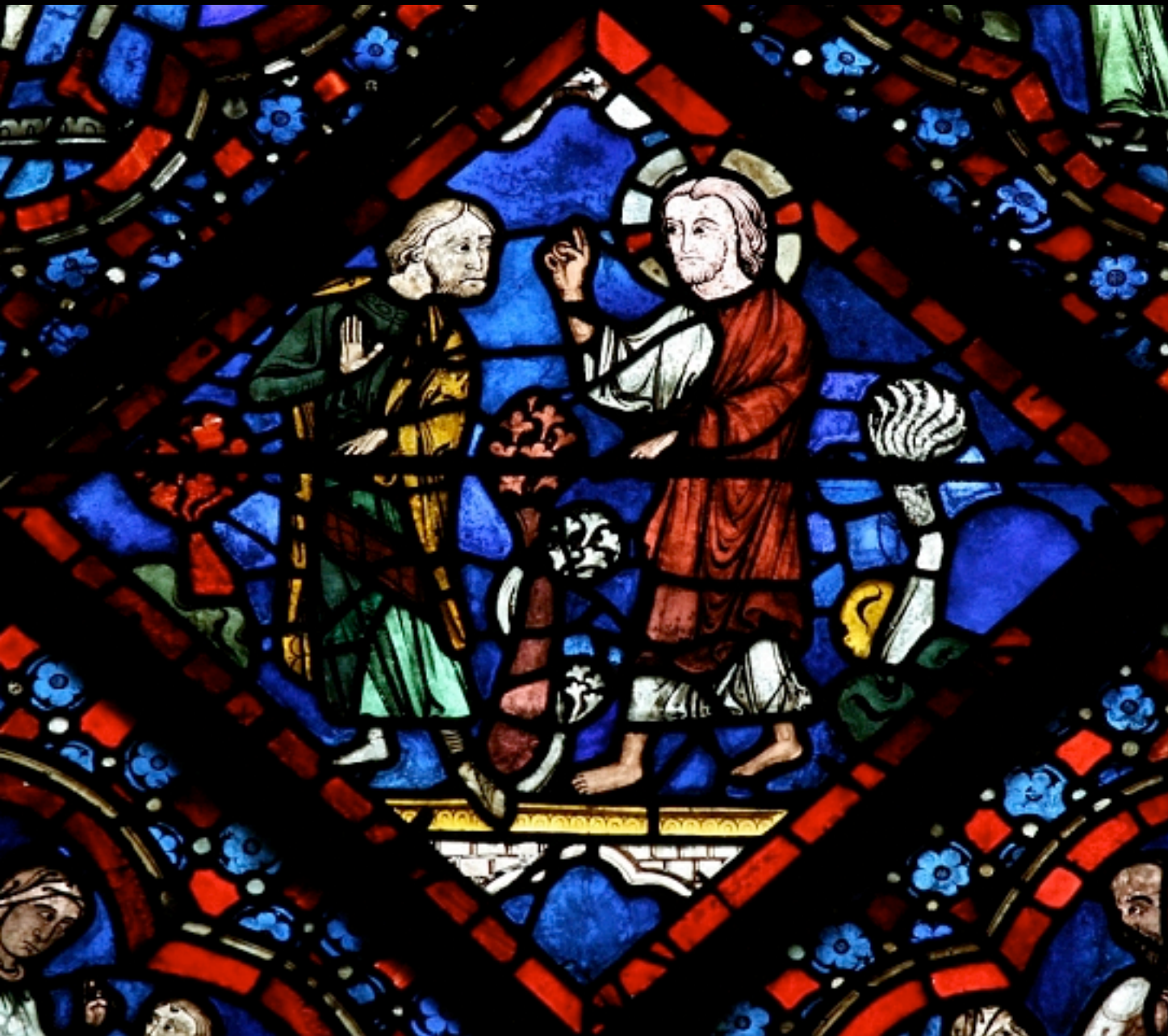
A. Scientists do not talk in equations but in words.

B. Language to describe the new concepts does not exist, except as the scientists discovering those concepts choose terms from everyday language, which are then metaphorical (e.g. wave/particle; horizon; black hole; Big Bang; cold dark matter).

C. Stories are how we understand everything. We even know ourselves as stories. We are undefinable right NOW except as beings with histories and habits and goals.

D. Cosmology demands new metaphors, and in return the new cosmological meanings of those metaphors can be turned around to help us see traditional questions in light of the cosmos.

To be “psychologically satisfying,” a cosmology must be not simply intellectual but involve some element of feeling right.



God tells Noah he is going to destroy the world but save him and his family. Detail of the Noah Window, located at the west end of the north aisle. Like most of the windows in Chartres Cathedral, it dates from the early 13th century.

Cosmology and Culture – Conclusions

We live on a unique scale in the universe.

We live in a unique time in the history of humanity – on the elbow of inflation

This is the age comparable to cosmic inflation – brief but about to set the pattern for the long term future.

Current generations have the chance to be heroes – or be reviled as ignorant, selfish, and hugely destructive.

All earlier cultures told stories in which their members were special and all others were lesser. Such stories are always about the outer world, and when understood literally, lead to conflict. In fact, according to Joseph Campbell, the true meaning can only be found symbolically: the inherent connotation is always psychological and metaphysical. Making a connection between the inner and outer world is the chief goal of religion, and is now also necessary to understand cosmology and consciousness.

No mythology which is not global can serve the planet any more. It may be possible for a scientifically-aware culture to create a mythology based conceptually on science but drawing its meaning from the realities and needs of the world today. This would be a centering cosmology.

It is the artist who brings the images of a mythology to manifestation, and without images (whether mental or visual) there is no mythology.

ARGUMENT OF THE BOOK

The universe is not the way it seems. For example, 99.5% of it is invisible.

New scientific research is painting the first new universe picture in centuries, and the first picture of the entire history of the universe EVER supported by scientific evidence.

This picture has a much higher probability of being true than any traditional understanding.

It is possible to understand this picture without being a cosmologist.

Why bother? Because the history of earlier cultures shows that a believable cosmology gives meaning to human life and inspiration to civilization.

If we are prepared to put in the effort to understand this picture, we can do so without mathematics through symbolic thinking.

ARGUMENT OF THE BOOK

Having done that, we discover that intelligent creatures are central to the principles underlying the new cosmos in fundamental ways. We, and all intelligent creatures, are made of the rarest material – stardust; we are at the center of the visible universe; we are at the middle of all possible sizes; and we are living at the midpoint of time in several different senses.

Acquiring a vivid sense of these realities and not just memorizing the words is essential.

Our centrality contradicts the secular consensus that we are insignificant beings on an insignificant planet of an insignificant star. And therefore we can no longer excuse our destructive behavior on the grounds that we are insignificant or dispensable.

ARGUMENT OF THE BOOK

One of the ways we live at the midpoint of time is that we have reached a planetary turning point: the inflationary growth of the human population and its resource use must stop. Either we can, with open eyes, plan how to get down off this peak, and actually begin to do it, focusing on the long term goal, or we can pretend the current road goes on forever and zoom off the cliff.

To achieve this global-scale transition down the other side, we will need the most accurate possible map of reality.

The most accurate map of reality is supported by scientific cosmology, which provides powerful new ways of thinking about the long-term. It is international and transcends race, being created by a world-wide community of scientists.

Now is the time to start applying new cosmological ideas to all fields in order to open our minds, build a coherent picture of the situation of our planet, and envision new solutions.

Every one of you can help do this. The moment you begin, you will be among the first on Earth to try.