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Preface

This is the last number of Volume XXIX of *TAD*. The Polanyi Society has been publishing material for thirty years. The first publication issued in the fall of 1972 was called a "Quarterly Bulletin" and was titled "Society of Explorers." It had six pages and included a membership list of 35 with some annotations giving members' interests; some of these folks are still members of the Polanyi Society . Also the Bulletin included a short list of recent publications identified as "based on Polanyi's thought, " and a feedback sheet asking for input about how future issues of the Bulletin should be shaped. In this first Bulletin, the principal purpose of the Polanyi Society was identified as "to provide interested persons with a communications network by which they can communicate with each other, and the group as a whole, regarding their work and interest in the thought of Michael Polanyi." Although some things have remained the same since the publication of the first Bulletin, many things have changed. We now, for example, have special issues of *TAD* such as this one focused on the work of Philip Clayton and its connection with the thought of Polanyi. If If I have remembered them all, this is the sixth special issue in the last decade and others are in the offing. Phil Rolnick worked diligently to put together the 2001 annual meeting session with Philip Clayton, co-sponsored by the Science and Religion Group of the AAR. We had the largest number of folks at this session in years. Rolnick also did yeoman's service in putting together this collection of material growing out of the session. Take a close look at his introduction and then enjoy the essays by Clayton, Hewlett, Peterson, Sanders, and Gulick as well as Thompson's careful review of a recent Clayton book. This is rich fare and Phil Clayton is due thanks for his interest in this Polanyi Society project and his generous and cooperative spirit.

Please also note on page 5 that the plans are already in place for an interesting annual meeting in Atlanta this November.

Phil Mullins

Tradition and Discovery is indexed selectively in *The Philosopher's Index* and *Religion One: Periodicals.* Book reviews are indexed in *Index to Book Reviews in Religion.*

NEWS AND NOTES

On March 6, 2003, **Paul Knepper** (knepper@mail.ecu.edu) gave a guest lecture, titled "Michael Polanyi and the Prospect of Post-Critical Criminology," to students at Tel Aviv University in the Faculty of Law. The presentation critiqued the epistemologies of Karl Popper and Michel Foucault (two prevailing perspectives in social-scientific criminology these days), and went on to sketch Polany's theory of personal knowledge and its implications for the study of crime. Knepper is Professor and Associate Dean in the College of Human Ecology, East Carolina University, Greenville, North Carolina, and is co-editor of *Israel Studies in Criminology*; he invites Polanyi fans to take a look at a recent call for papers for this journal which publishes social science, but also moral theory, historical and legal studies

Mary Jo Nye (nyem@ucs.orst.edu) is a historian of chemistry interested in Polanyi; she recently published a brief biographical statement (focusing on his contributions to chemistry) on Polanyi in *HYLE: International Journal For Philosophy of Chemistry*, 8 (Fall 2002), 123-127. This is also available online at http://www.hyle.org/journal/issues/8-2/bio_nye.html Some of Nye's scholarship treating Polanyi have been listed before in News and Notes, but the following are other recent essays:

"Laboratory Practice and the Physical Chemistry of Michael Polanyi," pp. 367-400 in *Instruments and Experimentation in the History of Chemistry*, ed. F. L. Holmes and Trevor Levere (Cambridge, Mass.: MIT Press, 2000).

"At the Boundaries: Michael Polanyi's Work on Surfaces and the Solid State," pp. 246-257 in *Chemical Sciences in the Twentieth Century*, ed. Carsten Reinhardt (Berlin: Wiley-VCH, 2001).

"Michael Polanyi's Theory of Surface Adsorption: How Premature?" pp.151-163 in *Prematurity and Scientific Discovery,* ed. Ernest B. Hook (Berkeley: University of California Press, 2002).

Two recent books on Polanyi's thought are **Stefania Ruzsits Jha**'s *Reconsidering Michael Polanyi's Philosophy* (University of Pittsburg Press, 2002) and **Esther Lightcap Meek**'s *Longing to Know: The Philosophy of Knowledge for Ordinary People* (Brazos Press, due out in July of 2003). We hope to review both books in a future issue of *TAD*.

Phil Mullins' essay, "Peirce's Abduction and Polanyi's Tacit Knowing," appeared in a recent issue of *Journal of Speculative Philosophy* (Vol. 16, No. 3, 2002: 198-224).

Electronic Discussion List

The Polanyi Society supports an electronic discussion group exploring implications of the thought of Michael Polanyi. Anyone interested can send e-mail to Struan Jacobs (swjacobs@deakin.edu.au) who is the moderator. The address for the list is polanyi-list@deakin.edu.au

2003 Polanyi Society Annual Meeting in Atlanta

The year's Polanyi Society annual meeting will be held in Atlanta, Georgia on November 21 and 22, 2003. As in past years, meetings are to be held in conjunction with the annual meeting of the American Academy of Religion and Society for Biblical Literature. To secure hotel reservations in the immediate convention area, it is necessary to register for the AAR/SBL annual meeting. However, anyone who is interested is welcome to attend the Polanyi Society meetings, whether or not they are attending the AAR/SBL meetings. Other hotels in Atlanta are not reserved for the AAR/SBL. If you want information about registration for the AAR/SBL meetings, go to http://www.aarweb.org/default.asp or phone (1-800-575-7185 or +1-330-425-9330 [outside US and Canada]) or email aarsblreg@reg@conferon.com. Room locations for the annual meeting sessions are not yet available but will, in the summer, be posted on the Polanyi Society web site (http://www.mwsc.edu/orgs/polanyi/) and will be listed in the AAR/SBL Annual Meeting Program as Additional Meetings. Additional information will be included in the issue of *TAD* to be published in the fall of 2003. When the complete papers are available in the fall, they can be downloaded from the Polanyi Society web site by clicking on the title.

Program

Friday, November 21, 9:00 p.m. - 11:00 p.m

Theme: Michael Polanyi's Understanding of Teleology"

Moderator: Paul Lewis, Mercer University

"Polanyi's Daring Epistemology and the Hunger for Teleology"

Richard Gelwick, University of New England

"The Discovery of Meaning through Scientific and Religious Forms of Indwelling"

John Apczynski, St. Bonaventure

Respondent: Walt Gulick, Montana State University-Billings

Open Discussion

Saturday, November 22, 9 AM. - 11:30 a.m.

Theme: "Science, Religion and Reality"

Moderator: Phil Mullins, Missouri Western State College

"Polanyi on Religion"

Tony Clark, University of St. Andrews

"The Tacit and the Unknowable: The Bearing of Each Upon Faith and Knowing"

Walter Mead, Illinois State University.

"Polanyi's Epistemology of Discovery as Applied to Science, Religion, and Astrology"

Aaron Milavec, University of Victoria

Open Discussion

Business Meeting (11:15)-Marty Moleski, Presiding

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Regarding Philip Clayton

Philip Rolnick
Guest Editor

ABSTRACT KeyWords: Philip Clayton, Michael Polanyi's ideas about emergence
This brief opening for a special issue of Tradition and Discovery: The Polanyi Society Periodical *on Philip Clayton's thought and its connection with that of Michael Polany introduces Clayton's essay and the responses by Martinez Hewlett, Gregory R. Peterson, Andy F. Sanders and Waler B. Gulick.*

This issue of *TAD* celebrates, discusses, and debates the work of Philip Clayton, who has already established himself as a leader in the field of theology and science as well as the field of philosophical theology. His work is broad-ranging and remarkably well-informed. It is hard to read anything of Clayton's without coming away with three things: a thorough treatment of the cutting edge issues; a good sense of who is doing what along the entire spectrum (Clayton seems to be able quickly to map and report on the entire range of interesting work); and finally, Clayton's own positive proposals and insights.

In Fall 2003, Clayton will take up his duties as professor of both theology and philosophy at the Claremont School of Theology. In 2001-2002, he was a guest professor at Harvard Divinity School, and has been professor and chair of philosophy at California State University, Sonoma from 1991 until the present. In the 2002-2003 academic year, he is the recipient of a grant from the John Templeton Foundation to support his research on the issue of emergence, an issue that his article in this volume also addresses. At Yale, he studied with Louis Dupré, and earlier, with Wolfhart Pannenberg in Munich. He has published or edited many books, with others on the way, and more articles, review articles, responses, and translations than you can shake a stick at (see the list of his major publications on page 7).

When first invited to be featured by the Polanyi Society, Phil Clayton responded that he was no expert on Polanyi but would be happy to launch an engagement of his work. In what is both an appreciation of Polanyi and a critique, Clayton's paper in this volume, "Emergence, Supervenience, and Personal Knowledge," does just that. Clayton first shows where Polanyi's work was helpful, almost prophetic, and then where he thinks that Polanyi took some wrong turns that have caused his work to be in some respects superseded by those working within the now dominant neo-Darwinist synthesis.

We are further honored to have several first rate respondents to Clayton's work. Martinez Hewlitt, a University of Arizona professor emeritus of cellular and molecular biology, argues that Polanyi's work on hierarchy in some ways calls into question many of the current assumptions in biology. Taking a cue from Polanyi, he points out that the chemistry of molecules is *insensitive* to information; otherwise, we could not have DNA molecules that perform the work that they in fact perform. In his defense of Polanyi, which he calls "On Polanyi, Clayton, and Biology: Some Musing of a Recovering Reductionist," Hewlitt argues that if emergence and supervenience are going to work among biologists, then Polanyi's theory needs to be applied at all levels.

Greg Peterson, professor of religion and philosophy at South Dakota State University, responds to Clayton's paper with a humorous summary of Clayton's positions followed by some critical questions about the issues of supervenience and emergence. Peterson suggests that rather than speaking of strong and weak emergence, it would be more helpful to speak of open and closed emergence or emergent systems. He opens and closes his essay by reference to the ancient dialogue on very similar issues between Chuang-tzu and Hui-Shih.

Andy Sanders, associate professor of philosophy of religion at the University of Groningen, the Netherlands, responds to Clayton's *God and Contemporary Science* with "God, Contemporary Science and Metaphysics: A Response to Philip D. Clayton." Sanders offers some observations and questions about Clayton's metaphysics; examines his theological methodology, especially in regard to science; looks at Clayton's treatment of divine agency in the world, especially his panentheist analogy; considers Clayton's emergentist supervenience; and concludes with some pointed questions about knowledge, judgment, and the fact-value dichotomy.

Walter Gulick, professor of philosophy and religion at Montana State University-Billings, offers an in-depth response to Clayton's thoughts on Polanyi and emergence. Gulick both affirms some of Clayton's criticisms of Polanyi and challenges Clayton's own position for being overly yielding to a lingering determinism. Gulick's own proposal analyzes how causality does and does not work on different, highly interwoven levels.

Finally, we are grateful to Curtis L. Thompson, professor of religion at Thiel College in Pennsylvania, for his in-depth and very helpful review of one of Clayton's major works, *The Problem of God in Modern Thought*.

Earlier versions of the papers (excepting Gulick's) were presented at the Polanyi Society meeting in Denver, Colorado in November 2001. Two sessions were devoted to Clayton's work. The first included an address by Philip Clayton and responses to *God and Contemporary Science*. The second session consisted of Clayton's "Emergence, Supervenience, and Personal Knowledge" and three responses. The Polanyi Society expresses its gratitude to Philip Clayton for his contributions to the Polanyi Society, and we look forward to his future contributions to the Academy and the broader civilization.

Philip Clayton--Biographical Sketch

Philip Clayton holds a Ph.D. in both Philosophy of Science and Religious Studies from Yale University. Having taught at Haverford College, Williams College, and the California State University, he is currently Ingraham Professor at the Claremont School of Theology and Professor of Philosophy at the Claremont Graduate University. Clayton has been guest professor at the Divinity School, Harvard University; Humboldt Professor at the University of Munich; and Senior Fulbright Fellow, also at the University of Munich. He is a past winner of the Templeton Book Prize for best monograph in the field of science and religion and a winner of the first annual Templeton Research Prize.

Clayton is the author or editor of 16 books, including *The Problem of God in Modern Thought; God and Contemporary Science*; *Explanation from Physics to Theology: An Essay in Rationality and Religion*, *Quantum Mechanics: The Problem of Divine Action; Evolutionary Ethics: Human Morality in Biological and Religious Perspective; In Whom We Live and Move and Have Our Being: Panentheism and Science;* and *Science and the Spiritual Quest*. He has published some 60 articles in the philosophy of science, metaphysics and theology. His current research interest lies in developing a theology of emergence, to be published next year as *The Emergence of Spirit*.

Since 1999, Dr. Clayton has been Principal Investigator of the Science and the Spiritual Quest program at the Center for Theology and the Natural Sciences, Graduate Theological Union, Berkeley.

Emergence, Supervenience, and Personal Knowledge

Philip Clayton

ABSTRACT Key Words: Polanyi, Michael; emergence theory; philosophy of mind; British Emergentism; reductionism; non-reductive physicalism; substance dualism; radical-kind emergence.
Michael Polanyi was perhaps the most important emergence theorist of the middle of the 20th century. As the key link between the British Emergentists of the 1920s and the explosion of emergence theory in the 1990s, he played a crucial role in resisting reductionist interpretations of science and keeping the concept of emergence alive. Polanyi's position on emergence is described and its major strengths and weaknesses are analyzed. Using Polanyi as the foundation, the article surveys the major contemporary options in the philosophy of mind and defends a particular understanding of the relationship of mental properties to brain states.

What, if anything, does recent work on emergence in the sciences, in the philosophy of mind, and in theology have to do with the thought of Michael Polanyi? The connection could, of course, be purely external and *ad hoc*: perhaps the coming few minutes will be one of those polite but pointless academic exercises where the speaker nods his head in the direction of the Polanyi Society and then proceeds to trot out some old paper that advances his well-worn ideas on some completely different topic. To be honest, I wasn't sure in advance of being able to avoid such a charade. But the intuitions of Philip Rolnick, who organized this session, were right on the mark. It *is* a new paper, and it *is* about Polanyi.

"About" does not mean uncritical. Polanyi's work is important for contemporary emergence theory in part because he is so right and in part because he is so wrong. Very recent work on emergence has developed metaphysical resources that now avoid what Polanyi thought was a forced choice between accepting reductionism, which leaves no place for the genuinely personal, and accepting what Polanyi called "finalistic" causes. Moreover, some of what Polanyi thought was good science turned out to be bad science, and it served him badly. But I am getting ahead of myself. Let's begin the story at the very beginning.

Polanyi on Emergence

Once upon a time there was a century dominated by the ideal of reductionism. It was a century in which some of the deepest dreams of science were fulfilled. Building on Newton's laws and Maxwell's equations, scientists achieved a structure capable of handling the very small (quantum physics), the very fast (special relativity, for speeds approaching *c*), and the very heavy (general relativity, or what you might call gravitational dynamics). Chemistry was, for all intents and purposes, completed (or so some are claiming). Crick and Watson discovered the biochemical information system that codes for all biological reproduction and heritable mutations, and not too many months ago the mapping of the human genome was completed and made public. With rather less success, psychology tried to make itself in the same image, spawning schools such as behaviorism, functionalism, and, more recently, sociobiology and evolutionary psychology. (Ironically, the only social science that has come close to matching the mathematical precision of the natural sciences is economics, the science of money. Small wonder.)

Writing in the heyday of this movement, midway between the British Emergentists of the 1920s and the rebirth of the emergence movement in the 1990's, Michael Polanyi functioned as a sort of prophet. Indeed, to the "cultured despisers" of his time, he must have seemed a little bit like Jeremiah, running through the streets of the lost cities and calling the lost to repent. Indeed, *Personal Knowledge* was so out of place when it was first published in 1958, and *The Tacit Dimension* so out of place when it was delivered as the Terry Lectures at Yale University in 1962, that the scholars who espoused their teachings were accused of something like a cult following, no unlike the followers of Teilhard de Chardin or even Swedenborg. Indeed, one wonders whether the nine years during which Polanyi worked "almost exclusively"[1] on *Personal Knowledge* were not more like the 40 days in the wilderness than they were like the triumphant entry into Jerusalem.

What was it that Polanyi got right? His argument for the crucial contributions of tacit knowledge and for the irreducibility of the category of personhood are so well known to this group that I will not bore you by repeating them. But I do need to describe his less well known position on emergence, since it will set the stage for the arguments concerning consciousness and supervenience to follow.

In his theory of tacit knowing, Polanyi recognized that thought was motivated by the anticipation of discovery: "all the time we are guided by sensing the presence of a hidden reality toward which our clues are pointing."[2] Tacit knowing thus presupposes at least two levels of reality: the particulars, and their "comprehensive meaning" (*TD* 34). Polanyi extended this "levels of reality" insight outward to a variety of fields, beginning with his own field, physical chemistry, and then moving on to the biological sciences and to the problem of consciousness.[3] In his view even physical randomness was understood as an emergent phenomenon (*PK* 390f.); all living things, or what he called "living mechanisms," were classed with machines as systems controlled by their functions, which exercise a downward causation on the biological parts (e.g., *KB* 226f.; *PK* 359ff.); and processes such as the composition of a text serve as clear signs that human goals and intentions are downward causal forces that play a central role in explaining the behavior of *homo sapiens*. Polanyi then wraps each of these argumentative steps together into an overarching philosophy of emergence:

> The first emergence, by which life comes into existence, is the prototype of all subsequent stages of evolution, by which rising forms of life, with their higher principles, emerge into existence.... The spectacle of rising stages of emergence confirms this generalization by bringing forth at the highest level of evolutionary emergence those mental powers in which we had first recognized our faculty of tacit knowing (*TD* 49).

Polanyi's Contributions to Contemporary Emergence Theory

But we are impatient people. We are not interested in historical credits for their own sake, but rather wish to know what in this author's work might be of assistance to us today.

Recently there has been a virtual explosion of interest in the notion of emergence. Scientists from physicists to psychologists are employing the notion to make sense of the data in their fields. Harold Morowitz, for example, has identified 28 distinct levels of emergence in his forthcoming book with Oxford University Press.[4] Other thinkers have used emergence theory to show that awareness in living things involves not just the monitoring of the external environment (a process too easily confused with perception), but also the monitoring of the organism's own internal states and the modification or potential modification of its behaviors as a result. Most recently, Terrence Deacon has linked emergence to the self-reflexivity of the feedback loop in perception,

cognition and language use.[5] In recent years authors are even beginning to write theologies of emergence.[6] Is there anything new or helpful that Polanyi can add to this blaze of interest in emergence theory?

Yes. Surveying recent emergence theories, I found several insights in Polanyi which, if they are appropriated, will advance the contemporary discussion. Let me mention just three:

(1) *Active and passive boundary conditions*. Polanyi recognized two types of boundaries: natural processes controlled by boundaries; and machines, which function actively to bring about effects. He characterized his distinction in two different ways: as foreground and background interest, and as active and passive constraint. Regarding the former distinction, he argued, a test tube constrains the chemical reaction taking place within it; but when we observe it, "we are studying the reaction, not the test tube" (*KB* 226). In watching a chess game, by contrast, our interest "lies in the boundaries": we are interested in the chess master's strategy, in *why* he makes the moves and what he hopes to achieve by them, rather than in the rule-governed nature of the moves themselves. (I remember how my kids, when they were young, were completely fascinated just by the regularities of the chess pieces' movements and by the rules that guided them; fortunately, though, I doubt that my six-year-old was a good example of the advanced appreciation of chess!)

More important than the backgrounding and foregrounding of interest, Polanyi recognized that the "causal role" of the test tube is a passive constraint, whereas intentions *actively* shape the outcome in a top-down manner: "when a sculptor shapes a stone or a painter composes a painting, our interest lies in the boundaries imposed on a material and not in the material itself" (*KB* 226). In *Theology for a Scientific Age* and in his various publications in the Vatican/CTNS series, Arthur Peacocke, a seminal thinker in the theology/science debate, has gone back and forth on whether boundary conditions should really be spoken of as causal forces. If he had appealed to Polanyi's distinction, the ambiguity would have been dissolved. Messages from the central nervous system cause hormone release in a much more active top-down fashion than does the physical structure of microtubules in the brain. Microtubule structure is still a constraining boundary condition, but it is one of a different type, namely a passive one. Much confusion in the literature would be removed by this distinction.

(2) *The "from-at" transition and "focal" attention.* Already in the Terry Lectures, Polanyi noticed that the comprehension of meaning involved a movement from "the proximal" — that is, the particulars that are presented — to the "distal," which is their comprehensive meaning (*TD* 34). By 1968 he had developed this notion into the notion of "from-at" conceptions. Understanding meaning involves turning our attention from the words to their meaning; "we are looking *from* them *at* their meaning."[7] Mind is a "from-to experience"; the bodily mechanisms of neurobiology are merely "the subsidiaries" of this experience (*KB* 238). Or, more forcibly, "mind is the meaning of certain bodily mechanisms; it is lost from view when we look *at* them focally."[8] In my recent work defending panentheism, I have used a similar distinction between focal intentions and the body's autonomous functioning in order to defend the possibility of divine actions without divine interventions that would break natural law.[9]

Note, by the way, that there are parallels to Polanyi's notion of mind as focal intention in the theory of consciousness advanced by the quantum physicist Henry Stapp, especially in his *Mind, Matter, and Quantum Mechanics*.[10] Both thinkers believe that we can comprehend mind as the function of "exercising discrimination" (*PK* 403n1). If Polanyi and Stapp are right, it represents good news for the downward causation of ideas, since it means that no energy needs to be added to a system by mental activity, thus preserving the law of the conservation of energy which is basic to all physical calculations.

(3) *The theory of structure and information*. Like many emergence theorists, Polanyi recognized that structure is an emergent phenomenon. But he also preserved a place for downward causation in the theory of structure, arguing that "the structure and functioning of an organism is determined, like that of a machine, by constructional and operational principles that control boundary conditions left open by physics and chemistry" (*KB* 219). Structure is not simply a matter of complexity. The structure of a crystal represents a complex order without great informational content (*KB* 228); crystals have a maximum of stability that corresponds to a minimum of potential energy. Contrast crystals with DNA. The structure of a DNA molecule represents a high level of chemical improbability, since the nucleotide sequence is not determined by the underlying chemical structure. While the crystal does not function as a code, the DNA molecule can do so because it is very high in informational content relative to the background probabilities of its formation.

Polanyi's treatment of structure lies very close to contemporary work in information biology.[11] Thus Deacon argues that "it is essential to recognize that biology is not merely a physical science, it is a semiotic science; a science where significance and representation are essential elements.... [Evolutionary biology] stands at the border between physical and semiotic science."[12] Perhaps other elements in Polanyi's work could contribute to the development of information biology, which is still in the fledgling phases.

Polanyi Criticized

At the same time that emergence theory has profited from Polanyi, it has also moved beyond his work in some respects. Let me briefly indicate three such areas, since they will help to propel us, I hope, toward a more adequate theory of mind and personhood.

(1) *Polanyi was wrong on morphogenesis*. He was very attracted by the work of Hans Driesch, which seemed to support the existence of organismic forces and causes (*TD* 42f., *PK* 390, *KB* 232). Following Driesch, Polanyi held that the morphogenetic field pulls the evolving cell or organism toward itself. He was also ready to argue that the coordination of muscles, as well as the recuperation of the central nervous system after injury, was "unformalizable ... in terms of any fixed anatomical machinery" (*PK* 398). While admitting that the science had not yet been established, he hitched his horse to its future success: "once ... emergence was fully established, it would be clear that it represented the achievement of a new way of life, induced in the germ plasm by a field based on the gradient of phylogenetic achievement" (*PK* 402). He even cites an anticipation of the stem cell research that has been receiving so much attention of late: the early work by Paul Weiss, which showed that embryonic cells will grow "when lumped together into a fragment of the organ from which they were isolated" (*KB* 232). But we now know that it is not necessary to postulate that the growth of the embryo "is controlled by the gradient of potential shapes," and we don't need to postulate a "field" that guides this development (ibid.). Stem cell research shows that the cell nucleus contains the core information necessary for the cell's development.

(2) *Polanyi bid, I fear, on the wrong philosopher in his philosophy of biology*. Aristotle is famous for the doctrine of *entelechy*, whereby the future state of an organism (say, in the case of an acorn, the full-grown oak) pulls the developing organism toward itself. In a section on the functions of living beings, Polanyi spoke of the causal role of "intimations of the potential coherence of hitherto unrelated things," arguing that "their solution establishes a new comprehensive entity, be it a new poem, a new kind of machine, or a new knowledge of nature" (*TD* 44). The causal powers of non-existent (or at least not-yet-existent) objects make for suspicious enough

philosophy; they make for even worse science. Worse from the standpoint of biology was Polanyi's advocacy of Bergson's *élan vital* (*TD* 46), which led him to declare the affinity of his position with that of Teilhard de Chardin.

(3) *This doctrine of vitalism that Polanyi took over from Driesch meant, in fact, a whole-scale break with the neo-Darwinian synthesis,* on which all actual empirical work in biology today is based. Beyond structural features and mechanical forces, Polanyi wanted to add a broader "field of forces" that would be "the gradient of a potentiality: a gradient arising from the proximity of a possible achievement" (*PK* 398). He wanted something analogous to "the agency of a centre seeking satisfaction in the light of its own standards" (ibid.). What we do find in biology is the real-world striving that is caused by the appetites and behavioral dispositions of sufficiently complex organisms. The operation of appetites cannot be fully explained by a Dawkinsian reduction to the "selfish gene," since their development and expression are often the result of finally tuned interactions with the environment. Combinations of genes can code for appetites, and the environment can select for or against them, without however needing to introduce mysterious forces into biology.

In the end, Polanyi went too far, opting for "finalistic" causes in biology (*PK* 399). It is one thing to say that the evolutionary process "manifested itself in the novel organism," but quite another to argue that "the maturation of the germ plasm is *guided* by the potentialities that are open to it through its possible germination into new individuals" (*PK* 400). It is one thing to say that the evolutionary process has given rise to individuals who can exercise rational and responsible choices; but it breaks with all empirical biology to argue that "we should take this active component into account likewise down to the lowest levels" (*PK* 402f.). This move would make all of biology a manifestation of an inner vitalistic drive; and that claim is inconsistent with the practice of empirical biology.

Supervenience and the Person

The prophet has played his role. Polanyi formulated the central principles of emergence during the Diaspora of the 1950's, helping the faithful to resist the slings and arrows of outrageous reductionism until biology could move on sufficiently to rediscover the role of emergence in natural history. To name just one example: re-recognizing the role of environmental influences in triggering gene expression has meant an important break from the radical reductionism of Dawkins and his friends. When Steven J. Gould broke from the reductionist model in the late 1970s, it was due in part to his recognition of the role of the environment not only in selecting for or against structures, but also in causing its development. Gould writes, "Minor adjustment within populations may be sequential and adaptive. ... Evolutionary trends may represent a kind of higher-level selection upon essentially static species themselves, not the slow and steady alteration of a single large population through untold ages."[13] The building blocks of the cell do not alone account for the cell's development and functioning; environmental factors and chemical changes at the level of the cell as a whole work to promote the expression of genetic potentials in a sort of "top-down" causation. What's right about the modern synthesis — its ability to account for major changes through a sequence of smaller genetic changes — has been retained; yet it has been *supplemented* by top-down theories that help account for gene behavior. Irreducible complexity has brought with it this expanded notion of emergence, which alone can account for broader, more sudden, and nonsequential change.

The question is: Can a verson of emergentism be formulated now that avoids the quasi-Aristotelian metaphysic that peaks out from time to time in Polanyi's writing? Or will we discover that any less "finalistic"

metaphysic will be ice too thin for theologians to skate on, such that it will crack under the weight and dump theology again into the frigid waters of physicalism, where it will either freeze to death or at best extricate itself only with the greatest of difficulty? Here the recent supervenience debate has moved us a step further along, as I hope now to show. Incidentally, I have heard it said that supervenience is too difficult a notion for use by theologians. I beg to differ. Let me merely summarize in three points what I think is the main contribution of supervenience theory.

(1) In the most general terms, supervenience means that one level of phenomena or one type of property (in this case, the mental) is dependent upon another level (in this case, the biological or neurophysiological), while at the same time not being reducible to it. In the past I have used the term *weak supervenience*, adapted from Jaegwon Kim, as a way of expressing this minimal position. *Strong supervenience* positions, by contrast, generally argue for a *determination* of higher-order phenomena by the subvenient level (e.g., for the determination of mental phenomena by the neural substrate), such that the subvenient level provides the "real" explanation for the phenomena in question.

(2) If supervenience is understood to be a *token-token* relationship — an individual instance of a mental property directly supervenes on an individual brain state — then, according to most standard presentations of supervenience, there is no real place for mental causation. For in each case the mental event will be dependent upon its corresponding physical event, making unclear why the explanatory story couldn't be told in terms of physical events alone. One can *say* that a mental input should be added to the chain of brain states causing other brain states. But it is not clear why the mental cause would not be redundant in this case, turning the resulting position into a de facto epiphenomenalism.

(3) Kim has relied on a version of the multiple realizability argument, which I believe strengthens the case for a *type-type* understanding of the relationship between the mental and the physical. Compared to many authors in the philosophy of mind, Kim shows a deeper appreciation for natural history and the evolutionary origins of mind. I would express a variant of his position in this way: in order to allow adequate place for mental causation, we must reject token-token identity theory. Instead, we understand mental properties to be a type of property that bears a dependence relation on another type of property, the physical (or neuro-physiological) states of the organism.

If this idea is right, the dependence relation of supervenience now has both a synchronic and a diachronic dimension. Mental properties depend upon the entire natural history that caused this complex brain and central nervous system to evolve, as well as depending on the physical state of the organism at a particular time. (To the best of our knowledge, corpses don't have qualia.) This mutual dependency is neither logical nor metaphysical — two requirements that have become the hobgoblin of the analytic philosophy of mind. Instead, the assertion of both a diachronic and a synchronic dependence of mental properties is our best reconstruction of the highly contingent natural history that led to organisms like us. Of course, this dependency relation *qua* natural history represents a firm break with all dualist theories of mind, thereby distinguishing the emergence approach as a separate ontological option in the debate.

But the contingent type-type relationship between the mental and the physical also allows one to give a more robust account of the nonreducibility of the mental than the competing accounts provide. Wherein, then, does the nonreducibility of the mental lie? How is it to be characterized? Much turns on this question — I would argue, the entire theory of personhood and personal knowledge. The only way to give an adequate answer, I

suggest, is to draw on the resources of emergence theory. Although I will not continue to use the term "supervenience" in the final section of this paper, you could understand the position on human personhood being defended as a version of *emergentist supervenience*.

Toward an Emergentist Theory of Mind

Rather than offering you a survey of the most recent articles and books on emergence — which has become a rather impressive body of literature — let me describe the decision points that one faces and then argue for a particular position on the nature of mind or personhood.

To advocate an emergence approach is already to have made certain decisions. It is to reject reductionist physicalism, the belief that all adequate explanations will finally be given in the terms of contemporary physics. On the other side, it is to reject substance dualism, the view that there are two distinct kinds of substances. (In the substance dualism of Descartes, for example, these were *res cogitans* and *res extensa*, thinking and extended substance).

Of course, there are other options, besides emergence theory, available to those who reject both reductionist physicalism and substance dualism. Among other things, one might be a dual-aspect monist, believing that there is just one kind or level of reality, even though it is apprehended by us sometimes in the mode of mind and sometimes in the mode of body; or one might be a panpsychist, believing that "it's mind all the way down," that is, that every level of reality has some sort of mental experience. Until relatively recently it was thought that one might also be a non-reductive physicalist, believing that all things are ultimately physical but not that all explanations (and hence not all causes?) can be reduced to the explanations of physics. I follow Jaegwon Kim, formerly its greatest exponent, in holding that non-reductive physicalism is an inherently unstable position rather than a useful halfway point between other options.[14]

So you want to be an emergentist; what are your options? The first decision point you face is between epistemic and ontological versions of the theory. According to epistemic versions, emergence has only to do with limitations in *our* knowledge of the physical order and/or with the particularities of how we come to know; ultimately, ontologically, all that exists are the physical systems whose behaviors are expressed by physical laws. Clearly, however, the more robust — and certainly the more ambitious — version of emergence theory includes ontological emergence. For these theories, emergence entails a genuine ontological difference in the world.

Ontological views, in turn, subdivide into those that only accept emergent properties and those that also accept emergent causal powers.[15] The emergent properties view is consistent with a belief that all that actually exists are physical objects controlled by physical laws. It's just that very complicated physical objects like ourselves give rise to some rather unusual properties, such as thinking of world peace, loving eggnog, and being able to play hopscotch. Such properties don't *do* anything; all the "doing" occurs at the level of the physical processes of which we are constituted. But they exist nonetheless. By contrast, emergent powers add a bit more to the ontology: they must exist in a more robust sense if they are going around *doing things* in the world.

Those of us who accept the existence of emergent powers have to choose between stronger and weaker claims on their behalf. Much of the theory of personhood you finally accept will depend on how strong an

account you give of emergent causal powers. Theologically-minded persons, I have noticed, leap instinctually toward a strong view of emergent causal powers, or what van Gulick calls "radical kind emergence." The weakest form of emergent causality you can defend (Van Gulick's "specific value emergence") is to insist that wholes and parts must have features of the same kind but may have different subtypes or values of that kind. Thus both the car and its parts have weight, but the car has more of it. A stronger version (Van Gulick's "modest kind emergence") would allow wholes to have features that are different in kind from those of its parts. The most ambitious form of downward causality, however, which I have called *strong emergence*, adds that the holistic features of a complex system need not be necessitated by the sum total of facts about the parts. "Accepting radical-kind emergence," Van Gulick writes,"would be conceding that there are real features of the world that exist at the system or composite level that are not determined by the law-like regularities that govern the interactions of the parts of such systems and their features" (p. 18).

Of course, we want human persons to be fundamental in the furniture of the universe. We want our intentions and goals to matter; we want our thoughts and feelings to be causally efficacious; we want things that we find meaningful (or: things that we *want* to be meaningful) really to *be* meaningful. Hence we tend to think that any views that don't give us these things — eliminativism, the identity theory of mind, non-reductive physicalism — must be false. Of course, we realize that old-fashioned Cartesian dualism conflicts with contemporary neuroscience and faces serious inconsistencies on its own. But some robust form of mental causation, one that allows our wishes and dispositions to be causally efficacious, *must*, we feel, play a role in the universe.

Unfortunately, there are serious difficulties facing mental causation, difficulties that I hinted at in the critique of Polanyi above. Radical kind emergence, the one that I just described as theologically the most interesting, is particularly vulnerable to such attacks. What are its costs, and should we be willing to pay them? One cost involves the danger of negating scientific study and scientific method; another concerns not being able to specify the evolution of neural states; and a third involves not being able to explain where downward causation takes hold and why it does so when it does. Let me summarize some of these difficulties before coming to my own concluding recommendation.

Recall Van Gulick's observation that for radical-kind emergence, "there are real features of the world that exist at the system or composite level that are not determined by the law-like regularities that govern the interactions of the parts of such systems." This claim — which I am inclined to accept — brings a problem, to put it mildly, for the scientific study of persons and their brains. It's much more amenable to modern science to say that the emergence of new macro-properties in a system is ultimately determined by the sum total of relations between the micro-properties of that system. To know the state of all the registers in your computer *just is* to know the state of the system, even though the *content* of the system may be a new emergent property such as a digitized image of the Mona Lisa.

The problem is a serious one. The neurobiologist William Newsome took me to task recently for suggesting in *God and Contemporary Science* that mental events could give rise to new brain events without there being a full causal story in terms of *prior* brain events. If Newsome's requirement is right, it's hard to understand what it means for mental events to initiate new causal sequences in the brain. Where, for example, would be the point of contact: would "mind" affect the outcome of quantum mechanical indeterminacies in the physics of the brain? Would it change the chemical composition at specific synapses? Or would it exercise its causality only at the level of "the brain as a whole," as Roger Sperry believed?

At first glance, quantum indeterminacies seem to offer the ideal opening for mental causation. Unfortunately, contemporary evidence suggests that quantum effects (say, superimposed quantum states prior to decoherence) would probably be eliminated well before one reaches the level of the neurochemical processes that are basic to brain functioning.[16]

The major *non*-quantum accounts of how mental causation might occur appeal to non-linear dynamics, chaos theory, and the field of complexity studies.[17] One problem is that all three of these approaches are still deterministic. Although they have intriguing features such as the role of "strange attractors" and a sensitive dependence on initial conditions, they do not specify where the input of "mind" or "free choice" could be.

Some scholars are seeking to provide proofs that this entire approach to the problem — trying to provide a linear analysis of mental causation in terms of neuron firings — arbitrarily rules out the possibility of genuine mental causal activity from the outset. Thus E. J. Lowe has argued that mental events must have specific goals: one makes the mental decision to buy a car, get out of bed, or sing the *Krönungsmesse*; they are discrete decisions rather than intermingled states. But neural events, by contrast, are "inextricably entangled."[18] Physical actions are products of an interconnected web of brain events; there are no discrete groupings that represent the neural antecedents of "deciding to open the door" or "deciding to pick up your books." Hence no physical account can be given that expresses the steps of the decision in neurological terms. Thus "we think of each decision as giving rise to just its 'own' movement and without any contributions from decisions to perform other, independent movements; and to abandon this thought is effectively to abandon mental causation as common sense conceives of that phenomenon" (p. 640). Hence, Lowe argues, we must either give up mental causation altogether, or we must understand it to be something more than some specific set of neural events.

The Dynamical Systems Approach

Perhaps you've noticed a certain dynamic in this discussion: it's like riding a see-saw. If you push off too hard from the mental side, you descend into the morasses of neurophysiological detail, and no mental causes are to be found. If however you push off too hard from the physical side, you end up in the world of purely mental terms, and no connection with the brain can be found.

I believe that more recent work on dynamical systems brings us a little bit closer to an adequate perspective on the human person. Such approaches shift from the neuronal level to broad brain systems as the level of analysis for mind. As Hardcastle, for example, writes:

> Hormones and neuropeptides impart data through the extracellular fluid more or less continuously in a process known as "volume transmission." What is important is that these additional ways of communicating among cells in the central nervous system mean that simple (or even complicated) linear or feedforward models are likely to be inaccurate. ... Discovering the importance of global communication in the brain has led some to conclude that it is better to see our brain as a system that works together as a complex interactive whole for which any sort of reduction to lower levels of description means a loss of telling data.[19]

This approach gives at least a hint of the direction one might take in addressing the mind-body problem. Global communication in the brain, if it exists, would reflect the kind of holistic effects that we have seen again and again in studying the ladder of emergence. Admittedly, neuroscientists do not yet understand "large-scale,

complex electrophysiological or bioelectrical activity patterns involving millions of neurons and billions of synapses."[20] But these are the *sorts* of processes that we can study and could in principle come to understand.

I therefore conclude that, among many other instances of emergence, the world evidences an emergent phenomenon that we call the mental life, which is associated with a significantly complex brain and central nervous system. From the neurological perspective, we come closer to it when we understand the behaviors of massively distributed systems involving multiple regions of the brain (or possibly, as Sperry thought, the brain as a whole). But only from the first-person or phenomenological perspective can we describe the conscious content of these states. Only when we rise to this level do we get to the lived human experience of emotions, volitions, thoughts — in short, that world of meaning and of meaninged relationships in which we live and move and have our being.

Summary and Conclusions

We began by looking at the concept of emergence as developed by Michael Polanyi. Although we found some areas where we had to resist his concept, we also found it useful in setting the agenda for an emergence theory of personhood. We then added in the resources of the concept of supervenience, discovering in it a powerful conceptual tool for expressing emergentist intuitions about the nature of mind. In the third section we looked at even more recent work toward an emergentist theory of mind. The category of *radical kind emergence* allowed us to outline, at least, how one might conceive mental activity in terms of downward causation. At the same time, it reveals the difficulties in giving a full neurological account of consciousness. I argued that, despite the difficulties, the costs are still worth paying.

Some assumptions guided the entire treatment, and I should now lay them out on the table before you. I have assumed, on the one hand, that if a given account of mental influence were incompatible with natural science, that would be a telling argument against it. I do think that Aristotle's doctrine of entelechies, of future (and thus merely potential) patterns pulling natural processes toward themselves, is incompatible in this way. As a result, I have particularly worked to avoid Polanyi's occasional flirtations with this idea. On the other hand, I assumed that we should select between neuroscientific theories, in part, based on how robust an account of mental causation they can deliver — even if it goes beyond the science we currently know.

This set of assumptions still leaves one with a certain amount of room to maneuver. But it can be refined until it represents a more detailed decision procedure. We need only add that the degree of untestability of a theory of mind correlates with the degree to which it becomes an affront to science; and the degree to which it becomes an affront to science represents at least prima facie reason to reject it. This decision procedure amounts, I suppose, to a dual wager. It is a wager that the ultimately victorious account will preserve a place for mental causation (and remember that you have to believe in mental causation even when you plan to argue against it!), and a wager that the victorious account will not invalidate the study of the brain or make such study irrelevant. Accepting this dual wager explains why many of us resist Cartesian dualism: since Cartesian mental substance has nothing whatsoever to do with the physical world (it belongs to another world altogether), brain science would never tell us anything about the nature of (Cartesian) thought. On the other hand, explanation through the micro-determinism of neural firings can never explain thought because it has not left a place for ideas to have any causal effect on the brain and central nervous system — and thus on one's actions in the world.

I have not been able to list and develop all the dimensions of human personhood suggested by this account, at least not today. But if I am right, no conceptual roadblocks stand any longer in the way of a full theory of human personhood. It can now draw freely not only on the neurosciences and cognitive psychology, but also on the whole range of the social sciences: psychology, sociology, cultural anthropology, and so on. Indeed, given the universality of religious rites, rituals and beliefs across human cultures, a full understanding of the human person will have to incorporate the spiritual dimension and those disciplines that address it as well. But this is an exercise for another talk.

In closing, as one considers the extremes of the mind-body debate during the last century — identity theorists, eliminative materialists, and reductive physicalists on the one side, and substance dualists of many shapes and colors on the other — one is struck by the power of the emergentist research program. Considering its ability to move further and further from anti-scientific postulations, to enter more deeply into genuine dialogue with the neurosciences, yet without losing the "hard core" of emergence, one must surely rank emergence theories as one of the most progressive and promising research programs in this field over the last 50 years. We must say in one sense that, like the British Emergentists of the 1920s, Polanyi has been superceded by the emergence theories of Roger Sperry, John Searle, certain supervenience theorists, and now by the radical-kind emergence theorists of the most recent years. Yet in another sense it is a testimony to Polanyi that he served as a crucial link in this chain, almost singlehandedly linking together the emergence theorists of the early and the late parts of the century. For this crucial function he continues to deserve our gratitude.

Endnotes

[1] *Personal Knowledge*, henceforth *PK* (Chicago: University of Chicago Press, 1958), p. xi.

[2] *The Tacit Dimension*, henceforth *TD* (Garden City, NY: Doubleday Anchor Books, 1967), p. 24.

[3] On the latter see esp. *Knowing and Being: Essays by Michael Polanyi,* henceforth *KB*, ed. Marjorie Grene (London: Routledge and Kegan Paul, 1969), esp. Part 4, "Life and Mind."

[4] See Harold J. Morowitz, *The Emergence of Everything: How the World Became Complex* (Oxford and New York: Oxford University Press, 2002).

[5] See, among other works, B. Weber and T. Deacon, "Thermodynamic Cycles, Developmental Systems, and Emergence*," Cybernetics and Human Knowing* 7/1 (2000): 21-43.

[6] See Arthur Peacocke, *Theology for a Scientific Age: Being and Becoming — Natural, Divine, and Human* (Minneapolis: Fortress Press, 1993); John Haught, *God After Darwin: A Theology of Evolution* (Boulder, CO: Westview Press, 2000); David Ray Griffin, *Unsnarling the World-Knot: Consciousness, Freedom, and the Mind-Body Problem* (Berkeley: University of California Press, 1998); Clayton, *God and Contemporary Science* (Grand Rapids: Eerdmans, 1999); Clayton, *The Emergence of Spirit* (forthcoming). Most radically, see Anthony Freeman, *God in Us: A Case for Christian Humanism* (Thorverton, UK: Imprint Academic, 2000).

[7] *KB* 235f., my emphasis.

[8] Ibid.; cf. 214. Polanyi writes later, "We lose the meaning of the subsidiaries in their role of pointing

to the focal" (*KB* 219). For more on Polanyi's theory of meaning, see Polanyi and Harry Prosch, *Meaning* (Chicago: University of Chicago Press, 1975).

[9] See *God and Contemporary Science*, esp. chapter 9.

[10] Henry P. Stapp, *Mind, Matter, and Quantum Mechanics* (Berlin and New York: Springer-Verlag, 1993).

[11] Hubert Yockey, *Information Theory and Molecular Biology* (Cambridge: Cambridge University Press, 1992); Werner Loewenstein, *The Touchstone of Life: Molecular Information, Cell Communication, and the Foundations of Life* (New York: Oxford University Press, 1999); Mike Holcombe and Ray Paton, eds. *Information Processing in Cells and Tissues* (New York: Plenum Press, 1998); Susan Oyama, *The Ontogeny of Information: Developmental Systems and Evolution*, 2nd ed. (Durham: Duke University Press, 2000); Roland Baddeley, Peter Hancock, Peter Földiák, eds., *Information Theory and the Brain* (Cambridge: Cambridge University Press, 2000).

[12] Terrence Deacon, "Evolution and the Emergence of Spirit," SSQ workshops, unpublished paper, p. 6.

[13] Stephen J. Gould, *The Panda's Thumb: More Reflections in Natural History* (New York: W. W. Norton, 1980), p. 15.

[14] See Jaegwon Kim, *Mind in a Physical World: An Essay on the Mind-Body Problem and Mental Causation* (Cambridge, MA: MIT Press, 2000). This work contains references to Kim's criticisms of non-reductive physicalism going back some eight years.

[15] See Robert Van Gulick, "Reduction, Emergence and Other Recent Options on the Mind-Body Problem: A Philosophic Overview," *Journal of Consciousness Studies* 8 (2001): 1-34.

[16] See e.g. C. Seife, "Cold Numbers Unmake the Quantum Mind," *Science* 287 (February 4, 2000), and Max Tegmark, "The Quantum Brain," *Physical Review E* (2000): 1-14. Against this view, the quantum physicist Henry Stapp has computed that the scale of microtubules is such that quantum effects associated with sodium ions could affect releases and thus the chemical composition of synapses (personal communication).

[17] See the excellent presentation in Michael Silberstein, "Converging on Emergence: Consciousness, Causation and Explanation," *Journal of Consciousness Studies* 8 (2001): 61-98.

[18] See E. J. Lowe, "The Causal Autonomy of the Mental," *Mind* 102, #408 (1993): 629-44.

[19] See V. Hardcastle, *The Myth of Pain* (Boston: MIT Press, 1999), quoted in Silberstein, p. 82.

[20] Silberstein, p. 82.

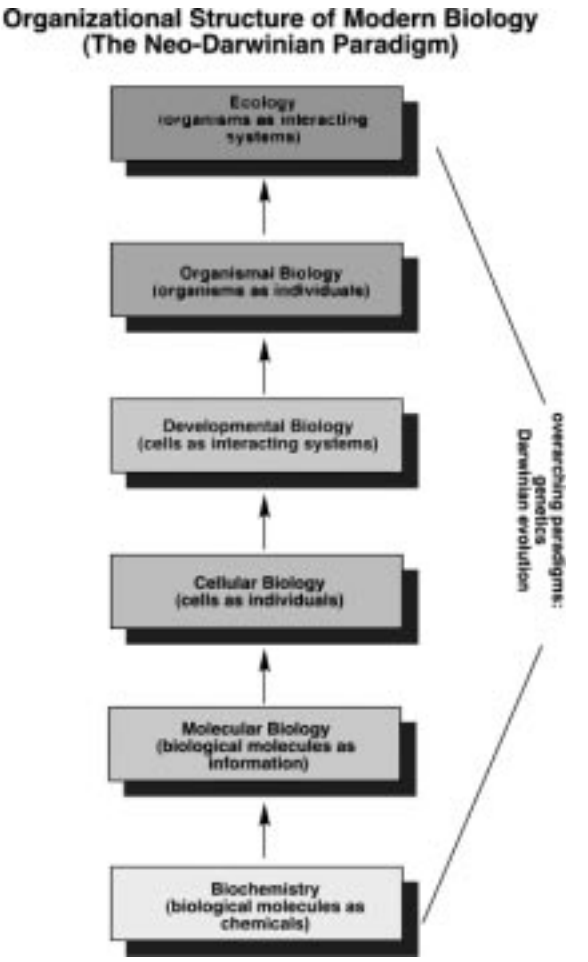
On Polanyi, Clayton, and Biology: Some Musings of a Recovering Reductionist

Martinez Hewlett

ABSTRACT Key Words: causality, emergence, molecular biology, physicalism, reductionism, supervenience. *Michael Polanyi critiqued the then burgeoning field of molecular biology and the neo-Darwinian synthesis that has since come to characterize the structure of modern biology. He pointed out correctly that the reductionistic approach lacked explanatory power in the case of living systems. Philip Clayton addresses the importance of Polanyi's thinking, even though it was not appreciated at the time it was presented. He argues, however, that while some aspects of Polanyi's biological perspective are important in considering emergent phenomenon, other ideas are less well received in the modern era. This article discusses the pros and cons of the Clayton view and presents a model for a biological structure that might embrace emergence and supervenience*

At the beginning of the 21st century, we have the opportunity, through the eyes of Clayton and Polanyi, to look critically at the discipline of biology. We see, much to the dismay of many of us who practice this science, a field that is lost in its 19th century roots while trying to espouse 20th or 21st century models.

The two principle organizing features of modern biology are products of the intellectual climate of the European 19th century, and, as expected, both reflect the prevailing philosophical assumptions of determinism and reductionism. These two ideas, Mendelian genetics and Darwinian evolution, come together in the middle of the 20th century to produce the Neo-Darwinian synthesis. As a result, the hierarchical structure of modern biology can be represented by the bottom-up organizational structure shown in Figure 1:



The extreme position of the ontological reduction represented in this figure is typified by the physicalism of biologists such as Francis Crick and Richard Dawkins, along with philosophers such as Daniel Dennett. In fact, at the heart of the much touted Human Genome Project is the conviction that sequencing all of human DNA will ultimately tell us everything there is to know about what it means to be human.

This philosophical assumption is inherent in models of the human nervous system that attempt to explain consciousness as merely an "epiphenomenon" of the biochemistry of neuronal activity.

Polanyi on Biology

The philosophical position of ontological reductionism was critiqued by Polanyi at its most important level, when he pointed out that the information content of biological macromolecules such as DNA could not, in fact, be accounted for simply by the chemistry of the molecules. He stressed that the information must be insensitive to the chemistry, otherwise all DNAs of biological entities could not be composed of the same four nitrogenous bases.

Polanyi's critique has been largely ignored in the modern synthesis. However, beyond this simple demonstration of the fallacy inherent in the assumptions of modern biology, Polanyi offered a wider vision, that of the emergence of systems from assemblages of the subunits contained within the system. It is this proposal that is the focus of Philip Clayton's presentation.

From the standpoint of a recovering biological reductionist, as Philip Clayton characterized me in 1998, this offers an opportunity to recast one's philosophical base. But before I propose an emergentist view of my own, let me comment on some of the contributions and critiques that Clayton discusses with respect to the work of Polanyi.

Clayton on Polanyi

As Clayton rightly points out, Polanyi's contributions to the current discussion cannot be overstated. His characterization of boundary conditions, both active and passive, as well as his theory of knowledge and mind become central to any present-day treatment of emergent phenomena. Of greater importance, I believe, is his theory of structure and information, with its explicit appeal to top down causality. I emphasize this because of the nature of biological information and because the focus of the biological physicalist has always been on the primacy of the informational molecules *qua* chemicals.

Clayton also offers necessary critiques of Polanyi's work. I would like to focus on two of these criticisms: Polanyi's interpretation of developmental biology and Polanyi's choice of philosophers or philosophies.

Developmental biology, including neurobiology, is perhaps the most active area of investigation within the general rubric of modern biology. When Polanyi considered the state of this discipline in the early 1960's all of biology was under the strict influence of the molecular biology paradigm. It is no wonder that, given his view of the reductionist mode of Jacob and others, he reacted strongly in another direction. His acceptance of "morphogenetic fields" and "gradients" can be seen, in retrospect, as errors. However, a closer examination of modern developmental models shows that such concepts as positional effects, cytoplasmic determinants, gradients of morphogens, and cell-to-cell signaling are commonly invoked. All of this means that, while "the cell nucleus contains the core information necessary for a cell's development" (Clayton, this meeting), it is likely that the DNA is a necessary but not sufficient explanation. Is it possible that Polanyi was partially correct?

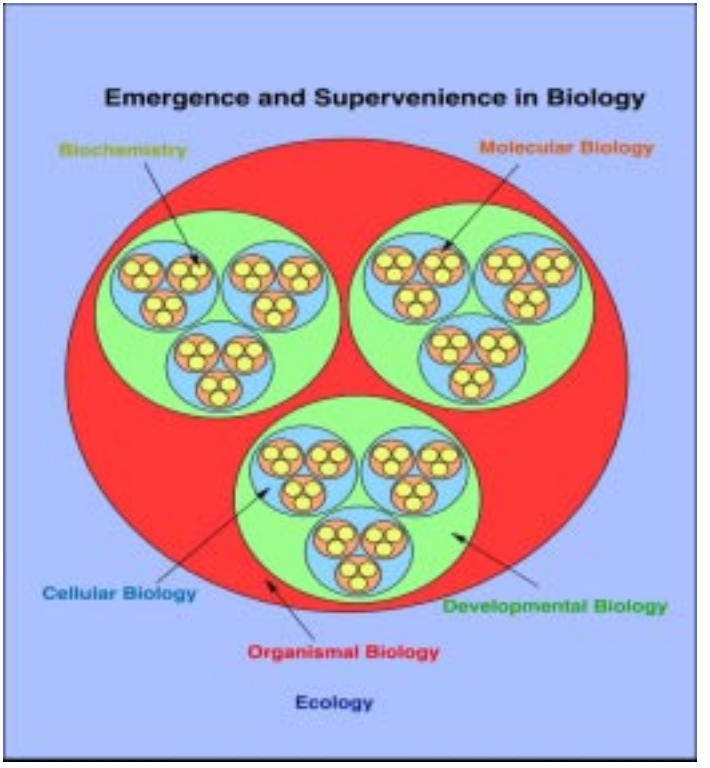
Clayton states that Polanyi may have "bid on the wrong philosopher." In his argument, Clayton mentions Aristotle's doctrine of *entelechy* as the critical flaw in this choice. Clayton wishes to avoid the "quasi-

Aristotelian metaphysic" in the development of emergentism. He focuses on strong supervenience as an explanatory model that strengthens the idea of emergence for consideration by theologians. In his seminal work, *God and Contemporary Science,* Clayton argues for "causal powers" as the strongest argument for downward causation in the case of strong supervenience.

However, the idea of causal powers strikes me as quite Aristotelian. William Wallace, in his book "The Modeling of Nature," develops a contemporary philosophical approach that he calls the causal model. In this work he argues that, like Aristotle, one can use the world of artifacts as an explanatory model for the natural world. In this model he recognizes four causes: matter, form, agent, and end. His recasting of the Aristotelian/ Thomistic view can easily be reconciled with a downward causation model, although the philosopher Michael Dodds prefers the term "inside out causality." So, it seems to me that the idea of causal powers fits nicely into this neo-Aristotelian view. *Entelechy*, of course, must be abandoned in any contemporary argument, in the same way that *elán vital* is a concept that has no explanatory usefulness. But it may be going too far to throw out the model with the interpretation.

A New Biology Emerging?

On the one hand, Polanyi has pointed out the logical error that lies at the heart of the molecular paradigm of the modern synthesis. On the other hand, Polanyi and Clayton both have constructed an important argument for supervenience and emergence as an explanatory model for the nature of consciousness and the mind. In between these two statements lies the entire hierarchical structure of modern biology. In order to bridge this, it will be important to reconstruct the view. To do this, it will be necessary to employ first the weak supervenience of Kim. In this model (Figure 2) the emergent properties of higher order structures are emphasized by the space that is not included in the sum of the subvenient parts. In addition, since no arrows are shown, the direction of the causation is left unstated.



This model may not satisfy the strong supervenience sought by the theologian. However, it may serve as a starting point in the discussion with biologists still lost in the hierarchy. I offer it as a lure that might rescue my colleagues who remain addicted to the powerful yet limited drug of ontological reductionism.

Emergence and Supervenience: A Reply to Philip Clayton

Gregory R. Peterson

ABSTRACT Keywords: Philip Clayton, Chuang Tzu, emergence, supervenience, closed and open systems. *Philip Clayton has put forth a clear and important position regarding the mind-body relationship in terms of supervenient and emergent realities. While I agree with Clayton on many points, I argue that there are important problems with current literature on supervenience and emergence. In particular, I distinguish between closed system emergence and open system emergence, suggesting that Clayton's position is closer to the latter than the former.*

I begin with a dialogue between the 4th century BCE Taoist philosopher, Chuang-tzu, and his friend, intellectual opponent and eminent logician, Hui Shih.

> Chuang-tzu and Hui Shih were strolling on the bridge above the Hao river. "Out swim the minnows, so free and easy," said Chuang-tzu. "That's how the fish are happy."
> "You are not a fish," replied Hui Shih. "How do you know that the fish are happy?"
> "You aren't me," said Chuang-tzu. "Whence do you know that I don't know the fish are happy?"
> "We'll grant that not being you, I don't know about you," said Hui Shih.
> "You'll grant that you are not a fish, and that completes the case that you don't know the fish are happy."
> "Let's go back to where we started," replies Chuang-tzu. "When you said 'Whence do you know that the fish are happy?', you asked me the question already knowing that I knew. I knew it from above the Hao river." (from Graham, p. 17).

I find this debate between Chuang-tzu and Hui Shih, occurring as it did some 2300 years ago, oddly relevant for discussion of Clayton's work. In its own way, the debate focuses on epistemology, and the two protagonists take quite different approaches as to how to even approach the question. Hui Shih, takes the scientific approach. He wants facts and theories that can be logically categorized and from which can be deduced clear and precise conclusions. Chuang-tzu, however, takes a different approach. In his final reply, he shows that he is not interested in the knowledge, but the implicit bounds within which such knowledge occurs. More on this later.

Philip Clayton has presented to us his views on emergence and supervenience, two concepts that have become central to his broader theological and philosophical project. In doing so, he has also attempted to show that some of the historical roots of modern emergence and supervenience theory run through the thought of Michael Polanyi, while at the same time attempting to show that Polanyian perspectives on emergence can be enriched by contemporary developments in the supervenience debates. While there are a number of points that might be pursued, I will quickly move to the issues that I consider central.

Clayton's position is essentially this. Polanyi's position on emergence: good! Polanyi's endorsement of dubious scientific theories that did not pan out: bad! Reductive physicalism, non-reductive physicalism, strong supervenience, token-token theories of mind-body relationship, and pretty much everything but a type-

type understanding of supervenience and emergence: bad! Epistemic emergence: Not enough! Full-blown, radical-kind, strongly emergent weak supervenience: really, really good!

I should note at the outset that there are a number of points that Clayton and I agree on. I largely concur with what Clayton has to say about Polanyi. I generally agree with Clayton's rejection of reductive physicalism as a metaphysical program and his general endorsement of emergence theories. On the characterization of supervenience and emergence, I start to worry some. As such, I offer the following observations.

Observation 1: I've come to regard most articles I read about supervenience theories as supremely unhelpful for the philosophy of mind and human nature: as far as I can tell, they have little relevance to how any theory of the relation of mind-body-brain would likely pan out. Clayton quite rightly criticizes token-token theories, most of which do not take into account issues of whole-part relations that would necessarily be central to any theory of mind. Too often, it is assumed that mental and physical properties are simple, discrete entities that can be easily and unproblematically correlated, as if the problem was no more complicated than currency exchange rates. But any single mental event involves thousands to millions of neurons, and it is not at all clear that this can be construed as a simple one-on-one relationship. I therefore concur with Clayton on his brief and sweeping characterization of what he calls strong supervenience, and I think he and others are correct in their estimation that strong supervenience theories are necessarily reductive in character.

Observation 2: Clayton speaks of weak and strong supervenience as well as weak and strong emergence. Clayton's analysis seems to imply a relation between the two. Strong supervenience correlates with weak emergence; weak supervenience correlates with strong emergence. In making these distinctions, Clayton is, I think, following the currents of discussion as they now stand. It is here, however, that the problems begin to emerge (or supervene?), for there are a range of possible meanings. Historically, the literature that advocates forms of strong emergence has been unclear on precisely what's being implied. A range of possibilities exist, and different forms are advocated by different authors.

For this reason, I have chosen a slightly different characterization that I hope more clearly brings out the issues involved. Rather than speaking of weak and strong emergence, I would rather speak of open and closed emergence (or perhaps emergent systems). A closed emergent system is one in which all the lower level physical parameters are known. It is thus not epistemologically emergent. Necessarily, then, a closed emergent system would obey known physical laws at the lowest levels, including the laws of thermodynamics. Closed emergent systems arise in situations where the lower levels organize themselves or are organized into complex interactive wholes that obey higher order laws and produce real and novel patterns. It is this whole-part relationship, combined with the development of higher order laws and novel higher order behavior that characterizes closed system emergence. It is important to note that many of the examples used to support a philosophy of emergence are of precisely this sort, such as Donald Campbell's soldier termites (1974). Nancey Murphy and George F. R. Ellis (1996) have used the desktop computer as an example of emergence, and in some ways the desktop computer is the example of closed system emergence par excellence, with clearly distinguishable levels of organization, from the physical elements to hardware organization to code to what appears on the screen. Presumably, closed system emergence allows ontological emergence of a radical kind. Whether it supports top-down causality is more complicated. I would suggest that it does, but Clayton might disagree. Certainly, closed system emergence has a price, inasmuch as it is relatively deterministic at the lowest levels, even if indeterministic at the higher levels.

In contrast to closed system emergence, systems that betray open system emergence are systems whose full workings are not known and which may rely on principles heretofore unknown. Open system emergence necessarily implies epistemic uncertainty. It may or may not imply ontological open-ness as well. Philosophers like John Searle (1992) and Colin McGinn (1991), for instance, can both be seen as advocates of open system emergence, but in both cases their claim is that our understanding of the mind-body relation is epistemically open (we currently and perhaps will never understand it) but ontologically closed, in the sense that they both believe that no new physical or super-physical properties are required to explain the relation. Roger Penrose's (1989) advocacy for a new theory of physics to explain the properties of mind is open in both senses, epistemologically because we currently don't understand the mind, and ontologically because new principles are called for. Most forms of substance dualism and panpsychism may be considered as radical forms of open system emergence. Not only do they call for new properties currently unknown, but new properties which seem at considerable variance with what we currently know about the world.

Observation 3: We might now ask, what kind of emergent supervenientist is Phil Clayton? Clearly, Clayton wants both ontological status and causal powers for the mind. One may argue that closed system emergence can give both. For many, this seems counterintuitive, for if the system is complete at the lower level, then that seems to imply there cannot be top-down causality. This is not necessarily the case, however, and it relies on a conceptual confusion that assumes that the ontological levels in a physical system are completely discrete. I would argue that this completely misunderstands the emergent character of many physical systems. If the mind is a closed emergent system, it is mind-ful by virtue of the organization of its physical constituents. One might say, borrowing Douglas Hofstadter's (1980) felicitous phrase, that closed emergent systems are not simply hierarchies, composed of independent levels, but tangled hierarchies, where levels are not completely discrete from one another. On this account, the mind is a physical system, but it is not merely a physical system, and we might say the same for the person as a whole.

While I am not sure, I suspect that Clayton would ultimately find this unpalatable. Elsewhere in his writings, he has argued that there can be mental causation without physical causation, something that would be impossible for a closed emergent system. If this is the case, when Clayton speaks of radical kind emergence, he is not simply speaking of new and novel properties that emerge out of the natural world as we understand it, but for new ontological categories altogether. The question then, is what kind of categories or things are we looking for? Once we open this door, it can open very wide very fast. Clayton shows some sympathy for theories that invoke quantum mechanics, but also acknowledges their limitations. Clayton is also quite strong in his rejection of substance dualism, although in his advocacy of mental causation without physical causation, he may be closer to it than he is willing to admit. Or, perhaps, because it is open, we cannot know at all. We must remain agnostic for now, and acknowledge that the human person is a multi-layered thing that can be approached at different phenomenological levels, while admitting ignorance as to how the levels connect.

Observation 4: All of this is very abstract. I tend to believe that philosophy works best when it can find concrete examples to mull over. So, I would pose three questions to Clayton as a way of helping him clear me up. First, can there be robot minds, a la Cog and Kismet (the current celebrities), and what would that imply? Second, both cockroaches and chimpanzees have brains, but do they have minds? And does the answer to this question tell us anything important? Third, are zombies possible? That is, is it possible to have intelligent behavior without that thing we call consciousness or subjectivity?

In fairness to Clayton, I'll reveal my short answers to these questions: chimpanzees, yes; robots, probably; cockroaches, probably not; zombies, I really doubt it. In saying this, I present my own feeling that the evidence on these questions remain difficult and the solutions less than clear-cut. In particular, I feel that there is a kind of dilemma most modern thinkers now face. On the one hand, there is good scientific evidence to believe that some form closed system emergence is the best way to go for understanding the mind-brain-body relation. Functionalist programs (speaking very broadly now) have been highly successful in the fields that compose the cognitive sciences, and promise to be so for decades to come. At the same time, there are good philosophical reasons to suppose that closed system emergence must be wrong, not least because it leads to implications for identity and personhood that are, from the first person perspective, both improbable and unpalatable. If Sophocles wrote about intellectual dilemmas rather than moral ones, he would, in my estimation, find a ripe subject here.

Concluding Observation: In truth, I felt much as Clayton did when asked to speak on this subject at a session of the Polanyi society. How forced will the connection to Polanyi be? Will I be limited to pleasant platitudes?

While I have certainly read Polanyi, I have never focused on his work, although I have always been appreciative of his emphasis on the tacit dimensions of thought, and indeed have become more so in recent years. It is with this in mind that I return to the dialogue between Chuang-tzu and Hui Shih. Like Hui Shih, I believe that we should take both scientific theories and philosophical constructs seriously, for the benefits of such effort are important in innumerable ways. Like Chuang-tzu, however, we must also take into account the boundaries within which such endeavors are pursued. Both scientific theories and more analytic oriented forms of philosophy aim for clarity, logical rigor, and completeness. At the same time, we can sometimes let our theories too easily drive our values, and when we turn to that most important of subjects, the human person, such drives can be dangerous indeed. It is perhaps this caution that tips me over into the camp of open emergence, impressed both by what we have achieved as well as by our own ignorance. And, by those boundaries within which our experiences occur. I suspect Polany might agree with that. At the very least, it may open our eyes to the false polarities and uncertain certainties that we sometimes are too eager to claim.

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Submissions for Publication

Articles, meeting notices and notes likely to be of interest to persons interested in the thought of Michael Polanyi are welcomed. Review suggestions and book reviews should be sent to Walter Gulick (see addresses listed below). Manuscripts, notices and notes should be sent to Phil Mullins. Manuscripts should be double-spaced type with notes at the end; writers are encouraged to employ simple citations within the text when possible. MLA or APA style are preferred; because the journal serves English writers across the world, we do not require anybody's "standard English." Abbreviate frequently cited book titles, particularly books by Polanyi (e.g., *Personal Knowledge* becomes *PK*). Shorter articles (10-15 pages) are preferred, although longer manuscripts (20-24 pages) will be considered. Consistency and clear writing are expected.

Manuscripts normally will be sent out for blind review. Authors are expected to provide a hard copy and a disk or an electronic copy as an e-mail attachment. Be sure that electronic materials include all relevant information which may help converting files. Persons with questions or problems associated with producing an electronic copy of manuscripts should phone or write Phil Mullins. Insofar as possible, *TAD* is willing to work with authors who have special problems producing electronic materials.

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God, Contemporary Science and Metaphysics: A Response to Philip D. Clayton

Andy F. Sanders

ABSTRACT Key Words: P.D. Clayton, panentheism, science, supervenience, humanities.
This paper is a response read at a joint session of the Polanyi Society and the Religion and Science Group at the AAR Annual Meeting in Denver, November 16, 2001. Though a paradigm example of the conversation between systematic theology and contemporary science, Philip Clayton's God and Contemporary Science *is questioned for taking the natural sciences too seriously: it endangers the autonomy of theology and by implicitly advocating a grand metaphysics, it creates an unbridgeable gap with ordinary religious meaning, and in regard to some theological doctrines, with science as well.*

The Metaphysics

Clayton's highly original version of panentheism appears to be moderate.[1] As he rightly points out, the lofty aspirations of metaphysical reason are *passé* (p.2) and, as becomes clear quickly, his panentheism lacks the abundant conceptuality of the Whiteheadean versions. Given the downfall of positivism and foundationalism, this means that Christian systematic theology now may begin at its very own beginnings without first having to make all sorts of apologetic moves (p.4). It also means that metaphysics cannot make the familiar absolutist claims anymore and has to be more modest.

However, we also read that metaphysical panentheism strives to offer the most adequate explanation of all the available evidence, of all that is. This striving is none other than the striving for "the final unification of knowledge" that lies at the heart of rational debate. Theological theory construction may greatly contribute to the endeavor, for it "may provide the most powerful explanations we possess of the world of our experience taken as a whole" (p.155).

There seems to be a puzzling discrepancy here between the modesty of Claytonian panentheism and its very ideal of a (future) unified knowledge. The former does, but the latter does not seem to fit well in our current postmodern, postfoundational context with its diversity, plurality, particularity, fragmentation, individualization and its turn to practice. It is a context in which, as Clayton rightly points out, the concept of God has become problematic and the question of God can only be treated in terms that are skeptical of all metaphysics. Seen in this light I would like to hear more about Clayton's reasons for his apparent optimism and confidence that there is still a place and an audience for the grand metaphysical ideal of total explanation and unified knowledge in the wider culture beyond the well-institutionalized context of the conversation between theology and the sciences.

Taking Science Seriously.

Clayton takes science very seriously. At least the following meta-methodological rules govern his construal of the relation between science, theology, and metaphysics. First, the interdisciplinary conversation

between theology and science can only be pursued fruitfully within a larger metaphysical framework. Second, if an issue is truly trans-empirical (non-scientific) it may still be resolved in a rational debate between the metaphysical positions in question. Third, if an issue is to some extent empirically relevant, let current science largely determine the parameters for its resolution. Fourth, when science raises metaphysical questions, they can be answered from many different and differing philosophical angles: naturalism (scientistism, determinism, materialism, ontological reductionism, physicalism) but also theism (deism, pantheism, panentheism) and, I would add, perhaps even humanistic atheism. I have no quarrel with these "isms", but I wonder whether science as the paradigm example of explanation is sometimes not taken too seriously.

First, in view of the emphasis on integrating systematic theology and natural science into a unifying metaphysics, I think there may be a legitimate worry about the autonomy of theology as a discipline. Assigning it the task to supplement science, for example, (p.260) may be nailing theology too tightly to the mast of the natural sciences.

Second, the emphasis on truth-claims and explanation sometimes leads to a puzzling characterization of religious contexts. Take the example of the camping incident where a boulder crashes down just next to the tent in which your children are sleeping (p.175; cf. also the example of surviving an automobile accident, p.246). One understands why he depicts the near accident in terms of causes and explanations: Is one allowed to claim, "God altered the course of the rock"? But what if we begin to depict the reaction to the incident in terms of gratitude: "Thank God!"? Rather than asking for an explanation of the alleged cause of this expression, a philosophical theologian may wish to enquire what it means to say seriously "Thank God!" in a situation where there is evidently no (normal) evidence of supernatural intervention. It seems to me that this theologian is nearer to religious practice, and doing something quite different, than Clayton's theologian. One wonders what the latter would say about the inquiries of his more contemplative and hermeneutically minded colleague.

Divine Agency in the World

The question of how to conceive of divine agency in the world is central to the book. Theologically, there are only two possibilities: either (a) God does not intervene (because, as everything is perfect, there is no need to do so) or (b) God does intervene directly in the world (p.190). Alternative (a) is theologically inadequate because it leads to deism. Alternative (b) is inadequate as well because it seems to suggest a Divine Repairman who is trying to fix all sorts of errors in the created world. Clayton then goes on to distinguish three kinds of divine intervention: (1) general conservation or sustaining (not at odds with natural science, because trans-empirical), (2) psychological interventions (miracles) and (3) physical interventions in the natural world. The latter kind raises the toughest problem, for if we are to have a full theory, theology must give an account of "where the causal joint is at which God's action directly impacts on the world" (p.192). Without such a theory, theologians would fail to make sense of their own views. They would also fail in their apologetic task for on any strong naturalist reading divine agency in the world is physically impossible.

Clayton then goes on to argue that on certain interpretations of quantum physics and recent theories of chaos there might be a locus for direct activity by God without breaking any natural laws. Thus it is not the case that modern science forbids direct action of God. What to think of this?

I think that in some contexts of conversation, say, between theologians and ardent naturalists, purely scientific considerations might be brought up to suggest that divine agency is logically, or perhaps even

physically, not impossible. But I do not see that theology should have to do this in every context. If, as Clayton says, it is allowed to assert that God's grace will safeguard continued existence of the subject after death (p.262), I do not see why one could not assert with equal right that God as the creator and sustainer of the universe (including all its operational principles), will always relate to the world when, where, and in (often mysterious) ways it pleases God. Though there is no science here, surely this statement is not unintelligible!

The Panentheist Analogy and Emergentist Supervenience

In his final chapter Clayton develops the so-called panentheist analogy between the relation of God's body and mind and that between a human person's body and mind. I think he is right in insisting that talk about divine agency must be analogous to the language of human agency. Some theists have criticized the analogy for being far too weak to bear the burden of providing "a guiding framework" for a doctrine of God (p.260). As Clayton himself points out, the analogy breaks down in at least two important respects: (1) whereas the human mind depends for its workings on the brain, the divine mind, as unique creator, is *in*dependent of the universe, (2) whereas the human body is not constructed by the human mind, the universe is created by the divine mind. The analogy is not meant to found anything but to enable us to talk about the human mind as dependent on the world in a different sense than the divine mind. Since Clayton explicates the difference (by appeal to the dipolarity of the divine nature) quite well, I think the analogy holds its own.

Underlying the analogy is a particular view of the body-mind relation, called *weak supervenience*, a view Clayton prefers to the many philosophical accounts of the body-mind relation on offer (substance dualism, epiphenomenalism, eliminative materialism, functionalism, the 'dual aspect theory'). Reinforcing it with the doctrine of emergence and with the notion of 'levels of emergence', the result is emergentist supervenience. Briefly, and normal physical causality aside, Clayton maintains that (1) mental states 'supervene' on physical states in the sense that, although the former emerge from, and thus depend on, the latter, mental states are not reducible to physical ones. (2) Mental states may cause other mental states and (3) mental states, events or processes may cause physical ones (by intentional causation). I have five points by way of comment.

Notice, first, that there are interesting similarities between Clayton's position and Polanyi's. For example, like Polanyi, Clayton posits the reality of consciousness, and, like Polanyi, advocates its ontological irreducibility to physics and chemistry (p.239) by appeal to the concepts of emergence, boundary conditions and the like.

Second, the similarities are not surprising because, as most of you will recall, Polanyi's philosophy of science and his epistemology influenced a number of authors in the field of science and religion from the sixties until at least the mid-eighties, notably Ian Barbour and especially Arthur Peacocke who clearly elaborated a number of Polanyian ideas further (e.g. the notion of hierarchical levels).

Third, Polanyi may even lend support to Clayton's account. For example, in regard to the crucial issue of irreducibility, Polanyi argues that in certain part-whole relations (or relations between consecutive levels of complexity), the laws governing the parts in themselves may explain a breakdown or malfunction of the whole, but cannot account for the successful operation of the organizing principles that govern the whole (cf. *The Tacit Dimension*, 1966, Ch.2: 'Emergence').

Fourth, what follows from emergentist supervenience regarding the ontological status of the mind? In what sense are the mind and consciousness 'real'? Would it not lead to a naturalist account of the human mind,

not unlike John Searle's (*The Rediscovery of the Mind*, 1992) that says, roughly, that the mind is an emergent higher-level feature of the brain and that both are part of the natural world?[2] Searle develops a devastating attack on materialism and argues forcefully for the ontological irreducibility of consciousness and subjectivity. Part of the natural world is subjective but current science cannot come to grips with it because it has stricken first person subjectivity out of the book of nature. He rejects the same philosophical mind-body accounts as Clayton. Do we have here a philosophical ally for a panentheism that is sensitive to the weaker varieties of naturalism?

Finally, supervenience seems to imply that due to its dependence on the body, the mind cannot continue to exist after death. According to Clayton, this need not imply that eternal life after death will be impossible for "one can assert that God by his grace preserves the existence of the subject after the death of her body for eternal fellowship with God" (p.262). Clearly, the doctrine of eternal life after death cannot be treated in the same way as the doctrine of divine agency. Apart from para-psychological data and reports of near-death experiences, the issue seems overwhelmingly trans-empirical. On Clayton's construal, should this not have consequences for the status of the doctrine of eternal life?

Knowledge, Judgment and the Fact-Value Dichotomy

At some places Clayton suggests that Christian theology should resist the fact-value dichotomy that is so deeply entrenched in modern Western culture. If I take him correctly, the dichotomy is between the empirical sciences that give us a single picture of the material world and the humanities that offer at most meaningful but often quite different perspectives on the human life world. At this point, not only among Polanyians certain familiar worries may begin to crop up. Clayton's metaphysical system, aiming exclusively at the explication of truth-claims and the explanation of all the available evidence, seems to keep the dichotomy intact, even to sustain it. For it employs the concepts of knowledge and explanation as pertaining to the realm of the 'objective facts', to how things really are. In contrast, meaning, value, understanding and judgment are used in relation to the 'soft' domain of (some of) the social sciences, the humanities and beyond them to religious and secular life view traditions. Examples in case might be the remark that "Science works well as an explanatory agent, but functions poorly as a world-view that might guide moral decision making and the human quest for meaning" (p.155), as well as the normative distinctions between knowledge-based reasons, propositional type claims and law-like regularities of the natural sciences on the one hand, as distinct from mere judgment-based reasons and judgment-type claims of the human sciences on the other (pp.182ff.).

But these analytical points cannot be conclusive. If there is to be unity in our knowing and understanding of the world as a world that is also meaningful, should we not aim at recovering subjectivity and personhood as essential features of this world? This move, I believe, was also central to Polanyi's attempts to show that knowing cannot be had without being and that all knowledge is to some degree personal. If I'm not mistaken, Clayton's larger project, in its own way, is moving in a similar direction.

Endnotes

[1] Cf. Philip D. Clayton, *God and Contemporary Science*. Edinburgh Studies in Constructive Theology, Edinburgh University Press, Edinburgh 1997.

[2] Cf. J.R. Searle, *The Rediscovery of the Mind*, MIT Press, Cambridge MA, London 1992.

Response to Clayton: Taxonomy of the Types and Orders of Emergence

Walter B. Gulick

ABSTRACT Key Words: Michael Polanyi, Philip Clayton, emergence, causality, supervenience, self-organizing systems, part-whole relationships, properties, boundary conditions, epistemological and ontological hierarchies, complexity theory.

Inappropriately reductive or deterministic appropriations of science haunt Philip Clayton's otherwise instructive appropriation of Michael Polanyi's thought for theological and ethical reflection. The work at hand utilizes contemporary complexity theory to augment Polanyi's notions of emergence and hierarchy and to provide a vision within which moral responsibility and theological inquiry make sense. It sets forth types and orders of emergence that bypass untenable notions of causality, reducibility, and determinism.

Philip Clayton has done a great service for the Polanyi Society in indicating how Michael Polanyi's claims about evolutionary emergence – one of the most controversial aspects of Polanyi's philosophical position[1] – stand in relation to several of the most discussed topics in contemporary philosophy of science and theology: emergence, supervenience, and (in the background) complexity theory.[2] It is clear that several of Clayton's overarching interests are consistent with issues Polanyi felt passionately about. Both thinkers will not be satisfied with any theory that undermines the freedom and responsibility of the person. Any vision of responsible personhood must leave a role for (if not exhaustively explain) mental causation. Each takes science very seriously, but also recognizes the limits of scientific explanation. Each ponders questions of ultimacy and affirms the significance of dimensions or levels of being beyond *homo sapiens*.

In the first three sections of his article, Clayton separates those aspects of Polanyi's understanding of emergence that he believes have proven fruitful from those claims that he sees as problematic. I'll begin by assessing his assessment, providing my own critique of Polanyi in the process. Then he presents a spectrum of recent views concerning how the mind and the person can best be understood from a scientific perspective. He argues that emergence theory is more faithful to the insights of both science and personal experience than any variety of physicalism, substance dualism or monism. I concur, but the notion of emergence to which Clayton alludes seems sufficiently inchoate that it is hard to move beyond his general point to specific claims. Clayton's notion of emergence is still susceptible to being undermined by reductive and inappropriately deterministic scientific theories. In the hope of assisting Clayton and others using notions of emergence to gain greater conceptual clarity, I attempt to sort out and simplify the different sorts of phenomena sometimes labeled with the term "emergence." I distinguish between the types and the orders of emergence. This twofold taxonomy is consistent with Polanyi's hierarchical vision of things and demonstrates that his thought, appropriately qualified, continues to provide a heuristically powerful philosophical framework for both scientific and theological inquiry.

Clayton on Polanyi's Accomplishments

Clayton describes three aspects of Polanyi's thought that he thinks make important contributions to contemporary conversation about emergence and three that he thinks have proven to be erroneous. I find that two aspects of Polanyi's thought that Clayton appreciates lead to flawed analyses and require modification. My criticisms are actually directed more at Polanyi than at Clayton. I will initially attend to Clayton's second point of appreciation of Polanyi before I turn to his first point.

(2) *The "from-at" transition and "focal" attention.* First, a clarification: What Polanyi terms the "from-at" structure of consciousness in "Life's Irreducible Structure" (*KB* 225-239) is no different than the "from-to" structure of consciousness, his usual terminology. It is unfortunate that Clayton relies fairly heavily on this article, because I find it one of Polanyi's less coherent explications. Clayton quotes Polanyi as follows: "Mind is the meaning of certain bodily mechanisms; it is lost from view when we look *at* them focally" (*KB* 238). Polanyi will be misunderstood here unless it is recognized that he is speaking of how we know other minds. When one turns within, mind is not the (focal) meaning of bodily functions but the process whereby meanings are produced. Mind is at least potentially what the phenomenologists call appresented in all its activities, whether it is engaged in looking (retrospectively) at its own activities, perceiving the world, or reading a book. That is, one can never make the mind in its subjectivity a direct object of inquiry, but one can always ascribe its underlying activity to any state of consciousness.

The use of Polanyi's thought that Clayton goes on to announce also seems problematic. Clayton says, "In my recent work defending panentheism I have used a similar distinction between focal intentions and the body's autonomous functioning . . ." (9). However, a person's body does not function autonomously in the from-to structure. Rather the embodied subsidiaries are conjoined with the focal meaning in a dialectical dance of mutual dependence. Moreover, from a Polanyian perspective, our guiding intentions are not more than momentarily focal, but are usually dwelt in subsidiarily. They function as standards of achievement. Clayton's point, however, seems to be this: intentions and other ordinary mental activities occurring at a higher level than the body's many autonomic processes need not interfere with these lower level processes. Analogously, he seems to suggest, God can be seen as making cosmic decisions and taking actions in ways that do not disrupt autonomous human activity or violate natural law. This is an intriguing analogy, but not without its dilemmas. Isn't human freedom seriously compromised if one correlates autonomic processes with autonomous human activity? And in using this analogy is Clayton comfortable with apparently giving up the traditional Christian claim that God listens to people and interacts with the world?

From an emergence point of view, also, Clayton's analogy seems suspect. When one shifts attention from a given level to an emergent level, the laws and structures of the higher level are inevitably quite different than the laws and structures of the lower level. But Clayton's analogy patterns the divine mind on the human mind, which at least makes the analogy look suspiciously more like a sample of projected anthropomorphism than a common type of emergence. Clayton is quite aware of this sort of criticism, as Andy Sanders makes clear in his discussion of Clayton's *God and Contemporary Science* in this issue, but the questions raised by his analogy remain unresolved. It seems that the way Clayton appeals to Polanyi's from-to analysis of consciousness is not yet sufficiently thought through to see if it might be helpful in relation to the foregoing problems.

(1) *Active and passive boundary conditions.* Clayton, in discussing foreground and background interests, and active and passive constraints, is helpful in his exposition of Polanyi's thought. However, his claim that Polanyi recognizes two types of boundaries — natural processes and machines — is not quite accurate, but I think Polanyi is the primary cause of confusion. Polanyi does use natural processes and machines as examples of boundary conditions. He says these "useful restrictions of nature [involve] the imposing of *boundary conditions* on the laws of physics and chemistry" (*KB* 226). The problem lies with the ambiguous notion of boundary condition, which Polanyi generalizes unhelpfully beyond its original meaning in physics. Sometimes boundary conditions seem to be spatial in nature, sometimes inherent properties, sometimes functions, sometimes imposed operational principles. In what sort of instance would boundary conditions be imposed on the laws of physics and chemistry rather than on the properties of the object being analyzed? Clayton's exposition is clearer than Polanyi's discussion.

Polanyi gives the following examples of the two types of boundary condition:

> When a saucepan bounds a soup that we are cooking, we are interested in the soup; and, likewise, when we observe a reaction in a test-tube, we are studying the reaction, not the test-tube. The reverse is true of a game of chess. The strategy of the player imposes boundaries on the several moves, which follow the laws of chess, but our interest lies in the boundaries – that is, in the strategy, not in the several moves as exemplifications of the laws. (*KB* 226)

In context, it is clear that Polanyi equates the first two examples above with machine-type boundaries, where our interest lies "in the effects of the boundary conditions." But we aren't really interested in the fact that the physical form of the saucepan – the boundary imposed on the soup – shapes the soup in a certain way. Nor is our primary concern about any effect of the test-tube. Our interest in each case lies at a different level than what would ordinarily count as a boundary: with preparing lunch to eat, or with testing some materials for some purpose. To be fair to Polanyi, his intention no doubt was to refer to the shaping of a saucepan and a test tube for certain purposes even as one designs a machine for a certain purpose, but even so, the design shapes the properties of metal and glass; it doesn't bound the laws of physics and chemistry. In his example of the chess game, Polanyi uses a dynamic example (not a natural process) that also does not illustrate the imposing of boundary conditions on the laws of physics and chemistry but rather on the rules of a game. What is significant about chess is essentially mental: it involves the strategic manipulation of certain rule-bound pieces which have conventional physical shapes but may just as well be represented on paper or by name.

There is another feature of Polanyi's two-tier analysis of machines that I find to be erroneous. He asserts that the operational principles of a machine "can never account for the failure and ultimate breakdown of the machine" (*TD* 39). The physical-chemical structure of the machine is said to account for failure (*TD* 39 again, but see *PK* 330, where Polanyi more accurately states that "physics and chemistry are blind both to success and failure"). Well, sometimes the operational principle is at fault, as for instance when the machine is poorly designed, accounting for some but not all the conditions in which the machine must operate. Firestone engineers, for example, would love to blame the laws of physics and chemistry for the accidents caused by their faulty tire design. Operational principles should not be considered abstractly apart from the conditions of operation.

Clayton's Criticisms of Polanyi

I find Clayton's three criticisms of Polanyi, which overlap and are actually variations on the one theme of vitalism, to be right on target. Polanyi is not a vitalist in the sense that he postulates the existence of some life substance that is responsible for biological evolution. However, his misguided emphasis on guiding principles (*M* 169), his attraction to the ideas of Driesch (Allen, ed., *SEP* 295, *PK* 338), and his affirmation of creative agency (*TD* 46) shows he is sympathetic to non-substantive varieties of vitalism. This problematic tendency towards vitalism seems to have its origin in Polanyi's extrapolation from his analysis of machines to the realm of biology (thus see the title of section 2, *KB* 226: *Living Mechanisms are Classed with Machines*). Just as some intention or design must pre-exist a machine, so by analogy he tends to argue that the ordering principles of a living being must pre-exist the function being ordered. Thus Polanyi is led to the untenable claim that phylogenetic emergence is activated by "an ordering principle capable of producing operational principles which the system had not previously possessed" (*PK* 399). This shadowy ordering principle seems more like a first cousin to Platonic Ideas than a reliable foundation for scientific knowledge. To be sure, the demonstrations of bottom-up emergence now central to complexity theory had not been developed when Polanyi wrote *Personal Knowledge*. Complexity theory shows how emergent, stable patterns may spontaneously develop in large, multi-faceted systems; the existence of mysterious pre-existing principles need not be postulated. Polanyi's real concern, however, is denying that life can be reduced to the laws of physics and chemistry, and his inadequate ways of expressing this legitimate concern do not invalidate the basic structure of his vision.

TWO APPROACHES TO UNDERSTANDING EMERGENCE

Polanyi's usage of the notion of emergence within the evolutionary perspective of part IV of *Personal Knowledge* was innovative for its time. But in recent years, there has been an explosion of interest in emergence, and the term has been used in a variety of ways. One of the reasons that discussion of "emergence" quite understandably irritates many scientists is that the term is generally not clearly defined and in some discussions — for instance, theological discussions — has taken on an honorific coloring. In the hope of facilitating a more nuanced use of the term, I will offer two related taxonomies of emergence. First, I will set forth three distinct ways in which the term "emergence" has been used as a counter to reductive programs of analysis. That is, I'll delineate three *types* of emergence. Then, secondly, I will essentially follow Polanyi in distinguishing topologically three fundamental *orders* of emergence. Each order manifests a distinctive causal power.

Types of Emergence

It is characteristic of all usages of emergence to postulate a coming into existence of something different in kind from what existed before and not causally or logically reducible to the supporting conditions out of which it appeared. Here I have articulated what I will stipulate to be two essential characteristics of emergence: 1) an emergent entity or state operates according to higher level principles or rules different from the lower level rules of the entities or state out of which it emerged, and 2) there is what Heinz Pagels termed a causal decoupling between the emergent phenomenon and its antecedents[3] – in other words, the emergent cannot be causally reduced to its lower level support such that beginning from the lower level one might accurately predict what must follow from that initial set of conditions. Here, then are three ways in which an emergent entity can be claimed to conform to these defining characteristics.

1. Part-whole emergence. The first conception of emergence to be explored is homologous with Polanyi's notion of levels, is consistent with ecological notions of interdependence, and also manifests many characteristics of Gestalt theory, for it is grounded in part-whole analysis. It requires that one begin by starting from some entity or system that exhibits a functional coherence or stability.[4] That is, one must begin by identifying a whole rather than an aggregation. In its original context, the selected whole will be seen to have an inside set of parts, a descriptive unity, and an outside set of properties. The fundamental claim to be demonstrated is that the outside set of properties is not *causally* reducible to the inside set of parts. The properties are an emergent phenomenon.

The freedom of an interpreter to select a whole for a chosen purpose gives part-whole sorts of emergence a broad range of applicability. Locating wholes that lend themselves to fecund analysis is a matter of skill in knowing. While anything may be selected as a whole, consideration of arbitrary collections as wholes will likely not be fruitful because the components have no internal dependencies, systematic relationship, or naturally re-enforced unity. But when appropriate material wholes are selected, the outside will appear as a set of *properties* and /or law-abiding processes that come to expression out of interaction with its particular environment.[5] A richer vocabulary is utilized when investigating living things or their functioning systems; the outside may be seen as *characteristics, traits, behaviors,* etc., depending on the nature of the organic whole and its environment being investigated.

The chosen whole's inside is comprised of *components* and an organization or *structure*. The nature of the inside can be comprehended through some analytic procedure. In contrast, the whole's outside represents how the whole "appears" in the context of the other wholes and forces forming the initial whole's environment and existing on roughly the same scale (that is, in a neighborhood). The inside components influence but are not causally responsible for the outside properties.

Here a brief digression on the history of causal language seems in order. The successful identification of the laws of mechanics early in the history of modern science accorded prestige to experimental science where the number of variables to be studied was severely limited. The language of causality was used to describe how changes in those limited variables impacted the subject or system under study in the experiment. But while the language of causality is useful in a mechanistic context where variables are limited, it becomes misleading when applied to either the whole constructed from parts or the complex systems of the real world evolving in ways better understood ecologically than mechanistically. A subsequent variation on the mechanistic language of causality is the logical language of necessary and sufficient conditions. Both the mechanical language of cause and effect and the logical language of necessity and sufficiency contributed to positivistic dreams of reductionism, of simplifying our understanding of the empirical world to expressions of the laws of physics and chemistry. In the twentieth century that dream fractured from discoveries on many fronts, of which quantum theory and chaos/complexity theory are perhaps the best known.

If causality is an inappropriate notion to use with respect to how a whole is emergent in relation to its parts, what sort of explanation (beyond the vague "parts influence or participate in the whole") illuminates the relationship? I believe both epistemological and ontological insights can arise from considerations of how knowledge unfolds at different levels of interrelatedness. Epistemological insight begins with the observation that humans tend to focus on those significant functional wholes that illuminate their projects of the moment. They name them: "tree," "chair," "cloud," bravery," "party," "truck." These noun/wholes may then be clothed with adjectival qualities: "tall," "comfortable," "fluffy," "admirable," "political," "red." The adjectives tend to describe *properties* of the identified whole rather than parts (components organized in structures). Interest in

parts is of a different order than daily commerce with things and events. Attention may be shifted from wholes to parts if there are problems to be solved or if scientific curiosity is aroused.

The significance of knowing a whole in terms of properties versus knowing it in terms of parts may be illustrated by comparing the recognition of a face with finding the right words to express a complex thought – a sort of poetic challenge.

> a) In recognizing the visage of an acquaintance one sees a familiar pattern – perceived image is correlated with mental image. In Polanyi's language, one tacitly indwells presented facial features and integrates them into the focal recognition of Jane or Joe as identified whole.
> b) However, in attempting to find the words to express adequately a still vague and hunch-like thought, one attends to the wholeness of the (still schematized and as yet not fully symbolized) thought and evokes words that are tried out to see if they say what one means. When one finds and organizes properly the right words, one feels a sense of satisfaction: the parts comprise the intended and previously mute whole.

In contrasting these examples, one sees that a face is known in terms of its visible *properties*, whereas articulating what one means to say involves construction out of organized *parts* (words structured grammatically). Two different epistemological procedures are involved, one leading to recognition of what is already known, and the other leading to discovery.

Polanyi's discussion of heuristic gradients grounded in tacit knowing and culminating in discovery or problem solving is illuminated by part-whole emergence in general[6] and the example of finding the right words in particular. In setting up a scientific program of research, a scientist attempts to identify an as yet incompletely understood whole in which the contributing parts and their structures and functions, only tacitly sensed, guide the scientist with a heuristic premonition that the way the whole functions is solvable. The more that the particulars of the whole are located and indwelt, the closer the investigator feels to comprehending through integration the meaningful whole that is the target of investigation. Once the indwelt subsidiaries merge coherently into a meaningful whole, the scientist experiences an "Aha!" Now attention can be shifted to making the parts explicit, just as the poet can attend to fine tuning the words once they begin fitting what the poet intends to say. The scientist can attend to the laws, material components, and arrangements that jointly constitute the no longer mysterious whole being investigated. Epistemology here harmonizes with ontology: just as the parts, laws, and arrangements are integrated by the knower to form the whole under investigation, so the relationship of the discovered parts to the whole is integrative rather than causal in nature.

The foregoing observations are but an application of Polanyi's comments, found for instance in *Science, Faith and Society*, about the skill required to identify a fruitful scientific problem and follow its tacitly sensed clues through to discovery.[7] It should be reiterated, vis-à-vis Clayton's threefold critique of Polanyi, that the final identification of wholes is a human activity made possible through symbols. While the identification and exploration of already existent wholes is a useful tool of discovery, contemporary complexity theory, consistent with evolutionary theory, does not postulate any pre-existing whole toward which a natural system must evolve.

A further ontological point, like the epistemological/ontological point just made, involves a change in perspective, but the shift is of fundamental importance. It involves the distinction between composition and

property. The outside appearance of any whole is effectively determined by the nature of the environment within which it dwells. In an acidic environment, the alkaline quality of the whole will stand out. In an environment of pockets of food available to a bacterium as the whole, cellular properties of directional motility will not only stand out but be selected for. In a waiting room, the soft fabric and ergonomic qualities of a chair as the whole will stand out. In each of these cases, the qualities of the environment make a certain few of many potential properties stand out. When a human being is present in the environment, the particular interests and perceptual abilities of that person will make particular affordances (to use J. J. Gibson's term) of the whole stand out. In relation to what occurs in the environment, the properties that stand out determine what transpires; the composition of the whole is generally irrelevant. That is, causality in the situation is a product of the interaction of the evoked or out-standing properties of the wholes at a certain level, not a bottom-up production in which the parts create the whole. The relation of part to whole is not causal but emergent, distinguishing a self-sufficient yet supportive inside from an environmentally articulated outside.

2. Transformational emergence. Sometimes emergence seems to be used as a synonym for process or change in general. It is usually reserved for dramatic changes in some self-identical entity where the rules of the emergent entity are quite different from the rules governing its predecessor state. But because there are no clear criteria of what constitutes emergence, the tiniest of changes could be called emergent. That is, Whitehead's process philosophy could be regarded as a philosophy of emergence. Each newly concrescent entity has unique features different from its predecessor (at least in terms of its cosmic placement). In a strained sense of the term, it manifests new principles. But it must be stated right away that transformational emergence has the weakest claim of any of the three types to be called emergence. If the criterion of causal decoupling is insisted upon, it has no claim. Let me explain.

Whatever the extent of change, the focus of transformational emergence is upon an entity in which the initial and final stages of change are understood as existing at roughly the same scale. Understanding transformational emergence begins by attending to the significant properties of a whole. What happens to this whole in a neighborhood is traced over a period of time. The emergent whole interacting with other entities at the same ontological level may at some point cross a threshold into a dramatic new form of organization. Thus, for instance, the mass of a large collapsing star may become so dense that it collapses into itself, forming a black hole. Is the black hole, so different than other astral phenomena, an emergent entity? Because the transformation is of the same massed material and it occurs in sequence at the same ontological level, there should be a continuous thread of causality stitching together each step of the process of change. Thus, while the first criterion of emergence (markedly different operational principles or rules) may apply to this dramatic example of transformational emergence, the second criterion (causal decoupling) would not seem to apply. Moreover, if this change-related notion of emergence is to be even marginally useful, some broadly agreed upon criteria of what counts as sufficient change to be considered emergence needs to . . . emerge.

When one examines the interaction of a selected whole with other dissimilar wholes on the same scale in the neighborhood, one will often find a mere collection having no particular order. Yet over time (sometimes it may take eons) all entities are affected to some degree by their environment. The effect may take on at least three forms:

a) The structures supporting the unity of the old whole may erode or decay because of long term interaction with water, exposure to heat, or other processes in the environment, effectively destroying the old whole as a unity. New wholes may form as byproducts of the change. Example: granite decays into clay and sand.

b) The whole may gradually – or dramatically — change as a result of external forces and environmental interactions. Because the evolved entity will not instantiate exactly all the same laws nor have just the same characteristics as it originally had, the new whole may be said to have emerged (in the weak sense) from the old whole. Example 1: the horse evolves from a small North American mammal into the magnificent beast it now is. Example 2: snow falls on a northerly mountain, is buried, and the pressure turns it into ice.

c) With skill one can sometimes identify a new stable pattern in which the whole one initially selected is captured and becomes a part contributing in some way to a new higher level whole, supporting thereby what Polanyi calls a "comprehensive entity."[8] The principles and rules governing the comprehensive whole will be different from the principles and rules governing the original whole, just as the principles and rules governing the original whole will be different from the principles and rules of its parts. The comprehensive entity may obtain a stability such that the original whole is always surrounded by the same other wholes and always involved in the same limited functions. In such a system, it will in effect lose its independent functioning. Causal efficacy will lie with the comprehensive entity. It would be a mistake to see the initial whole as having a bottom-up effect on the comprehensive entity. Transformation occurs in this instance, but the comprehensive entity that emerges is best analyzed in terms of either the first or third type of emergence. Example 1: copper ore is mined, smelted, and made into wiring for an electric motor. Example 2: snow falls on a northerly mountain, is buried and turns into ice, and becomes part of a glacier that severely erodes a mountain valley.

It can be seen from the two snow examples that what happens at one level may have an effect at another level. In fact, all things function at a variety of levels simultaneously. This view is consistent with Polanyi's hierarchical model of the world expressed, for instance, in his description of the making of bricks (*TD* 35) or the structure of a living being (*TD* 36-37). It is exemplified in the from-to structure of consciousness. But I do not believe this unfolding interpretation of emergence is burdened by the problems found in Polanyi's discussion of boundary conditions.

3. Self-organizing emergence. The third broadly accepted notion of emergence has risen to prominence out of complexity theory in general, and out of the study of self-organizing systems in particular. Self-organizing systems typically have the following components: material entities having properties (shape, charge, mass, etc.); forces relevant to the scale of the components under consideration (for humans, gravity and electromagnetic forces; for the nucleus of an atom, the strong and the weak force); specific energies (kinetic, chemical, etc.); and positive and negative feedback loops that facilitate growth, homeostasis or decay in relation to specific environments. It is an overall pattern of systemic functioning that may be said to be emergent. The emergent system operates according to rules different in type from the rules governing its various components, and there is a causal decoupling between the system as a whole and its contributing parts.

If part-whole emergence describes the structure of existent forms of emergence, self-organizing systems explain how emergent phenomena originally come into being. Self-organizing systems may arise, like transformational emergence, out of interactions at about the same scale, but what distinguishes them from examples of transformational emergence within a neighborhood is that the process of change issues in an entity or system that takes on a life, a dynamism, of its own. The continuity characteristic of a changing entity is broken, or perhaps better, is reconfigured (bifurcated) into a new sort of continuity. Different species of living beings are examples of self-organizing systems; their members receive feedback from their environments and regulate

their processes so as to fit into their environments in ways that maintain their integrity. Indeed, they seek out and colonize environmental niches where they are best able to thrive.

The world is home to many complex systems balancing order and chaos through adaptive response systems: cities, ecosystems, economic systems, the "social insects" (ants, bees), the human immune system. Most frequently, self-organizing systems seem to rely on a shift in scale that allows patterns to emerge out of large numbers of entities – molecules, structural iterations, independent human decisions. Entities at the micro level have certain properties as individuals, but when they are taken en masse and interwoven with other neighboring entities, a macro set of properties and laws is observable in self-organizing systems. Of course, when some entities are mixed together, nothing stable emerges; the mixture remains chaotic rather than self-organizing. Complexity theory is concerned with those emergent patterns that not only are intelligible but display features that make large scale patterns useful in the macro world. In other words, the emergent pattern of the self-organizing system is selected for, survives, and carries out new functions totally different from the functions of its miniscule parts.[9]

This third type of emergence takes place within human culture as well as non-human nature. The organization of capitalism in Adam Smith's analysis would be a good example. At the micro level each person within market capitalism seeks to advance his or her own interests by finding the best investment opportunities. Money functions as the crucial feedback mechanism in this view; the cost of goods and their selling price provide a potential investor with information as to where the best opportunities to make a profit lie.[10] The well-known paradox is that although each individual seeks to maximize personal interests, the system as a whole benefits society as a whole because it provides consumers with goods and services previously in short supply.[11] Smith talks about these large-scale benefits in terms of an "invisible hand." In his economics writings, Polanyi brings the discussion of capitalism nearer to current understandings of self-organization by speaking of capitalism as an example of "spontaneous order."[12]

Emergence, Supervenience and Human Existence

The foregoing review of types of emergence has been conducted more at the level of a cosmological inquiry than with the focus on God and person that characterizes Clayton's essay. The cosmology that has resulted is supportive of Polanyi's hierarchical view of reality. Polanyi articulated a simpler version of part-whole emergence than the one presented here. He described self-organizing systems even if he did not use that terminology or focus on their broad implications. So although I agree with Clayton's threefold critique of Polanyi, in general I find Polanyi's thought confirmed by the recent work in emergence theory. But what difference does it make for speaking about responsible personhood? Has progress been made towards articulating the emergentist theory of mind that Clayton seeks?

With respect to scientific understanding of the mind and person, the relationship between brain and mind has been at the center of discussion. Clayton finds the notion of supervenience useful to describe the relationship. There are a number of different interpretations of supervenience, but they all tend to accept the following two claims: that mental properties are higher level (supervenient) phenomena different in kind than physical lower level properties, and that the higher level properties are dependent on the lower level properties in a way such that "two things indiscernible with respect to lower-level properties, are indiscernible with respect to their higher-level properties."[13] Jaegwon Kim, the most influential exponent of supervenience theory, adds what he calls the "dependence thesis" to the notion of supervenient invariance: "[I]t is an explicit affirmation

of the *ontological primacy,* or *priority*, of the physical in relation to the mental, thereby opening the possibility of *explaining* the mental in terms of the physical."[14]

If my analysis of part-whole emergence was adequate, then certainly strong supervenience (by definition expressing the dependence thesis) must be rejected. Subvenient brain states support (as organized parts) but do not cause supervenient mental states (properties). What of the type-type correlation between brain state and mental state? Well, certainly I would want to claim that mental life is dependent on brain activity even if not reducible to it. So it would appear I would reject strong supervenience while accepting weak supervenience, thereby following Clayton. Not so. The problem with weak supervenience is that it really explains nothing. I accept the token-token correlation of strong supervenience, but I reject the ascription of causality that normally accompanies discussion of supervenience (and certainly is present in Kim). To explain my position more fully with respect to the causality involved in human thought, I will undertake two different sorts of analysis. First I will develop a useful analogy by exploring how water functions as a part and whole both as an emergent entity and a component of an emergent system. Then I will set forth three different orders of emergence that illuminate the uniqueness of human cognition.

Consider a molecule of water to be the beginning whole. It is composed of two hydrogen atoms bonded at a standard angle with one oxygen atom. The lower level properties of hydrogen and oxygen (the inside) do not cause the higher level properties of water (the outside given definition by an environment). Among the characteristics of water that may stand out as properties are its translucence, its polarity which dissolves many ionic compounds, its liquidity, its surface tension, its greatest density at a temperature above freezing, its relatively high boiling point, etc.

So much for a simplified version of water's part-whole emergence. I will now turn from a small scale analysis of a water molecule to a large scale analysis of water's participation in a system that exhibits some simple self-organizing characteristics: the ocean. The properties of water molecules, the overwhelmingly most numerous parts of an ocean, influence the ocean's dynamic structure. Oceans contain many dissolved salts because water molecules are strongly polarized. As a consequence, emergent but static properties of ocean water include a lower freezing point, a saltier taste, and a higher capacity for buoyancy than fresh water in a lake. Seawater's properties are emergent according to the first type discussed above. An ocean exists in a neighborhood that includes the sun's radiation, shorelines, an uneven bottom, and an air mass above it. Ocean water in tropical zones absorbs heat from the sun and becomes thereby less dense than the colder water of arctic regions. The colder water is moved by gravity to replace warmer water, and thus ocean currents come into being. Differences in heat and density also affect the air over the water and create winds that in turn create waves that in turn erode shores. Now, obviously, the properties of individual water molecules do not cause all the functions and behaviors of an ocean. To understand waves and currents, for instance, one needs to see the impact of forces at roughly the same macro-scale as the ocean.

An instructive analogy can be made using the relation between water molecules and oceanic erosion to illuminate the relation between brain neurons and a human state of mind or action. A cluster of water molecules in a large wave may actually crash against a cluster of rock molecules in a seaside cliff with enough force to dislodge bits of quartz, future grains of sand. Do we then say that the water molecules caused the rock to fracture? This would be to apply the notion of causality to the wrong level of influence. Much more explanatory power would come from stating that, say, the fury of a storm that was caused by a large atmospheric low coming from the north created the surf that caused erosion at high tide. In a certain way, the specific water molecules and rock

molecules are innocent entities used by larger scale forces and conditions. The water molecules did not independently cause anything; their velocity was caused by wind and wave.

The analogy to human consciousness is no doubt obvious. A given thought or action may be seen as derived from the firing of a certain set of neurons as connected by linked filaments and also connected by neurotransmitters acting across certain synapses. But it makes no more sense to say that this one system of neurons among the brain's trillions of neurons and uncountable connections caused the thought or action than it makes to say a particular cluster of water molecules caused the rock to fracture. One more appropriately seeks to understand the thought or action by asking what large scale event caused or evoked that response, just as one more appropriately asks what caused the large waves than focuses on the wave's molecules in order to understand shoreline erosion. Yes, a particular set of neurons has a token-token relation to a particular thought, but each set is the supportive component of much larger systemic forces known within consciousness as intentions, motives, drives, mental models, and the like. It is this sort of point I believe Clayton is making when he opts for a dynamical systems approach to understanding conscious experience. There is no reason not to declare that these larger scale mental forces are causally implicated in the rise of certain thoughts and actions.

I do not want to leave the discussion of supervenience without noting how misleading the concept is for comprehending the mind-brain relationship. The very suggestion that identical lower level configurations of the brain must result in identical higher level mental experiences replaces empirical evidence with logical considerations in a continuing manifestation of the tendency to logicism characteristic of twentieth century analytic philosophy. Empirical studies have demonstrated that no two brains are alike because brains grow in ways that capture the experience and learning of individuals, and no two individuals have identical experiences. While a supporter of supervenience theory might protest that the thesis of identical correlations is only a thought experiment, it encourages a view that human brains are identical in much the way that different CD-ROMs of the same computer game are identical. It also encourages those construing consciousness as comparable to software to interpret the designed programs as being the cause of the virtual reality of the game experience. In contrast, I argue for a view that all the levels opened up by first and second order emergence (to be described shortly) are co-equal in reality even if the defining forces and sorts of material/energy vary from level to level. That is, quarks are no more real than molecules are no more real than cells are no more real than organs (to give a highly condensed summary of emergent ontological levels).

Orders of Emergence

If discussion of emergence is restricted to the three types I have distinguished (part-whole, transformational, and self-organizing emergence), then the world will be seen to be populated with all sorts of emergent phenomena (innumerable if the second, weak form of emergence, transformational emergence, is acknowledged as a true form of emergence). Terrence Deacon has taken the lead in sharpening discussion of emergence by distinguishing between three basic species or orders of emergence.[15] His criterion of classification is topological, that is, based on relationships that differ in *type of causality*. Deacon's categorization seeks to highlight significant junctures in the evolutionary development of the cosmos. In this respect it is compatible with Polanyi's even stronger bias toward evolutionary theory. Polanyi's interpretation is centered about explaining anthropogenesis (*PK* 386ff), an orientation compatible with Clayton's concern to deal with God and persons. Since my aim in this discussion is to critique helpfully Clayton's paper, my description of the orders of emergence is closer to Polanyi's account than to Deacon's. I distinguish three different orders by attending

to the type of causality manifested in integrations or resolutions, moving toward autonomous causality by starting from mechanical causality, noting the emergence of signal responsiveness, and finally arriving at symbolic creativity.

First Order Emergence: Dynamo-Physical World. The first order of emergence describes processes at all levels of the material world. The complete realm of materiality with all its systems and subsystems is involved in the dynamo-physical world, but nowhere do self-replicating autonomous agents arise within this world. Rather first-order emergence concerns the developments and arrangements made possible by first, second and third types of emergence excluding the emergence of life. Events within the dynamo-physical world culminate in dumb and mute resolutions at both micro- and macroscopic levels, involving entities as divergent in scale as quarks and quasars. Typically resolutions emerge that occupy the lowest energy state possible in a given environment. In terms of classical Aristotelian notions, first-order emergence approximates formal and material causality.

Second-Order Emergence: Biological World. The second level of emergence arises when what Polanyi calls "active centres" (*PK* 336ff) come into being as living entities (primitive autonomous beings). Single-celled organisms introduce originally very primitive purposes into the world, telic behaviors which Polanyi claims can be distinguished from natural laws because they can succeed or fail (*PK* 331, 345; *SM* 60). As one ascends the evolutionary ladder, living things are coded with increasingly complex means of assessing and adjusting to their environments by finding food, avoiding enemies, and reproducing. Successful living can be perceived at an individual level – can the particular biological entity respond to the signals evident in its environment so as to survive? Can it learn to thrive? Success is more importantly measured at a species than an individual level, and here what is especially noteworthy is that all members of a species share in a family of genetically transmitted traits that allow the species to colonize a particular ecological niche and eventually either succeed or fail as a group. Living beings thereby transcend the mute resolution of forces characteristic of first-order emergence; they introduce a species of self-preserving, interest-centered causality into the world. In Aristotelian terms, final causality has entered the cosmos.

Third-Order Emergence: Human World. It seems highly presumptuous to claim for humans, puny in the vastness of the universe, one of three cosmic orders. But when one starts off intending to consider how human experience arises (anthropogenesis) and what, if anything, is unique about it, and if one uses as a criterion for distinguishing orders of emergence degrees of autonomous causality, then such a triumphalist conclusion seems unavoidable. Human consciousness, in its distinctiveness, is symbol-infused, and this allows for a selective purposefulness that transcends second-order emergence. Through indwelling symbols, a person is able to imagine what is not and what could be. Through symbols, humans are able to select between alternative visions for considered reasons, and this is the very essence of free choice. Symbols open up a considered past and alternative futures. They accumulate in memories and congeal as habits, and thereby they form cultures that shape human behavior. Thus humans engage in what Goodenough and Deacon[16] describe as niche construction: humans create the language and cultural worlds (Polanyi, following Teilhard, calls this the noosphere – *PK* 388) in which they live and have their being. Humans use the power of symbols to probe the material world and reshape it technologically in myriad ways. Humans comprehend and manipulate the blind processes of the first-order world as it emerges from mysterious, minute particles. Humans use symbols to create machines with operational principles comparable to the telic principles guiding biotic beings exhibiting second-order emergence. No other entities use symbols to manipulate the world as humans do. Thus symbol usage allows

for self-generated causality, a kind of emergent activity not highlighted by any of the three types of emergence. Human causality is uniquely autonomous in the known universe; it introduces conscious efficient causality to flesh out Aristotle's three other notions of causality.

Clayton and Causality

In his section, "Emergence, Supervenience, and Personal Knowledge," Clayton glimpses a notion of responsible personhood again and again, but then his language (and its associated conceptuality) betrays him and he falls back into some quandary. I will close by offering two related samples of this sort of conceptual regression and by re-emphasizing how emergence theory might yet save the day.

After describing Van Gulick's notion of radical-kind emergence, Clayton states that it is "much more amenable to modern science to say that the emergence of new macro-properties is ultimately determined by the sum total of relations between the micro-properties of that system. To know the state of all the registers in your computer *just is* to know the state of the system, even though the *content* of the system may be a new emergent property such as a digitized image of the Mona Lisa" (14). In the first sentence, the problematic term is "determined." In the second sentence, one of Clayton's errors is to imply that a state of computer elements is equivalent to (or causally linked to) an identifiable image. Let me elaborate.

Complexity theory makes it evident that the behavior of self-organizing large scale systems can be ordered but not necessarily predictable or reductively deterministic. What theorists call strange attractors or other phenomena may influence self-organizing systems like the brain to produce non-deterministic order. But more to the point when considering human consciousness, thoughts supported by some system of neuronic connections do not interact with thoughts supported by some other system of neurons in a manner characteristic of first-order emergence. It is the character of the thoughts themselves that influences subsequent states of consciousness, not the state of their supporting neurons, much less the state of the neurons' supporting molecules. Recall the wave and water molecule example. At the level of consciousness, there are a number of factors influencing future thought, and they generally come to expression at the same scale so they may be integrated or rejected. Within the temporal thickness of consciousness, sense data, reflections, purposes, anxieties, memories, etc. jostle for dominance. To think that subvenient factors *determine* unfolding mental states reveals one is ignoring the part-whole distinction between supportive parts (lower level phenomena) and emergent properties of mental life. It is to apply a simple mechanistic model when a far more sophisticated approach is called for, an approach comprehended better through models of organic growth, evolution, and ecology than through billiard balls or F=ma.

Perhaps applying part-whole analysis to the second sentence I have just quoted from Clayton will prove helpful. If we take as our whole the digitized image having a certain pattern, the emergent property of the shape in this case would not be even conceivable on the strictly material plane. It takes a person to recognize the image's significance by identifying the shape as Mona Lisa — a same-scale recognition of the given shape as being isomorphic with a remembered image of Mona Lisa. To turn to an inside analysis, the array of pixels would be reliant upon a certain state of computer registers (and if one just looks at the inside of the perception of Mona Lisa considered as the whole, it would be supported by a certain set of neuronic firings). Again, the state of the computer registers creates a pattern of pixels but not an emergent image; only a human, symbol using ("Mona Lisa!") third-order emergent mind can do that. And that recognized image is fully consistent with Van Gulick's

radical-kind emergence: it is a real feature of human experience not determined by the law-like activities of neurons but by the recognition of a similarity between a sensed image and a remembered image.

A second quotation from Clayton reveals how persistent is the lure of the language of determinism and causality for him, even when his interest is in human thought and action. "The major *non*-quantum accounts of how mental causation might occur appeal to non-linear dynamics, chaos theory, and the field of complexity studies. One problem is that all three of these approaches are still deterministic"(15). Again Clayton stumbles over an all too logically confined, level-ignoring notion of causality. Were he seriously to embrace emergence theory, especially third-order emergence when discussing human thought and action, he would not be faced with the obstacles to understanding his mechanistic conceptuality confronts him with. There are, of course, threads of continuity and connection observable in the three theories he cites. I say "of course," because the alternative would be a world of unintelligible chance and arbitrariness, and we do not experience such a random sort of world. But continuity and connection need not entail some anxiety producing determinism that proclaims first-order emergent systems have no independent integrity, second-order emergent systems are incompatible with purpose, and third-order emergent systems leave no room for human freedom. One of the lessons of emergence theory when it is set in a hierarchical view of the cosmos is that there are alternatives to rigid determinism and random chance. It is a lesson that Clayton's survey of the field helpfully prepares the way for. I await with great interest the theological vision Clayton might set before us if he were to use a more fully developed theory of emergence such as the one I have attempted.[17]

Endnotes

[1]Marjorie Grene is strongly critical of Polanyi's notion of evolutionary emergence. She states that when she had an opportunity to review evolutionary theory carefully, "I found Polanyi's argument (of Part IV of *Personal Knowledge*) even more shocking than I had originally thought it" ("Reply to Phil Mullins," in Randall E. Auxier and Lewis Edwin Hahn, eds., *The Philosophy of Marjorie Grene*. The Library of Living Philosophers, Vol. XXIX [Chicago and LaSalle, IL: Open Court, 2002], p. 61).

[2] Complexity theory stands for a perspective on a broad range of issues much more than it represents any generally agreed upon or precise set of theorems. Most fully identified with the work of the Santa Fe Institute, complexity theory emphasizes the unfinished, transitory nature of the universe in contrast to the Newtonian hope of discovering the limited set of defining laws that govern the universe. Emergence theory can be seen as a part of complexity theory. When thus considered, the orderly understanding of emergence sought in this response may seem quixotic. Santa Fe Institute economist Brian Arthur states, "What we're missing at the moment is any precise understanding of how complex systems operate" (quoted in M. Mitchell Waldrop, *Complexity* [New York: Simon & Schuster, 1992], p. 334). Robert May echoes this view. "It's becoming apparent that a theory of complexity in some sense of a great and transforming body of knowledge that applies to a whole range of cases may be untenable" (quoted in Georgina Ferry, "Sir Robert May: Complexity and Real World Problems," *Santa Fe Institute Bulletin* 16:1, 1.

[3] Heinz R. Pagels, *The Dreams of Reason: The Computer and the Rise of the Sciences of Complexity* (New York: Bantam Books, 1989), pp. 222-223.

[4] Percy Hammond provides a helpful overview of some of the issues confronting anybody wishing to make use of part and whole analysis. He reviews Peter Simons' book, *Parts: A Study in Ontology*, which concentrates much more on parts than wholes, and he judges Simons' mathematical approach to modeling to be at best only partly successful. See Hammond's "Parts and Wholes – Contrasting Epistemologies," *Tradition and*

Discovery XXVIII:3 (2001-2002), 20ff. My approach to identifying useful wholes is experimental in nature; one might use what Polanyi calls intuition to spot promising wholes and see if their analysis is fruitful. See Polanyi's "The Creative Imagination" in Marjorie Grene, ed., *Toward a Unity of Knowledge* (New York: International Universities Press, 1969), pp. 60-67 for Polanyi's discussion of intuition.

[5] Stuart Kauffman cites an example from Phil Anderson that nicely exemplifies the irreducibility of a property. "Gold is a yellow, malleable metal familiar to all of us. Nowhere in the quantum mechanical description of atomic gold are these macroscopic properties to be found. Moreover, there is no deductive way to arrive at these macroscopic collective properties from the underlying quantum mechanics of atoms of gold" (*Investigations* [New York: Oxford University Press, 2000], pp. 127-128). My reflections on the notion of properties began well before complexity theory came into being. I have long teased introductory philosophy classes with the query as to whether the chair we perceive or the chair formed by molecules is more real. As will become apparent, I've answered this variation on the appearance/reality (or primary/secondary quality) question with the claim that each is equally real, but differently real in terms of the requirements of unique ontological levels.

[6] Polanyi states, "I have identified the antecedents of problem-solving with the process of emergence" (*TD* 87).

[7] "There must be a sufficient foreknowledge of the whole solution to guide conjecture with reasonable probability in making the right choice at each consecutive stage. The process resembles the creation of a work of art which is firmly guided by a fundamental vision of the final whole, even though that whole can be definitely conceived only in terms of its yet undiscovered particulars" (*SFS* 32).

[8] See Phil Mullins' as yet unpublished manuscript, "The Comprehensive Entity as a Key Idea in Polanyi's Thought" (delivered at the Loyola Polanyi Conference in 2001) for a helpful description of how the notion of comprehensive entity comes to play a significant role in Polanyi's mature thought.

[9] Steven Johnson speaks of self-organizing systems as "complex adaptive systems that display emergent behavior. In these systems, agents residing on one scale start producing behavior that lies one scale above them: ants create colonies; urbanites create neighborhoods; simple pattern-recognition software learns how to recommend new books. The movement from low-level rules to higher-level sophistication is what we call emergence" (*Emergence: The Connected Lives of Ants, Brains, Cities, and Software* [New York: Scribner, 2001], p. 18).

[10] While in recent years a number of economists have begun understanding economic systems on the model of self-organizing systems, Jane Jacobs draws out the implications of this approach with panache and power I've not encountered elsewhere – see her *The Nature of Economies* (New York: Vintage Books, 2001).

[11] Johnson says a fundamental law of emergence is "the behavior of individual agents is less important than the overall system" (Ibid., p. 145).

[12] See Michael Polanyi, *The Logic of Liberty* (Indianapolis: Liberty Fund, 1998; reprint of University of Chicago Press edition, 1951), pp. 190-202, for a sustained discussion of spontaneous order. Struan Jacobs sets Polanyi's thought about spontaneous order in historical context in his "Michael Polanyi and Spontaneous Order, 1941-1951," *Tradition and Discovery* XXIV:2 (1997-98), 14-28.

[13] Dennis Bielfeldt, "The Peril and Promise of Supervenience for the Science-Theology Discussion," in Niels Henrik Gregersen, Willem B. Drees and Ulf Görman, eds., *The Human Person in Science and Theology* (Grand Rapids: Eerdmans, 2000), p. 129. I commend to Clayton John A Teske's "The Social Construction of the Human Spirit" in the same volume for a vision of the human spirit that would help flesh out Clayton's notion of personhood.

[14] Jaegwon Kim, *Philosophy of Mind* (Boulder, CO: Westview Press, 1998), p. 11.

[15] Deacon's argument is spelled out in erudite detail in "The hierarchic logic of emergence: Untangling

the interdependence of evolution and self-organization," a draft of a chapter to be published in B. Weber & D. Depew, eds., *Evolution and Learning: The Baldwin Effect Reconsidered* (Cambridge, MA: MIT Press, forthcoming.

[16] Ursula Goodenough and Terrence W. Deacon, "From Biology to Consciousness to Morality," article forthcoming in *Tradition and Discovery* and *Zygon.* This article, the Deacon article just mentioned, and Goodenough's *The Sacred Depths of Nature* (New York: Oxford University Press, 2000) have been important background resources for my thought about emergence. However, as mentioned, my delineation of the orders of emergence is parallel to Polanyi's account and differs slightly from Deacon's configuration. Roughly speaking, my first-order emergence combines Deacon's first and second-orders, my second-order is equivalent to his third-order, and my third-order underscores my conviction that the causal potency of symbolic thought is not done justice by seeing it as the complex product of Deacon's second and third-order emergence.

Notes on Contributors

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Emergence — A Response to My Critics

Philip Clayton

ABSTRACT Key Words:emergence theory, reductionism, determinism, causal decoupling, mind-body problem, Philip Rolnick, Martinez Hewlitt, Greg Peterson, Andy Sanders, Walter Gulick
The author responds to criticisms from the four respondents to his "Emergence, Supervenience, and Personal Knowledge," acknowledging areas where their points have improved the interpretation of science and the interpretation of Polanyi. The discussion focuses on the extent of the "causal decoupling" between parts and emergent wholes, with special attention to the question of whether (and if so, to what degree) brain activity causes thought.

I am grateful to Philip Rolnick, the Guest Editor of this issue, and to the respondents Martinez Hewlitt, Greg Peterson, Andy Sanders and Walter Gulick. The meetings in Denver were as open, as constructive, and as profitable as any session of the AAR I have ever attended; the result of those discussions, and of the written responses above, has been a more nuanced understanding both of the strengths of emergence theory and of the challenges it still faces.

To close a sophisticated debate of this sort with one-liner criticisms of the responses would not do it justice. I wish therefore to indicate substantial agreement with one, to acknowledge the alternate paradigm offered by another, and then to attempt a somewhat more detailed constructive response to concerns raised by the final two. Ideally, the net result of this issue will be a clearer understanding of the emergent structure of the world — one that neither overstates the discontinuities between levels nor understates the significance and uniqueness of the emergentist perspective.

Marty Hewlitt and I are, it appears, in substantial agreement. His final section, "A New Biology Emerging?" nicely expresses our common vision, which in many respects is Polanyi's vision as well. Hewlitt's Figure 2 portrays the integrated levels of emergence, which on our view represent the future of biological studies. We also agree that theories of entelechies or vital forces cannot be part of a scientific understanding today. Even without them, however, the sciences of emergence can trace emergent causal powers wherever they appear in the world.

In contrast to Hewlett, Andy Sanders offers an alternate model to the emergence approach. Influenced by Wittgenstein, he worries about linking the religious life too closely to developments in science. Consequently, Sanders questions my project "for taking the natural sciences too seriously," since the approach may "endanger the autonomy of theology" and "create an unbridgeable gap with ordinary religious meaning" (p. 28). The detailed warnings that Sanders gives merit consideration, since it would seem reasonable that theologians be concerned for the autonomy of their discipline, thus seeking to avoid unnecessary vulnerability to scientific or philosophical criticisms.

But is the degree of vulnerability entailed by emergence really unnecessary? The trouble is, many today no longer find it possible to insulate religion or theology from scientific thinking. For such persons religious beliefs and practices evoke such a level of skepticism — especially when they are cut off from what is known

(and how it's known) in the sciences and philosophy — that religion can no longer function for them as a source of existential meaning and purpose. They may *wish* that it were otherwise; indeed, they might even find themselves jealous of religious persons who can encounter critiques of religion during the week and still comfortably affirm religious truth claims on Saturday or Sunday. But for these persons such separation is not a live option. Either skepticism overtakes them and they refrain from all religious participation; or, at best, they engage in the practices while suspending belief in the truth claims that undergird them.

If such persons are to find the religious meaning that Sanders endorses, they will have to develop a form of belief, and a means of justifying it, that is less distant from science and philosophy, less distinct from the structures of credibility usually applied in those fields. If you can live your religious life with the relative insularity of a Wittgensteinian language game, then more power to you. The emergence argument is meant as a bridge for those of us who no longer can.

Peterson and Gulick are not opposed to allowing the dialogue between theology and the natural sciences to play a key role. Nonetheless, both worry that I grant too strong a place to the neuroscientific account of human thought. Peterson voices his opposition by questioning not only strong but also weak supervenience accounts of thought. His appeal to "open emergence" or "open emergent systems" amounts to the suggestion that human thought be explained in causal discontinuity from the study of the neural correlates of consciousness. In what follows I attempt to show that an emergentist response to the mind-body problem can and must give a larger role to neuroscience than Peterson is willing to countenance.

I am likewise grateful to Walter Gulick for his analysis of emergence in Polanyi's work. With regard to Polanyi, we do not disagree on any matters of substance, and his discussion furthers the task of interpreting Polanyi's groundbreaking work on this topic. Nor does Gulick's detailed account of the three types of emergence — part-whole emergence, transformational emergence, and self-organizing emergence — provide grounds for disagreement; his clear analysis and exposition represent helpful contributions. Once again it is only at the point at which the mind-body relation arises that difficulties emerge; here, I fear, his position is not sufficiently open to the role of the neurosciences in understanding the psychophysical unity that is the human person.

Like Peterson, Gulick worries that my approach to emergence is susceptible "to being undermined by reductive and inappropriately deterministic scientific theories" (p. 32). My view runs the risk of reductivism and determinism because it does not accept a sufficient "causal decoupling" between "the emergent phenomenon and its antecedents" (p. 35). At first Gulick's "causal decoupling" seems primarily to imply an *epistemic* limitation, namely that emergent phenomena cannot be predicted from a knowledge of the causal laws that function on the lower level (*ibid*.). His helpful discussion of "self-organizing emergence," for example, seems to presuppose this less radical interpretation. His discussion draws on the work of Deacon and Goodenough, who clearly maintain that the novelty emerging at later points in evolution is still causally constrained (though not determined) by interactions at lower levels. Is it not this continuing constraint that explains their resistance to "vertical" metaphysics — that is, any metaphysics that seeks to introduce spiritual forces, souls or God — and their decision instead to embrace a metaphysics of "horizontal transcendence"?

Gradually it becomes clear, however, that Gulick's "causal decoupling" is more radical than the idea that there are limitations on our knowledge of how lower levels causally constrain higher levels. At points it even seems that he intends to assert that neural firings do not play a causal role vis-à-vis human thought. He writes,

for example, "I accept the token-token correlation of strong supervenience, but I reject the ascription of causality that normally accompanies discussion of supervenience" (p. 41). This would seem to imply that what happens in one's brain plays *no* causal role in affecting what one thinks. Comparing water molecules to neurons and the behavior of the ocean to thought, he writes, "individual water molecules do not cause all the functions and behaviors of an ocean" (p. 41) and "the water molecules did not independently cause anything; their velocity was caused by wind and wave" (pp. 41f.). Thus, he concludes, "Human causality is uniquely autonomous in the known universe" (p. 43).

But in fact Gulick nowhere actually denies that neurons play a causal role in human thought. Each of the above statements is actually carefully nuanced: water molecules don't cause *all* the ocean's behaviors; water molecules don't *independently* cause anything; human causality is *uniquely* autonomous. Thought may be uniquely autonomous without being *fully* autonomous. Gulick is of course right to nuance his position in this way, for one would certainly not want to deny that brain functioning plays *a* causal role in human thought. If you administer alcohol, Prozac, or a hallucinogenic substance to a subject, you will cause changes in his mental functioning, even though the ingested substance will not determine his precise behavioral responses. (If you administer a sufficient dose of strychnine instead, your action will have an even more radical influence on the subject's thought: it will cause his thought to cease altogether!)

Gulick and I thus both agree that agents at an emergent level exercise a type of causality not reducible to causal forces at the subvenient level — even though the subject's functioning at the emergent level continues to be influenced by the causal forces and structures operating at the subvenient level. Parts influence, indeed sometimes *strongly* influence, the action of wholes. The action of water molecules, for example, contributes to the fracturing of rocks on the ocean's shore. Emergence is not the denial of this (I think obvious) fact; it is the insistence that such facts do not tell the whole story. As Gulick notes, "much *more* explanatory power would come from stating that, say, the fury of a storm ... created the surf that caused erosion at high tide" (p. 41, italics added). Part of the reason that we need emergent explanations — and thus part of the reason that one should accept the doctrine of explanatory non-reducibility — is that emergent wholes *also* exercise real causal powers.

If this analysis is accurate, then one must nunace Gulick's notion of "causal decoupling" in the same way. Perhaps we should speak of a *partial* causal decoupling. However we designate it, the idea is that, while lower levels continue to exercise some causal constraint on emergent levels, they do not determine all behaviors at the higher level; emergent wholes also contribute to the causal story, since they exercise their own, higher-order type of causality.

This short discussion raises the much larger issue: what is it that we mean by "cause" anyway? Clearly, if by causality one means exclusively *efficient causality as studied in the physical sciences*, then one will be hesitant to speak of the influence that two persons exercise on each other, say in the course of engaging in a lengthy philosophical discussion, as a causal influence. But for anyone who is willing to use the term causality in the broader sense of Aristotle's four types of cause (efficient, formal, material, and final), "cause" must mean more than efficient causality, more than the influence that billiard balls exercise on each other when they collide. (Since Gulick obviously has all four of Aristotle's causes in mind [pp. 43f.], it is difficult to understand his squeamishness about using the term causality in this broader sense.) One of the great strengths of emergence theory is its ability to account for the way that more complex types of causality emerge out of less complex orders of causality. Your ideal of a world at peace is one of the causal forces that leads you to exercise leadership in the anti-war movement; and there is no way to relate this type of causality to billiard-ball causality without

understanding the diverse emergent levels that are a byproduct of the evolutionary process.

This is by no means merely a verbal dispute; much turns on preserving the causal constraints that interlink the various levels of the natural world. In the emergence literature, one finds errors on both sides. On the other side, one finds authors who, while paying lip service to the importance of emergence, do not in fact allow it to have any effect on the study of the causes of human or animal behavior. In the original paper, I cited the work of the Stanford neurobiologist William Newsome. Newsome endorses emergence theory, yet he insists that when he is studying perception in higher primates, he proceeds by using "standard reductionist science." If emergence is more than an empty notion, its causal predictions should play a role in the complete explanation of the structures and behaviors of living organisms. In the end, the emergence theory that is really interesting is the one that makes the risky prediction that evolution involves breaks and discontinuities, producing new levels that require new techniques of study, new explanations, and new types of agency.

On the other end of the spectrum, one finds authors who use emergence to immunize humans from scientific study as thoroughly as Cartesian dualism once did. (Certainly this is not Gulick's intention.) The main error of the dualists and vitalists, for example, was to introduce a causal (and ontological!) level that was completely decoupled from the causal system that preceded it in the course of evolution.

The challenge for emergence theorists in the coming years is to avoid both of these extremes. Their work must contribute to progressive research programs in science and must prove crucial to interpreting the results. Perhaps the greatest danger is to appear fearful of or to block advances in scientific knowledge — especially in the area of the neural correlates of consciousness, where the breakthroughs of the next decade or so are likely to be revolutionary. It would be the ultimate irony if theology, long perceived to be fearful of scientific progress, should align itself with emergence theory, only to find that emergentists resist scientific advance as robustly as the theologians once did!

Once again, I am grateful to the four respondents for their probing questions and for contributing new analyses that advance the discussion further than my own contribution could have taken it. Here truly is an example of a whole that is greater than the sum of its parts.

WWW Polanyi Resources

The Polanyi Society has a World Wide Web site at http://www.mwsc.edu/~polanyi/. In addition to information about Polanyi Society membership and meetings, the site contains the following: (1) the history of Polanyi Society publications, including a listing of issues by date and volume with a table of contents for recent issues of *Tradition and Discovery*; (2) a comprehensive listing of *Tradition and Discovery* authors, reviews and reviewers; (3) information on locating early publications; (4) information on *Appraisal* and *Polanyiana*, two sister journals with special interest in Polanyi's thought; (5) the "Guide to the Papers of Michael Polanyi" which provides an orientation to archival material housed in the Department of Special Collections of the University of Chicago Library; (6) photographs of Michael Polanyi; (7) five essays by Michael Polanyi.

REVIEWS

Philip Clayton, *The Problem of God in Modern Thought* Wm. B. Eerdmans Publishing Co. 2000. pp. 531. $30. hardback ISBN: 0802838855.

Pantheism + Personality = Panentheism. This formula, though not actually present in the book being reviewed, points to the needed notion of God for our contemporary setting, which is still under the influence of Kant's strictures against metaphysical speculation. Three critical ideas are involved. First, there is the idea of pantheism: Spinoza's absolute or infinite includes all finite reality within itself but is finally locked immanently within the finite with no transcendence. Second, there is the idea of the divine personality: the later Fichte's understanding of a presupposed absolute which is present in the world while at the same time transcending the world serves as the paradigm of the relation between God and the world. Third, there is the idea of panentheism: Schelling of the middle period stands as the most helpful thinker for bringing the perspectives of pantheism and personality together in a full-blown dialectical notion of God. Such are the distinctions and the moves of which the book under consideration is made.

Philosophical theology has been given fresh air to breathe as a result of the scholarly labors of Philip Clayton in his *The Problem of God in Modern Thought.* This magisterial work clarifies why the notion of God became a problem in the modern world and then proceeds to make a case for panentheism as the best model of God for today. In the process, Clayton offers reconstructions of modern thinkers in the history of philosophy, showing the relevance of their thinking to contemporary reformulating of the notion of God. The fascinating journey is made from Descartes to Leibniz to Kant, then back to Spinoza (and Lessing, Jacobi, and Mendelssohn) before going to Fichte and finally Schelling. Along the way, Clayton's reconstructions retrieve one contribution or another from each thinker toward constructing an adequate notion of God for our time. His purpose is to "specify a coherent philosophical theology and to assess the conceptual difficulties it faces" (105).

The book is so powerful because of the effective way in which historical philosophical thinkers and contemporary philosophical issues are allowed to illumine one another. The opening chapter portrays the current intellectual context, highlighting the place of skepticism and pluralism, the hermeneutical shift and the pragmatic shift. But such concerns are not left behind in the unfolding narrative of the early modern history of philosophy. The historical reconstructions are informed by the contemporary questions. The result is a marvelous feast of ideas relevant to articulating a model of God.

In this at once historical and systematic project, the author identifies infinity and perfection as the two qualities that dominated theological and philosophical thinking up through the pre-modern world. These two strands of God as infinity and God as perfection were then combined in an onto-theological understanding that became problematic in the modern era. Clayton maintains that the eventual dissolution of these two ways of thinking about God in modernity was a good thing because "perfect-being theology" as developed most fully by Leibniz is problematic in that it does not allow enough room for divine agency. The logics of the two notions are very different and that of God as infinite leads one in a direction less plagued by difficulties but also toward a new set of models of God that are less traditional. For Clayton, a philosophical doctrine of God starts with the concept of infinity but gives this concept positive content by supplementing

it with other sources. This chosen starting point does direct one, however, toward a model of the world as within God and away from a model of God as separate from the world.

Clayton's reconstruction of Descartes moves creatively against traditional interpretations of him as the father of modern philosophy because of how he grounded all thought in the subject, either by way of his his *cogito* argument or his epistemological claims. Instead we encounter the effort to look closely at Descartes's understanding of God and his general metaphysics which posit an infinite subject as the ground of all finite realities and of human knowing. The *cogito* is not properly understood until placed within the context of the infinite. In the process of viewing Descartes's broader concerns, Clayton shows the centrality of theological issues for the agenda of modern philosophy. His book can be understood as a narration of theology's place in the history of early modern thinkers. As is the case with most of the major thinkers treated, the cast of scholars consulted—from Léon Blanchet to Jean-Luc Marion here in the instance of Descartes—is impressive indeed. Clayton offers a rereading of the theistic proofs of Descartes, and while they fail as proofs, they succeed in a fashion as conceptual clarifiers, for in the ontological argument one finds a conceptual apparatus for grasping the infinite ground that is always the presupposition of the thinking subject. Modern thought owes to Descartes the insight that the infinite, or the intuition of the infinite, as prior to finite realities, is the condition of possibility for conceiving them as they actually are.

Clayton incorporates Kant's criticism of theology but then finds ways to move beyond it. Kant's insight into the relation between language and reality cannot be ignored. However, the Kantian limiting of knowledge to objects of the senses is judged to be unacceptable. Theistic language need not be limited to regulative use. Metaphysics and theology of the onto-theological sort are no longer possible after Kant; the epistemic status of metaphysics has changed. However, a theology tending to the epistemic standards of the day will be able to offer more than theistic language as useful fiction but less than the absolutistic claims of pre-Kantian thinkers: in short, such language will serve regulatively as grounding knowledge claims and creating meaning and constitutively as making claims about the nature of the divine. Clayton offers interesting evidence that the later Kant of *The Critique of Judgment* and other later works was himself moving toward constitutive claims for God. He continues in Kant's wake by developing, with assistance from Scheiermacher's *Dialectics* of 1814, limit notions, which he sees as the means for saving theology from Kant's first *Critique*. Involved here is the distinction between reflecting (thinking) and knowing. Upon hitting an intellectual difficulty, a theology of limit notions does not dogmatically claim an inability to know that which is so difficult or aporetic but instead explores the difficulties and embarrassments of reason in order to learn more and possibly move toward constitutive claims about God. These claims are varied and lead to multiple models and thus to a pluralistic theology. But I would suggest that the phrase "pluralistic theology" is a bit misleading. Clayton endorses what might be called "methodological pluralism," which recognizes the importance of acknowledging plural prospects for rational consideration at critical junctures along the path of metaphysical questing or philosophical narrating or theological formulating. And yet he also acknowledges the metaphysical quest's intrinsic push beyond such plural options to unity, which leads the inquirer to settle on the best candidate for conceptualizing the issue at hand. At the end of the day, the theology possesses a unity, though it is pluralistic in the sense that multiple concepts or models entered into the deliberating process of moving toward that unified notion.

Clayton's theology of the infinite moves from Spinoza to Fichte to Schelling. Spinoza is so important because he conceives of an infinite that is distinct from the finite and at the same time encompassing the finite within itself. And yet, he is unsuccessful in deriving the finite from the infinite. Spinoza's *deus sive natura* (God or Nature) cannot be a strict equation. Clayton

concludes that some form of minimal personalist theism or panentheism, drawing on insights of Spinoza, should be allowed to emerge. Fichte becomes important in that emergence. The earlier Fichte endorses an idealistic panentheism; the later, however, sets forth a mystical or ethical panentheism that can be seen as a synthesis of Spinoza and Kant. Combining the need for philosophical speculation and for sharp epistemic limits, Fichte realized that the existence of a finite self-consciousness requires the postulation of an absolute dimension, an absolute Other.

The question remains how to conceptualize the infinite that stands in relation to the finite. It is Schelling's metaphysics of freedom that best fills this need. In fact, the intellectual hero of Clayton's narrative recounting the development of the notion of God in modernity is Schelling. In his middle period, Schelling builds on his early modern predecessors in developing not the notion of infinite substance, as Spinoza had done, but that of infinite subject. Schelling conceives God as genuinely personal. The break with Spinoza comes in his 1809 shift to freedom as the center of his metaphysics. An adequate understanding of subjectivity is key. Utilizing the idealist's distinction between internal (subjective) and external (empirical) necessity, Schelling's richer theory of subjectivity allows him to interpret the world's creation as a free act of the divine. This affirmation of the freedom of God carries with it a lessening of the human's ability to know God: the free God must reveal the divine character to humans via a process of self-manifestation rather than being available via rational scrutiny alone. The world is within God, but the world cannot be identical with God; therefore, God and world are in a dialectical relation. This leads Schelling to affirm that God is both ground and consequent: the dipolar divine reality includes both the infinite ground of all finite reality and the personal divine being who is unfolding within the process of becoming. The ground, then, is best understood as a subject, a subject who objectifies itself in creation through exercising its freedom. The world is the process of God's self-manifestation. Both the personal God and the world have their ground in the infinite ground. But the world, the creation, is finite, whereas the personal God, while logically dependent upon the ground, shares the ground's infinite nature. The theology of the infinite is the theology of the God of infinite freedom. This dipolar view of God as infinite ground and God as personal subject celebrates the divine life as made possible by "a pure act of freedom" that accomplishes "the transition from the infinite nature of the divine to reality" (507). Such divine freedom makes possible divine love.

One question can be raised in relation to this sure-to-become-a-classic book that Clayton has written. This concerns the absence of Hegel. Early on, Clayton indicates that this English text is closely related to a volume on the problem of God published in Germany in 1996; the two texts, he notes, come to the same conclusions but the arguments differ at a number of points. The German work is designated as the first of two volumes, and at various junctures in the English version the author refers to a future second volume that will continue the historical narrative that here ends with Schelling, responding to the line of thinkers from Hegel to Nietzsche, and offering a systematic defense of panentheism. With the promise to deal with Hegel in another setting, there are no extended treatments of him in this volume. But the references that do appear consistently betray a Hegel of the analytic philosophers whose naïve yearnings for and expectations of obtaining absolute knowledge, systematic completion, and totalistic closure leave him clearly guilty of what Clayton labels "the Hegelian fallacy" (469). Hegel and his followers seem all to be of the "unregenerate" sort, who as absolute idealists claim to know that thought corresponds fully to reality (357). There is, of course, another Hegel: one who is not so wildly rational as to claim full knowledge of the end of history before its end; one who is more the poetic romantic than the austere rationalist; one who carries out a history of philosophy that draws on the strengths of the various thinkers while correcting their weaknesses in a manner not dissimilar to that of our

philosophical theologian; and one who sees the need to examine the empirical deliverances of history in order to grasp the unfolding revelations of the Absolute Spirit, again not dissimilar to the claims of our eminent author. The thinking carried out in this work shares much with what Hegel was up to, so some might find that he is not as absent as Clayton thinks.

Clayton has learned much from Wolfhart Pannenberg, which he acknowledges in his Preface and at crucial moments in his argument. He translated Pannenberg's *Metaphysics and the Idea of God* in the late 80s and clearly received much inspiration from this mentor. He also acknowledges Louis Dupré, his mentor at Yale. Those who give this book a serious read will themselves encounter a knowledgeable and thoughtful mentor, to whom they will feel much gratitude for having written such an erudite and provocative statement about God. On the other side of the reading experience, the formula "Pantheism + Personality = Panentheism" makes good sense. The reader is left with a desire both for experiencing that God more fully and for Clayton's second volume.

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Tradition and Discovery is distributed to members of the Polanyi Society. This periodical supercedes a newsletter and earlier mini-journal published (with some gaps) by the Polanyi Society since the mid seventies. The Polanyi Society has members in thirteen different countries though most live in North America and the United Kingdom. The Society includes those formerly affiliated with the Polanyi group centered in the United Kingdom which published *Convivium: The United Kingdom Review of Post-critical Thought*. There are normally three issues of *TAD* each year.

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