Eucharistic Cosmos

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Thomas Merton was always trying to situate his religion in a larger context: psychological development, social justice, other religions. To extend the basic notions of Christianity in a cosmic context would be a congenial continuation of Merton's expansion. I here propose to describe the cosmos as an energy-sharing, self-organizing, symbiotic, Trinity-imaging reality—which is what I take the real (as distinguished from the ceremonial and symbolic) Eucharist to be. Eucharist is life-sharing. Life is organized energy-sharing. Trinity is agape-sharing, by which Persons, though distinct, are One.

The essence of Christianity is to see—and therefore to live in terms of—a total Reality that is expressive of the God who is Trinity and who is Incarnation. If this is the heart of the Christian religion, then it behooves the contemplative, especially, to be conscious of the great universe, an expression of God's trinitarian and incarnational presence every way we look, on all levels of organization from quarks to humans, and in everything that happens, from exploding stars through the struggles of life (including point-of-view "good" and "evil") to sublime moments of art and mystical union.

This article will sketch briefly my ideas on Trinity as community, Incarnation as God's ecstasy, and the universe as self-organizing and symbiotic. This will prepare the way for a discussion of the human being (brain and consciousness), a proposal to see the cosmos on the model of the Incarnation, and a conclusion regarding the practice of a trinitarian eucharistic spirituality.

The Trinitarian Community

Many metaphysicians have taken as their starting point the fact that Being is somehow both one and many. This is the context in which

I appropriate the concept of God as Trinity, develop it as a Person-Community, and extend it as a paradigm for the universe.

I think that the greatest advantage of the concept of God as Trinity over other approaches is that it recognizes that plurality cannot be reduced to unity nor derived from unity. It is almost truer to say that unity derives from plurality, or rather from the interactivity that plurality makes possible. For the coincidence of unity and plurality in the Godhead comes from the nature of God as agape. Agape has the unique feature of establishing both differentiation and unity by the same principle. Agape, as seeking the good of the beloved, requires that there be an other to love. But, as love, it also seeks union and is not satisfied until complete union is achieved. It is the nature of that union, which must not destroy the differentiation, that is of interest as a paradigm for the Trinity's creative expression in the universe.

Here I share some background with Thomas Merton. We were both exposed to the ideas of Daniel Walsh. I find Walsh's way of talking about Person very helpful for the way I want to talk about the Trinity. Also, it was Walsh who said that choice of starting point is all-important, and the place to start is "God is Love." He even said, "Love is so intense that it expresses itself as the Trinity. The Trinity is not God; the Trinity is the first expression of Love, who is God."[1] A remarkable utterance.

For me, this is saying something that is the key for a theology of the cosmos. The central reality is *interaction.* Not just (static) relationship. Not attitude or orientation. Love is essentially dynamic. It is the donation or the sharing of whatever "energy" is the relevant "self-hood" of the participating parties. It itself is the union of plurality and unity.

Although the agape that is God is not self-seeking but self-giving and Being-giving, it is nevertheless reciprocal. No one gives only and does not receive. Thus agape defines a community, and this community has the characteristics of a *system:* all parties contribute and all parties receive. There is no starting point and no concluding point.[2] The interactivity of all the parties constitutes the reality of the union-being of the whole as a whole.

1. Daniel Walsh, "Person and Community," Gethsemani Archives Document 5 (Trappist, Ky.: Abbey of Gethsemani, Nov. 6, 1971) 4.

2. This neglects, for purposes of establishing a paradigm for creation, the non-reciprocal order of the processions.

The "parties" to the Love interaction are Persons, says Walsh. Persons are distinguished from natures. Nature answers 'what?'; Person answers 'who?'. Natures are created by the free will of God. Persons arise from the being of God. Persons are uncreated. That applies to all Persons, including those who afterwards express through created natures, such as angels and human beings.[3]

Walsh himself suggested two "effusions" of Persons from the being of God (Love): the traditional Trinity of the divine Persons, and a second effusion of Persons who would be endowed with finite natures.[4] However that may be, it seems clear to me that ultimately there must be a single community in the divine life. The affirmation of such a community of Oneness among the Persons and the achievement of such a community among the created natures is what we are all about. The divine intent is "that they may be one as we are one" (John 17:22). And how are the divine Persons one? Through their mutual indwelling. The total reality of each divine Person is Love, agape, self-giving, being-giving. Thus each Person is active with an ecstatic movement to give itself, to give full being, to each other Person. This is eucharist inside God, each "feeding" each other with each one's own being.[5] My contention is that this interaction—which is Love—is the Oneness of God, and is the paradigm for creation. All that is made is made in the image of God, and this image is of the divine interactive eucharistic Community.

Incarnation as God's Ecstasy

The eucharistic movement is ecstatic. The incarnational movement is ecstatic. I want to see the cosmic interaction as eucharistic and incarnational, see it as God's ecstasy. We have two applicable texts.

> Philippians *2:4-7:* Let each of you look not (only) to your own interests but (also) to the interests of each other. Have the attitude

3. D. Walsh, Gethsemani Document 3, "Anselm and Duns Scotus on Faith and the Person," (The Catholic University of America, 1966) 23. For fuller discussion, see B. Bruteau, Feature Book Review of Robert Imperato, *Merton and Walsh on the Person,* in *International Philosophical Quarterly* XXXI:3 (Sept. 1991) 353–63.

4. D. Walsh, Gethsemani Document 14, "Chapter Talk," June 1967, 3–4.

5. Expanded discussion of this can be found in B. Bruteau, "Trinitarian Personhood," *Cistercian Studies* XXII:3 (1987) and in "The One and the Many: Communitarian Non-Dualism," in B. Bruteau, ed., *The Other Half of My Soul: Bede Griffiths and the Hindu-Christian Dialogue* (Wheaton, Ill.: Quest, 1996) 268–307.

> among yourselves that is also in Christ Jesus, who subsisting in the form of God, did not deem it robbery to be equal with God, but emptied himself, taking the form of a slave, being generated in the likeness of human beings.

There are two words here that can be interpreted in various ways, *hyparchon* ("subsisting") and *harpagmon* ("robbery"), and one deserving of further comment, *phroneite* (have . . . attitude). *Hyparchon* is made from *hypo,* "under," and *arche,* "the beginning" (or "the first"), and means (as a noun) one who commands under another, a lieutenant; or, as a verb it can mean to begin doing something, or to arise and be ready, or to lie under (this is where the "subsist" comes from) in the sense of being taken for granted (or being the ground of), or to belong to or to be devoted to, or to be sufficient. If we put all this together, perhaps we may say that Christ Jesus feels that he belongs to and is devoted to God, who is the ground of his being, and therefore he must arise and be ready to begin doing what God commands, since he is in the position of lieutenant.

Harpagmon comes from *harpazo,* which means to ravish away, to carry off, to grasp hastily, to snatch up, to seize. The noun therefore means something that is seized, booty, plunder. There are several possibilities here. Either Jesus did not reach out to seize divinity, or he did not consider that it was taking something to which he had no right. Or it could mean that he did not insist on clinging to (grasping) the divinity that was his. I will use this last interpretation for application to the incarnation in the cosmos. But there is still another interesting possibility. *Harpazo* can also mean to grasp with the mind. The effect would then be that Jesus did not consider being equal with God to be something that was to be grasped only with the mind but something that was to be put into practice. And at this point the sense of *phroneite* comes in, for *phronesis* is a kind of wisdom, the kind often called "prudence," a practical wisdom, wisdom put into practice. And the kind of *phronesis* Jesus practiced is well expressed in the exhortation "Let each of you look to the interests of each other." (This, by the way, is a characteristically Jewish ideal, expressed also as the pious person's attitude of "What is mine is yours and what is yours is yours.")[6]

6. This ideal was exemplified in the life of Hillel the Elder. See Yitzhak Buxbaum, *The Life and Teachings of Hillel* (Northvale, N.J.: Aronson, 1994) 170, citing *Pirke Avot* 5:13.

The self-emptying can be seen as having two stages—or "effusions," if we borrow Walsh's word, or "ecstasies," if we use mine. The first is the ecstatic movement from divinity to humanity (in the text), which I choose to expand to the whole of the cosmic reality. The lieutenant commander, who is rightfully in the "form of God"—which we now understand to be formlessness, infinitude—does not cling to that but pours himself out in ecstasy and takes on form, finitude as such. To be finite is to be a slave, a *doulos,* one who is in bondage or is subject to another. Finite beings are all subject to the laws and conditions of their existence, limited by their natures, and many of them subject to one another in various ways.

The second ecstatic movement is the one urged by the Pauline text, seconding Jesus and the usual Jewish teaching: pour yourselves out for one another. Give yourselves without stint, without limitation. Here we have already a hint of how the circle will be closed, the Infinite becoming finite and the finite—in the very terms of its finitude—becoming infinite.

We can also see in the *phronesis,* the practical adoption of the divine ecstasy, the interaction that I have proposed as essential to the dynamic Godhead. It is agape, it is energy-sharing, it is systemic, it makes oneness, wholeness. As the dynamic of the cosmos, it will take different forms (including some that are apparently not seeking the interest of the other at all).

The second text I find applicable is John 1:18:

> No one has ever seen God. The only-begotten God *(monogenes theos),* the one being in the bosom *(kolpon)* of the Father, That One exegeted *(exegesato).*

Here "God" refers to the Infinite Ground, the invisible Father, the First, the Archon. The only-begotten God may be (more or less the same as) the *Hyparchon.* The *Hyparchon* is in the *kolpon,* the "hollow," of the Father, having his being in the ultimate Ground of the Father to whom he is devoted. This *Hyparchon* is the One who "exegetes." To exegete is to manage, direct, govern, to go first, lead the way, guide, to teach, to expound, interpret, to describe or devise. It is also to be one who opens up the meaning of the sacred. I choose to see such exegesis as a kind of ecstasy. It "unpacks" and externalizes the reality hidden in the unity of the *kolpon,* in the "emptiness" of the invisible and ineffable. And it does so by "devising," that is, giving form.

These two, the *Archon* and the *Hyparchon*, the Invisible One and the Exegete, dwell within each other. What is enfolded (enstatic) in the Invisible is unfolded (ecstatic) in the Exegete. What is hidden in the formlessness of the First is displayed in the differentiated forms of the Second. If the exegesis is seen as Incarnation and the Incarnation as referring to the entire Cosmos, then the Cosmos can be regarded metaphorically as the interior of the Hidden One exteriorized, turned inside out. And the incarnate Exegete will manifest the interactivity that is the dynamic within the Person-Community of the Ground. The Cosmos will be built of interactivity and this interactivity will be a kind of eucharist, cross-feeding and energy-sharing.

The Theocosmic Exegete and the Nature of Finitude

The Exegete, like agape itself, does two things: it establishes distinction, or "severalization," and it unites by interactivity; it makes different, and it makes one. This is how a finite world is constructed. The Theocosmic Exegete, God exegeting Godself by making the world, does the characteristic Godlike thing: being many who are one. Both the "unpacking," the spreading out in variety of the unlimited potentialities of Being, and the gathering together so as to make still more different kinds of things, and gathering them yet again and again in assemblies of assemblies—both the scattering and the gathering are acts of the Exegete.

The diverse beings of the universe exist in terms of one another, in terms of their relations to one another, of their interactions with one another. They constitute mutual support systems and systems of such systems. Each one is able to be what it is only in the context of what it is doing for the others to which it is related. Self-being and for-others-being arise together.[7] In the natural world, there are many activities

7. Keiji Nishitani, in *Religion and Nothingness*, trans. Jan Van Bragt (Berkeley: University of California, 1982) has an interesting discussion of what he calls "circuminsessional interpenetration" in the context of the Kyoto School's understanding of *Shunyata* (Emptiness) and Heidegger's concept *Dasein* (lit., "there-being," in the sense of the facticity of existence): "all things are master and servant to one another. . . . To say that a certain thing is . . . servant to every other thing means that . . . it is a constitutive element in the being of every other thing, making it to be what it is and thus to be situated in a position of autonomy as master of itself" [148]; ". . . self-centeredness only comes about at one with other-centeredness, and other-centeredness at one with self-centeredness. And this is quite

and processes. But it is the *inter*actions,[8] the relations of several processes to one another, that make the universe-process, that build up the structure and the operation of the various levels of wholes that the cosmos is. These processes "mutually indwell" one another, so dependent are they upon all the others in order to be themselves. But this is just the way enstasis and ecstasis are related and united in the Trinity.

Just as in the Trinity there is no such thing as a single Person, so in the universe there is no such thing as a single being. All beings exist in co-acting communities, or systems of many beings. And it is from the collective, cooperative, interactions of the beings in the systems that whole new levels of being emerge.[9] This fundamental feature of the natural universe is significant for the view I am proposing of the cosmos as a kind of "incarnation" of the Trinity. It cannot be done by any single cosmic being. It can be done only by the whole cosmos, in its multitude of ordered and creative interactions. It can be done only by scattering and gathering, or severing and clumping.

To begin to get a sense for this, consider a figure drawn on a sheet of paper, any sort of figure, a closed curve. The figure has a boundary. The boundary defines it, separates the inside of the figure from the outside. The closed boundary makes the figure contain its insideness. This is the beginning of selfhood in the finite order. Also, we might think of the boundary as drawing the space together inside itself; it makes a spot, a body, a corpuscle, in the space. There is a togetherness inside the boundary that there is not outside. The figure is discrete, set off, separated. When you have drawn several ("severed") discrete bodies, you can relate them to one another in various clumping patterns. The discrete bodies, and the discrete clumps of discrete bodies, will be "different" from one another in various ways, initially just by being severed from one another, but then by being in different clump patterns. And then there will be clumps of clumps and patterns of clumps of clumps and patterns of patterns of clumps of clumps. We

natural and as it should be" [264]. I believe this is congenial with my sense of the enstatic/ecstatic relation (see note 5 above).

8. See, e.g., John H. Holland, *Hidden Order: How Adaptation Builds Complexity* (Menlo Park: Helix, 1995) 3, for examples of the importance of interaction in the immune system and the central nervous system.

9. See Stuart Kauffman, *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity* (New York: Oxford, 1995) 24, on the emergence of new levels of reality as wholes.

may notice that there is more unity in a patterned clump than there is in a single bounded figure. And more unity even than there was on the unmarked paper before the severing line was drawn. This is the exegesis of the invisible in terms of finitude.

In the natural world, beings will have relations of mutual reference, of position and motion in space and time, motions that affect clumping, patterning, and renewed severing, which in turn will limit the kinds of motions. Motions and patterns take place in terms of natural law, restricted according to the values of the cosmic parameters. From the motions, the patterns, the interactions, new wholes emerge with their own characteristic patterns, motions, patterned motions, with their own natural laws.

The emergent wholes are now the individuals for further unions. Each new level emergent exists precisely as the group of interacting individuals. It is not their product as something separate from them; it is themselves, interacting. The emergent cannot be divided, taken apart, and still be itself, still be present. It has its own definition, boundary, and selfhood. A great change may have taken place, as when non-living molecules by their interactions compose a living cell. These interactions are eucharistic sharings. Their emergents are analogical christic bodies. As the compounding goes forward, the exegesis unfolds.

Patterned clumping and behavior according to natural law means that some behaviors will be possible, others impossible. Wood will burn in air, which contains oxygen, but not under water, which is composed in part of oxygen. The clumping interactions, forming emergents, have opened up new interactions and blocked others. And most interesting of all, they have made some developments—under appropriate conditions—inevitable. Once there are clumping and patterning (combinations and permutations), possibility and impossibility (probability and branching development), in limited populations, certain things will spontaneously happen. Some of these will come right out of the nature of finitude itself.

Emergents will form when the conditions for them are right, but they need the conditions to continue. The first needs are for multiplicity and diversity, repeated copies of the same thing and many different kinds of things. A great deal of diversity is required in order to have a high chance of getting useful interactions. But diversity is available. And here is one way we can see inevitability. Notice that the number of ways of putting pieces together is always much greater than the

number of pieces themselves. And when patterning is included, the diversity is much greater still. If, for these pieces, there is a certain probability of a particular interaction occurring, and if there are sufficient multiplicity and diversity, the probability of that interaction actually happening a significant number of times will approach inevitability, even if the probability in any single encounter is quite low. The chance may be one in a million, but if you have a million, then you should get one. And since there may be more than one way of obtaining a given effect, the diversity will improve the chances in this way as well. This has a great deal to do with formation of molecules, shuffling of genes, and filling of niches in the biological world.

Finally, finitude and the need of organized beings to have the conditions for their existence continually met, result in issues of scarcity of resources, competition, cooperation, trickiness of various sorts (deceptions, dominations, cheating), predation, parasitism, enslavement, failure, death, and destruction. The drive to be and to be more, pressured by the limitations of the environment will bring forth also sensitivity (gaining information about the environment), intelligence (processing and applying the information), social organization, language, consciousness.

All of these are exegesis of the Invisible in the forms of finitude. Being tends to be more and to be in every possible way. It expresses as Being-communicating, interactive and holistic. Finite being has difference and change. These will be possible and necessary because it can be said of a finite being (as it cannot of the infinite) what it is *not*. "Not-being" will play a major role in everything about finite being, whereas infinite being is the "fullness of Being" and nothing can be denied of it. Finite being will be severed and interactive and novelty-creating.

Nobody "causes" these things to happen. There is no "choice" about whether this will be done. Nor does the Infinite "design" the forms of the finite. The forms of the finite arise from fundamental necessary relations in finitude itself. But those "necessary relations" include chance, spontaneous order, historical accidents, natural selection acting on complex adaptive systems, learned behaviors, and conscious choices by those beings capable of such acts. The amazing thing about the finite is that out of very simple entities and rules there come, stage by compounding stage, life and self-awareness, and morality and science and art. The Infinite is exegeted in the forms of finitude and then that finitude so knits itself up into more and more complex organizations that eventually it becomes capable of knowing itself as the

exegesis of the Infinite and revering the Infinite in Itself and in Its finite expression. All a eucharistic feast of splendor.

To and From the Stars: Pre-Biotic Energy-Sharing

It seems that stars are the crucial things in getting this universe well started. If stars can be made, then the rest will very likely follow. If stars cannot be made, nothing of what we know will follow. But how are stars made? Stars are formed by the clumping of matter with large distances in between. And where did the matter and the large distances come from? They are both accounted for by something called "the inflation scenario." It is a modification of the Big Bang schema for the origin of our particular universe, unproved but widely accepted.

The observed Hubble expansion—clusters of galaxies moving away from each other—and the detection of the cosmic background radiation lead to the conclusion that our observable universe originated in hot thermal communication. There was a time, about fifteen billion years ago, when all the matter we now see was close enough together that collisions could average out the temperature. The matter was close enough together because the universe was very small in the first tiny fractions of its existence, and all the matter was created together at that time. It came out of a field of potential energy, the "inflaton," which converted to what is called "rest mass" of matter. The potential was actualized simultaneously with the space expanding very rapidly for a very brief period. What made it expand? Negative gravity. The energy of the negative gravity balanced the positive energy of the appearing matter. Perhaps we may think of it more or less correctly as being like steam compressed in a small container, then suddenly released in a large space. The expansion causes the temperature to drop and so the steam condenses into liquid water. The space seems to sweat water throughout its volume. A phase change has occurred.[10] (For a fuller explanation, please read note 10 now.)

10. Inflation runs from time 10^{-35} second (from "the beginning") to 10^{-32} second; the size of the universe, much smaller than a proton, increases by a factor of 10^{50}. According to Heisenberg uncertainty relation between time and energy (when the time interval is known, the energy is unknown: energy may appear and disappear within the interval), "empty" space can produce energy as matter/ antimatter "virtual" particles, coming into being and annihilating again. By Einstein's $E=mc^2$, energy is equivalent to mass and thus is subject to the gravitational force. The force is figured in terms of density and pressure. Mass can also be thought of as inertia, the force required to initiate motion or to change speed or direction of motion, at rest inertia and moving inertia. Density measures at rest inertia and pressure measures moving inertia. The gravitational force is proportional to the density plus three times the pressure (for three dimensions). If the pressure term is high, the gravitational force will be controlled by the pressure term. The pressure term is a combination of positive kinetic energy and negative potential energy. The inflaton is almost entirely potential energy, so the pressure term will be negative and will be dominant in calculating the gravitational force. This means that the gravity will be negative, or repulsive. This is what produces the rapid expansion (this replaces, for its duration, the regular Hubble expansion). The expansion reduces the temperature (probability of a particle colliding—exchanging energy—with another particle), so the virtual particles that have come out of the energy field do not find partners for annihilation and thus they remain. The potential of the inflaton converts to actual energy in the form of matter and radiation. When the potential is exhausted, the negative pressure ceases. Positive density again rules gravity and the universe resumes Hubble expansion.

See Jeremy Bernstein, *An Introduction to Cosmology* (Englewood Cliffs, N.J.: Prentice Hall, 1995) for a technical exposition, and John D. Barrow, *The Origin of the Universe* (New York: Basic, 1994) for a popular presentation.

The rapid expansion accounts for the fact that matter and radiation now too far apart to be in communication by any transmission at the speed of light were formerly close enough together to reach thermal equilibrium; and it solves some other Big Bang puzzles. But one of the consequences of the inflation scenario is that it requires that the density of the observable universe be exactly the critical density needed to keep the universe on the edge between fly-away expansion and crunching recollapse. All the baryonic matter (protons and neutrons are baryons) that we are so far able to observe adds up to only about 10% at most of the required density. So, if inflation's mathematics are right, there must be some other kind of matter out there. See Michael Riordan and David N. Schramm, *The Shadows of Creation: Dark Matter and the Structure of the Universe* (New York: Freeman, 1991).

What is of interest for our cosmic incarnational approach is the analogy to the Invisible/Exegete union of John 1:18. The negative energy of the repulsive gravity and the positive energy of the appearing matter and radiation are not two separate entities or forces or operations. They are two sides of the same reality. The potential energy of the field (negative) causes the gravitational pressure to be negative, so the space expands. Expansion causes the potential energy to convert to actual, so matter and radiation appear. Given that the original field is full of potential energy, this is a perfectly natural event. The Being-pressure of agape in the God-Community makes it perfectly natural that it should express itself in creation, in the exegetical cosmos. Another level of analogy suggests that the primary analogate may be the enstatic/ecstatic relations among the Persons. Because the nature of

Being is agape, these are two aspects of the same reality. In the same way, the Invisible Father and the unitarily generated Exegete are one reality.

Energy-sharing continues in the early universe as the elementary particles are formed. The original particles from the matter condensation of the inflaton are X mesons and anti-X mesons. They decay into quarks (and anti-quarks) which unite to form protons and neutrons (and anti-protons and anti-neutrons).The decay rates of the X and the anti-X are different, so slightly more quarks are formed than antiquarks, and consequently more protons than anti-protons. When the mutually anti-particles have finished annihilating one another, what is left is a matter, rather than an anti-matter, universe. The annihilations produced photons (radiation particles), one photon for every particle annihilated, so the universe is also full of light. The matter particles now interact with one another and reheat the universe.

Some of the photons turn into electron/positron pairs, and the pairs annihilate back into photons. But the (Hubble) expanding universe continues to reduce the temperature, and at time one second the photons no longer have the energy to turn into pairs. The existing pairs annihilate, but again, for every billion pairs, there is one electron left over. So there are as many electrons as protons.

Originally there were as many neutrons as protons. But while protons are stable, neutrons decay in a matter of minutes. However, while the temperature was high enough, protons and electrons could unite to replace them. But when no more electrons were being made from photons, neutron production fell off so that we now have only two neutrons to every ten protons—which is why the universe has more hydrogen (just protons) than any other element.

The next milestone is at one minute, when atomic nuclei begin to assemble: one proton, one proton plus one neutron, plus another proton, plus another neutron equals helium. There matters rest, about 75 percent hydrogen and 25 percent helium, for the next three hundred thousand years. By that time the temperature has fallen enough that energetic photons can no longer bump electrons from their attachment to nuclei. Nuclei pick up an electron for every proton and matter becomes electrically neutral. And since the photons are no longer bumping into electrons, they are able to travel reasonable distances in straight lines, and the universe becomes transparent to light.

This decoupling of matter and radiation opened the way to the formation of stars. Stars have to form under the influence of gravity, weakest of the four natural forces, and there had been too much competition from the other interactions up till now. Now matter begins to clump together as stars and galaxies and clusters of galaxies and superclusters. This process goes slowly, but by one billion years, galaxies are forming.[11]

The galactic cloud fragments into hundreds of billions of small clouds as it collapses under self-gravity, and the small clouds concentrate in the same way. They are spheres of hydrogen and helium. As they become denser (more than 160 times as dense as water), the temperature in their interiors goes up tens of millions of degrees. High temperature means vigorous collisions, energy-sharing. Both the strong and the weak nuclear forces are at work. The weak force enables some of the protons to emit positrons and thus turn into neutrons; and the strong force enables the protons and the new neutrons to stick together. Two protons and two neutrons make helium-4 and a lot of extra energy as radiation. One by one the stars are turning on.

The first nuclear synthesis is of helium from hydrogen. When a star's hydrogen is used up, it no longer has enough pressure from inside to resist gravitational collapse, and it begins to contract and grow denser and again hotter. At this stage it welds helium into carbon. Nitrogen and oxygen are spin-offs of this process.[12] Hydrogen, oxygen, carbon: the makings of hydrocarbons, foundation of life. If the star is massive enough (at least four solar masses), the synthesis of still heavier elements can follow: sodium, magnesium, silicon, sulfur—components of the land masses of planets. A further stage of synthesis leads to element number 26, iron, most stable of all. Central star-reactions stop here but heavier elements can be made in its outer atmosphere where neutrons emitted from the core can be captured by synthesized nuclei. Captured neutrons may decay into protons by emitting electrons and thus turn the nucleus into one of higher atomic number.

11. Joseph Silk, *Cosmic Enigmas* (Woodbury, N.J.: American Institute of Physics, 1994) is mostly about galaxy formation. Riordan and Schramm, 115–53, covers this stage of the evolution, with helpful illustrations.

12. See Barrow, 124–5, for the extraordinary coincidence by which carbon fits an energy level—a "resonance"—greater than the sum of the energies of the helium and beryllium nuclei, so that it is very easy for a lot of carbon to be synthesized. But once made, the carbon could easily have been converted into oxygen by union with helium, except that this reaction just fails to be resonant, and therefore, although plenty of oxygen is made, the carbon survives in equal quantity. P. W. Atkins, *The Periodic Kingdom: A Journey into the Land of the Chemical Elements* (New York: Basic, 1995) traces the formation of other natural nuclei.

Having reached its "iron age," the star may contract its outer regions and then explode them out again, scattering the heavy elements. Second generation stars in formation can sweep these up, gaining a headstart on their own synthesis operations. Heavy elements not taken by stars are subject to collisions in the interstellar medium, and in this way intermediate number elements not synthesized in stars can be formed. By the time we have passed through three generations of stars, we may have a little of all the ninety-two natural elements.

The time is now about ten and a half billion years. There may have been more than three generations of stars. Some burn out quickly, others last a long time with a steady production of light and warmth. In the interstellar medium there are molecules as well as atoms. They are on dust grains, bits of silicon, oxygen, magnesium, and iron, covered by a thin layer of water ice. Radio telescopes have found about a hundred different kinds of molecules with up to as many as thirteen atoms per molecule. Among these are carbon monoxide, water, methane, and ammonia. The most numerous combinations are of carbon, hydrogen, oxygen, and nitrogen, the very elements that make up almost all of living bodies.

Symbiotic Catalysis: The Origin and Nature of Life

I like to use the word "symbiotic" in a much broader sense than the "mutualism" of biology. I use it to describe any kind of sharing in which each party does something important for the other, in which both benefit, and indeed in which the interaction between the two (or more) constitutes a new unit of reality in some way. In this sense it is closely related to "self-organizing," which means a process in which relatively simple units are linked by their own natures to compose a higher level unit with its own rules of order and relationship.

After the formation of atoms and molecules, the next place we look for this exegetical incarnation of trinitarian life is in the complex interactions of biomolecules. Sugars are formed based on carbon rings of shared electrons—so thoroughly shared that they are called "delocalized," no longer identified as belonging to their atoms of origin but to the molecule as a whole, their collective charge spread continuously over the entire assemblage. Hydrogens and oxygens being added, we have a proper carbohydrate. A sugar of special interest is ribose, because it is the foundation of ribonucleic acid, RNA, one of the coding

molecules (together with DNA) for making the other molecules of which living bodies are composed.

To the ribose molecule are added a phosphoric acid group, which will handle energy storing and releasing as well as chaining, and a nitrogen base group, which will handle the coding. With these additions, we have a molecule called a "nucleotide." When a number of these are chained together, we speak of RNA. Life seems to have started with RNA; we will come to DNA later. RNA chains can self-assemble because the phosphate groups can link to one another. But RNA can also do another thing: it can replicate. The nitrogen base groups are rather like pieces of a jigsaw puzzle and certain matching ones can fit together: adenosine pairing with uracil, and guanine with cytosine. This enables a length of RNA chain to attract the nucleotides to form a complementary chain. If the double strand then splits, each single strand will attract complements, and they will have succeeded in replicating each other.

But a molecule that can copy itself this way will soon make many copies, using available atoms or small molecules in its environment. If various RNAs, with different sequences, share an environment, they will be in competition with one another for these raw materials, and any advantage that any sequencing pattern can show in relation to obtaining materials and copying at speed will enable it to make more copies and constitute a larger portion of the population. This can be demonstrated in the laboratory.[13] Variants can arise from copying errors and take over a population. This is darwinian selection acting on a self-replicating molecule, the first "gene."

What might give an RNA such an advantage? Finding a catalyst to make its reactions go faster. Among the early RNA sequences there must have been some that linked amino acids to their ribose sections. This brought the amino acids close enough together that they could make their customary peptide bonds. Some of the resulting peptides could act as enzymes and catalyze certain reactions. If among those

13. See, e.g., Nigel Calder, *The Life Game* (New York: Viking, 1973) 80, description of an experiment in which a portion of genetic material (plus an enzyme and appropriate food) is allowed to replicate in a test tube. Then poison is introduced. Replication stops for a short while, but within minutes mutant versions of the genetic strand appear and replication resumes. See also Bryan Bunch, "Self-Replicating Molecules That Are Not Alive," *The Henry Holt Handbook of Current Science and Technology* (New York: Holt, 1992) 166–7, and Christian de Duve, *Vital Dust: Life As a Cosmic Imperative* (New York: Basic, 1995) 61.

reactions was the replication of the RNA sequence that had helped assemble the peptide, then a powerful catalytic cycle had been formed.

The RNA, being in a certain sequence, would force the amino acids to assemble in a certain sequence, and that sequence would define the peptide. A particular RNA makes a particular peptide, which helps make the same RNA again. Natural selection would then work on both the peptides and the RNAs and their combinations. One of the results of this winnowing was that the peptides concerned became limited to proteins, made of a select group of twenty left-handed amino acids.[14]

This is clearly a symbiotic relationship. But we will now see it compounded. One kind of RNA making one kind of protein is one cycle. If this protein, in addition to catalyzing the assembly of its own RNA, facilitates another RNA, perhaps by helping with some portion of its translation into protein, and that protein in turn helps the first RNA with a part of its work, then the two cycles are helping each other. Adding yet more simple cycles, each doing something different to help what is now becoming a community effort, we have what Manfred Eigen called a "hypercycle."[15] This is our best explanation so far of the transition from the non-living to the living. When we have a hypercycle enclosed in a cell membrane, we will have the magic moment when life began.

William Loomis believes that although each step in achieving the hypercycle may have been rare, the diversity and supply of chemicals was so great and hindrances so few that in a few million years there could easily have been hypercycles all over the planet. And this new method of creating proteins increased the diversity of materials and thus the likelihood of successful hypercycles forming. "By directing the polymerization of [only] four different amino acids in peptides

14. C. de Duve (previous note), p. 63. The difference between a "peptide" and a "protein" is that a peptide is any chainlike assemblage of any amino acids, whereas a protein is a special class of peptide, made of a large number of amino acids but limited to a set of twenty specific L-amino acids (from Latin *leavus*, left-handed).

15. Manfred Eigen and Peter Schuster, *The Hypercycle: A Principle of Natural Self-Organization.* See Calder, 78, for photo, and surrounding pages for popular exposition of how the hypercycle works. See William F. Loomis, *Four Billion Years: An Essay on the Evolution of Genes and Organisms* (Sunderland, Mass.: Sinauer, 1988) 22–7, for technical explanation, including the "hairpin" turn of RNA that exposes the three-base "codon" which specifies an amino acid, and calculations of how many subcycles are needed for a fully functioning hypercycle.

up to fifteen amino acids long, nucleic acids could specify millions of different peptides."[16] This is a natural principle that shows again and again: a very few different items, because of the huge numbers of their combinations and permutations, can give rise to enormous numbers of interactive communities of various sorts.

This is the proposed cosmic eucharistic sharing that makes a christic body in image of the trinitarian unity. Each new level of being manifests properties not possessed by its components, but properties that emerge from what constitutes the compound union itself, namely the *interaction* of the constituents. The new properties are the properties of the integrated dynamic of the assemblage.

Community Life

The new hypercycles soon improved their lot by enclosing themselves and a good supply of building materials (food) within lipid bilayers, cell membranes equipped with ports for entry and exit of desired and undesired products. At some point these primitive cells could be styled "bacteria," carrying the code for making themselves in a new and improved nucleic acid, the double-stranded DNA, deoxyribonucleic acid ("deoxy-" because the sugar has lost one oxygen atom). DNA has very stable double strands, using base-pair bonding, which RNA does not, and so it is preferred for long-term storage of the information. It does not do any "work," leaving that to RNA, which actually guides the assembly of the proteins, but like a queen bee in the middle of a hive, it is tended by enzymes and opened for transcription, its directions being carried out by the multitude of workers who comprise the other tenants of the cell.

Like all cells, bacteria treasure their DNA, but they are also very generous with it. Gene-swapping goes on all the time among the different strains of bacteria, by a variety of means.[17] Bits of DNA—"small replicons"—pass through openings in cell membranes or through conjugation tubes or by being encased in capsules with tube-tails that can attach to other cells and deliver replicons down their chutes. Sorin Sonea and Maurice Panisset declared in their *New Bacteriology* that "in nature any bacterium has access to most, and possibly to all, genes

16. Loomis, 27.

17. See Sorin Sonea and Maurice Panisset, *A New Bacteriology* (Boston: Jones Bartlett, 1983) 41.

belonging to other bacterial strains." The bacteria therefore constitute "a planetary bacterial entity." This entity undergoes "evolution as one individual or as a communicating society, just as mankind undergoes cultural and technical evolution."[18]

The next example of community living is the formation of the eukaryotic cell from a symbiosis of bacteria. This origin of the large cell with another membrane inside to protect its DNA and a number of specialized bodies whose behaviors benefit one another, was proposed by Lynn Margulis. It seems to have been a creative response to the great oxygen poisoning (free oxygen released by the photosynthesis practiced by cyanobacteria) about two billion years ago that killed 90 percent of living things. Some bacteria had become tolerant of the oxygen by growing protective membranes, and some others had become able to use the oxygen. These latter, the aerobes, invaded the protective anaerobes and somehow neither destroyed them nor were destroyed by them. The host cell was able to use the energy-rich products of the aerobe's efficient metabolism, and the small aerobic partners benefited by living in the rich soup of the host's fermentation wastes.[19] All the rest of Earth's creatures (other than the bacteria) are descended from this symbiosis.

Multicelled organisms now appear and their differentiated organs and tissues form another kind of community. A very sophisticated expression process turns on certain genes for certain purposes and turns them off again. Cells develop one way or another depending on what their neighbors are doing, where they are located in the body, and what stage of development they have reached.[20] All the various organs and organ systems work together, united by the DNA carried in each of their cells, and the body as a whole is a single individual. Individuals live in the context of their environment and those who succeed in earning a living there leave progeny to carry on their genes. Genes for making bodies that adapt well to the environment and are more prolific in offspring will crowd out alternative genomes. There is a lot of competition among variants. Variations in the genome come from mutations at the molecular level, from copying errors, and from several devices for gene shuffling. Prominent among these, of course, is sex, with its meiotic crossover and recombination of genes. But another interesting process is the rearrangement of genes within a single genome by modular assembly.

18. Ibid., 112.

19. Lynn Margulis, *Symbiosis in Cell Evolution* (San Francisco: Freeman, 1981). Margulis does not think that the nucleus itself resulted from symbiosis, but she does believe that the other organelles (bodies within the cell which function analogously to organs) in the eukaryote arose through symbiosis. The aerobic bacteria concerned, for instance, became what we call *mitochondria*, which all of us (eukaryotic types) have in our cells.

20. Lewis Wolpert, *The Triumph of the Embryo* (New York: Oxford, 1992).

This is a method used on several levels by nature. It takes advantage of history, using combinations already worked out in the past. This was the method used to string together polymers, such as RNA and proteins, mixing the four bases of the nucleic acids in the one case and the twenty amino acids in the other. A few units combined in many different ways. Genes can be put together by a similar method from minigenes.[21] The advantage is this: a basic portion of a gene that has proved to be very successful can be conserved unchanged, while remaining portions can be varied for application to particular situations.[22] The proteins made from these modularly assembled genes will also be put together from modular units called "domains." This avoids having to start from scratch each time. The domain that repeats a basic function can be coded for by the conserved minigene; only the variable functions of the protein will need new minigenes. Even the variable domains may be assembled from ready made sub-units in this way, allowing new combinations to appear quickly.

Further reflection on modular assembly shows that the development of life is a highly probable affair, for at each advance the modular units will already have been tested and selected. The number of combinations of these units, although large, is not so large that it cannot be exhaustively explored, all combinations being submitted to natural selection before proceeding to the next level of assembly. Christian de Duve, who holds that life and consciousness are bound to emerge from the step by step modular assembly, says that "as evolution proceeds in a given direction, the range of available

21. Not all of DNA codes. Stretches of coding DNA, called "exons" because they "express" as proteins, are interrupted by stretches of non-coding DNA, called "introns." Enzymes can cut out the introns and splice the exons together when it is time to copy them. At this point the modular units can be assembled in various ways. See de Duve, 75–8, 222–6.

22. The conserved portion, which will be the same in all these varied genes, even across species lines, is called a "homeobox." See de Duve, 197.

choices narrows, and its commitment becomes increasingly focused and irreversible."[23]

Competition and Cooperation

All lesser group involvements take place in the grand community of the ecological region. Here non-living features, such as land, water, climate, make significant contributions as well as the bacteria, the plants, and the animals. The relationships can be quite intricate. Bacteria have mutual assistance programs with the roots of plants; they also live in the guts of termites and in the digestive tracts of ruminants. The methane they produce affects the atmosphere, keeping it from collecting too much oxygen and setting the forests on fire. Tiny polyps in the oceans form coral reefs which become homes to many other species. The oceans themselves moderate climates, opening up niches for life. Flowing between islands, they promote speciation by isolating kin groups. Diversity increases. Food chains develop. Predators and prey evolve better senses, abilities, protective devices. Social organizations develop.

At this point we need to remember that trinitarian life, when expressed in terms of finitude, requires both "scattering" and "gathering," both severing and uniting. This means that each living creature must act to preserve its own existence and to promote the copying of its genes. If it does not do this, there will not be multiplicity, diversity, evolution, and therefore no exegesis in terms of incarnation. So a great deal of what we call "selfishness" and looking to one's own interests is needed. On the other hand, out of this self-interest drive various forms of cooperation have emerged, gradually—as intelligence grew—showing as empathy, until true morality appeared.

Predator-prey relationships bring out two interesting points. The first is that "good" and "evil" are historically point-of-view judgments. What is good for the predator is inevitably evil for the prey. This relation has persevered to the human era and the cultural institution of warfare: what is good for the victor is evil for the conquered. Victors believe that God has been on their side; conquered peoples, who have frequently sustained heavy losses in families, territory, means of livelihood, culture, puzzle over why God abandoned them and try to invent new theologies to cover their hurt. Sometimes the

23. Ibid., 77; see also 86 and 226.

conquest is largely economic or cultural, but the point-of-view judgment is the same: the economic policy or religious/social form that prevails believes itself right and the destruction of its competitor justified.

The other interesting point is that out of predator-prey relationships all sorts of progressive variations arise. Keener senses was a first development: smell, hearing, sight. But that had to be integrated into a complex feedback process in a nervous system that could couple the detection of items in the environment to appropriate actions. Eventually the formation of internal models of the environment and of the possible interactions of the animal with the environment gave great advantage; alternative courses of action could be played out internally without wasting time and energy actually doing them. Intelligence evolved. Not wasting energy has been a consideration from the beginning. That was a strong reason for using modular assembly; taking up ready-made modules saved making them from still smaller units. This is the foundation of eating, ingesting molecules already assembled by some other body's expenditure of energy. The same "reasoning" applies to letting some other animal kill a prey, then running that animal off and eating the prey oneself, and even to tricking someone else into raising your children for you, as cuckoos do.

Trickery, cheating, taking advantage of others usually pays off handsomely, and a great deal of it is done. Butterflies, for instance, imitate the colors and patterns of other butterflies that predators have learned are poisonous or bad-tasting. This protects the cheats for a while, until the predators discover the subterfuge and start eating both models and mimics, whereupon the models' variants begin to show in larger proportions and their mutation prevails. Many predators have learned how to disguise themselves and lie in ambush, just as many prey species have gradually shaped to resemble twigs or leaves or shadows in the grass. More intelligent animals will sometimes play deliberate tricks on their fellows, giving false alarms to distract others while they themselves consume the special treat. The insistence on looking out for one's own genes leads to destruction of another male's cubs and the forced production of one's own. The prevalence of rape among our species and the higher incidence of child abuse on the part of step-parents (and unlicensed companions of parents) are the behavioral descendants of a long line of ancestors.[24] This, of course, is in no

24. Many examples of this sort of behavior can be found in Lyall Watson, *Dark Nature: A Natural History of Evil* (New York: HarperCollins, 1995).

way an excuse or justification for behaviors that we clearly identify as wrong, but it does show where they come from and why.

On the other hand, cooperation has also risen through the ranks, beginning with the structural symbioses we have already mentioned. Colonies, mating pairs with offspring, hiving insects, herds, and packs all share life-protective and life-promotive functions in their groups. Altruism, as the willingness to deprive oneself for another, appears in proportion to the fraction of genes shared with a close relative, and very gradually is extended beyond close genetic relationship, to others of one's species and to other species. Gestures of friendship have developed, food and grooming sharing stabilize bonds, rituals of conciliation and peace-making grow up, grieving for others' pain or loss or death has its beginnings in the beasts with larger brains. Human goodness, as well as human sinfulness, has antecedents.[25]

The Human Brain

Modular assembly and complex interactions, with their emergents in compounded organized order, are again in evidence when we look at the human brain. Even a single neuron is a very complicated affair, operating by electrical polarization (collecting a charge) and depolarization to pass a message from one end of the cell to the other, and by highly specialized chemistry to pass it on to the next cell.

The neuron's input end is a forest of dendritic fibers, branching and subbranching, and receiving chemical signals through its thousands of synapses from other neurons. As all this information is funneled toward the cell body, a number of factors act to process it: whether the original inputs were stimulating or inhibitory; whether their relay was delayed (or blocked) at junctions where subbranches join major branches; whether an impulse was passed by an OR gate (either one of the subbranches would do) or by an AND gate (both branches needed); additional information coming in from synapses located closer to the cell body. The decision the cell needs to make—

25. See Robert Jay Russell, *The Lemurs' Legacy: The Evolution of Power, Sex, and Love* (New York: Putnam, 1993); Frans de Waal, *Peacemaking among Primates* (Cambridge, Mass: Harvard, 1989), and *Good Natured: The Origins of Right and Wrong in Humans and Other Animals* (Cambridge: Harvard, 1996); Alfie Kohn, *The Brighter Side of Human Nature: Altruism and Empathy in Everyday Life* (New York: Basic, 1990).

either "remain polarized" or "depolarize"—is passed along the cell membrane from one patch to another, each ion channel in the membrane opening or closing as stimulated by the one before it. But there are also synapses on the cell body, and the "decision" is subject to change. At the farther end, the axon is covered (in patches) with insulation, but the uncovered spots can still receive last minute corrections to the debatable decision, which is eventually settled and transmitted through the axon's branches to its synapses with all the further cells with which it communicates.

These single cells (of which there are about two hundred billion in the whole brain, thirty billion in the cerebral cortex), complicated as they are individually, next link in sequences and in assemblies and in sequences of assemblies, and in assemblies of assemblies, until they are a global network. Each level of organization has its own output product, from a simple reflex to a perception, to concepts and organizations of concepts and reflections on concepts. Probably these arrangements are actively *constructed* by the brain itself and winnowed by a selection system of the same type as that operating among the genes. This would include making copies of the neuron patterns, having competitions between the patterns, having modular units of patterns form larger patterns, and being capable not only of producing variants by copying error but of constructing variants by changing one or more modular units without necessarily changing all the rest. Especially valuable core modules might be repeated again and again in many different variants, a kind of embedded grammar.[26]

And what about the chemical aspect of this communication net? The molecules that stimulate the receptors at the synapses are neurotransmitters; there are dozens of them known so far. Some of these are excitatory, others inhibitory. The amount of chemical released into the synaptic cleft can vary. The number of post-synaptic receptors sensitive to a given transmitter can vary. When the transmitter has been released and has stimulated its receptor to start an impulse in the next cell, the transmitter will usually be reabsorbed by the "button" from

26. Alwyn Scott, *Stairway to the Mind: The Controversial New Science of Consciousness* (New York: Springer-Verlag, 1995) 80–94. The cell assembly idea originated with Donald Hebb, *The Organization of Behavior* (New York: Wiley, 1949). See also William H. Calvin, *How Brains Think* (New York: Basic, 1996) and William H. Calvin and George A. Ojemann, *Conversations with Neil's Brain: The Neural Nature of Thought and Language* (Reading, Mass.: Addison-Wesley, 1994).

which it was released and recycled; this recycling time can be varied. In a general way, synapses change strength with use: the more they are used, the more transmitter is released, and the stronger the synapse is. All this adjustability is what enables the brain to learn, to remember, to create. Without it, the living circuitry would be as rigid as our electronic machinery's.

Recently discoveries have been made indicating that brain neurotransmitters may reach other parts of the body and be received and have effects there. Not only that, but these other tissues—especially immune cells—may also be able to synthesize transmitter molecules and send them out. On the other hand, hormones—thought to be produced only by glands—are being produced and stored in the brain. Exciting work has been done by Candace Pert and her colleagues at the NIMH, showing that there is a family of peptides (about sixty to seventy of them) that interact among three major systems: the nervous system, the endocrine system, and the immune system. The endocrine system, through its hormones, regulates and integrates various functions; for instance, there are numerous different growth-promoting hormones, some of which stimulate division in a wide variety of cells, others being more specific. The immune system (spleen, bone marrow, lymph nodes, and several types of immune cells in circulation) not only defends the body against invaders but is responsible for tissue repair and wound healing and for "tissue integrity" and maybe even the body's "molecular identity" (by the lymphocytes regulating the number of cells and their molecular constituents).

These peptides include neurotransmitters, hormones, endorphins, growth factors, and other special molecules that attach to a multitude of specific receptors on the surfaces of all body cells. Remembering the important contribution of the hormones to our emotional experiences, as well as the cognitive activity of the brain, we can say that we have here a genuine "psychosomatic" network of unifying interactivity for the entire body. This is how the body keeps in touch with itself, shares its news and its assistance, and accounts itself one single unified being.[27]

27. Fritjof Capra, *The Web of Life: A New Scientific Understanding of Living Systems* (New York: Anchor, 1996) 280–5. Pert is quoted as saying, "I can no longer make a strong distinction between the brain and the body" (Boston, Elmwood Symposium, 1989, unpublished). Capra points out that peptides influence mood and behavior, and that all bodily functions are emotionally colored (e.g., the entire intestine is lined with peptide receptors). For detail see Candace Pert, *Molecules of Emotion: Why You Feel the Way You Feel* (Los Angeles: Simon & Schuster, 1977).

Human Consciousness

But does this wonderful human brain-body explain human consciousness? With human consciousness we come to a situation we have not faced in any of the other levels of the cosmic organization. We experience our own consciousness *subjectively*, as subjects, from the inside. All the other levels of organization we had observed from the outside, objectively, seeing them as objects of our cognition. But in the case of our own consciousness, we do something more than and quite different from knowing it as an object for our cognition. We know it by being it. We ourselves are the cognizer.

It is also true that we can reflect on the facts of our consciousness and can observe that some subjective experiences can be correlated in a rough way with certain objective observables: various interactions with the environment match pleasure or pain, blows to the head can knock you unconscious, anesthetics can put you to sleep and keep you from remembering, intoxicants can loose you to strange perceptions and regrettable behavior, even psychosocial incidents can terrify you, make you angry, depress you or exalt you. We can trace perception through certain areas of the brain; we can identify language areas and motor areas; and we can relieve certain illnesses by brain surgery.

But can consciousness—not the behavior of our bodies, objectively observable, but our subjective experience of being aware, of being conscious of being conscious, of being ourselves—can this be exhaustively explained and accounted for in terms of the objective observables alone? Some neuroscientists claim Yes, others insist No. A strong example of the first school is Francis Crick, who believes that he himself, his joys and sorrows, his sense of being "I," his personal identity and experience of free will, "are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules."[28] In other words, nature has evolved a combination of molecules so artfully working with one another as to produce a creature which experiences itself as transcendent of the molecules, but which also discovers

28. Scott 138, citing Crick, *The Astonishing Hypothesis: The Scientific Search for the Soul* (New York: Simon and Schuster, 1994).

that this is an illusion and its sense of being a "self" is not true. The creature knows that it isn't there.

Examples of the other view are Erwin Schroedinger and Eugene Wigner. Schroedinger argues that we exclude subjective experience from the world-picture we are willing to take seriously and then claim that we have discovered that there is no such thing there. But, Schroedinger asks, who has framed the picture and determined its contents? We ourselves; our conscious self is the picture-maker. Wigner says something similar, that the starting point in physics is not actually the position of a particle but the knowledge of the observer concerning the position of the particle. Therefore it is "unreasonable to describe the basic concept—the content of the consciousness of the observer—in terms of the derived one . . . the concept of the positions of atoms."[29]

Most recently, David Chalmers has set aside the "easy problems" of showing how some particular brain behaviors result in certain observable effects, and has directed attention to "the hard problem" of understanding the nature of our interior, subjective experience of consciousness. This cannot be done by the old-fashioned materialistic reductionist methods, or even by contemporary nonreductionist materialist methods. A whole new approach is needed. It is no use trying to "explain" consciousness in terms of "structure and functions." It is not that kind of problem. It doesn't exist in that context. You cannot account for subjectivity in terms of objectivity.[30]

I propose to make my contribution to this question in these terms: What does it mean to "explain" something? Presumably it means to give an account of something less well known in terms of something better known. Explanations are either of the axiomatic type—tracing back to axioms and definitions and ultimately to undefined terms—or of the dictionary type—going round in a circle, every word of any explanation having to be explained elsewhere in the explanation-network. In practice, we feel that we have an adequate explanation when we are no longer motivated to ask for one. But that satisfaction depends on the context of all our thoughts about what we think we understand and what constitutes "understanding." This context is shaped by collective and social consensus, often accompanied by explicit criteria, such as conformity to some authority (living or written), or measurability or repeatability or other standard of public shared judgment. An interesting question is whether "explanation" so restricted always results in "understanding."

29. Ibid., 115–6. The Wigner quote is from "Are We Machines?" *Proceedings of the American Philosophical Society*, 113:95-101, 1969.

30. David J. Chalmers, *The Conscious Mind: In Search of a Fundamental Theory* (New York: Oxford, 1996).

The definition of what constitutes an acceptable explanation, therefore, may have built into it certain exclusions that prevent certain things from being "explained." In the present case, only explanations in terms of the behavior patterns of matter are acceptable in the scientific community. I cannot help being amused by the way all these researchers into consciousness and its relations with nervous systems (and other systems), are terrified of being thought "mystical" by their peers. Their works invariably contain a disclaimer to this effect somewhere, usually in the form "There is nothing mystical in this." I wonder what they think "mystical" means—probably psychic or occult or superstitious or to be taken on faith without question—in any case inaccessible to the agreed upon criteria of what an explanation is allowed to be. But our own experience of being conscious is a very difficult case, as Chalmers has pointed out, for it does not seem to be readily handled by the acceptable explanation schemes.

I propose therefore to revert to the rather simple definition of explanation as accounting for the less known in terms of the better known, and to ask, What is better known to us than our own consciousness? And why should we not face the fact that an explanation of a subjective experience cannot be had by excluding the subjectivity and admitting only a postulated objective arrangement as what is really there, the experience we have notwithstanding. I suggest that we acknowledge consciousness as a primary reality, a ground reality, something that cannot be explained in terms of something else because there is nothing else prior to it or simpler than it or better known than it in terms of which such explanation might be couched. This is, I would urge, our actual lived experience. We do not experience our consciousness as a composition or an effect. We experience it as that which experiences all the things that we do experience. We experience it as the prior on which all else depends, as the knower of the known. It is what we start with and what we end with in our explorations of reality.

There are some interesting derivatives from this view. If our subjectively experienced consciousness is a primary datum, then it is not exhaustively accounted for as an emergent from bodily

interactivities, even though some of its modifications can be correlated with some of the latter's. It must always be included in its own right as an independent ingredient. But if this is the case, then there would not seem to be any ground for excluding it from any level of cosmic organization. It must run all the way back.

This is reminiscent, of course, of Teilhard de Chardin's *dedans* and *dehors*, the within and the without, or consciousness and complexity, the twin aspects of any reality. "Within-ness," like "without-ness," is here a cosmically generalized term, showing in appropriately specific ways according to the various levels of organization in the universe. We have been able to identify and describe the levels of the *dehors* because we have comparable access to all of them. We do not have comparable access to the various levels of the *dedans*. Our access to our own within is unique. So we cannot give directly experienced phenomenological accounts of the "consciousness" of cats, fish, bumblebees, pansies, bacteria, etc. But we can allow for the possibility that it is there in that level's own way.

And we can do something more. We can pull the whole thing together by remembering the model of the Incarnation and regarding the within and the without as two dimensions of a single fundamental reality. We can use the basic concepts of Daniel Walsh and Teilhard here as names for the most general form of "interaction," having both subjective and objective aspects. Walsh said that the starting point is all important and that the starting point is *agape*. Teilhard said that what links all beings without exception is "the affinity of being for being," his definition of "love." Every level of organization is simply this affinity, showing in more and more complex (compounded) and more conscious ways.[31] The *dehors* and *dedans* are two dimensions of a single reality. Teilhard's "affinity," Walsh's *agape*, are indicators of a ground-level reality, a universally generalized reality.

It is important not to be distracted by Walsh and Teilhard calling this ground-reality "love." This word, much cheapened in our culture, makes us think of human emotional experience as the primary analogate. This is incorrect. The primary analogate is the interactivity—whatever that is—of the Trinity. This is then exegeted in the cosmos in terms of the two dimensions of material substances and the various forms of unifying interiority for which we do not have a proper terminology except at our own level, where we are reflexively aware of it as our conscious selfhood. Both of these dimensions exhibit the differentiating and unifying interaction of the Ground indicated by the term *agape*.

31. Pierre Teilhard de Chardin, *The Phenomenon of Man* (New York: Harper & Row, 1961) 264 (Torchbook edition).

Just as at the top of our complexity/consciousness scheme there is nothing more suitable in terms of which to explain our *within* experience of consciousness, so at the reductionistic bottom of the *without* explanation chain we have the Laws of Nature, the cosmic parameters, and the four fundamental forces. What explains them?[32] We do not explain them. We start with them. They explain other things. But are they not instances of "affinity of being for being"? So we have two dimensions. For us, from our standpoint, the unexplained is at the "top" for the within and at the "bottom" for the without. But both are clearly interactive being-sharing to form unions. This is what I call using the model of the Incarnation. And it is this same reality that I have been calling here the eucharistic sharing of being. It is the trinitarian being-by-union.

I consider that trinitarian eucharist is a good term for what is going on. Eucharist is what forms the Church. Church is the living body of people who are united by sharing *agape*. If they do not share *agape*,[33] no amount of church membership or believing or even reception of sacraments—external signs of the reality which is divine *agape*—will constitute them Church. Church is the *corpus Christi quod est ecclesia*. Church is the Body of the Exegesis of the Trinity. Eucharist is the sharing in both dimensions, the without and the within, the interactivity, the cross-feeding of each with all, giving every aspect of one's being ("body, blood, soul, and divinity") as nourishment for all the rest. Incarnation is perhaps the structural name for What Is, but Eucharist is the dynamic name for What Is Going On.

Conclusions for Spirituality

I see several applications of this proposed view for our everyday spirituality. The first probably is to see that the traditional ideas and terms and beliefs are not uncongenial to contemporary understanding of the natural world. On the contrary, they seem to me to cast

32. On this question, see Paul Davies, *The Mind of God* (New York: Simon Schuster, 1992).

33. Consider John 13:34-35 and I Corinthians 13:2.

very helpful light on it. And at the same time, our natural knowledge helps us to see that the traditional doctrines have further layers of significance which we may not have mined as yet. This has the consequence of making us feel more comfortable in our contemporary world. We can hold it all together, we do not have to set aspects of it at odds with one another. We ourselves can feel "at home in the universe," as Stuart Kauffman puts it. We are kin to everything else. Everything else is kin to us. If we find divinity in ourselves, there is divinity all the way through. The whole thing is a divine expression, an exegesis, an incarnation.

A further ramification from this would be that we can study the sciences, we can work in the world, we can believe in the cosmic enterprise, we can see our efforts, though small, as definitely contributing to the over-all expression. We can put the untoward events of a finite world—shaping itself up by trial and error, accomplishments along with side effects, point-of-view good and evil—in perspective. We can exert ourselves to increase the good for all without making an unsolvable theological problem and mystery out of the means by which all this is happening. We can remember that all events are significant on their own proper levels. We can give up expecting moral or personal relationship meanings in natural biological or physical events.

We can stand amazed at the creativity of the world's expression of its Creator, who has "given birth to" a world which has evolved to the place where it can "give birth to" God. The universe is a gigantic Theotokos Project. That is what is going on. How it is going on is according to the necessities of finitude and the creative possibilities of combining them. That is, by being many and one together like the Trinity, by being a within joined with a without like the Incarnation, and by being sharing of Being like the Eucharist.

We can devote ourselves to practicing what the sacrament of the eucharist means. It is not, therefore, primarily a ceremony in a building set apart for religion. It is primarily the building up of the Body of Christ, as St. Paul said. The Messiah—bringer of peace, justice, and loving-kindness—"comes" as this Body grows. It is not a single magical individual; it is a whole community, whose limits are not known. The Body grows as the members feed one another with their lives, with trinitarian interaction, *agape*.

For Thomas Merton, I believe, this would have social, political, economic, and interreligious application, and I agree with this. Full

Eucharist means sharing on every level of our reality. I like to talk about "Jesus' Suppers"[34] as celebrations and sharings that may actually have taken place in Galilee and as multilevel sharings that could take place now. I see them as starting with ordinary food sharing, expanding to other material goods such as shelter, clothing, medicine, tools. On a next level there would be energy sharing, working with/for one another, also sharing emotional energies, being supportive. Sharing of mental goods would come next, news, personal stories, memories, ideas, what makes us feel that we are a community; also, we can teach one another and clearly this is what Merton felt he had to do. Above this is the sharing of the deep and precious insights and revelations that have shaped our lives; I imagine Jesus telling the story of his baptismal realization of the universality of the divine filiation, on which all the rest of his ministry was based. And as others tell their secret stories of God's favor to them, devotion and joy and happiness emerge and are shared by all.

There is no particular membership requirement for participating in such a eucharist. Life-sharing with anyone in any way becomes an "element" for eucharist. Anyone participating in the life-sharing becomes thereby a member of Church, of the Messianic—peace-bringing—Body. We can therefore address ourselves to furthering, deepening, our social/political, economic, religious sharing as eucharist-practicing. And if we are to have purely ceremonial eucharists, let us devise them so that they can be inclusive rather than exclusive, so that they can say clearly what the cosmic Eucharist is, One Body.

34. See Bruce Chilton, "Origins of the Eucharist," *Bible Review* (Dec. 1994) 39, and B. Bruteau, "Jesus' Suppers," *The Roll* (Sept. 1996).