

EVOLUTION AS REVELATION OF A TRIUNE GOD

by James F. Salmon, S.J., and Nicole Schmitz-Moormann

Abstract. In 1917 Pierre Teilhard de Chardin wrote an essay that proposes union as a way to observe how the process of evolution takes place. He spent the remainder of his life broadening and sharpening the vision, which was based on union in nature. We propose that this vision and the historical development of thermodynamics and classical statistical mechanics offer insight into union and even into the divine life that many Christians believe to be triadic. We briefly situate union in the triune divine life in early Christian tradition as it was believed and practiced. We then interpret three stages of development in the sciences of thermodynamics and statistical mechanics that support the theme of union in nature. Next we describe the development of Teilhard's thought during his scientific career and his tests of the theme of union, principally in his private journals, now being edited. We offer examples of Teilhard's application of union to his own spiritual life and compare his understanding of union with those of Paul the Apostle and John of the Cross. Finally, although the Christian God's triadic life was not a particular concern of Teilhard, we propose union in nature as a vestige of the divine life.

Keywords: self-organization; Pierre Teilhard de Chardin; union; union in divine life; vestiges of the Trinity.

One of the greatest challenges of the Christian faith is to explain what one means by a triune God—Father, Son, and Holy Spirit. As theologian Karl Rahner notes, “With all due respect to the church’s official and classical formulation of the Christian doctrine of the Trinity, and taking for granted an acceptance in faith of what is meant by these formulations, we still have

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to admit that the assertions about the Trinity in their catechetical formulations are almost unintelligible to people today, and that they almost inevitably occasion misunderstandings" (Rahner 1978, 134). Therefore many Christians relate to God only in terms of the divine interaction with the world. This raises the question of the relationship between a philosophical concept of God and the God of Christian revelation.

In 1917 Pierre Teilhard de Chardin, while at the front during World War I, wrote the essay "Creative Union" (Teilhard 1968). The essay proposes union as a way to observe how the process of evolution takes place. Later in his private journals (Teilhard 1975b)¹ he reported further constructive reflection about the process of union. He concluded on 8 September 1918 that "union is essentially a cosmic, sacred act . . . [that] ends up with total integration." The private journals reveal that he spent the remainder of his life broadening and sharpening the vision based on this insight about union in nature. It is important for this discussion to stress that Teilhard never stopped seeing himself first as a scientist. He quotes in the journal his 7 April 1950 letter to Jeanne Mortier: "I am a child of the Earth before being a child of God! Before, in that sense that, irremediably, by innermost structure, I only can grasp the Divine through the Cosmic. . . . If you do not see that you will never understand me."

We propose that Teilhard's understanding of union in evolution, together with the historical developments of thermodynamics and statistical mechanics, may offer some insight into union "as a cosmic, sacred act" and even into the life of the revealed triune Christian God. The paradigm of evolution will be assumed as a basis for reflection, and we presume that evolution is a result of some form of natural selection and the phenomenon of self-organization of matter.

A TRIUNE GOD

The trinity of the Christian God was not explicitly revealed in the Old Testament, and even the earliest New Testament writings reflect the challenges to the believer of trinitarian Christian faith. How could these Christians, mostly monotheist Jews, witness to the presence of God that they experienced in Jesus of Nazareth and still maintain their belief in God as one? "Indeed, even though there are so-called gods in heaven and on earth (there are, to be sure, many 'gods' and many 'lords'), yet for us there is one God, the Father, from whom all things are and for whom we exist, and one Lord, Jesus Christ, through whom all things are and through whom we exist" (1 Corinthians 8:5–6 NAB)

The apostle Paul writes to Corinthian fellow Christians in a second letter: "The grace of the Lord Jesus Christ, and the love of God, and the fellowship of the Holy Spirit be with you all" (2 Corinthians 13:13 NAB). This blessing is thought to be already in use in the earliest Christian litur-

gies. It implies that God, the Lord, and the Spirit are a certain unity (Hartman 1963, 2494). Moreover, biblical scholars verify the genuineness in Matthew 28:19, in which Jesus commands his disciples to baptize in the name of the Father and of the Son and of the Holy Spirit (Albright and Mann 1971, 362). Biblical texts and early Christian writings, such as the *Didache*, are cited to verify this common belief of the earliest Christians. Proposals that the formula was a post-Nicene retrojection into the text are universally disproved.

When the New Testament speaks simply of God it means the God who has been seen at work in the Old Testament. He is the “Father,” he has a Son and he gives his Spirit. “God” does not stand for the “triune Godhead”. . . . The existence of some sort of distinction follows at once from the fact that the three words are not simply used interchangeably but occur beside one another in the same context. (Rahner 1970, 295–96)

Though the Gospel of John and the Epistles of Paul show a marked theological advance over the synoptic Gospels, there is no systematic doctrine of the immanent triadic life of God in the New Testament. Defining attributes of God were formulated at the two earliest ecumenical Councils of the Christian church: Nicea I (325) and Constantinople I (381). As the Australian theologian Gerald O’Collins writes:

. . . any progress that was to take place would do so in the light of the convictions enshrined in the Nicene-Constantinopolitan Creed.

That creedal confession presents a divine communication in creation and salvation history that presupposes an eternal communion within God: the Father, the only begotten Son, and the “proceeding” Holy Spirit. In particular, God’s self-communication *ad extra* through the missions of the Son (who “came down from heaven” and “became man”) and the Spirit (who “spoke through the prophets” and effected the incarnation) in the history or “economy” of salvation presupposes and reflects the self-communication *ad intra*: the eternal generation of the Son and procession of the Spirit. Thus the “economic” Trinity or Trinity in creation and history on which the Creed largely focuses reveals the immanent Trinity and is identical with it. (O’Collins 1999, 125)

Systematic theology in the early days of Christian life borrowed conceptual categories from Greek and Roman rhetoric and philosophy to articulate precisely and to systematize organizationally their understanding of orthodox Christian beliefs. This language suffered severe limitations in the effort to express the Christian mysteries of incarnation, redemption, ecclesial community, and the trinity of God. This language was drawn from the physical sciences of the day. Aristotle’s “meta-physics” came after physics logically as well as chronologically. Therefore the foundational model for philosophical terms and relations was the objects and methods of scientific investigation of those days. Quite obviously these terms were neither congenial nor suited to the expression of personal relationships—the very core of these Christian mysteries. Moreover, in its conceptual formulation this language expressed *being* in preference to *becoming*. The

result was an explanatory system that took little account of the interpersonal, the historical, and the evolving process of growth and development.

Meanwhile, without slipping into a form of tritheism, there has been a long tradition and practice of Christian prayer to the Persons of the Trinity. Traditionally, to be a person is to be an interpersonal subject, sharing love and giving oneself in love, and true personal individuality comes through existing in and for other persons. This interpersonal relationship in prayer is common in Christian spirituality: "Dear Lord—it is our Father who tests and strengthens us in this way. Dear Lord—it is Jesus Christ who suffered all temptations as we do, only without sin, that he may be an example and a help for us. Dear Lord—it is the Holy Spirit who intends to sanctify us in the struggle" (Bonhoeffer 1990, 311).

In recent years, thanks to the discovery of historical consciousness, the birth of psychology, sociology, and anthropology, and the development of philosophies of human interiority, theologians are bringing personal schemes of understanding to their reflection on the Christian mysteries, including three persons in God. Having discovered and developed these personal categories and the deeper theological insights that they yield, some Christians who are scientists have brought these same categories and insights back into the domain of natural science and the interpretation of creation, evolution, and the relationships between and among various physical elements. Teilhard is exemplary in this regard.

We propose that Teilhard's longtime reflection about the reality of union in nature that he observed in evolution offers insight into the "economic" activity of God that is congruent with New Testament theology and early Christian tradition. It also offers a possible approach to stimulate explicit attention to the triadic life of God.

CHEMICAL SELF-ORGANIZATION

"It is now generally admitted that biological evolution is the combined result of Darwin's natural selection as well as of self-organization which results from irreversible processes" (Kondepudi and Prigogine 1998, xii). Next to Darwin's natural selection, the development of a thermodynamic theory of self-organization in irreversible processes is relatively new and has its own fascinating history.²

As recently as forty years ago most thermodynamics courses in the United States concentrated on the first of three stages in the development of the science. This first stage emphasized studies of reversible physical processes like the water phases of ice-water-steam.³ Even advanced courses often began with analyses of phase equilibrium systems, like the water system, and of Sadi Carnot's basic insights in 1824 that analyzed the cycle in the steam engines that were rapidly industrializing Europe in the nineteenth century. Using Carnot's cycle as a model, Rudolf Clausius (1867) proposed generalizations that led to his well-known enunciation of the two

laws of thermodynamics: “The energy of the universe is constant,” and “The entropy of the universe approaches a maximum.” This state of maximum entropy, Clausius said, was the state of perfect thermal equilibrium. The introduction of entropy, a critical concept for the development of the science of thermodynamics, made the important distinction that irreversible processes produce entropy and reversible processes leave the entropy constant.

There is entropy that can transfer across the boundaries of a system, $d_e S$, and entropy that is produced inside the system, $d_i S$. The second law of thermodynamics states that the entropy generated inside a system, $d_i S$, is positive in irreversible processes. On the other hand, $d_i S$ approaches zero in reversible processes.

James Clerk Maxwell was the first to understand that the second law of thermodynamics is inherently a matter of probability: it is only unlikely, but not impossible, that heat should flow from a cold body to a hotter one. In an effort to quantify the improbability of heat’s flowing the wrong way, in other words, just how unlikely it was that the second law would be violated, Ludwig Boltzmann found a statistical approach to thinking about entropy. Although classical Newtonian mechanics was the key ingredient, Boltzmann constructed a calculus of probabilities to handle the infinite number of possible distributions of energies among a finite set of particles like a gas in any container. He found that thermal equilibrium was simply the most probable way of sharing a fixed amount of energy among the particles. The closer the particular arrangement of particles in the body is to thermal equilibrium, the more likely it is; the further from the optimal arrangement, the less likely (Albert 2000, 38–40). In fact, today “Entropy may be regarded as a measure of our degree of ignorance as to the state of a system” (Jaynes 1957, 626).

In 1877 Boltzmann formulated the simple relationship that measures how close any microscopic distribution of particles is to equilibrium. This mathematical expression for the thermodynamic entropy of a distribution, $S = K \log W$, turns out to be an explicit function of the number of arrangements of particles compatible with a state. S is the entropy of the distribution, K is a constant called Boltzmann’s constant, and W represents the number of arrangements compatible with that distribution of particles. Thus, Boltzmann was the first to show the relation between the microscopic behavior of matter and macroscopic laws of thermodynamics. The equilibrium condition of a gas of a certain mass and energy that is enclosed within a container of a certain shape and volume is the condition in which the gas uniformly fills the container. Boltzmann’s equation gives a quantitative measure of the disorder of the particles within a body. Maximum disorder among the particles is thermal equilibrium. Although this first stage of development of the science of thermodynamics was not directly concerned with biological evolution, it played an important role in the

growth in nineteenth- and early-twentieth-century science and the technology that was derived from it.

In 1931 Lars Onsager set the second stage of the development of thermodynamics when he applied certain linear mathematical microscopic reciprocal relations to systems at near-equilibrium conditions (Onsager 1931, 410–13). His equations showed theoretically how these systems remain at equilibrium despite small fluctuations and perturbations in the system. When there are large numbers of particles in a system, microscopic damping mechanisms bring the system back to the equilibrium state. Thus, if a force in the system, like a temperature gradient, influences a flux, like a material diffusion process, then the diffusion process will also influence the heat flow. This principle of microscopic reversibility applied by Onsager manifested the significance of these damping mechanisms in systems at near-equilibrium conditions. Onsager's contribution, along with the increase of $d_i S$ during irreversible processes, was the foundation for nonequilibrium thermodynamics using linear equations and shifted a century-long interest in equilibrium and reversible thermodynamics to nonequilibrium conditions and irreversible processes (Prigogine and Stengers 1984, 138).

The third stage in the evolution of thermodynamics revolutionized the science by clarifying chemical phenomena that had no satisfactory explanation up to that time. One well-known example occurred in 1951, when B. P. Belousov discovered temporal oscillations in the cerium-ion-catalyzed oxidation of citric acid by bromate ion. Belousov reported that two of the intermediate components of the reaction are yellow and colorless. Therefore, one expects to observe a blurred mixture somewhere between yellow and colorless. But he found that the whole container periodically in sequence becomes yellow, then colorless, then yellow again, and continues indefinitely under controlled conditions. Now known as an example of a chemical clock, its periodic exactness can exceed the reliability of many mechanical oscillators. Belousov's discovery of this self-organization of oscillations in that chemical system was so unexpected that he was unable to find a journal in which to publish his discovery until 1958. He finally found a remote Siberian medical journal, read by few scientists, to report this "remarkable" phenomenon (Belousov [1958] 1985). The discovery was not followed up until 1964, when it was noticed by A. M. Zhabotinskii's professor in Moscow, who suggested that Zhabotinskii investigate the reaction reported by Belousov. Zhabotinskii verified and developed Belousov's data and described models to explain spatial patterns and traveling waves that also can form in the solutions, now known as the *B-Z* reaction. Since the 1960s investigators have applied sophisticated measurements to the *B-Z* reaction and other newfound oscillating chemical systems (Geckle and Salmon 1986, 908). These reactions are now being tested as models for applications to study nonlinear systems in geology, physics, engineering, and especially biology.

Chemical clocks have become popular because they violate our intuition about molecules colliding at random in a disordered fashion and moving irreversibly to equilibrium, as predicted by the Boltzmann equation. A form of unity exists in the self-organizing system, instead of the expected spontaneous tendency to equilibrium. Moreover, an irreversible tendency to maximum entropy, and therefore disorder, seemed to deny the possibility of the inorganic world's participating in the evolution of the order required for life forms. But far from being chaotic, the behavior of the intermediate components of yellow and colorless is coherent. Matter is no longer seen as purely passive dead stuff, as in a mechanistic worldview, but is associated with spontaneous activity. Molecules seem able to "communicate" as they synchronize their periodic change of color. A new unity of supramolecular scales, in both time and space, appears to result from inorganic chemical activity. Investigators have proposed kinetic mechanisms to understand the unity in such complex chemical reactions and a theoretical framework based on nonlinear differential equations in order to interpret the stability of periodic chemical structures within the science of thermodynamics. They found that small fluctuations and perturbations drive a reaction in some chemical systems under certain conditions, like temperature and concentrations, toward this far-from-equilibrium but steady state. These chemical systems seem to form an activity of quasi-union in nature.

AN EVOLUTIONARY VISION OF UNION

Teilhard's private journals from 1915 to the end of his life reveal that he investigated the notion of union as a key qualitative element to describe what takes place in evolution. In the early years he is preoccupied with the natural world. Because his 1925–44 private journals have never been recovered in China, we have relatively little idea of his development of this theme in his private reflections. The 1944–55 journals return to union in evolution, and by this time it is extended to such fundamental Christian mysteries as Christology. However, he never lost sight of being "a child of the Earth before being a child of God." In 1920 he wrote in his journal,

It is as essential to increase without limits the resurrected Christ as it seems challenging, and a provocation to the most sensible critics of the gospel facts, to increase without limits the human science of Christ viator. There again is an overflow of theology on the Real. —What is true about Christ at a transcendental level must not be transposed into the experimental level. —This perpetual mix-up makes a "convincing" exposition of the Christian faith very difficult: —our most liberating and sacred dogma then sounds false to ears tuned to the Real.

We propose that Teilhard's vision of union introduces a process metaphysics that is based on his scientific experience. He was not looking for a concordism but for some meeting ground to confront his Christian faith.

This offered him an opportunity to explore basic Christian mysteries. One ultimate traditional meeting ground of faith with reason is in metaphysics. Many agree with Alfred North Whitehead:

Religion requires a metaphysical backing; for its authority is endangered by the intensity of the emotions which it generates. Such emotions are evidence of some vivid experience; but they are a very poor guarantee for its correct interpretation.

Thus dispassionate criticism of religious belief is beyond all things necessary. The foundations of dogma must be laid in a rational metaphysics which criticizes meanings, and endeavours to express the most general concepts adequate for the all-inclusive universe. (Whitehead [1926] 1954, 81)

Although he considered two basic concepts in union as early as 1917 (Teilhard 1968, 155, 165), by 1944 Teilhard is examining the meaning of notions related to union such as unifying, unified, and unity. He reaches a conclusion that is fundamental for his meaning of union. He writes in Latin on 1 November in his journal:

Plus esse = plus a pluribus uniri [More to be = to be more united from many]

Plus esse = plus plura unire [More to be = to unite more the many]

The first description realizes the passive aspect of being, and the second description realizes the active aspect. What seems significant is that the approach may offer an opportunity to explore and expand a metaphysics and analogy of being to a metaphysics and analogy of becoming. Being is realized and maintained union. But being may also be seen as a temporary aspect of the general process of becoming. "Becoming is the *sine qua non* of science, and indeed, of knowledge itself" (Prigogine 1997, 153). This understanding includes the dynamic element that some people consider to be absent in the classical philosophy identified with Aristotle and Thomas Aquinas.

Throughout his published writings Teilhard manifests awareness of the law first proposed by Clausius. Although Boltzmann's equation that relates entropy to the state of disorder in a system is not explicitly mentioned by Teilhard, the role of chance and probability in evolution and the meaning of the equation is a central concern for him.⁴ As early as 1918 he analyzes the dissociation of particles as opposed to levels of their convergence. Later, on 8 October 1945, he writes in his journal, "to deepen the notion of tangential: initially at the limit, builds a pre-granular continuum (infinitely granular and a-central) completely determined (because *N* is maximum and centreity is minimal). Capital point: centreity (interiorization) developed itself by arrangement (neocenters)."⁵ Here *N* for Teilhard is close to what in the Boltzmann equation may be interpreted as the number of arrangements of particles that define the entropy of the system. When *N* is maximum, the entropy is maximum, and the system is at equilibrium. Each particle, granule, acts independently, and there is no unity

in the acentric system. On the other hand, one observes self-development in chemical self-organizing systems like the *B-Z* reaction. A unity and coherence exist, but not real union. Teilhard's introduction of centricity permits one to distinguish levels of union.

In his discussion of "The Qualitative Laws of Growth" in *The Human Phenomenon*, Teilhard relates the evolution of consciousness to centricity:

We can say that the concentration of a consciousness varies in inverse ratio to the simplicity of the material composition that it lines. Or again: the richer and better organized the material edifice it lines, the more perfected is the consciousness.

Spiritual perfection (or conscious "centricity") and material synthesis (or complexity) are merely the two connected faces or parts of a single phenomenon.

And here we have by the fact itself reached the solution of the problem we posed. We were looking for a qualitative law of development capable of explaining from sphere to sphere first the invisibility, then the appearance, and then the gradual dominance of the inside in relation to the outside of things. This law reveals itself once the universe is conceived of as passing from *state A*, characterized by a very large number of very simple elements (that is, having a very impoverished inside), to *state B*, defined by a smaller number of very complex groupings (that is, having a richer inside).

Because they are at once very numerous and extremely lax in *state A*, the centers of consciousness are only manifested by effects of the whole, *submitted to the laws of statistics*. They therefore collectively obey mathematical laws. This is the particular domain of physicochemistry.

In *state B*, on the contrary, since these elements are less numerous and at the same time better individualized, bit by bit they escape the slavery of large numbers. Their fundamental and non-measurable spontaneity shines through. We can begin to see them and to follow them one by one. And from then on we have reached the world of biology. (Teilhard 1999, 27–28)

The *B-Z* chemical clock and other chemical and physical nonliving and self-organizing systems seem to offer individual examples of a level of union that can be described in limit cycles predicted by nonlinear equations. Among systems described in many books that discuss self-organization in nature are such simple physical systems as the Bernard Effect and Taylor instability (Prigogine 1983, 34–38). They are in the "domain of physicochemistry." At the same time it is difficult to think of such systems in the same way as one thinks of a cell that has achieved a different level of union. The self-organizing physicochemical system is somewhere between *state A* and *state B*. In *state B* the whole, say a cell, is at a dynamic equilibrium that is greater than the sum of its parts. There is a degree of "centricity" in which the system, the cell, acts as a whole from the inside. The stable but nonequilibrium state is certainly not "the large number of very simple elements" found in *state A*. We suggest therefore that the level of union found in self-organizing inorganic systems be considered an intermediate step in the process toward union found in biology, and that it therefore fulfills Prigogine's statement that it is an element in the story of evolution.

A THEOLOGICAL VISION OF UNION

Through the years between 1918 and 1955, as Teilhard clarified his own thought about union, he made more than 155 entries on the subject in his journals that are available. On 8 April 1919 he noted three levels of union at the organic level. He calls the first level a union of rivalry (*union de rivalité*), which he describes: “while fighting against each other, elements create a gradual equilibrium (at the inferior limit = union of inertia).” Teilhard calls the second level a union of utility (*union d'utilité*). He describes the union as “economic and egoistic (cf. coral): mutual adaptation by ‘Taylorism’, reciprocal advantages.”⁶ He calls the third level a union in soul and life (*union dans l'âme et la vie*), which he describes: “= transformation of 1) and 2) = elements unite.” Elements 1 and 2 refer to *union de rivalité* and *union d'utilité*, respectively. As he tries to clarify his understanding of matter, he asks himself this question: “Note well—Can it be said that the human soul is born of the unifying material process or if it is ‘incarnated’ in order to unite (save) Matter? . . . But, then Matter would represent *something absolute, of supreme interest*, that is ‘primary!’”⁷

Beginning in May 1950 Teilhard’s journal entries are especially concerned with his essay “The Heart of Matter” (Teilhard 1978). On 26 May he lists three levels of spiritual union that take place in evolution: *mécanisation*, *fusion*, and *eu-union*. It is significant to note in passing that the spiritual is implied even in his notion of organic union. Although it would be interesting to discuss more fully the development and relationship of Teilhard’s levels of union, we limit our discussion here only to *eu-union* because of its special relevance for religion.

The general meaning of *eu* in Greek is “well” or “good” and “commonly implies greatness, abundance, or easiness” (Liddell and Scott 1958, 278). Teilhard divides *eu-union* into two components that he labels *amour* (love) and *vision* (vision). These components have in common what he calls *centre-à-centre* (center to center). The level of “centreity” of the beings involved determines the quality of *amour* and *vision*. Two days after the 26 May entry he adds, “*Important*: Like love, reflection personalizes” (*Comme l'Amour, la Réflexion personnalise*), and adds, “because it works from center to center like the two vectors of electromagnetism” ([*parce que opère du centre-à-centre!*] *Les 2 vecteurs* [cf. *électr-magn* . . .]).

On 24 and 26 June he returns to the redaction of “The Heart of Matter” and considers three possible chapters for the essay: (1) Cosmology (*Kosmo-logie*), (2) Christology (*Xristo-logie*), and (3) The Divine Milieu (Le μ). He identifies cosmology with “At the Heart of Matter = function ω (state ω),” where ω is the natural point of convergence of humanity and also of the whole material cosmos. Christology is identified with “A Heart of the World = Christ- ω (= the Human),” and the risen Christ is the point toward which all people (“souls”) of faith converge in communion. The

divine milieu, which might include *theo-logie*, theology, is identified with “The Heart of God = essence of monotheism = $\Delta\omega$,” that is, God-Omega. Point omega is the point where the universal cosmic center, postulated by anthropogenesis, and the universal Christic center that is set by theology coincide.

It is striking that union for Teilhard includes the distinction between Christology and the divine milieu. The risen Jesus of Nazareth is the Christ- ω in the world that is human. Like Paul, his foremost teacher and inspirer, he was enraptured with “the incommunicable beauty of Christ himself” (Teilhard 1961, 45). He took seriously Paul’s 155 references to living “in Christ.” The formula does not always have the same value for Paul (Murphy-O’Connor 1984, 183), but it is our contention that Teilhard shared with Paul a Christian experience that is often overlooked by theology manuals. And that experience is not different from that of John of the Cross, who speaks of a union of love whereby one ultimately lives the life of God. “When there is union of love,” John writes, “it is true to say that the Beloved lives in the lover and lover in the Beloved. Love produces such likeness in this transformation of lovers that one can say that each is in the other and that both are one.” John then quotes the apostle Paul (Galatians 2:20) and comments: “In saying, I live, now not I, he meant that even though he had life it was not his because he was transformed in Christ, and that it was divine more than human. He consequently asserts that he does not live, but that Christ lives in him. In accordance with this likeness and transformation, we can say that his life and Christ’s life were one life through union of love” (John of the Cross 1953, 237).

Like Paul and John of the Cross, Teilhard used the term *Jesus* in a way of formally underlining the historicity (humanity) of him who for Christians is now the Risen Lord, the Christ. Theological anthropology for Teilhard, John of the Cross, and Paul had a christological basis. In order to find the true and essential meaning of humanity, they did not look to contemporaries but to the Christ. Life can be embodied in the pregnant sense of a person’s authentic existence. Like Paul and John of the Cross, Teilhard shared this authentic Christian existence in his personal life that also included the dying of Jesus. The climax of the process of union with Christ is the trinitarian experience in a divine milieu, whereby, identified with the Son and filled with the Spirit, one addresses the Father as *Abba*.

Perhaps his closest Jesuit friend near the end of his life, the French biologist Pierre Leroy, who was carrying on a research program at the University of Chicago, recalled this conversation with Teilhard:

The last time I saw Teilhard was in New York a few days before Christmas, 1954. I found him weaker and harassed. Little did I know that I was never to see him again alive. One day we were going to the restaurant for lunch. We were walking the streets of New York. All of a sudden he stopped, put his hand on my shoulder, looked at me intensely, and he spoke a testament as he said: “Now I think I can tell

you. I am living continuously in the presence of God.” Just in those streets in New York. Imagine!⁸

Teilhard composed an important essay in 1944, “Centrology, An essay in a dialectic of union.” He proposes in the introduction “an essay in universal explanation—not an *a priori*, geometric synthesis starting from some definition of ‘being’, but an experiential *law of recurrence* which can be checked in the phenomenal field and can appropriately be extrapolated into the totality of space and time” (Teilhard 1970, 99).

He would have been ready to accept, and indeed would have liked to see formulated, “some generalized ontology” that would be at the same time an understanding of faith, embracing the evidence on being implied in the dogmas of the Trinity and the mystical body. For his own part, however, whatever the object to which his thought was applied, he would prefer to express it “in some sort of phenomenology.” (de Lubac 1967, 101)

We propose in the next section that indeed Teilhard’s metaphysics of union could support gain of insight into the central mystery of the Christian faith, the Trinity of God.

VESTIGES OF THE TRINITY

Teilhard’s approach is bottom up. It begins by looking at the phenomena, an approach especially familiar to experimental scientists, and therefore to Teilhard, who was internationally recognized for his research contributions in geology (Schmitz-Moormann 1995, 93). There is no doubt that, like other scientists, he was a “philosopher in spite of himself” (Schoonenberg 1960, 2) and believed in “vestiges of the Trinity” in the evolutionary creation that he examined.

Teilhard’s being a philosopher in spite of himself was not new among natural scientists. For example, in the “General Scholium” that concludes Isaac Newton’s *Principia* we read, “And thus much concerning God: to discourse of whom from the appearances of things, does certainly belong to Natural Philosophy” (Newton 1934, 546). This belief was contrary to tendencies in Western Protestant and Roman Catholic theology in Teilhard’s lifetime that emphasized the proclamation and the confessional aspects of Christian faith (Dulles 1978, 81–93). Following Karl Barth’s reaction to nineteenth-century liberal theology, emphasis was placed on God as the wholly other, the transcendent Lord, who chooses to self-reveal only by choice, as preeminently in Jesus Christ. And as Ian Barbour notes, “No single man has had greater influence on twentieth-century Protestant thought than Karl Barth” (Barbour 1966, 118). Reaction to nineteenth-century liberal theology, especially Modernism, had a similar influence among many Roman Catholics. These tendencies were one reason for objections to Teilhard’s bottom-up writings by some influential theologians in the Roman church. It is well known that Teilhard as a Jesuit was

permitted to publish only scientific writings during most of his lifetime.

Even the great Karl Barth, while carefully protecting the “mystery of faith,” admitted a moment of truth in the assertion that there are “vestiges of the Trinity.” Eberhard Jüngel notes, “Barth sees the relative rightness in the assertion of ‘vestiges of the Trinity’, the ‘particles of truth’ which are present in spite of the fundamental questionableness of the idea, in that we must talk about God, that revelation must be stated in worldly language, and that in fact it has been expressed in that way” (Jüngel 1983, 348).

Models and images have assisted understanding as a common human activity, not only for religious thinkers but also in science and art. As noted earlier, Maxwell and Boltzmann developed statistical mechanics by considering vestiges of kinetic systems that they could not see. Moreover, besides the circle that represents perfection and the triangle as a symbol of the number three, Christian artists actively represent vestiges of the triune life of God. For example, in a fresco in the Gothic Church of St. James in Urschalling, Bavaria, the Holy Spirit is depicted as a lovely woman embraced by the Father on her left and by the Son on her right. This fresco gives the Spirit more visual strength than the usual symbol of a dove. We propose that Teilhard’s union is worldly language that can consider and talk about God.

In 1924 Teilhard wrote “My Universe,” an essay in which he offered to . . . provide us with an interpretation of the world. This I have tried to work out for myself in the theory of Creative Union:

Creative union is not exactly a metaphysical doctrine. It is rather a sort of empirical and pragmatic explanation of the universe, conceived in my mind from the need to reconcile in a solidly coherent system scientific views on evolution (accepted as, in their essence, definitively established) with the innate urge that has impelled me to look for the Divine not in a cleavage with the physical world but through matter, and in some sort of way, in union with matter. (Teilhard 1969, 44)

How might this empirical and pragmatic conception, as a metaphysics of union, begin “to look for the Divine not in a cleavage with the physical world,” creation? In the Christian tradition, God both transcends and is immanent in the world. In a static cosmos, the classical distinction between existence and essence was extended to God. That is, in any finite being there is a real metaphysical principle of distinction between essence and existence. For example, any human being exists as a human person but could just as well not exist. Except for God, the act of existence in any being is limited by its essence, what it is. Thus, existence is limited in all finite beings, and only in God is there real identity between essence and existence. Christian theologians have been fond of quoting the call of Moses in the book of Exodus, where God is described as *I AM* (3:14), which is claimed to corroborate existence as God’s essence for the metaphysics of being. “St. Thomas [Aquinas] is only following the steps of a long line of Christian writers when he bases his exposition of the nature of

God on the pentateuchal text” (Mascall 1949, 11). Here only a rational distinction is made between God’s essence and existence. Every being is similar to God in that it exists, no matter what it is. The similarity and dissimilarity in existing beings is the basis of the analogy of being. Nothing in the cosmos can be totally other than God, no matter how infinitesimal; otherwise it would not exist.

According to creative union, the basic process of evolution is the ongoing union of elements in a process of becoming to produce higher levels of being, and therefore becoming. In an evolutionary and dynamic cosmos any metaphysics of being must include becoming. The analogy of being is enriched with an analogy of becoming. The process of becoming through union brings forth new levels of being, and therefore new levels of similitude with God. In our worldly language we adopt vestiges of the Trinity in the world of becoming in order to appreciate a reflection of God in creation.

If union is a general definition of being, then we assume that union is present in God. In fact, God must be absolute union, just as the essence of God is existence in the metaphysics of being. One can ask, then, What is the nature of this union? Is God united to a partner? For example, is God in partnership with creation? If so, God would be relative to the partner and not the absolute transcendent monotheistic God that is revealed in the Bible.

In an “essay in cosmology” Whitehead (1929) proposed a philosophy of organism with demands: “Also, it must be one of the motives of a complete cosmology, to construct a system of ideas which bring the aesthetic, moral, and religious interests into relation with those concepts of the world which have their origin in natural science” (p. vi).

Whitehead’s metaphysics includes God’s “bipolar” natures as “not *before* all creation but *with* all creation” (1929, 521). The proposition seemed to many readers to integrate God into the universe. Hence, because they conceived it as a form of pantheism in its original form, some rejected the proposal. Developments in this form of process metaphysics and theology have since become welcome additions to philosophical and theological discourse. Many Christians, however, are waiting for this cosmology to further clarify such issues as God’s transcendence and the divinity of Christ. It is hoped that in time concepts and the technical language of this process metaphysics will be simplified and receive further clarification.

Any real union of the monotheistic God with the cosmos is therefore not acceptable, because then God would be in need of this union in order to exist. Neither the biblical understanding of God nor Christian tradition agrees with such an interpretation. On the other hand, if the transcendent God is isolated from the world, one can be left ultimately with various forms of deism. And here there is no room for a meaningful doctrine of the Trinity.

It is significant that Kant, one of the greatest thinkers of the Enlightenment, rejected the Christian doctrine of the Trinity as a piece of useless speculation. He wrote: "From the doctrine of the Trinity, taken literally, nothing whatsoever can be gained for practical purposes, even if one believed that one comprehended it—and still less if one is conscious that it surpasses all our concepts." (O'Donnell 1988, 19)

It was in reaction to this tradition of the Enlightenment and to deism that Barth reinvigorated Christian theology. His immediate reaction was to the anthropocentrism of a theology of human experience proposed by Schleiermacher. Barth put the emphasis on the gift of God's revelation in Christ. In his insistence on the good news of the Word of God, it is obvious that, like Schleiermacher, he addressed women and men whose God was distant and silent. "Barth's doctrine of revelation is meant to be a joyful response to the contemporary person who finds himself in this situation of darkness and anguish. . . . According to Barth, the doctrine of the Trinity provides the structure without which faith becomes unintelligible" (O'Donnell 1988, 19).

Teilhard's journals and writings indicate that he did not spend a great deal of time thinking about the triune divine life. He considered himself a scientist, not a philosopher or a theologian. His primary interest as a geologist and paleontologist was in the evolution that he called cosmogenesis and its "axis of anthrogenesis." As a Christian, his primary religious interest was in the place of Christ in evolution. Many commentators have discussed his interpretation of the role of Christogenesis in evolution (Salmon and King 1995).

In 1948 Teilhard introduced the essay, "Comment je vois": "Here will be found—to be endorsed or criticized—an authentic and complete summary of my present intellectual attitude to the world and to God—the essence of my faith" (Teilhard 1975a, 164).⁹ He applies here the principle of union to the triune divine life: "Thus, even in these primordial depths, the ontological principle we adopted as the foundation of our metaphysics is seen to be valid and illuminating: in a sense that is strictly true, God exists only by *uniting himself*" (Teilhard 1975a, 194).

Is the process of becoming through union that is revealed in evolution a revelation of the eternal united trinitarian Christian God? Historically the tribal God of ancient Israel became the almighty, eternal, unchanging God of the scholastics, based on a Greek, static metaphysics. For Teilhard it was incongruent for God to be immutable, isolated, and static, as postulated by a rational metaphysics of being. "Here ontology has to be adapted to the message of faith and not be schoolmaster to this message" (Rahner 1978, 21).

If being is defined by union and only exists as long as union is realized, then the being of God can be described as absolute union. Moreover, human experience of the highest form of union known is interpersonal, for example, the union found among persons loving each other. But we

humans experience this union as relative. We try to give ourselves completely in love with one another, but human experience always falls short of perfect love. Perfect union, and therefore perfect love, between persons can exist only in persons who are constantly and eternally uniting themselves. We realize that this being in perfect love of the three persons acting as one God in union is beyond human comprehension. As Karl Schmitz-Moormann wrote, "The mystery of the perfect loving union may allow for the paradoxical statement that each divine person, in perfect union with the others, acts as one God" (1997, 132).

It is important at this point to recognize the distinction between union and fusion. In his 1944 essay on "Centrology," Teilhard recognizes this distinction when he describes laws of modification of evolution that describe how "everything in the universe moves in the direction of unification." He writes:

Secondly union *differentiates*. By that I mean that by reason of their association under the influence of a center higher in order ($n + 1$), the centers of the order n do not tend to become blurred and confused together; on the contrary, their own nature is reinforced: just like the working parts of a mechanism which can be adjusted to one another only if they are constructed in a large number of exactly determined shapes. Such are the multiple cells that make up a metazoon [*sic*], and such again the nervous fibres of a brain, and the various members of an insect colony. Organization not only presupposes but also produces the complexity upon which its unity flowers. This is a fact of universal experience. (Teilhard 1970, 116)

Persons also can become more themselves in union with others. If we locate this experience of evolution in God's triune life, Father, Son, and Holy Spirit become what they really are in their interpersonal union. Each person fully participates in loving the others, and the more these persons are in loving union the more they are differentiated in themselves. There is no essential identity of the persons; rather they become what they are in their dynamic union. Each person can assume roles that seem to be portrayed in the Bible. This union of the one God in three persons united in loving is, of course, in itself a profound mystery beyond our imagination. But Teilhard's ontological framework, based on evolution, suggests vestiges of the Trinity in a dynamic activity that goes beyond that adopted by traditional metaphysics.

One approach to testing the validity of union might apply four criteria that have been proposed to assess theoretical scientific systems: agreement with the data, coherence, scope, and fertility (Barbour 1990, 34). Although creative union does not fulfill these criteria as a finished metaphysical doctrine, we believe, with Teilhard, "There is no exhaustive presentation of truth; there are simply lines of penetration through which we can see a still unexplored immensity of the real opening up for us" (Teilhard 1975a, 164). Following Paul, he found the union of the Divine with matter in the incarnation of God in Jesus Christ. This union with

God in Christ promoted the special union to which we have referred. It was inevitable that he reflected on the “exhaustive immensity of the real opening for us” that he found in the reality of union.

CONCLUSION

In a 1971 essay Ian Barbour observed, “There is, however, one aspect of his [Teilhard’s] thought to which little attention has been given, namely his undeveloped *process metaphysics*, which, I have suggested, plays a crucial role in his synthesis of scientific and religious ideas” (Barbour 1971, 324). This suggestion seems to be as useful today as it was thirty years ago.

As far as we know, Teilhard was not clearly aware of the intriguing second and third stages of the development of thermodynamics. We suggest, however, that the theme of union in the evolutionary process incorporates valuable insight: “Without this new coherence due to irreversible, non-equilibrium processes, life on earth would be impossible to envision” (Prigogine 1997, 3). Further, Teilhard’s vision of union supported his interior growth as a working scientist who attempted to understand the Christian faith. We urge professional philosophers and religionists to investigate and expand the proposals about union that disconcerted some theologians fifty years ago and can offer valuable insight to religion and science.

NOTES

This essay is inspired by conversation and friendship with the late Karl Schmitz-Moormann. We acknowledge with thanks the insightful comments of James L. Connor, S.J., and Joseph Earley.

1. The only other published work of Teilhard’s private journals are the German volumes: 1974–78, *Tagebücher 1–3*, ed. and trans. Nicole and Karl Schmitz-Moormann (Olten: Walter Verlag). All other references in this text are to the remainder of Teilhard’s unpublished handwritten journals, which are being prepared for publication by Nicole Schmitz-Moormann.

2. For our purposes here, “reversible” thermodynamic processes may be exactly restored to their starting point, and “irreversible” processes cannot be restored—without the application of further external energy input to the system. In a system something remains the same in a reversible process, and in an irreversible process it does not; that something is called *entropy*. Three systems may be distinguished in thermodynamics: *isolated* systems do not exchange energy or matter with the exterior; *closed* systems exchange energy with the exterior but not matter; *open* systems exchange both energy and matter.

3. These studies are still based on the genius of Josiah Willard Gibbs, who published three papers in *Transactions of the Connecticut Academy of Sciences* between 1873 and 1878. For an interesting qualitative historical description of Gibbs’s role in the development of thermodynamics and of probability in scientific studies, see Lindley 2001, 147–62.

4. It is quite enlightening to look through Teilhard’s comments in his journals about the books he read. For example, he read in its French translation Erwin Schrödinger’s *What Is Life*, where Schrödinger shows the importance of statistics and probability in evolution. Teilhard wrote a review of the book in “Revue des Livres” (1950, 275–76).

5. In order to understand evolution, Teilhard made a distinction between tangential and radial energy. This distinction is discussed in a forthcoming publication by the authors in collaboration with Harold Morowitz. For our purposes here, tangential energy may be thought of as thermodynamic energy and radial energy as connected with evolution.

6. In a footnote dated 8 April 1919 in his journal Teilhard lists as reference the 1911 edition of *The Principles of Scientific Management* by Frederick W. Taylor.

7. *Faut-il dire que l'âme humaine naît du processus unitif matériel, ou bien qu'elle est "incarnée" pour unir (sauver) la Matière? . . . Mais, alors, la Matière représenterait quelque chose d'absolu, de suprêmement intéressant, de "primaire"!*

8. Talk recorded at the annual Cosmos and Creation Conference, Loyola College in Maryland, 1987.

9. The more accurate translation of the title of the essay is "How I See."

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