



nova notes

NOVA Catholic Community

May 2010

Chair Notes...

Calling Forth Meeting

The Calling Forth Meeting will take place on Sunday, May 8, 2010. The Annunziatas have graciously agreed to host. The meeting is from 5:30-9:30 and starts with a pot-luck. With luck, our new process will streamline things a little bit so that a big chunk of the evening can be spent on visioning for NOVA. The Peace and Social Justice Committee may be leading the way on this. At the NOVA night in April, the Committee was trying to see if anyone wanted to start a special one or two year effort where we could have an exciting impact.

Future Growth of NOVA

This is a subject that I hesitate to write about, because I am ambivalent about the value of increasing the membership of a church, at least as an end in itself. Still, even in the Acts of the Apostles we read that the numbers of followers of Jesus increased and that was assumed to be a good thing.

One of the things we tried was putting an ad in the Washington Post during Lent. The ad was up for six weeks; it referred the reader to a website that, in turn, had links to our website and that of a few other small Catholic communities. Only about 30 people visited the website. The ad is not running now. Ken Chaison is thinking about next steps, for example, running the ad in neighborhood newspapers. Please contact Ken if you would like to help on this.

Mike Timpane and Kate Doherty have been meeting on the subject of attracting new families, youth, etc. and Mike will lead a discussion on future growth.

Next General Meeting

We are tentatively planning another General Meeting on Sunday, June 6, 6:30-9:00 p.m. at the Barrett's Party Room. There were two agenda items left from the March 13 meeting to decide: 1) Whether when NOVA plans a Community-Led Liturgy, the community is open

to having ordained Christian ministers outside the Church take a leadership role in the liturgy at the invitation of the planners for that day; and 2) Whether when NOVA plans a community-led liturgy, the community is open to having laicized, married or suspended Catholic priests take a leadership role in the liturgy at the invitation of the planners for that day. After deciding on these questions we'll hold the future growth discussion.

American Catholic Council

The American Catholic Council (ACC) is planning a National Council in Detroit on June 10-12, 2011. This reminds me of a people's ecumenical council. ACC is a movement bringing together a network of individuals, organizations, and communities to consider the state and future of our Church. They are asking Catholic groups around the country to host "listening sessions" as a lead-up to the council. Essentially, these are sessions where the issues raised by the ACC Declaration and the Catholic Bill of Rights and Responsibilities are presented and discussed and comments are collated and returned to the ACC planners to insure that the materials they present in Detroit in 2011 represent "grass root" Catholic concerns. They have now held more than 20 of these sessions, with 20-200 people attending each. Generally, there is a guest speaker, but not always, and they have some suggestions if someone is needed.

Bill Casey, who lives in Alexandria and is currently Chair of Voice of The Faithful (VOTF - National) indicated that VOTF of Greater Washington would like to work on such an assembly, and he is looking for a contact person within PAX and or NOVA to work with him and his friends on this. The ACC website contains most of the materials required to do so: program suggestions, questionnaires, invitations, etc. Bill Callahan once told me, the best way to be of service is to find someone who's doing something good and help them out. This may be a good way for a small community like ours to amplify its voice. If you're interested, contact ACC directly. Here's a link to their website: [American Catholic Council](http://www.americancatholiccouncil.org).

— Tom Clarkson

May Birthdays

NOVA Message Line	(703) 852-7907
Chairpersons	Tom Clarkson Gloria Mog
Treasurer	Joe Formoso
Coordinator, Community Life	Cece Michelotti
Liturgy Coordinator	Jeanne Clarkson
Padre Cadre Coordinator	John Mooney
Music Coordinator	Victoria Robinson
Peace & Justice Coordinators	Dianne Carroll & Marie Keefe
Christ House Coordinator	Kopp Michelotti
Facilities	Glenn Passin
Newsletter Editor	Judy Christofferson

The NOVA Catholic Community invites you to celebrate the Eucharistic liturgy with us every Sunday in Arlington, Virginia.

Note: Our Liturgy is usually celebrated at Kenmore Middle School, Arlington Blvd. and Carlin Springs Rd, Arlington, VA. Beginning Memorial Day weekend up to our Fall Retreat weekend in September, we celebrate at Lacey Woods Park, George Mason Drive near Washington Blvd., unless otherwise noted.

Liturgies at Kenmore begin at 10:15 a.m.
Gather at 10:00 a.m.
Liturgies at Lacey Woods begin at 9:30 a.m.
Gather at 9:15 am

Call the Message Line (above) or check the NOVA website for the latest information.

**June Newsletter Deadline:
May 25**

- 3 Cathy Goldschmidt
- 4 Jean Mendez
- 8 Ann Passin
- 10 Dianne Carroll
Jim Hug
- 11 Elena Bailey
- 17 Katie Chaison
- 20 Ella Carroll Teal
- 24 Anna Reich
Genevieve Schmidt
- 27 Alicia Cackley
- 30 John Mooney

Please send Judy Christofferson your birthday if you would like it to appear here (month/day only).

NOVA is praying for. . .

Sonja Donahue, who appreciates a card, a call or a visit.

Eve Birch, who is searching for a new place to continue offering safe shelter to the homeless.

Jody Furlong, who would also appreciate a phone call or note.

Archer Heinzen, who is recovering from surgery.

Walt and Carolyn Landry, as they are about to take a 5,000-mile trip across the country and Walt is continuing to recover from a stroke.

Peggy Meyer, who would welcome a visit, call, or note. (Please call ahead before visiting.)

Warren Reich, who is trying to regain his strength after surgery, and **Anna Reich** and her family in Australia .

Meg Tuccillo, who is recovering from a serious fall.

Remember these and any other NOVA members and their friends and family who need our prayers.

Liturgies: Cycle C

Inclusive Readings and Music Selections are available in the new NOVA Yahoo Group Files. Please give all music selections to the Music Liaison the Sunday before your liturgy and print 65 copies of the liturgy program. Liturgies at Kenmore begin at 10:15 a.m. and at 9:30 at Lacey Woods Park.

May Music Liaison Tim White

May 2 - Fifth Sunday of Easter

John Haughey, SJ – Cathy and Larry Goldschmidt
Acts of the Apostles 14:21-27
Psalm 145:8-13
Revelations 21:1-5
John 13:31-35

May 9 - Sixth Sunday of Easter

Joe Kenna - Linda Rosenberg and Kathy Scheimer
Acts of the Apostles 15:1-2, 22-29
Psalm 67:2-3, 5-6, 8
Revelation 21:10-14, 22-23
John 14:23-29

May 16 - Seventh Sunday of Easter

Dan Madigan, SJ – Peace & Justice Group
Acts of the Apostles 15:1-2, 22-29
Psalm 67:2-3, 5-6, 8
Revelations 21:10-14, 22-23
John 14:23-29

May 23 - Solemnity of Pentecost

(Baptism of James Cambridge)
Quinn Conners, O. Carm. - Goldschmidts
Acts of the Apostles 2:1-11
Psalm 104:1, 24, 29-31, 34
1 Corinthians 12:3-7, 12-13 *or* Romans 8:8-17
John 20:19-23 *or* 14:15-16, 23-26

May 30 - Solemnity of the Holy Trinity

Bill Callahan - Victoria Robinson
Proverbs 8:22-31
Psalm 8:4-9
Romans 5:1-5
John 16:12-15

Note: This liturgy begins our summer liturgies in Lacey Woods Park Pavilion (located on George Mason Dr. near the intersection with Washington Blvd., Arlington). The liturgy starts at 9:30 a.m.

June Music Liaison Tim White

June 6 – 10th Sunday in Ordinary Time

Joe Kenna - Clyde and Judy Christofferson
(Baptism of Marie Noelle Christofferson)
Genesis 14: 18-20
Psalm 110: 1-4
1 Corinthians 11: 23-26
Luke 9: 11-17

June 13 - 11th Sunday in Ordinary Time

Bill Callahan - Ormando-Kane Family
2 Samuel 12: 7-10, 13;
Galatians 2: 16, 19-21
Psalm 32: 1-2, 5,7,11
Luke 7:36 - 8: 3 or 7:36-50

June 20 - 12th Sunday in Ordinary Time

Joe Nangle, OFM - David Mog
Zechariah 12: 10-11; 13: 1
Psalm 63: 2, 3-4, 5-6, 8-9;
Galatians 3: 26-29;
Luke 9: 18-24

June 27 - 13th Sunday in Ordinary Time

Quinn Conners, O.Carm. - Nancy and John Veldhuis
1 Kings 19: 16, 19-21;
Psalm 16: 1-2, 5, 7-8, 9-10, 11
Galatians 5: 1, 13-18
Luke 9: 51-62



Easter Vigil Offertory Table

Volunteer Opportunity – Upcoming Events – Thank You Note

Gunston Volunteers Needed

Nova volunteers distribute bags of non-perishable food, cereal provided by Nova, and perishable items such as eggs, milk, and meat that are picked up at the Arlington Food Assistance Center warehouse on the night of distribution. Produce items are picked up every other week by Eric Carroll at the produce markets downtown (and funded by the Nova Peace and Justice budget). The distribution takes place at the Gunston Middle School Recreation Center in Arlington. Many volunteers have been active in this project for a lot of years. Training is provided for anyone who would like to join the volunteers at Gunston. New volunteers would be assigned with Nova members who have Gunston volunteer experience. If you are interested in being a volunteer: email Dianne Carroll at diacarroll@comcast.net

May Schedule (blanks indicate volunteer needed):

May 6: Eric, Joe A. _____

May 13: Tim, Jerry, _____

May 20: Mary Grace, Jenn _____

May 27: Glen, Syd, _____

June Schedule:

June 3: Arabians, Cathy G, Mary Grace/Jenn

June 10: Tim, Jerry, _____

June 17: Arabians, Cathy G, Mary Grace/Jenn

June 24: Glen, Syd, _____

NOVA Community Life Team Request

The team is asking each member of the community to help us. If you are aware that a NOVA member is having any kind of hardship and may benefit from a little attention, please let one of us know. You can call or email any of us with the information. With your help we can better serve one another in our community. Thanks so much!

— Teddi Ahrens, Joe Annunziata, Ken Chaison, Cece Michelotti, Catherine Schmitt, Marlene Shade, John Tarrant, and Tim White

Upcoming Nova Meetings: Save the Dates

Date: Saturday, May 8, 5:30-9:30 p.m. – Annual Calling Forth Meeting

Location: Home of Rosemarie & Joe Annunziata
The meeting will begin with a pot-luck dinner. We will use the new Calling Forth process we are trying out this year to select the next Community Co-Chair. All are encouraged to think about where they would like to see the Community put its efforts in the coming year as well as any specific ways they might be able to contribute.

Date: Sunday, June 6, 6:30- Meeting

Location: The Barrett's Party Room
(See Chair Notes, page 1, for agenda topics.)

Thank You

To All Our Dear Friends in NOVA:

Thank you all again for your cards, messages, and encouragement following my father's death. Also, thank you so much for the donation, in his memory, to the "Friends of The Air Force Academy Library." He spent much of the thirty years after he retired working tirelessly to improve the AFA Library and enlarge its holdings, including one of the world's best collections of memorabilia from the World War II Prisoners of War in Germany.

With deep gratitude, Carolyn Miller



Bernice, Kopp, Cece and Others on MS Walk, part of MOM Team that raised \$10,000

Peace and Social Justice Committee Proposals

The community made some very important decisions at NOVA Nite on April 18, which will allow us to continue to fashion a focused response to community concerns about peace and social justice activities.

The Peace and Social Justice (PSJ) Committee had been asked to create a framework for a peace and social justice program based on the following interests: 1) getting to know more about the PSJ projects, 2) fostering ways to partner with others, and 3) considering how to create a greater impact with our efforts. The committee brought two proposals to the community for discussion.

Below are the proposals as modified and accepted by the community. The committee will begin to put them into action immediately.

PROPOSAL 1: *The Peace and Justice Committee proposes a plan to better inform NOVA community members about the social action projects that are funded by NOVA.*

About six times a year, the Co-chairs will arrange to use our liturgy space for an extra 60 minutes so that the sponsors of four to five projects can present current information about those projects and respond to questions from the community.

Project sponsors will be responsible for **briefly** outlining the project's level of financial and volunteer support from NOVA, the number and characteristics of clients served, activities carried out by the project, the project's accomplishments and measures of success, and any important issues the project will confront in the near future.

Once a year, project sponsors will prepare an article for the newsletter with the current information specified above. In addition, throughout the year, sponsors are welcome to submit to the newsletter short items about specific issues or events of the project.

ACTION: The committee will circulate a calendar for sponsors to sign-up for a Sunday presentation.

PROPOSAL 2: *The Peace and Justice committee proposes a plan for increasing our impact with funds, incorporating new projects and potential partnering with others.*

Background: In a variety of ways over the last few years, some in the community have expressed a desire to explore how we might intensify the impact of our PSJ efforts. This is in addition to NOVA's commitment to meet pressing needs as they arise and are brought to the community, something we deeply value. It's also important to state that all the work done through our projects has been valuable and reflects community commitment. As we manage approximately \$56,000 for PSJ efforts, it is important to assess what impact we are having and whether we are living up to our commitments as a community.

ACTION: We are inviting any NOVA member(s) to create a proposal designed to bring about a *targeted impact* where our funds and efforts might make a big difference. A specific proposal will allow the community to figure out how to pull it off, how to get the funding needed – whether by fundraising, working with other groups, examining how we currently use funds for projects, etc.

Next steps:

1. Submit a proposal to the PSJ Committee by May 16 describing need, impact, how to go about it, and funding needed.
2. The PSJ Committee will review and clarify all proposals and bring them to the community.
3. The community will select one and brainstorm how to implement it.

The energy and commitment that the community has directed to these peace and social justice discussions has been remarkable and the PSJ Committee looks forward to helping implement these proposals.

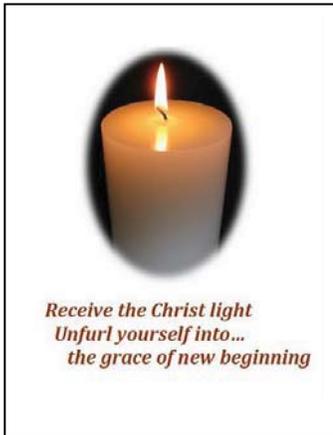
— Submitted by Joe Annunziata, Dianne and Eric Carroll, Marie Keefe, Kopp and Cece Michelotti, Cathy Showalter, Meg Tuccillo, John Veldhuis, and Tim White.

Stations of the Cross Created by Women of Chrysalis Program*



*The Chrysalis Program has provided a safe, supportive environment for spiritual growth and transformation for hundreds of women at York Correctional Institution, Niantic, CT. The goal of this interfaith living unit is to help each woman deepen her personal faith, develop tools for spiritual and emotional healing, and use these tools to address her personal life issues. The Rev. Valerie Dixon (former Nova member) said in response to Nova reflections on the stations during Holy Week: *"I wanted Nova to know that the photos and reflections on the Stations of the Cross were an unexpected and truly wonderful gift! I passed the sheets around so that everyone could see the pictures while I read from the booklet of reflections. The women were so pleased, touched, and amazed that others could be moved by their simple art work and take the time to let them know. Thank you so much!"* The prison ministry website is www.faithbehindbars.org.

Joe Kenna's Holy Thursday Homily



Receive the Christ Light! What is this Light of Christ that we are to receive? “One whole-hearted thought is enough to attain the mind of Buddha.” - “One whole-hearted thought is enough to attain the mind of Christ.” This mind of Christ is the Light of Christ. I believe that Jesus embeds this whole-hearted thought, this LIGHT, in this evening’s Liturgy. It goes far beyond foot-washing, service, tradition and all the other words we use to describe what we commemorate. This whole-hearted thought has to do with a radical gesture of life that underpins all of Jesus’ life and ministry but it is simply this: All life is ONE. We are ONE with each other. We are ONE with the universe. We are ONE most especially with the Gracious Mystery called Yahweh. This connection is not just a metaphor; it is the fundamental mystical truth that all of us are an expression of the **omnipotent**,

omniscient and **omnipresent** God. Jesus refers to this connection as the Kingdom of God. We are by grace what Jesus is by nature, and we are called to live out of this whole-hearted thought, to make decisions and life choices out of this whole-hearted thought...to be co-creators with “Heshem” (the Name) to create world systems that reflect and embody this whole-hearted thought. Even Einstein understood: “Separateness is an illusion.” This fundamental ONENESS of all is the light of Christ.

This whole-hearted thought of the mind of Christ stands in stark contrast to the prevailing conscious we encounter in our daily lives. It is a world view that we are separated – little atoms – living our feverish little existences, totally hermetically sealed off, not only from each other, but from the physical universe and from God

The problem comes from the superficial ego mind, the part of us that thinks we are separate – the part that attaches to the illusion that we are separate, that my identity is the toys that I surround myself with. As Nietzsche said: “The person we lie to most is ourselves.” This lie is very destructive; in fact **all suffering comes from this mistaken identity**. We lose our power when we seek it outside ourselves in security, money, control. Freud identified a psychic drive besides sex as *Thanatos*, a seductive aspect of the ego that pulls us toward death. Our Loneliness, depression, jealousy – all indicate we have bought into the illusion of separateness. “The world is one great mental hospital and we are all walking around hallucinating most of the time.”

So what is the door out of this insanity? How do I receive the Light of Christ?

1. Let go of ego.

We are so afraid of letting go and either in God or in ourselves. and debilitate myself by clinging begin to choose to abandon attachments and trust that my sufficient. Jesus washing the model of the letting go of ego. demands on a disciple, but one disciple to wash the rabbi’s feet. top.” Yet, this intimate act is disciples.



letting be, that we have no trust Love cannot distrust. I de-skill to my bloated ego. But, I can clinging to my egotistical oneness with “Heshem” is disciples’ feet is such a great The rabbi could make great thing he could not ask: the That would be just too “over the exactly what Jesus does for his

2010 Holy Thursday (continued)

2. Seek boundless compassion.

The highest work that God ever works is compassion. Compassion is closely linked to justice. In compassion, justice and peace kiss. Compassion is powerful, and you are powerful when you make choices that reflect your compassionate commitment to justice. We have no concept of the POWER within! Scientists talk of a zero point field (vacuum) in which one cubic meter of absolute vacuum contains enough energy to heat all the oceans of the world. If we could harness this power, your body could heat all of New York City for one month. Boundless compassion releases incredible energy. One time in Middle Ages, one hundred thousand died in the plague – fifty thousand from the plague and fifty thousand from fear. In compassion and justice, you are more powerful than you can dream. I was listening to the radio last Sunday driving home from mass, and heard a Jesuit priest talk about his work with gangs in Los Angeles. For years his organization has been practicing boundless compassion for over 2500 gang members with great success. I was a hazard on the road wiping tears from my eyes as I heard the stories. We can't be powerless... we just believe we are!"



3. Dance with God.

As Meister Eckert says: “At every deed, however puny, that results in justice, God is made glad – glad through and through. At such a time there is nothing in the core of the Godhead that is not tickled through and through and that does not dance for joy.”

When we have the courage to let go of our egotistical attachment, seek boundless compassion that moves toward justice, our lives become a cosmic dance with God. Our lives take shapes, movements and forms we could not otherwise dare dream of. So tonight at this place at this time: Receive the Christ Light! Let the dance begin!

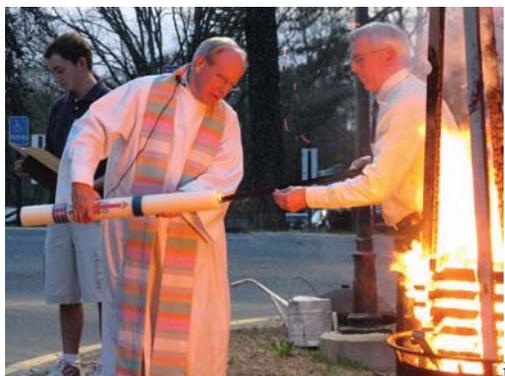


Preparing Holy Thursday Dinner



Nova-Tones Rehearsing for Holy Thursday

2010 Easter Vigil Pictures



Lighting of Easter Fire



Ana Cackley Assisting Quinn with Easter Blessing



Preparing to Present the Offertory Gifts



Ormondo-Kane Family Assisting with Communion



Easter Figures on Agape Table



Kathy and Rosemarie at Agape

Theology for a Small Planet

A collection of essays by Clyde Christofferson © 2009-2010

Part 2: From Kindness to Social Justice

B. Life and Society

Physicists tell us that the cosmos is winding down, inevitably getting colder and colder. This is the meaning of the Second Law of Thermodynamics, as expressed in the phrase “entropy is increasing.”

Is this the cosmic equivalent of what we recognize on Ash Wednesday: “dust thou art, and to dust thou shalt return”? Is the cosmos a cold and dusty place, or at least headed in that direction?

Were that the case, one might suppose that God’s creation is going in the wrong direction. Or, perhaps as logically, one might doubt the wisdom of ascribing such a wrong headed creation to a loving God. If we cannot make sense of cosmic entropy, what sense is there in the notion of God the Creator?

The reality is much more interesting than that. Even at the level of pure physics it now appears that the total mass-energy of the universe (a number of kilograms with fifty-six zeroes behind it) is exactly balanced by a negative quantity of the same scale. The sum is zero, as if God had taken nothing and split it in two to create the universe.

Something strange is going on, and we are just recently (in the last fifty years) getting our arms around it. It is becoming clear that “evolution” is not the exclusive province of biology. The cosmos is evolving, and the progress of that evolution is evident in physics as well as biology. The physics evolution began first, and the biological evolution could not begin until the physics evolution had reached a certain point.

Furthermore, this evolution appears to have an integral connection to entropy. Yes, the universe may be winding down on average, but there appear to be windows of time and pockets of space where the stuff of the universe – in its then current evolutionary form – heats up to create new things and then cools down so as to preserve the new things that were created. This has a sort of “ratchet” effect, with each new creative stage having a period of stability because of cooling. Because of the interaction in these stages between heating up and cooling down the term “thermoentropic” seems appropriate. It also seems appropriate to describe the new creation at each stage as a “thermoentropic novelty.” And each of these stages is circumscribed by a “thermoentropic

window” of time and takes place within a “thermoentropic pocket” in space. These terms fit most easily with physics, but can be applied metaphorically to the stages of biological evolution.

Looking at cosmic evolution in this way leads to an obvious question: what is next after biology? And then what? There is creativity and novelty all along the way. Perhaps we are deceived by the physics, which points to a dead end. Stay tuned.

Clearly, it’s not all physics, by any means. And yet even the physics shows an evolutionary progression, from energy to quarks to basic particles like protons and electrons to a series of more complex chemical elements. This greater complexity has developed within limited windows of space and time, consistent with increasing entropy of the universe as a whole.

When we hear the term “evolution,” we often think of Charles Darwin and the development of biological organisms. Darwin’s study of the biological evidence available to him from his long journey aboard H.M.S. Beagle in the 1830s led him to conclude that changes in the environment, coupled with scarce resources, led to a struggle in which those species best adapted to the changes survived and produced more offspring. And over long periods of time, an accumulation of these adaptations resulted in different species. Darwin’s name for this process was “natural selection,” a term which the audience for his 1859 book *On the Origin of Species* understood as something akin to the breeding of cattle and horses, which might be called “artificial selection.”

The mechanism by which living things change to become different was not understood by Darwin. Gregor Mendel had written a letter to Darwin describing his experiments with peas, and the letter was found in Darwin’s papers but without any indication that Darwin had taken notice. Not until Mendel’s work was rediscovered some fifty years later did the science of biology find a theory of genes to explain Darwin’s process of natural selection. Then, another fifty years later, Crick and Watson discovered the double helix structure of the DNA carrying our genes and, after another fifty years, the entire human genome had been mapped.

DNA has a history of its own, a very long history as it turns out. DNA is so old that all multi-celled living things are related. We joke about having 98 percent of our genes in common with Chimpanzees. But we have 50 percent of our genes in common with trees, and bananas. When you eat a banana, you are eating a distant relative.

Actually, there is a curious reason why members of the animal kingdom must consume their biological relatives in order to survive, whereas plants can survive with water and sunlight. The villain of this story – oddly enough – is the oxygen we need to breathe. The basic chemicals needed by all living things – amino acids to make proteins, nucleic acids to make DNA, lipids to make fats and hormones – formed naturally near volcanic vents in the oceans of the early Earth soon after these oceans formed some 3.8 billion years ago. This process was confirmed in 1952 by experiments conducted by Stanley Miller, a graduate student of Nobel Prize winning chemist Harold Urey. Miller added heat and electrical sparks to a combination of methane, ammonia, hydrogen and water.

The key to the experiment was avoiding oxygen, which is highly reactive and quickly destroys amino acids and the other building blocks of life.

The plot thickens. The early Earth had no free oxygen, so amino acids and the other basic chemicals of life formed spontaneously. Through a process that might be called “chemical evolution” more complex organic molecules formed in this oxygen-free environment – somewhat analogous to the way that discrete chemical elements were created in stars. Although all the details are not yet understood, chemical “evolution” builds upon itself through a succession of stable building blocks, eventually combining into more complex molecules. Some of these molecules curled up to form cell-like spheres with semipermeable membranes. Chains of nucleotides developed, perhaps through RNA, into the pair of linked chains we know as DNA, within primitive single cell structures called prokaryotes.

Energy is critical to this story, in several ways. First, energy is a resource. Initial cellular structures got their energy from the Earth’s molten core, through volcanic vents. Then some prokaryotic cells migrated to the surface of the ocean, and at some point develop the ability to use another energy resource -- the sun – via photosynthesis. Photosynthesis requires the chlorophyll molecule, which manages a conversion process that combines carbon dioxide and water with

sunlight to produce free oxygen and energy storing sugar molecules.

The micro-fossil evidence of algae that use photosynthesis goes back 3.5 billion years, not long after the beginnings of life and the formation of DNA and single celled prokaryotes. The villain of the story – oxygen – starts building up in the atmosphere about 2.5 billion years ago. Over the next billion years or so, as more oxygen becomes available through photosynthesis, the prokaryote population is poisoned – or perhaps starved is a better term – because the amino acids at the base of their food chain were being destroyed by oxygen.

This environmental pressure led to the evolution of a more robust form of cell, the eukaryote, more than a billion years ago. Eukaryotes tend to be much larger than prokaryotes and contain “organelles” for metabolizing oxygen. It appears that that eukaryotes evolved from symbiotic relationships among prokaryote cells hard pressed to survive in the face of oxygen poisoning.

Second, energy – kinetic energy – is also destructive. In prokaryote cells DNA chains live a hard life. They are constantly pummeled, and sometimes broken, by other molecular objects flying around within the cell. Yet DNA has a structure which is able to rebuild itself. The two chains are connected by successive pairs of nucleotide “bases” A, T, C and G (Adenine, Thymine, Cytosine and Guanine). “A” links only with “T” and “C” links only with “G”. So when links in the chain are broken off the remaining link looks for a matching “base” within the cell to replace the missing link. The same rebuilding process operates more systematically during reproduction when the DNA chains unzip.

This reconstruction depends upon the presence of the “base” nucleotides and the other “food” for DNA. A cell can be viewed as a container where a solution of these “nutrients” can more efficiently feed the DNA reconstruction process.

In the prokaryotic cell, DNA is unprotected. The reconstruction process continues to repair DNA chains that have been damaged. However, the reconstruction is frequent (because the cell is full of moving objects that collide with the DNA and cause damage) and not always accurate. The result is variation, from daughter cell to daughter cell cloned from the same parent, and – in conventional Darwinian fashion – development of new species of prokaryotic cells.

Something new happens with eukaryote cells. DNA is protected within a nucleus, a new structure

within the cell. This is a much quieter life than the DNA had to endure in prokaryote cells. In a sense, the nucleus provided a relatively “col” – and therefore more stable – environment for the DNA. This is the positive side of “entropy”, which allows development of more complex DNA structures (e.g. DNA chains coiled into long “slinky”-like chromosomes) and more adaptable forms of reproduction. Prokaryote cells simply cloned themselves by splitting. There was some variation (and consequent evolution of new species of prokaryotic cells) because of the constant damage and reconstruction of DNA floating loose within the cell.

Eukaryote cells evolved a much more efficient mechanism for obtaining variation. Instead of simply having a single cell clone itself by splitting, two different cells contribute half their DNA to form a new cell. The resulting cell, like each of the two parent cells, has two sets of chromosomes, one from each parent. But the contribution from each parent is a mix from the grandparents. Each new cell will have a different mix, which is the mechanism for variation from generation to generation.

This method of variation is called “sexual reproduction” and enables more rapid adaptation to the environment. Consequently, eukaryote species proliferated. Eventually – about six hundred million years ago – there developed a further adaptive mechanism, namely, cooperation among cells having the same DNA.

Once discovered, this mechanism quickly radiated in what is known as the Cambrian Explosion of multi-celled organisms. Various genetic lines developed. Of most interest to us as human beings, organisms with backbones developed about 500 million years ago, and some of these migrated from the sea to land about 400 million years ago. Reptiles came 350 million years ago, and the first dinosaurs and mammals about 250 million years ago.

Most large animals, including the dinosaurs, became extinct following an asteroid impact some 65 million years ago. This extinction allowed smaller animals to expand into the environment vacated by the larger animals, and it was during this period that the first primates evolved. For good or ill, it appears that fairly dramatic changes in the environment have been a major factor in driving evolution.

At some point in this evolution we part from chimpanzees. Chimps -- like other animals -- have brains that enable them to adapt over the period of

their lives. But chimps appear to have limited ability to transmit what they learn to succeeding generations. In any community of chimps, the learning does not further accumulate after one or two generations. New chimp communities learn their full set of skills in a generation or two, and learn nothing new thereafter. Young chimps learn from their elders, but their elders know no more than their elders before them.

By contrast, each generation of humans benefits from collective learning in the form of adaptations not available to their parents. We take that for granted today, although we tend to focus on technology and are not sure whether such a principle applies to our politics. Alas, we may have to wait for another “thermoentropic novelty” to advance our politics.

Darwin's "natural selection" provided a high level explanation of a mechanism for biological evolution. Organisms that evolved brains were thereby better able to adapt to changes in their environment. By way of analogy, a society with collective learning is better able to adapt: it is able to improve its adaptive tool set over time. Chimpanzees can't do that.

But how does "collective learning" enable this improved adaptive capability? It is perhaps easiest to see this in the advances of science and technology, where the edifice of knowledge is systematically recorded and transmitted, using the language of mathematics and the methods of science. Individual consumers of new technology benefit from this process.

It is said that “history is a great teacher.” Over time, our analysis of history has enabled us to understand that which had earlier been ascribed to “gods”. For example, the “divine right of kings” gave way to a more candid recognition that we were making our own beds, whether or not we put kings in them.

It is this kind of insight that led Pope Leo XIII to speak about our responsibility for the structures of society in *Rerum Novarum*. In the century since that encyclical Catholic social teaching has fleshed out many of the details of this responsibility. The obligation to critically examine the structures and institutions of society and reform them is termed “social justice.”

But viewed from the perspective of cosmic evolution, what is the meaning of “social justice”? Is it not “kindness” writ large on the social fabric?

More on that theme next time.