

CONVIVIUM

A six-monthly review of
post-critical thought

NUMBER 22

MARCH 1986

CONTENTS

Page

- 1 News and Notes.
- 4 Polanyi's Understanding of Religion Reconsidered. A. Milavec.
- 15 Polanyi's Philosophy of Science. P. Hodgson.
- 26 Personal Knowledge and Sex Education. D. Scott.
- 31 Michael Polanyi's Humour D. Scott.
- 32 From Skills to Thought: A Consideration of "Fodor's First Law of the Non-Existence of Cognitive Science." R. Hodgkin.
- 35 Michael Polanyi F.R.S. 1891-1976 (For the Dictionary of National Biography 1971-1981 Supplement.) R. Hodgkin.
- 37 BOOK REVIEW: Harold P. Nebelsick, Circles of God: Theology and Science from the Greeks to Copernicus. By David Bagchi.

FROM TRADITION AND DISCOVERY:

- 39 Polanyi in Novels. Richard Gelwick (A Prefatory Note).
- 40 Agassi on Polanyi: Comments on Joseph Agassi's Science and Society.
J. Apczynski and Michael Chiarello.
- 48 List of Subscribers.

Contributors to This Issue

- | | |
|---------------|--|
| A. Milavec | Lecturer and Author, Ohio. |
| P. Hodgson | Nuclear Physicists, Oxford University. |
| D. Scott | Author. |
| Robin Hodgkin | Retired Lecturer in Education, Author. |
| David Bagchi | Research Student, Oxford. |
- J. Apczynski and M. Chiarello are authors and lecturers at St. Bonaventure University.

NEWS AND NOTES

The present issue of Convivium offers quite varied fare. In the last issue we reproduced John Puddefoot's papers given at the Philosophical Society Seminar at Rewley House, Oxford on Polanyi's thought. In this issue, the second of Peter Hodgson's two papers appears. The first paper on the Freedom of Science was published in March, 1984. The seminar catered for people with little or no previous knowledge of Polanyi's thought and the talks were intended to be introductory, so subscribers who are as yet not too familiar with Polanyi's philosophy of science will find this paper a useful introduction. In 1982, Aaron Milavec's book, To Empower as Jesus Did, was reviewed in Convivium and we are glad to have this article from him on Polanyi's understanding of religion - the fruit of his researches into unpublished letters and manuscripts in the Chicago archives. I hope this interesting article will give rise to correspondence and discussion in future numbers of Convivium.

Drusilla Scott has been inspired by Jere Moorman to explore the humour of Polanyi, but also contributes a serious and thought-provoking article on sex education, a welcome and highly relevant contribution to the growing number of books and articles on education which Polanyi's ideas have provoked. In addition to a review article by Robin Hodgkin and a review of Nebelsick's book by David Bagchi, we have found room to include Robin Hodgkin's biography of Polanyi which appears in the Dictionary of National Biography.

It is with regret that I have to give the news of the death of Michael's widow, Magda Polanyi, who died in Oxford on February 18th.

As I would remind you, 'News and Notes' is mainly intended to pass on to you information that comes in from subscribers about matters of interest to our readers. This time, there is virtually nothing to report and I feel slightly disgruntled over what seems to me to be a rather deplorable lack of interest. I will give you an example of the sort of thing that I find exasperating. One member of Convivium wrote recently and mentioned a review he had done for a certain journal on a book which "has quite a lot of material from Polanyi in it". He then went on to mention a thesis someone had produced which expressed "a different view to Polanyi's on Corporate Planning in the 30s and 40s". It did not seem to occur to him that Convivium would have been glad to have a note of the title of the book, or a bit more information about it and/or the thesis. I am convinced that many of you are in a position to send in interesting items of news and information, which I would be only too pleased to pass on to other Convivium readers who are less in the swim of things. Many of you are involved in the life of a lively University department or other institution. Most of you come across books and articles from time to time that would merit mention in our pages. More of you could, in fact, contribute articles or notes from

your own 'post-critical' thinking. Sometimes I despair about the future of Convivium, though I must report that there is still a strong feeling in some quarters that Convivium ought to become part of a widely read journal of post-critical thought on a broad basis and with a European readership, not just the U.K. It is because of this 'vision' that we are for the moment carrying on.

This brings me to the question of our FINANCES. In the last issue, I indicated that these were shaky. As a result, two generous donations have come in of 100 each, which will keep us out of the red after paying our March bills. This is in spite of the fact that I have received only 26 subscriptions for 1986, of which four are new members. Fifty-nine of you have not yet paid your 1986 subscription, (which is now 5), and fourteen of this number also owe for 1985. I have decided that we can no longer afford to send Convivium to those who owe two years subscription, so I will write to these fourteen subscribers in the hope that it is vagueness and not lack of interest that accounts for their failure to respond to earlier reminders. As an experiment, I am listing only paid up members on the back page. These are the sheep. If you are a goat, your name will not be there, so PLEASE TAKE THE HINT AND REACH FOR YOUR CHEQUE BOOK AT ONCE.

I would like to end with some good news. David Bagchi, who completes his D.Phil. this summer has offered to be guest editor of Convivium for the next two issues. Please give him your strong support. For the sake of continuity, I will continue to receive your contributions (and subscriptions!), but will pass any material you send on to David. I hope that eighteen months will be time enough for me to complete the book I retired to write many years ago! Now that I have got down to it seriously, it is proving to be a perfect illustration of the circularity of knowledge. No matter where I begin, it always seems that the reader should have read the rest of the book first, in order to understand any of it. To add a bit of humour to a rather bad-tempered 'editorial', you can think of me during the next year, lying beside my typewriter, like the exhausted centipede in the ditch, wondering which of my hundred legs I should start off on, in trying to apply Polanyi's thought to theological issues.

Notes from Tradition and Discovery (Vol XIII, No 1, Fall, 1985-86).

Carol R. Fox, an ordained minister in the American Baptist Churches and a Ph.D. candidate in psychiatry and Religion at Union Theological Seminary in New York has an article "Modesty and Mystery: An Essay on Coming to Know the Real Other," Union Seminary Quarterly Review, XXXIX (No 4, 1984) in which she uses Polanyi to show how we can become more open to knowing a person or God. She begins with the psychological concept of projection as understood by Carl Jung and others and moves to the need for an epistemological "upheaval" that helps us become more modest and more realistic about our conceptual abilities. She then employs tacit knowing as a way of altering

our assumptions about the other (person or God) and a way of affirming the reality of the other. She says: "The focus here is not on what we know but on what we do not know. While seeing as clearly as we can what we do know, it is important to recognize, see, gaze at, attend to, that which we do not know.... Modesty is a loosening of our preconceptions, a recognition of our not-knowing, which aids our knowing. We do not give up trying to understand, but we do not limit ourselves to that which we can understand either." (pp.307, 308).

Thomas F. Torrance's theology is the subject of an entire issue of the Reformed Review, 38 (Autumn, 1984). Polanyi chose Torrance to be the literary executor of his estate, and Torrance is one of the foremost proponents of Polanyi's seminal contributions to scientific understanding. The opportunity to gain a synoptic view of Torrance's vast work is, therefore, very useful. The major article is by Robert J. Palma of Hope College, a member of the Polanyi Society and a former student of Torrance. Among the many facets of Torrance's theology developed by Palma is the importance of science in doing theological work and ways that Einstein, Maxwell, and Polanyi have suggested their interrelations.

William H. Poteat writes that Duke University Press expects to publish his major work Polanyian Meditations. Polanyi Society members will want to watch for the publication notice. As soon as the book is available, we shall be eager to review and to discuss its contributions.

A Second Chicago Polanyi Summer Seminar will be held. The unanimous view of those taking part July 29-August 3, 1985 was that they would like to return for another session. In addition, we expect others may wish to have this opportunity for study with other Polanyi scholars and exploration in the Polanyi archives. The date for the second seminar is not yet determined. It could be in 1986 or 1987. Please let Richard Gelwick or Gene Reeves, Meadville Lombard School of Theology, 5701 S. Woodlawn, Chicago, IL 60637 know which summer would interest you most. The accommodations and meeting rooms, the convivial evening activities, the libraries and cultural events were all so excellent that we anticipate that future seminars will definitely succeed. The group of seven was smaller than we at first expected, but the size was very helpful and we now hope that future groups will not have to be much larger. Participants this summer were: John Apczynski, Richard Gelwick, Walter Gulick, Jere Moorman, Phil Mullins, Gene Reeves, and Shirley Thomas.

Walter R. Thorson, Department of Chemistry, University of Alberta gave two lectures, "Christian Faith and Science in Society" and "Realism and Reverence" for the Joint Meeting of the American Scientific Affiliation, Canadian Scientific and Christian Affiliation and Research Scientists' Christian Affiliation July 26-29, 1985 at St. Catherine's College, Oxford University. The first paper uses Polanyi extensively to show the role of faith in science. The second paper argues for the advantages of Polanyi's

approach over Owen Barfield's, which though helpful in intention Thorson finds to be too Kantian by separating the phenomenal and noumenal, among several difficulties. We hope to have a paper on this in a future issue.

POLANYI'S UNDERSTANDING OF RELIGION RECONSIDERED

Part 1

The 1979 Annual Meeting of the American Academy of Religion set off a debate respecting Polanyi's epistemology of religion. Drusilla Scott and R.T. Allen took up this debate in issues number 12 (March, 1981) and 17 (October, 1983) of Convivium. This summer, I was granted an Occasional Fellowship which enabled me to examine the letters and unpublished manuscripts of Polanyi which form part of the Special Collections at The Joseph Regenstein Library (Chicago). My attention naturally turned to the unresolved issues surrounding Polanyi's understanding of Christianity. My sleuthing having come to a close, I am now prepared to share my findings and insights.

1. William T. Scott has helped to contextualize the discussion of Polanyi's perspective on religion (Zygon 17 [1982] 83-87) by noting (a) that Polanyi was raised by secularized Jewish parents, (b) that he was baptised Catholic at the age of 28 after having been strongly affected by his reading of Brothers Karamozov six years earlier, (c) that his later years demonstrated an attraction toward Protestant Neo-orthodoxy, and (d) that he never considered himself a regular communicant within any particular church. At the age of 53, Polanyi wrote, with unusual candor, to Karl Mannheim of his personal religious orientation:

As a boy and young man I was a materialist and an eager disciple of H.G. Wells. My religious interests were awakened by reading the Brothers Karazomov in 1913. I was then 22. For the following 10 years I was continuously striving for religious understanding and for a time, particularly from 1915 to 1920, I was completely converted Christian on the lines of Tolstoy's confession of faith.

Toward the middle twenties my religious convictions began to weaken and it was only in the last 5 years that I have returned to them with any degree of devotion. My faith in God has never failed me entirely since 1913 but my faith in the divinity of Christ (for example) has been with me only for rare moments (19 April 1944, 4:11 - Box 4, Folder 11 of Regenstein Collection).

Polanyi sent a copy of this letter to Magda, his wife. Her response emphasizes both the rare candor of this disclosure and the danger attendant upon such disclosures:

I would have liked to keep the copy of your letter to Mannheim. It does give a true picture of your road until now, and I

am so bad at remembering things.

I have of course no idea what made you write to Mannheim about such intimate matters, but as usual I am afraid that you will be misunderstood and fear that you have wasted all that cadour [sic] on a conceited fool. I hope I am wrong (23 April 1944, 4:11).

Polanyi associates himself with "Tolstoy's confession of faith." Leo Tolstoy, following his conversion experience of 1878, downplayed the institutional and sacramental aspects of Christianity which he perceived as serving to keep the poor in ignorance and submission. Central to Christianity was Tolstoy's image of Jesus as the noblest of men and the wisest of teachers who, without claiming to be God, proposed a transcendent moral ideal for all humankind. It is undoubtedly this latter aspect of Tolstoy's "confession of faith" which Polanyi identifies as his own. Magda might well have been uneasy and preferred that her husband had said nothing of this since such an admission could easily alienate committed Christians.

2. Richard Gelwick and Harry Prosch, two men who have enjoyed extended exchanges with Polanyi, have come away with significantly divergent impressions of how Polanyi regarded the ontological status of religious realities. R.T. Allen summarizes their divergent view as follows:

What Gelwick gives us is a 'maximalist' interpretation of Polanyi's writings which has him definitely affirming the reality of God, whereas Prosch gives us a 'minimalist' account in which the reality of God is not affirmed, outside purely imaginative integrations... (Convivium 17 [1983] 28).

I would suggest, paradoxically, that both views can be credited. Polanyi was a very sympathetic listener and responder. As such, he did not initiate religious discussions but could and would resonate strongly with anyone who espoused a religious orientation. Thus, for someone who approaches Christianity as a specification of noble human yearnings that have been mistakenly supernaturalized and reified, Polanyi would strongly concur. On the other hand, those Christians who shared with Polanyi their personal and felt commitment to the living God never failed to come away with a sense that Polanyi shared their faith experience. Gelwick and Prosch, consequently, may both have discovered a sympathetic reflection of their own personal religious orientations when engaging Polanyi. As for Polanyi himself, he was sufficiently a gentleman and sympathetically broad minded so as to embrace both of their personal horizons of understanding.

During the second half of 1963, Polanyi exchanged a burst of letters with a woman, Elizabeth, whom he had enchanted and whose loving admiration drew him out of his reserved self. Judging from her long, romantic letters, it is apparent that Elizabeth called forward and enjoyed a dimension of Polanyi that neither Gelwick nor Prosch tapped. At one point in her letters, Elizabeth delicately captures a truth about Polanyi which she conveys as a reflection upon Lord Simon:

I am just reading Mary Stork's life of Lord Simon.... It is happy to be reminded of him and to learn much about his early life and so on, with the kind of pain...which is in its way a due and proper blessing. But somehow nowhere in the book, scanning ahead through it, do I see the man I knew -- the deeply tender and loving heart, the generosity, the curiosity about poetry and religion when confronted with someone committed, however faulty, with both. It would have seemed to me presumptuous to suppose one might have seen a different Lord Simon from other people -- indeed I never did suppose it, though I do remember how constantly he said to me, "I have never met anyone like you in all my life." But I see now that this may, most strangely, be true, and I wonder too whether this may not be true in every relationship where there is an unqualified love, a complete commitment at whatever level. Perhaps this itself makes a unique revelation of each to each. I come to think this is true; it certainly seems to me beautiful. You can see that you were in my mind here (13 November 1963, 6:4, emphasis mine).

One could make a case for asserting that the force of this last line need not apply to the earlier characterization of Lord Simon. However, when this line is read in the context of the revelations throughout her letters, it seems more certain that Elizabeth spoke of Lord Simon in precisely the terms which delicately reflected her relationship with Polanyi. While reading Elizabeth's letters, I found myself feeling, for the first time while reading Polanyi correspondence, that I was invading the privacy of these two people. Elizabeth, needless to say, unwittingly preserved a glimpse of Polanyi that is privileged. For this I am thankful.

3. Even though Polanyi did not have theological training, he did, nonetheless, allow himself to be influenced by Paul Tillich and Tillich's disciple, J.H. Oldham. Oldham, the director of Moot, initially invited Polanyi to join the triannual weekend discussions of Christian issues in 1944. Over the next twenty years, Polanyi became a personal friend of Oldham and had an implicit confidence in his theological judgment. I do not think that it would be misplaced to identify Oldham as the individual who most influenced Polanyi's writings respecting the function and the phenomenon of religion. This influence prevented Polanyi from taking a simplistic, fundamentalistic, or pietistic orientation toward Christianity. Consider, for example, the following segment of a position paper prepared by Oldham for one of the Moot discussions:

Alisdair MacIntyre in his apologia for his Christian position in Metaphysical Beliefs says (p. 186) that the religious attitude has two elements in it. The first is the practice of worship. The second is that his God acts in the universe. The former statement the ordinary man can understand, but what is intended by the second? When he reads the works of theologians he finds statements...about God's

"mighty acts" in history. What does this mean? How does God act in history? The question has perplexed me for many years.

The dilemma is this. If God's acts are identifiable, i.e. cognizable by science or by observation, we bring Him into the phenomenal world and reduce Him to the level of the secondary causes which operate in that world. If His acts are not identifiable, we expose ourselves to the charge brought by a multitude of critics that we have removed God so completely out of the world that He has ceased to make any difference whatsoever.... In sifting away unworthy conceptions of Him we have elevated Him out of existence altogether (15:9).

Such considerations may have prompted Polanyi to retain a centrality for worship in his vision of Christianity without ever being able to settle the issue of the ontological status of the "God" evoked within that worship. Polanyi was barred from making a simplistic parallel between how a physicist takes note of the existence of electrons and how a believer takes note of God.

Oldham may have been the one responsible for turning Polanyi's attention to Tillich's first volume of Systematic Theology when the British edition appeared in 1953. Judging from the underlining and the marginal notes, Polanyi only read small segments of it. It is telling, however, that the only segment that Polanyi copied on the inside back cover and underlined within the text is the following:

The question of the existence of God can neither be asked nor answered (I:262).

One can feel for Polanyi in this instance. He himself does not have an adequate apprenticeship within a Christian context which would allow him to experientially touch and taste the Lord of History. Neither does he have the added theoretical apprenticeship which would allow him to make sense of and to unravel the dilemma painted for him by Oldham and Tillich. As a consequence, Polanyi was perhaps condemned to remain indecisive when it came to the reality of God.

While doing the University of Chicago lectures in 1970 with the close collaboration of Prosch (who later edited and expanded these lectures for publication in the volume Meaning), Polanyi undoubtedly was satisfied with framing Christianity within the horizon of mythic, poetic, and moral truth -- issues which preoccupied him at that time. Since myths, poems, and moral ideals are anthropomorphic creations evoked out of deeply intuited longings which defy exact epistemological and ontological specification, Polanyi did appear to be satisfied with exhausting the content of "God" as a mythopoetic reality. This situation might have been quite different had Polanyi made contact with an adequate theological anthropology which would have enabled him to regard authentic human self-expression and self-realization as tantamount to divine communication and salvation. Nothing can be secular for

God, and every secular advance must disclose an emergence of the divine possibilities provided by the Lord of Creation. Thus, a theologian like Karl Rahner can write as follows:

The history of mind and the history of revelation are coextensive. What we usually call revelation history (from Abraham and Moses to Jesus Christ) is not, strictly speaking, the history of revelation, but a special and privileged part of that global salvation history constituted by God's self-communication (as part of human existence) and encountered throughout mankind's history at different levels.¹

Not only did Polanyi lack an adequate theological anthropology, but he also lacked a comprehensive understanding of the very anthropologists of religion whom he did consult. For example, in Meaning he makes extensive use of Eliade's analysis of ritual as abolishing profane, chronological time so as to recover the sacred, mythic time. Completely absent, however, is Eliade's major contention that the religions stemming from Abraham inaugurated a revolutionary orientation wherein the myth of cyclic regeneration was supplanted by the myth of linear history as theophanic. As a consequence, Polanyi's omission gets him into trouble. Not having an overarching grasp of Eliade's methodology and conclusions, Polanyi is limited to borrowing only those elements of Eliade which trusted advisors undoubtedly indicated would be congenial to his own work. In so doing, informed readers are put off by what they rightly regard as an elliptical or misleading representation of Christianity. Illustrations of this discontent can be found within the articles by Phil Mullins and Ronald L. Hall in the Zygon edition devoted to Polanyi (March, 1982).

4. Polanyi has taught us that the transmission of a cultural heritage necessitates a sustained apprenticeship under appropriate masters. Lacking such an apprenticeship, one is necessarily blind and deaf to the habitual perceptions and standards of excellence which guide the performance of the master. Polanyi, when everything is said and done, was a creative master within those very areas wherein he was adequately apprenticed and a groping beginner within those areas wherein he lacked an adequate apprenticeship. While I have been immensely enriched by Polanyi's startling reexamination of the scientific enterprise and have found intellectual satisfaction in extending his epistemology and sociology of knowing into other cultural domains, I fear that most of what Polanyi attempted respecting the artistic and religious domains will be largely abortive.

It remains the task of trained theologians to appropriately extend Polanyi's thought into those domains where he was largely only a sympathetic stranger. The task at hand, consequently, is not a historical reconstruction of Polanyi's religious position but the designation of how Polanyi would have been positioned had he been privy to an informed Christian apprenticeship. In the end, every historical reconstruction will only satisfy the curiosity of historians; a theologian requires an imaginative extension of

Polanyi into domains which were beyond Polanyi's ken. It would be a mistaken enterprise, consequently, for the inheritors of the Polyanian tradition to endeavor to settle contemporary issues in the epistemology of religion by appealing to the "authority" of their common mentor. Prosch appears to have come to a parallel conclusion in this matter when, after gathering together the texts which "show that Polanyi did not think of God as a kind of reality which existed independent of our articulate systems, he cogently ends by acknowledging that "the question remains whether he should have thought God existed as such a reality" (Zygon 17 [1982] 47f).

Part II

5. At just those times when Christians would expect Polanyi to alert them to the clues disclosing divine providence, he fails to do so. Thus, for example, in the closing chapter of Personal Knowledge Polanyi carefully traces his dissatisfaction with mechanistic interpretations of evolution and ends up requiring that there be a "cosmic field" which exerts a marginal control directing the chance mutations within the biosphere. Any Christian accustomed to marveling at the traces of evolutionary development from the primitive amoeba to the highly complexified mammals might be expected to be carried away into perceiving the hand of God guiding and luring this drama throughout its eons and eons of uneven development. Polanyi was aware that Whitehead had no hesitation to name "God" at the center of every emerging actual entity and that Teilhard painted a grand testimony for God within the clues left by the ascent of humankind. Yet, for himself, Polanyi could not confess that he himself was so carried away. He could only acknowledge that others are so carried away:

We may envision then a cosmic field which called forth all these [bionic] centers by offering them a short-lived, limited, hazardous opportunity for making some progress of their own towards an unthinkable consummation. And that is also, I believe, how a Christian is placed when worshipping God (PK:405).

There is something reassuring here. Polanyi did not pretend to be what he was not nor to experience what he could not. Nonetheless, a Christian can find herein a confession of belief in some transcendent and purposeful energy gradient within the cosmos which eternally calls the myriads of living centers into being and being more. The honesty and the awesomeness of this rudimentary confession arrived at within a strictly secular pursuit cannot but persuade the Christian that Paul was indeed right when he judged that "his eternal power and deity has been clearly perceived in the things that have been made" (Rom 1:20).

6. While Polanyi never speaks of the clues for God as being found in cosmic or human history, he does preferentially speak of worship as serving to evoke the divine presence:

It is therefore only through participation in acts of worship --

through dwelling in these -- that we see God. God is thus not a being whose existence can be established in some logical, scientific, or rational way before we engage in our worship of him. God is a commitment involved in our rites and myths (M:156).

Something is lacking here. By localizing the emergence of "God" within the humanly contrived dimension of worship (a term which embraces rites, ceremonies, doctrines, and myths [M:152]), Polanyi risks localizing the meaning of "God" within worship as analogous to the power of "aesthetic truth" to grip us as we give ourselves to prophetic art (M:152-160). Yet even the poet, painter, and playwright create their artificial forms precisely because they have experienced something that is compellingly important and their art is deliberately fabricated so as to carry the viewer/hearer into this selfsame experience. Art, consequently, has an evangelical mission directed toward the transformation of those who submit to its influence. Polanyi is closer to this stance when he discusses the fierceness of the opposition to innovators in art (e.g. M:93) than when he considers how illusion and suspension of belief function in artistic productions (M:89-92). Finally, when Polanyi considers how Zen meditation exercises and rites de passage function to alter the interiority of the initiate (M:130f), I believe that Polanyi arrives at a paradigm for worship that is, by far, the most satisfactory.

For this reason, I would have preferred Polanyi to have classified the Christian texts and rites as having their counterpart in the classical experiments of science. Anyone who would be a physicist, for example, is required to painstakingly reproduce for him/herself Milliken's oil drop experiment. Under the direction of a master physicist, novices in the scientific profession learn to dwell within the clues offered by this experiment such that their scientific imaginations and habits of judgment are informed by the discrete nature of electrical charges. By ritualistically reproducing the classical experiment, physicists-to-be enlarge their native powers of perception so as to conform to those which Robert Millikan prophetically arrived at first in 1912 and which, subsequently, has become a hallmark for anyone who would want to think and to work as part of the community of modern physicists. The classical texts (the canonical Scriptures), the classical rites (the canonical prayers), and the classical exemplars (the canonized Saints) function within the church much in the same way as the classic experiments in physics (PK:133, 163) and consequently every Christian must expect to submit himself to be informed by these classics which serve to evoke and to impose correct modes of perceiving and of imagining upon a widely dispersed (in place and in time) body of Christians. Anyone who would style him/herself "a Christian" without having attained the discipline to correctly dwell within and be transformed by the Christian classics would simply be akin to the person who imagined him/herself as "a physicist" after having conducted a few experiments and having read a few issues of Popular Science.

While the Christian classics originate from and competently evoke the prophetic stance of Jesus and his disciples in much the same way as the Millikan oil drop experiment originates from and evokes the prophetic stance of Millikan, the Christian classics obviously have functions which go beyond those attributed to the classical experiments. The Scriptures, for example, have a depth of meaning which allows Christian seekers to return to them again and again over many years and generations without having thereby exhausted their power to evoke fresh prophetic discoveries of their calling before God. In contrast, most experiments in physics need only to be conscientiously enacted once so as to exhaust their meaning. Similarly the classical liturgies function to publically celebrate the historical achievements of God in the past and to provoke a readiness to cooperate with what God has in store for the future.

No classic in science functions in these modes. Millikan's classical experiment is enshrined in museums of science and technology around the world and his achievement is honored in science textbooks; yet, his experiment is not repeated publically by scientific adherents at regular intervals for the purpose of celebrating his prophetic achievement and of evoking as-yet-unforeseen implications of that achievement. In point of fact, Millikan's oil drop experiment is only one link in a great chain of classical experiments leading to our present day. Mozart's violin concertos, on the other hand, are frequently sources of renewed delight and prophetic guidance for those violinists who have been playing Mozart on and off for thirty or forty years. Musical classics, consequently, share something of the depth of meaning and lifelong power of self-transformation that is evidenced by classics within Christianity.

Time and space do not allow me to further develop what I have presented here. For the moment it suffices to suggest that Polanyi may have been wooed away from some compelling parallels between the scientific and religious classics because he became enchanted by certain authorized portraits of the religious enterprise and had few personal religious experiences to rely upon. As such, persons apprenticed in both the scientific and religious realms might expect to find that Polanyi's characterization of science has untapped and unnoticed applications for understanding the conduct of Christianity.

7. I indicated in Part I (sec. 1) that Polanyi described his profession of faith as akin to that of Tolstoy in so far as he was only, on rare occasions, able to believe in the divinity of Christ. Lacking a proper religious apprenticeship, Polanyi was never in a position to gain the type of reverence for Jesus that characterizes Christians. In his writings, he never feels inclined to say anything specific about Jesus or his message. Repeatedly, however, he makes allusion to Paul's doctrine of saving grace which he habitually interprets as evoking the awesome impossibility of pursuing a discovery. In 1968 he responded to the religious inquiries of Gil-

bert Doan in precisely these terms:

It would go too far if I tried to tell you now exactly what my religious beliefs are. Fundamental is the fact that from the beginning of my enquiries [sic] in the early years of the war, I was guided by a conviction that the Pauline scheme of redemption is the paradigm of the process of scientific discovery. It demands us to undertake a task for which our explicit faculties are clearly insufficient, trusting that our labours [sic] will be granted success by powers over which we have no command. It is this doctrine of grace which I recognised [sic] in our relations to perfection, wherever we feel charged to pursue it, well knowing that we cannot achieve this end (3 June 1968, 7:1).

Within The Study of Man Polanyi writes that the correct response to greatness is reverence which submits itself to be influenced by the one judged to be great (SM:96). Christians have sometimes forgotten this when they have imagined Jesus as the one who saves them through juridic bargaining (paying the debt due for our sins) and who transforms the sinner with no more personal engagement than that of Cinderella being touched by the magic wand of her Godmother. In contrast, the synoptic Gospels present Jesus as the "master" who surrounds himself with "disciples" who apprentice themselves to him in the traditional Jewish master-disciple relationship.² Any hint that the disciples are being groomed to be applauding spectators who will engender a personality cult following his death fades when, in Matthew 10 (and parallels), Jesus sends his disciples out in pairs to accomplish on their own those very feats which characterized his own personal ministry and divine calling. As a result, Polanyi has much to offer by way of offsetting a spectator-type Christianity and by way of reestablishing a correct relation to greatness. Ironically, in The Study of Man, Polanyi describes the self-transformation of an admirer in the choice of his hero as it relates to Napoleon (SM:95-97). Everything, however, which Polanyi develops relative to our "cosmic calling" and "historiography" could be appropriately applied to Jesus and the Gospels.

8. Five years before his death, prior to the time when his mental faculties began to oscillate into periods of murkiness, Polanyi prepared an eight-page manuscript entitled, "Religious Faith." This manuscript would appear to represent Polanyi's last sustained reflections on religion (other than his proofreading of Meaning during this same period). When I first read these lines, they seemed to summarize the historical period that Polanyi remembered that gave rise to his own convictions regarding religion:

Belief in God has been held by men since the beginning of human thought up to the rise of modern science in Europe. I think the change [toward unbelief] started in England from its rationalist theory of knowledge. Then it spread to France and from there to Europe's other intellectuals reacting particularly against the mas-

sacres by the religious wars. But as the retreat from religion spread over Europe a revival of faith grew in England, particularly among the lower classes, and this separated England--and America--from the movements that shattered the religious beliefs in Europe. I myself grew up in a spirit of scientific defiance, which in my youth spread from Balzac to Einstein, from Beaudelaire to Nietzsche, and over modern painting and all other kinds of culture. This was our European civilization in which religious authorities were rejected by the same powers through which they had ruled men's minds from the beginning of our times.

England, which had first spread scepticism in the 18th century, and which had coined romantic novels and poems and joined the romantic rise of French freedom, now cut itself off from European revolutions and from all the shattering voices and arts that opened the European torrents and led Europe to its rebellions and its destructions.

Hence it is now in England that I have to explain what I know of God. My first point is that the restraint of this country from the devastations of the past century may have saved what is now left of Europe. It shows that the liberating forces of science may produce great progress, as they did in England, without destroying religious culture. Karl Marx was sheltered here, the thoughts of Hegel became known, and cries of disaster were heard from Europe, yet [England continued its way of life] without joining these forces. This is perhaps why the English, who go on stopping their busses and most of their railways on Sundays, as if everybody went to their church next door, may have saved the residues of Europe and even retained some dreams of a remaking of Europe.

This may be my first word for belief in God. The withdrawal of England from the fulfillment of scientific world views in Europe has saved this country and perhaps even the residues of Europe now living in shatters. I first arrived at this kind of Europe some twenty years ago and, seeking a name for it, have called it an ecstasy of perfection achieved by violence--or more briefly: a moral inversion. And this is my first conclusion, namely that the beneficial effects of a growing natural science become disastrous when a mechanistic view of man achieves control over man's views. This is what Dostoevski [sic] declared in his early notes of 1864: Let us rather go mad, he said, than accept a mechanical conception of man (July 1972, 41:11).³

In sum, it would appear that Polanyi's life was marked by a deep humanism which was sensitive to religious ideals even though he personally never found Christianity decisive for his own self-understanding. Polanyi's early enthusiasm for the Enlightenment with its detestation of religious

fanaticism is recorded with sharp precision in his 1950 essay, "Perils of Inconsistency," The Logic of Liberty (Chicago: University Press, 1951). Twenty-two years later, Polanyi, restricted by declining faculties, continued to feel the deep themes that guided his generative years. Now, however, the sophisticated overlay is gone and the bedrock convictions are exposed and unadorned. Thus it is that this rudimentary essay, written when Polanyi was 81 years old, probably best presents his own instinctual response to religion. The fact that Polanyi's youthful emergence of religiosity came through his reading of Dostoevski's Brothers Karamozov, and that he defines his mature faith in terms of Dostoevski's faith may indicate that here is the central nerve which permitted Polanyi's humanism to be diffused with religious sympathies. Polanyi read Niehbur (1943), Teilhard (1960), Tillich (1963), Eliade (1968)--yet there is little indication that he has found their writings engaging outside of discovering some marginal confirmation of his own previously held convictions.

Oldham once wrote to Polanyi: "Ever since I have known you, I have always thought of you as a fighter" (19 May 1958, 15:5). Polanyi's fight was against a skepticism that was sustained by a philosophy of science which held such a detached vision of human knowing that it could only be practiced by angels and not humans. In this fight, Christianity failed to help him even though he noted that it unwittingly served the masses of England and America by shielding them from the extremes of the Continent. For this fight, Polanyi found that the faith of Dostoevski sufficed.

The capacity for...skillful religious knowing seems universal, at least in children. Once acquired, the skill is hardly ever lost, but it is rarely mastered at an advanced age without some previous training in childhood (PK:282).

FOOTNOTES

1. Karl Rahner, "Reflections on Foundations of the Christian Faith, Theology Digest 28 (1980) 211. For revelation to be revelation-for-us, it must always be experiential and anthropomorphic. The content of revelation, meanwhile, is never God as abstracted from the human condition but always what God is enabling/calling humanity to become. For more details, see Karl Rahner, Foundations of Christian Faith (N.Y.: Crossroad, 1982) 142-175 and E. Bourke, The Word in History (N.Y.: Sheed & Ward, 1966).
2. Aaron Milavec, To Empower as Jesus Did (Lewiston: The Edwin Mellen Press, 1982) 83-144.
3. Polanyi later revised this document removing nearly all the personal references. This accords well with Polanyi's propensity to be carried away by spontaneous moments of self-disclosure. Later, however, upon reflection, such moments were deemed inopportune and, as in this case, deleted.

Aaron Milavec

POLANYI'S PHILOSOPHY OF SCIENCE

Lecture given at the meeting on 'Michael Polanyi: Philosopher-Scientist', Rewley House, Oxford (22-23 June 1985)

Polanyi came to the study of the philosophy of science rather late in his life. His motive in studying it was to defend the freedom and integrity of science from a widely accepted view that he considered to be profoundly mistaken. This aspect has already been considered in the previous lecture (See Convivium, no. 18 (1984) p.13); now we want to consider his views on science itself.

Polanyi's views have the richness and depth that come from an intimate knowledge of scientific research from the inside. He worked for many years as a physical chemist, attaining great distinction in that field. In addition, he had read widely in the history of science, and developed his own views in the light of his knowledge. This accounts for much of the attraction of Polanyi's writings for the scientist. Many writings on the philosophy of science appear to the working scientist as desiccated abstractions in which he has difficulty seeing the living reality he knows so well. In Polanyi, the scientist recognises one who has himself experienced the struggles and disappointments of scientific research, and is correspondingly more ready to accept his account of what he is doing.

Polanyi knew that scientific research is a complex activity not describable by a series of instructions. It is an activity that engages many of our abilities to the full; judgement, integrity, perseverance are all deployed in the day-to-day activity of scientific research. He also knew very well that scientists are members of a world-wide community, and understood the complex interactions between the members of that community that make science possible. This brings other abilities in to play and raises many of the problems of the relation of the individual to the community that are familiar in society as a whole. These include the age-old questions of authority and freedom, as well as problems connected with the right to choose the subject of research and to the means to carry it out. The extent and depth of Polanyi's analysis is the reason for the widespread interest in his work, not only among scientists but also among philosophers, teachers and educationalists.

Polanyi's work on the philosophy of science must be seen in the context of the fundamental debate on the objectivity of scientific knowledge. This is very far from an abstract debate of interest only to academic philosophers; it is of the highest possible relevance today. I am acutely aware of this myself when I try to make a contribution to what is euphemistically called the nuclear debate by injecting what I regard as some objective facts. I am then informed that all scientific judgements are socially conditioned, and what I say is simply the result of my unthinking support of the

prevailing capitalist establishment. Polanyi was well aware of such attempts to destroy scientific objectivity from the study of science in Marxist societies.

Basically the fundamental issue is whether the scientific enterprise is the progressive discovery of the structure of the real objective world, or whether it is the ordering of our sense-impressions into the most convenient pattern. According to the former view, there exists a world independent of ourselves (although of course we are part of that world) that continues on its way whether we attend to it or not. Some of us are interested in the innermost workings of that world, and we spend our lives trying to understand it. In this endeavour we are partly successful: we do understand its structure and workings in some respects, though other aspects remain unknown. We are convinced that much of what we learn is real enduring objective knowledge.

The contrary view thinks of us as continually receiving a stream of sense-impressions, sights, sounds, pointer readings. If we are to render this intelligible we must organise these sense-impressions into a pattern, into a system of relationships. Scientific theories are thus no more than convenient maps that enable us to find our way around the world, and to predict its future behaviour from past and present observations. On this view it is quite conceivable that an entirely different map will prove as good as or better than our first map. Indeed this process of discarding one map in favour of another frequently happens in the advance of science, as for example when Einstein's relativity replaced Newton's classical mechanics. This theory of science has many variants and a complex history: broadly speaking it stems from the positivism of the Vienna circle and was most influential during the middle decades of the century.

This difference between two views of science has been described by Polanyi in his Personal Knowledge: 'The discovery of objective truth in science consists in the apprehension of a reality which commands our respect and arouses our contemplative imagination; such discovery, while using the experience of our senses as clues, transcends this experience by embracing a vision of reality beyond the impressions of our senses, a vision which speaks for itself in guiding us to an ever-deeper understanding of reality.' (PK 5) The opposing view he describes as the reduction of scientific theory 'to the rank of a convenient contrivance, a device for recording events and computing their future course'. (PK 6) Polanyi laments that this is the widely accepted view, and that the conception of the objectivity of science is 'generally shrugged aside as out-dated Platonism, a piece of mystery-mongering unworthy of an enlightened age'. (PK 6)

Polanyi's response is to examine in detail the history of science, and from this he concludes that 'twentieth-century physics, and Einstein's discovery of relativity in particular, which are usually regarded as the fruits and illustrations of this positivistic conception of science, demon-

strate on the contrary the power of science to make contact with reality in nature by recognising what is rational in nature'. (PK 6)

One of the initial difficulties in studying the implications of Einstein's theory of relativity is that the account given in most textbooks of its historical development is completely false. The history of any scientific discovery is usually exceedingly complicated, and most scientists (and in particular the writers of textbooks) have little interest in it. They want to present the essential scientific results as clearly and as simply as possible, and they tend to re-arrange and to simplify the historical development to serve this purpose.

According to the textbooks, Einstein developed his theory of relativity in order to explain the unexpected result of the experiment of Michelson and Morley. This experiment showed that the velocity of light is the same in all directions. This is not what would be expected from the idea that light consists of oscillations of an all-pervading ether because since the earth is moving round the sun, it must be moving relative to the ether. The experiment was designed to measure this motion, and gave a null result. Einstein, following Mach, then realised that scientific theories must contain no reference to quantities that are not observable; reference must be made only to observables. Now the ether is unobservable, and so therefore is motion relative to it, and we must exclude them from our theory and concentrate instead on relating the results of measurements of position and time. In this way he obtained his theory of relative motion, relativity.

This account is misleading in several respects. As he relates in his autobiography, Einstein first had an idea that was to lead to relativity at the age of sixteen. He asked himself what a light wave would look like to someone travelling along with it at the same velocity. It must be represented by a stationary solution of Maxwell's equation of the electro-magnetic field. However no such solutions exist. He went on to ask himself what transformation must be used to connect measurable quantities in one frame of reference to those of the same quantities in another frame moving with respect to the first in such a way that the equations remained unchanged. The required transformation had indeed already been found by Lorentz. This explained not only the result of the Michelson-Morley experiment, but also led to many other results that have established the theory as an essential part of physics.

The essential point is that Einstein reached his new ideas by a contemplation of the way reality must be. As Polanyi says, he discovered rationality in nature. (PK 11) His theory was a construction of the mind that was found to account for reality. This is shown by his autobiography in which he recalls that he discovered relativity 'after ten years' reflection from a paradox upon which I had already hit at the age of sixteen: if I pursue a beam of light with the velocity c (velocity of light in a vacuum), I should observe such a beam of light as a spatially oscillatory

electromagnetic field at rest. However, there seems to be no such thing, whether on the basis of experience or according to Maxwell's equations. From the very beginning it appeared to me intuitively clear that, judged from the standpoint of such an observer, everything would have to happen according to the same laws as for an observer who, relative to the earth, was at rest'. (quoted in PK 10)

It will be noticed that there is no mention here of the Michelson-Morley experiment. As Polanyi says, 'its findings were rationally intuited by Einstein before he had ever heard about it. To make sure of this, I addressed an enquiry to the late Professor Einstein, who confirmed the fact that "the Michelson-Morley experiment had a negligible effect on the discovery of relativity".' (PK 10) 'The usual textbook account of relativity as a theoretical response to the Michelson-Morley experiment is an invention. It is the product of a philosophical prejudice. When Einstein discovered rationality in nature, unaided by any observation that had not been available for at least fifty years before, our positivist textbooks promptly covered up the scandal by an appropriately embellished account of his discovery.' (PK 11)

The example of Einstein's theory of relativity shows the primacy of rational thought in scientific discovery. The scientist first of all has an idea, a vision of reality, if you will, and he proceeds to test it by comparing it with experience. If it appears to be refuted by experience, he need not abandon his idea immediately, for the apparent exceptions may later fall into place for some reason not understood at the time. If however it contains a true account of reality, it will succeed not only where it was designed to succeed, but will bear fruit elsewhere. Thus the basis of Einstein's relativity theory is much wider than the Michelson-Morley experiment and has led to new conceptions such as the equivalence of mass and energy.

The alternative view, that science is simply the most economical description of the facts of experience, is refuted as soon as we examine what this implies in more detail. In the first place the scientist does not collect facts at random; he does so in a most careful and systematic manner, and his way of doing this is controlled by more or less developed theories. When he has his facts they are thus immediately confronted by a theory. If scientific research were just a matter of correlating facts, this can always be done in an infinite number of ways, and how is he to decide between them?

'There are an infinite number of mathematical formulae which will cover any series of numerical observations. Any additional future observations can still be accounted for by an infinite number of formulae. Moreover, no mathematical function connecting instrument readings can ever constitute a scientific theory. Future instrument readings cannot ever be predicted. But this is merely a symptom of a deeper inadequacy, namely that the explicit content of a theory fails to account for the guidance it affords to future discoveries. To hold a natural law to be true is to believe

that its presence will manifest itself in an indeterminate range of yet unknown and perhaps unthinkable consequences. It is to regard the law as a real feature of nature which, as such, exists beyond our control.' (Science, Faith and Society p.9)

It is one of the great merits of Polanyi's analysis of scientific research that he brings out the essential contribution of the personal judgement of the scientist. There is no such thing as 'the scientific method'; if there were, it could be carried out by a computer or a robot. It is an intensely personal activity that depends on judgement at every stage: what problem to study, what theory to use, how to carry out the experiment, how to make the measurements, how to interpret the results, what to do if there is a discrepancy between theory and experiment, when to stop the measurements, whether to publish the results, what to do next and so on.

According to Polanyi, scientific propositions do not refer definitely to any observable facts, but 'describe something real which may manifest itself in many indefinite ways'. (SFS 29) Thus 'there exist no explicit rules by which a scientific proposition can be obtained from observational data, and we must therefore accept also that no explicit rules can exist to decide whether to uphold or abandon any scientific proposition in face of any particular new observation. The part of observation is to supply clues for the apprehension of reality: that is the process underlying scientific discovery. The apprehension of reality thus gained forms in its turn a clue to future observations: that is the process underlying verification. In both processes there is involved an intuition of the relation between observation and reality: a faculty which can range over all grades of sagacity, from the highest level present in the inspired guesses of scientific genius down to the minimum required for ordinary perception. Verification, even though usually more subject to rules than discovery, rests ultimately on mental powers which go beyond the application of any definite rules.' (SFS 29)

'Such a conclusion may appear less strange if we consider the phases through which the propositions of science are usually brought into existence. In the course of any single experimental enquiry the mutual stimulus between intuition and observation goes on all the time and takes on the most varied forms. Most of the time is spent in fruitless efforts, sustained by a fascination which will take beating after beating for months on end, and produce ever new outbursts of hope, each as fresh as the last so bitterly crushed the week or month before. Vague shapes of the surmised truth suddenly take on the sharp outlines of certainty, only to dissolve again in the light of second thoughts or of further experimental observations. Yet from time to time, certain visions of the truth, having made their appearance, continue to gain strength both by further reflection and additional evidence. These are the claims which may be accepted as final by the investigator and for which he may assume public responsibility by communicating them in print. This is how scientific propositions normally come into

existence.' (SFS 30)

'The certainty of such propositions can differ therefore only in degree from that of previous preliminary results, many of which had appeared final at first and only later turned out to have been only preliminary. Which is not to say that we must always remain in doubt, but only that our decision what to accept as finally established cannot be wholly derived from any specific rules but must be taken in the light of our own personal judgement of the evidence.' (SFS 30)

'In choosing a problem the investigator takes a decision fraught with risks. The task may be insoluble or just too difficult. In that case his effort will be wasted and with it the effort of his collaborators, as well as the money spent on the whole project. But to play safe may be equally wasteful. Mediocre results are no adequate return for the employment of high gifts, and may not even repay the money spent on achieving them. So the choice of the problem must not only anticipate something that is hidden and yet not inaccessible, but also assess the investigator's own ability (and those of his collaborators) against the anticipated hardness of the task, and make a reasonable guess as to whether the hoped-for solution will be worth its price in terms of talent, labour and money. To form such estimates of the approximate feasibility of yet unknown prospective procedures, leading to unknown prospective results, is the day-to-day responsibility of anyone undertaking independent scientific or technical research. On such grounds as these he must even compare a number of different possible suggestions and select from them for attack the most promising problem. Yet I believe experience shows such a performance to be possible and that it can be relied upon to function with a considerable degree of reliability.' (PK124)

As an illustration of the subtlety of Polanyi's analysis of scientific research we will begin by examining his attitude to new discoveries. Scientists are continually checking each other's work, and it is this network of validations, in a large number of overlapping areas, that validates the truth of science as a whole. Now what does a scientist do if he finds a result which disagrees with what was previously found experimentally, or with the predictions of an established theory? The usual accounts of scientific research say that such differences are taken very seriously. In the case of disagreements between two sets of experiments, new experiments are made to resolve the discrepancy; in the case of disagreement with a theory, then the theory is rejected.

In fact none of this happens. Scientific research is beset with so many pitfalls that it very often happens that discrepant results are obtained. What is the scientist to do? If he were to take each such result seriously, he would not have time to do much else. So he uses his judgement, and in most cases rejects the discrepant result as due to some external and uninteresting cause.

Polanyi gives many examples of this from the history of science. He

recalls that Rutherford received a stream of reports of new results from all over the world; most of them he discarded, but a very few he seized upon and saw in them the germs of a new line of enquiry, and developed them with all the resources at his command.

As another example he recalls the work of Miller, a respected American physicist, who spent many years repeating the Michelson-Morley experiment and obtained results indicating a small but definite velocity of the earth relative to the ether. Although this work was done with extreme care, his results were simply ignored. The theory they threatened, Einstein's theory of relativity, seemed to be so securely based that a refutation was just not conceivable.

It may of course happen that the scientist is wrong to reject a discrepant observation. Here again Polanyi quotes a revealing example. The French astronomer Lalande, in the course of his extensive series of measurements of the positions of the stars, noticed that the co-ordinates he measured for a certain star on 8 and 10 May, 1795 were discrepant. So he crossed out one and marked the other as doubtful. After all, if one is measuring the co-ordinates of thousands of stars, it is expected that one makes the occasional mistake. And yet it was not a star that he observed but the planet Neptune, which was identified as such only in 1846. If Lalande had followed up that discrepant observation he would have discovered the planet himself. (PK 182)

How then does the scientist decide what to take seriously and what to ignore? To answer this question Polanyi developed his theory of 'tacit knowledge', summed up in the expression 'We know more than we can tell'. To illustrate this he quotes the familiar example of riding a bicycle. We all know how to do this, and yet we would be quite unable to write down a series of instructions so explicit that someone who had never ridden a bicycle would, after reading them, be able to ride immediately. Most people would be unable to describe how they keep their balance or how they turn a corner. It is quite a subtle and complicated affair that we soon relegate to our subconscious without ever articulating it in detail.

Another example given by Polanyi is the recognition of the face of a friend. (Tacit Dimension 4) We are quite unable to describe the face in sufficient detail to enable a third person to perform the act of recognition, and yet we are able to recognise the face ourselves without difficulty. Further examples are the ability to swim, which is similar to the skill of riding a bicycle, and the skills necessary for medical diagnosis. (PK 101)

Scientific research is thus a skill, which can be learnt only by attending carefully to the example set by someone who already has that skill. We watch what he does, follow his movements as far as we can, and at a certain point we 'catch on'. If we don't succeed in doing this, we never learn the skill, and the teacher can do nothing beyond repeating the lesson in the hope that it will catch on the second time. Polanyi remarks that many of the

great scientists were taught in their youth by other great scientists, as they in turn must have been able to convey to their students some of their more subtle skills. This account of learning stresses that it is not the technical transference of objectively specifiable information, but that there is a gap that must be bridged by the intelligent co-operation of the pupil. The reception of the message in its entirety depends on the receiver discovering for himself the components that cannot be communicated explicitly.

Polanyi draws attention to the role of the subconscious in the learning process. Experiments have been made that show that subconscious learning does indeed take place, and Polanyi suggests that this is a component of all learning. (TD 8) Most of us know what it is like to try to understand something for an extended period without success, and then suddenly finding that it becomes clear. This may happen when we are not actively thinking about the problem at all, the solution just comes to our mind. These experiences do suggest that subconscious processes are going on continually and are an essential part of the learning process.

It is characteristic of tacit knowing that we become aware of the general through the particulars, our attention being concentrated on the general and not on the particulars. Once we look directly at the particulars we lose the whole. As an example of this, we recognise a face through the individual features, but if we were to look at the features individually we would lose the whole face. Similarly, if we concentrate our attention on the individual letters in a paragraph, or on the individual notes of a piece of music, we again lose the whole.

The admission of the tacit component to our knowledge raises a serious problem for the philosophy of science. 'The declared aim of modern science is to establish a strictly detached objective knowledge.' (TD 20) But if tacit knowledge is always a component of scientific knowledge, then how can it be truly objective? Polanyi accepts this limitation to scientific knowledge, but it does seem possible to argue that although part of our knowledge is tacit, it becomes shared knowledge as it is assimilated by the whole body of scientists in a certain field. The knowledge is known to be shared by the unity of discourse among the scientists concerned. This is indeed a quite common experience of a scientist entering a new area, even if it is closely related to what he knows already. At first the papers he reads seem to be catalogues of partially related particulars. Then, as he thinks about it from the inside, it begins to cohere as a unified body of knowledge, and he understands why this scientist has studied this aspect and another one a different aspect, each with the aim of adding to the knowledge of the whole. This integration is a tacit process and yet the result can be properly termed the knowledge of an objective reality.

Another aspect of scientific research to which Polanyi draws attention is the changing criteria as to what constitutes acceptable science. As

an example of this he quotes the work of Kepler, who found that the orbits of the seven planets corresponded very well to the radii of the seven regular polyhedra one inside the other and just touching. He considered this to be a major discovery; we would dismiss it as a mere coincidence. (TD 64) Another, more bizarre, example is provided by a letter published in Nature recording that the average periods of gestation of a number of different animals ranging from rabbits to cows are integral multiples of π . The evidence was considerable and the agreement good, but no biologist would accept such a result. Our conception of the nature of things tells us such a relationship is absurd, and indeed it was only published as a joke. (TD 64)

These considerations draw attention to an important aspect of the scientist's work, namely deciding what is important and what is trivial. Polanyi proposes three criteria for the scientific interest of a contribution: its exactitude, its systematic importance and the intrinsic interest of the subject matter. These criteria cannot function apart from the consensus of the scientific community. (PK 135)

Polanyi rejected any specific set of rules for empirical induction. He mentions that some of these claim to show (a) how to proceed by a prescribed operation from clues to discovery or at least (b) to show how to verify, or at the very least (c) how to falsify, an empirical proposition according to some such rules. Claim (a) must be rejected in view of the demonstrable fact that discovery is separated by a logical gap from the grounds on which it is made. It is a travesty of the scientific method to conceive of it as an automatic process depending on the speed of piling up evidence for hypotheses chosen at random. The history of the great scientific controversies teaches us that claims (b) and (c) are equally unfounded. (PK 167)

'All formal rules of scientific procedure must prove ambiguous, for they will be interpreted quite differently, according to the particular conceptions about the nature of things by which the scientist is guided. And his chances for reaching true and important conclusions will depend decisively on the correctness and penetration of these conceptions. There is a type of empirical discovery that is achieved without any process of induction. De Broglie's wave theory, the Copernican system and the theory of Relativity, were all found by pure speculation guided by criteria of internal rationality. The triumph of the Michelson-Morley experiment, despite its giving the 'wrong' result, the tragic sacrifice of D.C. Miller's professional life to the pursuit of purely empirical tests of a great theoretical vision, are sardonic comment on the supposed supremacy of experiment over theory. Admittedly, other controversies, like those of fermentation, hypnotism and extra-sensory perception, seem to centre altogether on questions of factual evidence. But looking at these disputes more closely, it appears that the two sides do not accept the same 'facts' as facts, and still less the same 'evidence' as evidence. These terms are ambiguous precisely to the

extent to which the two opposing opinions differ. For within two conceptual frameworks the same range of experience takes the shape of different facts and different evidence.' (PK 167)

The common conception of the scientist is of one coldly detached, recording dispassionately the results of his observations. This is far from the reality. Polanyi draws attention to what he calls the intellectual passion of science: 'Passions charge objects with emotions, making them repulsive or attractive; positive passions affirm that something is precious. The excitement of the scientist making a discovery is an intellectual passion, telling him that something is intellectually precious and, more particularly, that it is precious to science.' (PK 134)

'The function which I attribute here to scientific passion is that of distinguishing between demonstrable facts which are of scientific interest, and those which are not. Only a tiny fraction of all knowable facts are of interest to scientists, and scientific passion serves also as a guide in the assessment of what is of higher and what is of lesser interest; of what is great in science, and what is relatively slight. I want to show that this appreciation depends ultimately on a sort of intellectual beauty; that it is an emotional response which can never be dispassionately defined, any more than we can dispassionately define the beauty of a work of art or the excellence of noble action.' (PK 135)

'Scientific discovery reveals new knowledge, but the new vision which accompanies it is not knowledge. It is less than knowledge, for it is a guess; but it is more than knowledge, for it is a foreknowledge of things yet unknown and at present perhaps inconceivable. Our vision of the general nature of things is our guide for the interpretation of all future experience. Such guidance is indispensable. Theories of the scientific method which try to explain the establishment of scientific truth by any purely objective formal procedure are doomed to failure. Any process of enquiry unguided by intellectual passions would inevitably spread out into a desert of trivialities. Our vision of reality, to which our sense of scientific beauty responds, must suggest to us the kind of questions that it should be reasonable and interesting to explore. It should recommend the kind of conceptions and empirical relations that are intrinsically plausible and which should be therefore upheld, even when some evidence seems to contradict them, and tell us also, on the other hand, what empirical connections to reject as spurious, even though there is evidence for them - evidence that we may as yet be unable to account for on any other assumptions. In fact, without a scale of interest and plausibility based on a vision of reality, nothing can be discovered that is value to science; and only our grasp of scientific beauty, responding to the evidence of our senses, can evoke the vision.' (PK 135)

One of the central problems in the philosophy of science is how to reconcile the working scientist's sense that in the course of his work he is discover-

ing certain truths about an objectively-existing world, and the philosophical arguments that can be urged against that conviction, supported by examples from the history of science.

Thus it can be argued that the activity of the scientist consists essentially in ordering his observations and measurements into the most convenient and coherent pattern. When new results become available he either fits them into the existing pattern or, if this is not possible, he rearranges the pattern. In periods of revolutionary change it may be necessary to change the whole pattern, as for example occurred when Einstein's relativistic dynamics replaced the mechanics of Newton. In what sense, therefore, can we say that Newton's Laws are 'true'? And if we say that they are not true, then how can we say that anything in science is anything but provisional and subject to replacement by a more comprehensive theory?

In answer to this one can say that it is oversimplified to say that a theory is 'true' or 'false'. There are degrees of truth, and it is quite possible for a theory or a concept to be a useful approximation to the truth; it is neither wholly true nor wholly false. Thus we can say that Newton's Laws describe very well the behaviour of particles moving at velocities much less than the velocity of light, and this remains true. Einstein's theory of relativity shows us how to treat motions at much higher velocities, and his equations reduce to those of Newton in the limit of low velocities. It could be argued that nevertheless the Newtonian and Einsteinian concepts of space and time are quite different, so that there is a decisive break between the two theories at a very fundamental level. Once again it can be replied that this distinction is too sharp, and that there is an analogical relation between the two sets of relationships.

But can we be sure that advances in science will always be of this type? Is it not conceivable that new observations may require a conceptual reformulation so radical that there will be no such links between new and old? This does not seem to be possible, if only because whatever new observations are made on matter under new extreme conditions, the old observations still remain. It is always necessary that the new theory accounts for both the old and the new observations, and this necessarily implies an analogical relation between the two theories.

The problem can usefully be approached from a quite different direction. Einstein himself often expressed his ideas in quasi-theological terms. Thus when discussing Heisenberg's Uncertainty principle he remarked that 'I like to think of the electron as Gott sees it'. God sees the world as it really is, in its innermost essence, and He knows the laws that it obeys. The laws devised by physicists are thus inevitably approximations, both mathematically and conceptually, to the reality as known by God.

It does not follow from this that the development of science must inevitably follow the same road. If one imagines a completely different scientific development on another planet, it will not be the same as the

development that has taken place here on earth. In what ways would it be different? Obviously in numerous superficial ways, such as the choice of units and notation. If the physical conditions on the other planet are very different from those on earth the phenomena that first attracted systematic investigation might be quite different from those first studied here. Yet as science develops, as concepts of greater generality are formulated, it is inevitable that the different scientific developments will approach one another as they approach more closely the truth as seen by God.

REFERENCES

- M. Polanyi: Personal Knowledge (Routledge and Kegan Paul, 1958)
M. Polanyi: The Tacit Dimension (Routledge and Kegan Paul, 1967)
M. Polanyi: Science, Faith and Society (University of Chicago Press, 1964)
S.L. Jaki: The Road of Science and the Ways to God (University of Chicago Press, 1978)

Peter Hodgson

PERSONAL KNOWLEDGE AND SEX EDUCATION

"A society which wishes to preserve a fund of personal knowledge must submit to tradition."

Anyone who is familiar with Polanyi's ideas about the place of tradition and authority in learning, knows that he does not speak of tradition as the opposite of progress or as the preservation of the status quo. On the contrary, he shows how the tradition and authority of the scientific community makes possible genuine originality and progress in science. Without this tradition and authority, so much bogus science would flourish that the scientific journals would be clogged with it, and genuine originality would get no hearing, as happens in countries where there is no established community of science.

The judgments of authority can be mistaken on occasions, and a valuable new insight may be suppressed for a time, but its general rightness is enough, and without it there could be no progress. "Science is constantly revolutionised and perfected by its pioneers, while remaining rooted in its traditions."

With this understanding of the necessity of tradition goes Polanyi's emphasis on apprenticeship as the only way of learning arts and skills which cannot be fully specified in a text book. This, Polanyi says, is as true in science as in the sphere of crafts and personal skills.

It is by indwelling a tradition, imitating a skilled person in whom the learner has confidence, that these skills are learned. Polanyi gives

the example of a child learning to speak--"All arts are learned by intelligently imitating the way they are practiced by other persons in whom the learner places his confidence." Just as children learn to speak by assuming that the words used in their presence mean something, so throughout the whole range of cultural apprenticeship the intellectual junior's craving to understand the doings and sayings of his intellectual superiors assumes that what they are doing and saying has a hidden meaning, which when discovered will be found satisfying."

I believe that the arts of mothering, parenting, bringing up a child, are most surely among those arts to which Polanyi's insight applies. He says that the principles of an art can be better understood from its practice than from its maxims; and this is true of the art of mothering. More can be learned about good mothering from watching and working with a good mother--as more can be learned about golf from playing with a good golfer--than from the instruction manuals on mothering or golf.

Polanyi makes another interesting point about this kind of learning: that the pupil can learn from the skilled person things which even the skilled person is unaware of knowing, having never tried to analyse or express the principles of the skill.

In applying this to sex education. I am defining sex education in the broadest sense, as the learning by the child of the whole human meaning of sex; learning what it is to be a sexual being in the human mode. This would include learning how a family is created and sustained, what is the human value and meaning of a family, what part each sex plays in it, and what constraints on unhumanised behaviour are necessary for the meaning of the family to be realised. Polanyi's idea of logical levels indicates how the discovery of higher level meaning in a spread of lower level particulars demands that we cut out the irrelevancies on the lower level. Thus in transmitting a message it is necessary to cut out the noise, so that the message can be read; and if you want to join an orchestra and play classical music, you have to understand the value of silence, and resist the temptation to make any sound you feel like making on your instrument, in the interests of the more meaningful sounds that the orchestra is to make.

I am mustering these Polanyian ideas because I want to show how a widespread modern view of sex education goes entirely counter to them. Among those who are concerned with the subject, there has been much argument about what sort of sex education, if any, should be given to children in school. Over the last twenty years there have been great changes, as a powerful network of organisations influenced by the International Planned Parenthood Federation has largely taken control and imposed its aims and methods on the subject. The teaching practised and promoted by this network is essentially 'factual' and 'value free', and based on a philosophy which its critics find deeply disturbing. The critics trace this philosophy, with its elements of population control and eugenics, back to such thinkers as Malthus, Darwin

and Galton; they also cite the views of Dr Brock Chisholm, first President of the World Health Organisation, who seems to have had a fanatical determination to eradicate all notions of right and wrong, and to liberate children from national, cultural and parental influences. Accepting that these ideas have affected the movement, I find it interesting to look back beyond the theories of the particular thinkers who are quoted, to the essentially Cartesian thinking which produced them, and which in sex education and birth control policies is still exerting its sinister influence on the young.

In this brand of sex education the emphasis is on facts: the facts of the reproductive system and of contraceptive practice. The philosophy behind it is that if children are given enough facts they will be able to make wise decisions. There is hardly any mention of family, children (except as disasters to be avoided), parents (except as hindrances to freedom, full of outdated notions), laws (except for the need to get rid of obsolete or archaic sex laws). There are traces in its literature of what Polanyi calls 'moral inversion', which put very simply means that if you believe only in what is clear, explicit and provable, then morality, love, loyalty and all such intangibles are not real, and anyone who professes to be acting from such motives is a hypocrite. For instance, in a Brook Clinics' booklet, it is suggested that parents who object to their daughter being on the Pill without their knowledge should examine their own motives. Are they not unconsciously jealous of their child's enjoyment of her sexuality? Facts are supposed to be 'value free' and these sex educators are insistent there must be no moralising or 'preaching' and that there are no moral implications in teenage sexual relations except that pleasure should be shared and children should not be born. But again, one can trace what Polanyi described as moral scepticism fired by moral passion: for while maintaining their amoral factual approach these sex education enthusiasts can fulminate in moral denunciation of their opponents.

As one would expect, the explicit and factual approach goes with a belief in experts and a suspicion of parents, and of the family, traditional, 'indwelling' approach. I had once some correspondence with a teacher of sex education in a large school. When I suggested to him that surely, in this subject of all others, parents should be involved, he replied that he agreed in principle but in practice he found parents far too ignorant to be of any use and he even knew some parents who did not know the difference between vulva and vagina! I replied that in my opinion, it did not matter whether they knew these words or not.

Of course I am not saying that facts do not need to be given, but how they are given is all important. In a family, a child's questions can be answered when they are asked, unemphatically and in a language he understands, by a parent who is likely to know what sort of answer he is seeking (the desired answer to "Where did I come from" might just be "Birmingham") and how much he really wants to know. One mother was asked one morning "Why

are we born, why do we die, why was the world made, what was there before there was a world?" While she was drawing a deep breath and mustering her thoughts, the child said "What's for dinner?" This was the only answer he really wanted at that moment. What is objectionable about the factual sex education given in school is that it is given to large classes and sometimes with brutal frankness. It cannot be suited to the mental and emotional development of all the children, and it has no context, either in the child's mind or in a subject. In a fairly advanced biology lesson, the correct naming of parts of the body would be a necessary ingredient but it would cover all the parts; the sexual part would not be isolated and focussed on, as it is in sex education. In some material, it is hard to know what level the information given is intended; the illustrations are neither diagrammatic nor realistic. A booklet for young children called "How we Grow Up" contains some illustrations which are very strange, when you think of seeing them through child's eyes. They represent a male and a female body, flesh coloured, but blank except for internal sex organs in diagram form apparently on the outside of the bodies, no faces, but red brains with an indication of the position of the pituitary gland! But these are innocuous booklets, which cannot be said of some. A book sponsored and approved originally by a well known birth control organisation (although later repudiated when it drew a lot of criticism) is called "Make it Happy," and describes every kind of sexual activity including incest and bestiality, with no moral distinctions made, only a remark now and then to say that one or other is illegal. It does not mention families (except under Family Planning Association), nor marriage (except as an option not open to a girl under sixteen who finds herself pregnant), nor parents, nor children (except a Children's Rights Workshop). Yet it is recommended on the back cover by Dr Peter Jackson, (National Council of the Family Planning Association) as "A book that should be in every teenager's library." What a sad introduction to life! This book encourages focussing on the body, on particular parts, and gives no ghost of encouragement to any search for meaning. In contrast, Polanyi speaks about how we dwell in our bodies--"Our body is the only aggregate of things of which we are aware almost exclusively in such a subsidiary manner"--that is, simply as our means of being aware of the outside world. "To be aware of our bodies in terms of the things we know and do is to feel alive." When I think of this, I feel sorry for the teenagers who are to lose that "feeling alive" in the things they know and do, because they are made to focus on the fragmented parts of experience.

When thinking of these two opposed approaches to sex education--the indwelling approach and the explicit, individual, anti-traditional approach --I was interested to reread what the anthropologist Margaret Mead says about family and tradition in her book "Male and Female." She writes about the very early human invention of the nurturing role of men. With a few limited exceptions, she says, "every known human society rests firmly on the

learned nurturing behaviour of men." This can be destroyed, but women's nurturing behaviour is more deeply physically inbuilt and can with difficulty be eradicated. The primary unit is mother and child, the biologically given. Mead continues: "...at the base of those traditional forms through which we have preserved our learned humanity is the family--some form of the family, within which men permanently nurture and care for women and children. When the family breaks down, as it does under slavery...in periods of extreme social unrest or abrupt transition...the delicate line of transmission is broken...and the special conditions under which man has held his social traditions in trust are violated and distorted....So far, no break in the family tradition has been prolonged enough to eradicate man's memories of how valuable it was... The abortive attempts in history to build societies in which homo sapiens would function, not as the human beings we have known but as a creature who could more profitably be compared to an ant or a bee...stand as new types of warning that we hold our present form of humanity on trust; that it is possible to lose it." Margaret Mead gives as one example of the "delicate line of transmission" being broken, the time in Nazi Germany when illegitimacy was rewarded with special sunny nursing homes for mother and child--"the State taking over completely the male nurturing role." This may not be so far off what we are now doing, with sex education making no difference between normal families and what are called "one parent families," and the authorities endorsing this by special provision of flats for the single teenager and her child.

Michael Polanyi and Margaret Mead, both believers in tradition and indwelling as the way of handing on the learning of personal skill, both saw tradition as the true way of progress. Only by indwelling our traditions, Polanyi believed, so as to discover their deep meaning, can we give new form to the expression of that meaning in new circumstances. And Margaret Mead saw the long tradition of the human family leading forward towards what we have never yet fully achieved--a family structure and way of living that should use fully the best gifts of each sex, working in harmony together.

It is clear that many families are not at present capable of giving the kind of nurture and support that can enable children to grow in the tradition and pioneer from it. Rather than abandon the education of indwelling, which alone can give what the children need, we should employ more social inventiveness to support and revitalise families so that they can give this nurture. Some hopeful experiments have been made in this enterprise. Gerald Heard has written about this, that the parents, and specifically the mother should clearly be the ones to fulfil this nurturing role. But it is also clear that such educators cannot be so raised and so kept in the right teaching state, unless the community can give them the backing they need by its common knowledge, faith, and high social practice to their full capacity. For, it must be said again, what the parents have to supply to the child is not information or instruction, but a climate of

dynamic security, faith in the deepest sense of the word, a triumphant banishment of fear through the conviction that all experience is simply an opportunity for creative response."

Such nurturing is indispensable. The tradition in which the child is nurtured will never be perfect: no tradition is, but what we need to work for is a society in which all children have a nurture from which they can grow while remaining rooted. The factual, value free instruction which sees having a baby as the worst thing that can happen to a single girl, and directs all its thought against that, is blind to the more terrible but less tangible results of early promiscuity. A baby of course is a fact, a visible tangible and very audible fact, while misery, heartache, despair and family breakdown, however real, are not so concrete and countable. It is not surprising that the factual approach does not even succeed in reducing the numbers of illegitimate children, which rise inexorably, while more and more means of preventing them are handed out to the teenagers, and the responsibilities of the family more and more taken away.

Drusilla Scott

MICHAEL POLANYI'S HUMOUR

Jere Moorman has had his fun with Polanyi's ideas; now I think it might be fun to let Michael Polanyi himself have a go. So here is my selection of Polanyi jokes; all to be found in the pages of Personal Knowledge.

1. (About the theory of Natural Selection) "As a solution for our problem it is logically on a par with the method of catching a lion by catching two and letting one escape."
2. (On the limitations of the inductive method) "Our expectation of life does not increase with the number of days we have survived. On the contrary, the experience of living through the next 24 hours is much less likely to recur after it has happened 30,000 consecutive times than after only 1,000 times. Attempts to train a horse to do without food will break down precisely after the longest series of successes; and the certainty of amusing an audience by one's favourite joke does not increase indefinitely with the number of its successful repetitions."
3. (Probability statements can never be strictly contradicted by experience) "There is a story of a dog owner who prided himself on the perfect training of his pet. Whenever he called "Here! Will you come or not!," the dog invariably either came or not."
4. (Copernicus and Newton were convinced of the truth of their theories before the fruits of the theories could be observed) "The attempt to replace the quality of truth in which they believed, by the observation of the

fruitfulness which this belief anticipated, is like the Bellman's advice for spotting a Snark by its habit of dining the following day."

5. "Take hammering. This performance implies the conception of a hammer, which defines a class of objects that are (actual or potential) hammers. It will include, apart from the usual tools of this kind, rifle butts, shoe heels and fat dictionaries, and establish at the same time a grading of these tools according to suitability. The suitability of an object to serve as a hammer is an observable property, but it can be observed only within the framework defined by the purpose it is supposed to serve."

6. "To apply the utmost ingenuity and the most rigorous care to prove the theorems of logic or mathematics, while the premises of these inferences are cheerfully accepted without any grounds...might seem altogether absurd. It reminds one of the clown who solemnly sets up in the middle of the arena two gateposts with a securely locked gate between them, pulls out a large bunch of keys, and laboriously selects one which opens the lock, then passes through the gate and carefully locks it after himself--while all the while the whole arena lies open on either side of the gatepost."

7. "The application of crystallographic theory to experience is open to the hazards of empirical refutation only in the same sense as a marching song played by the band at the head of a marching column. If it is not found apposite it will not be popular."

Will anyone contribute some more Personal Jokes?

Drusilla Scott

FROM SKILLS TO THOUGHT

A consideration of "Fodor's First Law of the
Non-existence of Cognitive Science"

In his dense and jocular book The Modularity of Mind (MIT 1983) Jerry Fodor has two main messages, both of which are of interest to anyone reflecting on the mind being 'the meaning of the body' (Polanyi, Rothschild, Knowing and Being, p.222). One is that the cerebral component of a complex skill develops and functions in neural isolation from other skill systems; the second is about how these modular systems cooperate through some superordinate system and it is here that he expresses doubts about the possibility of cognitive science.

Fodor first argues that recent studies in artificial intelligence, neuropsychology etc. have rehabilitated many of the claims of the old faculty psychology propounded by Franz Joseph Gall (but not the phoney phrenology which followed, and gave it a bad name). The argument is that organisms can

only evolve and use complex information-holding and information-processing systems (e.g. those for speaking or for face recognition or for swinging from trees) if such systems are largely modular and encapsulated from each other. The sensory input, the way this is processed and, to some extent, the output of any one system must be free from interference from parallel systems. (I became interested in this when studying the main types of human competence which underly all educational processes--see Playing and Exploring, 1985 and also Howard Gardners, Frames of Mind, 1984).

Crucial questions arise when one begins to consider how such modules of brain organisation, largely encapsulated from each other, might be coordinated without positing some little mental homunculus or ghost in the machine to do it. These are problems which would have intrigued Michael Polanyi, and some neuro-psychologically inquisitive readers of Convivium may wish to ponder them. When I first read Fodor, I thought he was going to take the leap and eliminate the ghost in the machine altogether. That is what his 'first law of the non-existence of cognitive science' seemed to imply. What I expected was something like a 'from the parts to the whole' argument. It would have been on the lines of my favourite chamber music analogy: of a group of musicians, small enough to do without a conductor--a quintet, for example. This would be a good model for five 'encapsulated' competence systems. When the musicians play together the signalling between them is at a minimum. What, then, coordinates them? First, much shared experience, leading to similar tacit knowledge. Second, a shared score: either on the music stands or remembered. Each player reads the score in different but harmonious ways, each having a particular line to follow. Third, though the players do not prompt each other or signal much about what is to come, they do listen attentively to each other's immediate output. And fourth, they share an intention, of making a particular musical achievement together. Somewhere between the third and fourth there runs a focus of joint attention and action. This is their shared focal awareness. This offers a Polanyi-type account of what might have been happening in a quintet or, analogously, when three or four or five modular human capacities are synergistically operating--each affecting each--without the intervention of a ghostly conductor. This is the path which Fodor didn't take and he would almost certainly claim that the evidence is against it.

He retreats from a radical subversion of orthodox cognitive science when he slips the ghost back into the picture: partly by using the words 'central processing' and 'machine'. He writes:

A lot is known about the transformations of representations which serve to get information into a form appropriate for central processing; practically nothing is known about what happens after the information gets there. The ghost has been chased further back into the machine but it has not been exorcised. (p.129)

It is not only such mechanistic assumptions which hold Fodor back.

He is also, quite rightly, searching for ways to describe what kind of process goes on in the massive 'association cortex' of the human forebrain. What he describes sounds at first like total chaos and might be totally chaotic, if it were not for the highly ordered modular systems which are ready to work through it. How, he wonders, are we to understand lack of organisation at the centre?

Then there are the rest of the higher brain systems (cf. what used to be called 'association cortex'), in which neural connectivity appears to go every which way and the form/function correspondence appears to be minimal. There is some historical irony in all this. Gall argued from a (vertical) faculty psychology to the macroscopic differentiation of the brain. Fluorens, his archantagonist, argued from the unity of the Cartesian ego to the brain's equipotentiality. The present suggestion is that both were right. (p.118)

The key word here is 'connectivity'. What Fodor is saying is that if the main associative parts of the cortex are to maximise connectivity then 'stable neural architecture'--patterns with clear form/function qualities--will not be conspicuous.

If you were a stranger from the planet Uranus, looking at a British road map and trying to understand it, you would often be right to ask, 'where's that line leading from? going to? why in that direction?' There are form/function questions about road travel. But here and there you would come to patches of the map where connectivity rather than 'function' ruled--Spaghetti Junction for example. These, or railway marshalling yards, are analogs of connectivity systems but in extremely primitive form. Fodor is trying to think of large areas of the forebrain in which connectivity predominates over 'hard wired' function. These will involve many millions of nerve cells and thousands of millions of switchable lines. I find that difficult to imagine. But it is at least clear to me that Spaghetti Junction is a slightly better model than, say Clapham Junction. The first works without a controller, provided that the subsystems (cars + drivers) obey the rules; the railway junction analogy, on the other hand, implies a little man, or his ghost, tucked away in a signal box.

A final thought about the competent musical group with no conductor: perhaps it is a useful model. In a quintet there are only relatively short periods of peak performance when five players work in harmony with no chat and few signals. Then the great work goes forward from the individuals towards the integrated achievement. But could this happen without long periods of relaxed, less integrated effort beforehand? Are there not considerable times in the life of a quintet when chat and feedback, mutual criticism and analysis of subsidiaries are important? Perhaps all rehearsals and all plan-making sessions are examples of that half-hidden phase in the build-up to some achievement when connectivity between the participants is more urgent than getting there.

R. Hodgkin

MICHAEL POLANYI F.R.S.

For Dictionary of National Biography 1971-81 Supplement

Michael Polanyi was born in Budapest on March 11, 1891, the fifth in a family of six. His father, then Mihaly Pollacsek, was a railway entrepreneur of Jewish extraction. His mother, Scile (nee Wohl), was at the centre of a lively intellectual circle in Budapest. Michael was educated at the Minta Gymnasium and at the University of Budapest where he qualified in medicine. He also studied physical chemistry under Professor Bredig at the Karlsruhe Technical High School.

Polanyi's early studies on the third law of thermodynamics led to a stimulating contact with Einstein. He served for a period as a medical officer in the Austro-Hungarian army and then returned to Karlsruhe where he met his future wife, Magda Kemeny, also a chemist. In 1920 he moved to the Kaiser Wilhelm Institute of Fibre Chemistry in Berlin. Here he met many inspiring colleagues and developed the technique of using X-ray analysis for studying fibrous and metallic structures. Here too he wrote more than half of his many papers on this and other topics--topics which were to continue to engross him for twenty years. They concerned, particularly, the rates of chemical reactions--the precise study of gasses meeting each other in a tube for example--and, second, some highly original studies of the adsorption of gas molecules onto solids. His professorial title, received in 1926, and his life membership of the Max Planck Institute were the result of his work on reaction kinetics and his stimulating influence on many collaborators. Notable among these were H. Eyring, H. Mark and E.P. Wigner.

Even before Hitler came to power, Polanyi, Schrödinger and others in the Institute began to organise resistance to the pressures which were being put on Jewish scholars: the danger signals were becoming clear. In 1933 Polanyi accepted the Chair of Physical Chemistry at Manchester University.

The Polanyis had two sons, George (b. 1922) who became an economist and John (F.R.S. b. 1929) who also became a physical chemist. Michael's own researches continued in the new setting. Perhaps the major methodological and conceptual innovations to come out of his laboratory were, first, the exact method of investigating the properties of gaseous diffusion and, second, the development of transition state theory of chemical reactions generally. These continue to be valuable elements in research and discussion half a century later.

During the nineteen thirties Polanyi's attention turned to a quite different theme--the growing threat to science and to all human culture from totalitarianism. Unlike most intellectuals at that time he understood the danger from the left as well as from the right. He and a few others, such as J.R. Baker, challenged J.D. Bernal and J.B.S. Haldane for their advocacy of centrally planned science. Polanyi's first philosophical-political book, The Contempt of Freedom, appeared in 1940. He was elected F.R.S. in 1944

but his interest was beginning to settle, beyond scientific research, on wider cultural and philosophical issues.

Polanyi, like his near contemporaries, F.A. Hayek and Karl Popper, was trying to understand the relationship between freedom and orderliness, not only in the depths of nature but in the dynamic processes of human action and knowledge. In 1948 he gave up his Chair of Chemistry and accepted a personal Chair at Manchester in what was termed 'Social Studies.' But it was the vision of a new kind of philosophy, one that would relate science harmoniously to other modes of human knowing which drew him on. In 1951 Polanyi published The Logic of Liberty which, with the Gifford Lectures (1951, 52), were forerunners of his great work on these themes, Personal Knowledge (1958).

The subtitle of Personal Knowledge was Towards a post-critical philosophy. Though Polanyi made full use of critical, empirical and analytical methods, he never gave them priority. He knew that the roots of science lay deeper and he claimed that the commitment of an explorer, or of a group of explorers, to the discovery of hidden order in the universe and of faith in that order were prior requirements for all acts of discovery. Empirical search and critical analysis follow. This reversal was the linchpin of his thought. It grew out of what he would have called his own 'tacit knowledge' for he knew it in his bones, from having done thirty years of successful, cooperative scientific research. He saw it supremely illustrated not only by Einstein's theories of relativity but also by the way in which these had been discovered. Yet when Polanyi came to set all these insights down in black and white many people did not like it. He was challenging the conventional wisdom: that scientists are cool and detached and that their judgments are value free. Polanyi's further writings, The Tacit Dimension (1961) and Knowing and Being (1969), consolidated and further developed the new approach. Many of his insights were taken up by others: by T.H. Kuhn, for example, in the philosophy of science and by T.F. Torrance in theology.

In 1958 Polanyi moved to Merton College, Oxford, as Senior Research Fellow. During the fifteen years that followed he travelled widely and published papers on philosophical, political and aesthetic subjects. In a somewhat wry epigram, which suggests something of his humility his deep commitment and openness to truth, he states his purpose: 'to achieve a frame of mind in which I firmly hold what I believe to be true, even though I know it might conceivably be false' (1958). He died in February, 1976.

R. Hodgkin

BOOK REVIEW

Harold P. Nebelsick, Circles of God: Theology and Science from the Greeks to Copernicus. (Theology and Science at the Frontiers of Knowledge) (Edinburgh: Scottish Academic Press, 1985) ISBN 0 7073 0448 2. xxviii + 284. Index. 16.00

A Theology don once confided that he felt excluded from the entire Aristotelian/Thomist/neo-Thomist world of thought simply because he could not see why a circle was meant to be better than a square. For those who share this disability, and for those who do not, Nebelsick's latest book will make fascinating reading. It is a story told on two levels, tracing the influence of the notions of harmony and circularity--the 'circles of God'--on our understanding of the universe while at the same time noting the continual interplay, sometimes beneficial, sometimes deleterious, between theology and science.

To the casual observer the sun, moon and stars seem of course to revolve around the motionless earth in a perfectly circular movement. More careful inspection, however, reveals that the same body may vary from time to time in size and brightness. As such variations can only be explained by their changing distance from the earth, their orbits cannot be perfect circles. It is the attempts by man over two millennia to reconcile the results of observation with the a priori demands of a theological aesthetic which Nebelsick charts and does so--as Professor Torrance remarks in his introduction--with the determination of a detective.

The concerns of the Pythagoreans were religious before they were scientific, and mathematical before they were religious. The distances between the heavenly bodies were decided on the basis of the progressions found in geometry: the planets themselves and the intervals between them were presumed to hum in accordance with tonal progression in music. These 'mysteries' were the carefully guarded secrets of the Pythagorean priesthood. Two centuries later, Plato's Timaeus pictured the universe as consisting of the flat disc of the earth surrounded by a concentric nest of immense, transparent hat boxes on which were fixed the planets. By the time of Eudoxus of Cnidos, the celestial system had become a series of concentric spheres around the earth. To account for the orbits' 'apparent' uncircularity, Eudoxus assigned not one but several such spheres to each planet. Aristotle increased the total number of spheres to 55, although his proposal was based less on observation than on the necessity of stellar movers becoming increasingly moved according to their proximity to the earth. A new direction was taken by Aristarchus of Samos who put the sun at the centre of the universe. This of course remained a minority view.

The definitive work of classical astronomy, unrivalled until Coperni-

cus' De revolutionibus, was that of Ptolemy, who combined the Pythagorean belief in the universal relevance of mathematics with the Aristotelian belief in celestial circularity and terrestrial linearity. He accounted for the apparently irregular, elliptical motion of the planets by placing them on the circumferences of smaller circles centred on larger circles centred on the earth.

The reaction of Christian theologians to the science of antiquity--a science which in turn owed much to Greek pagan theology for its development --was largely positive. Clement of Alexandria, Basil of Caesarea and other major fathers embraced it and, via mythicisation at the hands of Pseudo-Dionysius the Areopagite, it found a firm place in the writings of the great scholastics and even in Dante's poetry. Even so blatantly magical a group of beliefs as Hermeticism could achieve respectability and considerable popularity in orthodox Christian circles during the Renaissance. The 'ancient theology' (so-called because it was deemed to be older than Plato) combined Neopythagorean number mysticism and Neoplatonic world harmony with the divine gnosis of Egyptian magic. It promoted the idea of a fixed world surrounded by concentric circles of ever greater perfection, representing the hierarchical chain of being. It inspired Nicholas of Cusa's geometrical theology and, more importantly, Nicholas Copernicus' heliocentric cosmos.

It is in his treatment of the Copernican revolution that Nebelsick himself is at his most revolutionary: Copernicus, he argues, was no lonely, reluctant rebel fearful of the church's censure, no hero of modern science, but a tireless publicist of his own ideas who attracted the support of Roman Catholic and Protestant alike and who was probably influenced by Hermetic heliocentrism during his time at the university of Bologna. 'Whether or not Copernicus, like the ancient Pythagoreans, turned his thoughts to the heavens because their beauty and order were reflective of divinity, he certainly saw beauty and order there and attempted to fashion a system which would do these qualities justice.' (218) In Nebelsick's opinion, Copernicus broke no genuinely new ground because his system still retained, with some slight adjustments, the divinely-given circles. It was only when Kepler, on the basis of observation, squashed the circles into ellipses that physics could finally break free of its metaphysical pre-conditions.

Circles of God relates the well-known story of how the development of modern science suffered at the hands of an Aristotelian-inspired theology and its dogged proponents. But it also shows that science could not have developed at all without the impetus of theology. Nebelsick argues that theology and science are at their best in a complementary and mutually corrective 'dialogue': this is, he assures us, not the same as the medieval 'synthesis', which was in fact no synthesis but a bundle of contradictions held together by the dominance of one discipline over another.

The central thesis of the book is the principle pioneered by Torrance, that nature has its own rationality imparted by the God on whom it is

contingent; alien, preceived patterns need not, and should not be, imposed upon it. The difficulty this thesis encounters is that nature's 'divine' rationality may be no more than a human pre-conception. It may be that the beauty, symmetry and rightness of the new physics are the modern, transitory equivalents of celestial circularity. Perhaps there is no final solution to this problem. Nebelsick himself rejects the opinion of Andreas Osiander (the Lutheran minister, mystic, patron of science and in-law of Thomas Cranmer) who believed in the value of hypotheses which accounted for the evidence, even if they eventually turned out to be untrue. A continual process of self and mutual correction may well prevent us, as Osiander put it, from looking fools to later generations, and lead us nearer the truth, where all disciplines meet.

David Bagchi

FROM TRADITION AND DISCOVERY

POLANYI IN NOVELS

(A Prefatory Note)

One of the benefits of being a general coordinator for the Polanyi Society is seeing the growth and vitality of Polanyi's influence. This summer in Chicago, we had an experience of "indwelling" the thought of Polanyi in papers by philosophers, theologians, a writing and literature teacher, and a multidisciplinary business man. The topics of papers covered computers, ethics, pedagogy, mysticism, humour, and theology. Four members of the seminar are or have been chairs of their academic departments and one is a Dean of a school. The afternoon periods devoted to research in the Polanyi archives opened up new perspectives on the meaning and development of Polanyi's thought. Ten years earlier this exploratory experience would not have been possible to this extent. The University of Chicago archives were just starting to organize the Polanyi materials. The burgeoning of articles and dissertations on Polanyi was just appearing. By the summer of 1985, we find ourselves rich with quality scholarship and publications to the extent that we now need complex organization to keep up with the pace of Polyanian scholarship. Almost daily in a university context, one can encounter allusions in references or in concepts to Polanyi's thought. Yesterday a colleague specializing in teaching writing told me about the use of Polanyi's concept of tacit knowing in helping students overcome the mistaken belief that you know it all explicitly before you write it on paper. A few days earlier another colleague in semiotics showed me the acknowledgments to Polanyi in her textbook. Most telling about the spread of Polanyi's thought

is its inclusion in a popular American detective novel, Happy are the Meek. The author, Andrew Greeley, says describing the work of the leading character, detective Father Blackie Ryan:

Then, for no reason connected particularly to the conversation, the formless image of the evidence I need leaped into full consciousness --perfectly delineated. As Michael Polanyi observes, every intellectual breakthrough requires faith, works, and grace. Faith that there is a solution, hard intellectual work to search for it, and then a moment of blinding illumination. (p.147)

Nobel laureate Saul Bellow also had his hero in Herzog allude to Polanyi in one of Herzog's professorial problem solving letters. Polanyi has become a part of our major intellectual heritage.

Richard Gelwick

AGASSI ON POLANYI: COMMENTS ON JOSEPH AGASSI'S
SCIENCE AND SOCIETY

I

One element of Michael Polanyi's theory of personal knowledge is that one's antecedent assumptions and presumptions, one's operative oversights and insights, in short one's fundamental commitments shape a person's perception and understanding of reality. Hence what a person notices and fails to advert to, what counts as a meaningful datum and what is ignored as inconsequential, what the significant relationships of possible elements in one's perceptual field are, in short one's "picture of the world" or "vision of reality" are all determined by a person's prior commitments and experiences. While all this is practically a truism in the contemporary discussion of the philosophy of science, it is worth recalling that a major factor in the recognition and acceptance of this insight has been the pioneering work of Michael Polanyi himself.

Joseph Agassi's Science and Reality is a remarkable--or perhaps, in his terms, dislocating (91)--illustration of this commonplace, particularly insofar as it contends that there is a certain complementarity between Polanyi's portrayal of the workings of the scientific community and Karl Popper's version of "the logic of scientific discovery." Moreover, Agassi offers his analyses as a peculiar sort of homage to Polanyi, one that takes the form of an emphatic dissent. I shall begin these reflections by taking up the former question regarding Agassi's dislocating reading of Polanyi, and shall return to his efforts to pay him homage later.

With respect to the former point, then, I mean that Agassi's reading is provocatively distorted. He reads Polanyi as a "sociologist of science"

(the subtitle of the work is "Studies in the Sociology of Science"). This is, undoubtedly, an interesting perspective on Polanyi. But it is equally a truncated view which is signalled by Agassi's contention that Thomas Kuhn's view of science is a vulgarization and popularization of Polanyi's theory. I have no doubts that somewhere in the publicly unacknowledged background of Kuhn's theses regarding the "structure of scientific revolutions" lies the groundbreaking work of Polanyi. At this level Agassi is clearly correct, and it is to his credit that he is willing to declare this publicly. But that Kuhn has represented the thrust of Polanyi's theory of knowledge, even if concessions are granted for "vulgarization," is not readily granted.

Why is it that Agassi reads Polanyi this way? Put very simply the reason is that Agassi's fundamental commitment is to a nonjustificatory epistemology, and he views Polanyi as attempting to ground science--in an epistemologically foundationalist sense--in the communally held assumptions of any stage of the historical unfolding of scientific theories. If this is so, then it follows that whatever the leaders of the scientific community uphold as "reasonable" or "scientific" is to be accepted, even if only provisionally. To portray the "foundations" of science in such a way is descriptively accurate in Agassi's estimation but prescriptively wrong and even immoral (85-6) since it is nothing more than an appeal to extrinsic authority.

This reading of Polanyi is epitomized in Agassi's reflections on "genius in science" (ch. 15), which were stimulated by Polanyi's essay of the same name. I find it particularly revealing that Agassi sees the crux of the issue raised by Polanyi to be the sociological function of "genius," which he places in a Romantic understanding of history. For Enlightenment thinkers, genius had little place in science since it was assumed that everyone began de novo by doubting past assumptions and establishing reasonably what was to be held. The Romantic reaction, on the other hand, emphasized continuity with the past as the repository of the wisdom of the sages to which ordinary mortals must be subservient, while it simultaneously legitimized progressive innovation in the extraordinary case of the immortal genius. Even though he admits that Polanyi is anti-Romantic in his views of science, nonetheless Agassi contends that Polanyi's use of the notion of genius serves the same sociological function that it did in Romanticism, namely to provide some legitimacy for a severely restricted range of rebellion in an otherwise authoritarian system (201). From this sort of reflective process Agassi concludes that Polanyi grounds the rationality of science in a blind leap that consists in initiating oneself to a closed guild controlled by a group of ruling elders who preside over what is essentially an elitist, undemocratic, and authoritarian establishment. By contrast, what Agassi proposes is an egalitarian theory of genius (205-207), where all individuals act with full moral and intellectual autonomy in accordance with the degree of their abilities and circumstances.

I suspect that by now those familiar with Polanyi's essay, "Genius in Science," must be marvelling at the kind of spectacles Agassi is wearing. Had Polanyi's aim there been to offer a diachronic sociology of science (as Thomas Kuhn arguably does), then there might be some discernible relationship between Agassi's reflections on Polanyi and his attempt to move beyond in a more democratic fashion. In actuality, however, Polanyi's aim in this essay is to point to the role of personal judgment relying on tacit powers of integration for the grasping and resolution of scientific problems, including the weighing of any evidence that might "refute" the proposed solution. "Genius" is introduced explicitly as an exemplary, though certainly not exhaustive, case of "perception" in science. The point, in other words, is that the general cognitive processes involved in the ability to learn how to recognize a good problem and pursue it to some sort of resolution are highlighted in cases of recognized genius. The community of scientists never legitimately exercises control over the individual scientist's intellectual or moral autonomy. This stance is clearly expressed in Polanyi's writings from his early distinction between general and specific authority to his mature admission, in Personal Knowledge that all his cherished assumptions drawn from Western culture could be wrong. He did not in fact accept this possibility because by dwelling in many of these assumptions, that is by accepting their authority, he believed he had made a more profound contact with reality. Furthermore he believed he knew these realities on legitimate grounds, even though he could specify explicitly only some of these reasons.

It is precisely at this point that Agassi's Popperian allegiance to a nonjustificationist position comes into play. Nothing can count as the explicit, ultimate criterion for any knowledge claim. In effect, Polanyi has seen this, but Agassi believes he simply transfers the foundations of science from the individual scientist to the society of scientists. According to Agassi, what Polanyi should have done upon his recognition of the inadequacy of logical positivism to provide foundations for science is to recognize that science was composed of hypotheses which are at best on the way toward truth. That is, scientific theories must be accepted as hypothetical and open to challenge, and the scientific community ought to foster (on moral grounds) as much novelty as possible (83, 100).

Most students of Polanyi would recognize this sociological conflation of his thought as a half-truth which prevents Agassi from recognizing the more comprehensive elements of his theory. In our discovery of reality personal judgment operates in a historical matrix which includes, to be sure, the sociological context. For Polanyi literally everyone exercises such judgment, some more responsibly than others. In Agassi's reading of Polanyi, only the leaders of science do (70-71). Why such a discrepancy in interpretations of Polanyi? I would attribute it to my opening observations: Agassi's reading is so coloured by a nonjustificationist epistemology that

he sees any attempt to provide "reasons" for accepting the truth of some claim to be an implicit reversion to the illusory security of indubitable certainty sought by foundationalists of both the rationalist and empiricist stripe. This aim is not only impossible to fulfill, but of even greater consequence for Agassi is its tendency to stultify the growth of science. This moral commitment to radical openness, in other words, so colours his reading of Polanyi that he reads "authoritarianism" or "extrinsicism" everywhere any attempt is made to offer "reasons" for a judgment, even if those reasons are tacitly held by the person making the judgment. In the process of his argument, however, Agassi must gloss over his own recognition of the "necessity" for "some sense of discrimination" (49) over scientific claims. And in such glosses the clues appear which enable us to discern how Agassi tacitly honors Polanyi.

As we turn now to Agassi's attempt to pay homage to Polanyi, I should like to offer a reading of Agassi that may be as dislocating as Agassi's is of Polanyi. My proposal, offered simply as a conjecture of course, is this: Agassi's homage to Polanyi is much more profound than he suspects. His fundamental stance on the issue of rationality is precisely the same as Polanyi's with the exception that Polanyi's position is more generally stated to take into account all human endeavors to relate intelligently to reality.

This can be indicated, I believe, by a consideration of Agassi's response to the "tu quoque argument" in his defense of rationality. The argument runs that, since the rationalist must make a prior commitment to rationalism and since this prior commitment is beyond explicit justificatory procedures, even the rationalist must start out with an irrational choice. Hence the conclusion appears to follow that a commitment to rationality is no more justified than (or is just as irrational as) any other sort of commitment.

Agassi contends that Polanyi's and Popper's philosophies both accept this argument and that Polanyi opts for an irrationalist version of rationalism (465). This contention would be correct only if all knowledge were explicit for Polanyi. What Polanyi in fact holds is that by the time we can discover ourselves thinking we already have a fund of tacit assumptions for ordering our lives and relating to reality. And while we can question or even reject any explicit formulation of these assumptions, we can do so only in light of others that we are simultaneously assuming on the tacit level. Clearly one such tacit assumption might be formulated as a transcendental imperative, "Be reasonable!" To question this or to explore its implications is possible only on the condition of its prior and concurrent operation in our lives. Hence for Polanyi the tu quoque argument in its stark form cannot arise except in the illegitimate formulation which tacitly presupposes rationality while ostensibly and explicitly questioning it absolutely.

At its core Agassi's response is identical, though expressed differ-

ently and with more limited application. He contends that rationality is a part of our lives and the more appropriate question concerns what we wish to do about it. He sees, in other words, that the bald statement of the question is artificial. "The very ability to ask it tells us we are [rational]" (475), he affirms correctly. Agassi's major concern upon appreciating this insight is that we do not revert to some form of naivete that rigidly ascribes to some dogmatic assumption an unquestionable status. While this may happen, it clearly need not, indeed ought not. Rather, to use Paul Ricoeur's expression, what might emerge is a "second Naivete" purged by the hermeneutics of suspicion. This, I submit, is the intent of Agassi's view of living in a tradition of critical inquiry. Such a process should turn into a life project or, as Polanyi would put it, a calling where freedom is in perfect service.

II

John Apczynski is disturbed by Agassi's reading of Polanyi. I am, in turn, disturbed by Apczynski's reading of Agassi. I will return to the latter, but first I offer my own account of Agassi and his reading of Polanyi.

For Agassi, epistemology becomes sociology with the collapse of the radicalist program of classical epistemology. The latter, as advocated by such writers as Rene Descartes and Francis Bacon, urged each person to think his beliefs afresh, breaking with tradition and consensus, and to find the unbiased truth. Now, rather than ask "What should I believe?" the problem is better stated as "What should we believe?" Nonetheless, sociology is incomplete. It serves well enough to answer descriptive questions, i.e., what are the conventional norms governing belief in this or that community? Yet, unless the norms are looked at critically--should these norms be accepted? How may these norms be improved?--the individual within the community is left with a heteronomous will. So, it is our moral responsibility, as members of the community of learning who agree to be governed by its norms, to raise critical questions (to preserve our autonomy) and to act on them.

Before going further, let me point out that Agassi is a student and sometime follower of Karl Popper, as well as an admirer of Polanyi, and that he believes he has followed his teacher's advice to the bittersweet end, which is apostasy (18). And this is not surprising: the philosophy of the Open Society should encourage dissent among its followers. Indeed, says Agassi, dissent is a tribute (xvii). In this spirit, Science and Society is a tribute paid to Popper's respected intellectual adversary, Michael Polanyi.

Polanyi, says Agassi, shares the honours with Popper as philosophers of the avant garde who abandon the psychologism of classical epistemology--especially empiricism and its heart, inductivism--and who break ground for sociologicistic approaches to science and knowledge (xvii & 85ff). Moreover, in many respects, Polanyi is correct in his description of the norms which govern the social reality of scientists and of all thinkers who seek a fair

hearing for their views by the community (86 & 207). Yet these norms are far from ideal: they can and should be improved. Agassi concedes that Polanyi would accept this while insisting that improvement only come from within the scientific community (123-125) and its leadership (97). But such a view is "self-verifying," to use Agassi's term, which means that its truth is established by its acceptance (131). At the same time, much of Polanyi's description ignores the degree to which defiance of the scientific leadership exists both inside and outside of the scientific establishment (205ff). Yet we can and should reject this view and the injustices and conservatism which it justifies (131). Moreover, Popper's utopia can serve as a model towards which to move and, especially, where it might not (yet) correctly describe the community. (Again, this might even apply to the master's teachings [see xx, 76, 82-83, 205-208].)

Agassi's criticism of Polanyi's views, therefore, is at the same time a critique of science as it stands. The critique of science is, briefly, that it operates too often as a closed guild with all the authoritarianism and conservatism of its medieval antecedents. The criticism of Polanyi is that his theory of science tends to legitimate the guild system and protect it from such criticism (70-71). Science is not open enough, not accessible to beginners, amateurs and the man and woman on the street (204). Nor does it respect the autonomy of its common practitioners, those followers of the scientific fashions which are dictated by the elite of scientific leaders (207).

We must now ask: Is Agassi's criticism of Polanyi too harsh? Is the reading of Polanyi--as the ideologist of the scientific guild system--fair? I am no expert on these important questions, and I must admit that my own introduction to Polanyi's views was as a student of Agassi. I was present when Polanyi first presented his paper, "Genius in Science," to the Boston Colloquium with Agassi as commentator--at Polanyi's request I am told, and I do not recall Polanyi complaining about being misinterpreted. So perhaps the greatest service I can provide the readers of this journal is to let Apczynski's criticism of Agassi's reading of Polanyi stand unchallenged except, I would trust, by our critical readers, and to direct my comments to his reading of Agassi.

Apczynski claims that Agassi's Popperian spectacles distort his reading of Polanyi in a way which confirms the latter's thesis of the theory-ladenness of observation. Such a claim, it could be argued, would corroborate Popper's hypothesis that justificationism leads to "reinforced dogmatism" where criticism is explained in such a way that it is transformed into confirming evidence for the criticized view (12). Yet I would rather not pursue this intriguing variation of the tu quoque argument for reasons I hope will be apparent from the remainder of my note. Rather, let me take up the question of Agassi's nonjustificationism which is crucial for an understanding of his work, particularly his critique of Polanyi and of science.

According to Agassi, both Popper and Polanyi employ skeptical arguments against the radicalism of the Enlightenment epistemology (98). The latter, however, does not reject the very idea of justifying science. That is accomplished, at the level of the individual scientist, through a process of apprenticeship by which one becomes committed to the living tradition of scientific research. But such a theory, says Agassi, could be "short-circuited" if a tradition were created which disagrees with it. The "only alternative visible," in Agassi's words, is "the idea of science without a shred of justification, with no confirmation or corroboration of any kind, with no Arcimedean point, no foundation, no anchor, in nature or man--in psychology or sociology--science as a search rather than as an achievement" (100). This is nonjustificationism.

So Agassi is a proponent of a nonjustificationist epistemology. This means that he advocates abandoning the futile search for the final truth in justified beliefs and replacing it with the search for errors in our beliefs through criticism while hoping for the progressive improvements of our always imperfect knowledge. Our focus here should not be on the skeptical rejection of justification. Admittedly, for many people this rejection creates a barrier to appreciation which is difficult to overcome. Perhaps this is because of the uncritical assumption that the justification of our beliefs is a necessary condition of their rationality and that, in the absence of alternatives, the rejection of justification is an invitation to irrationalism. Yet, I agree with Agassi that rather than discount the validity of the skeptical challenge to justification, we should seek rational alternatives. And this brings us to the proper focus of Agassi's concerns which is with our moral responsibility: Popper's identification of justificationism with authoritarianism prompts Agassi's rejection of both as heteronomy or the violation of moral autonomy (207).

In the view of many critics, including John Apczynski, the above identification is narrow, and the moral judgment brought to bear upon it is blinding. There are, such critics contend, ways of supporting our beliefs which do not violate our autonomy, and therefore the identification is refuted. Apczynski argues that Agassi himself acknowledges such forms of justification, indeed even their necessity, yet fails to see the utopianism of his position. Thus is he blinded by his nonjustificationist biases.

Let's look more closely at these arguments: Are there ways of justifying beliefs which leave intact the moral autonomy of the believer? Is the nonjustificationist morality impossible to abide? Does life force us to justify our beliefs on occasion? And would this gainsay the allegedly utopian standards of the nonjustificationist's anarchism? In other words and finally, does Agassi's work provide its own refutation?

In a later chapter, Agassi presents two theses concerning the rationality of belief which may be supposed to be an elaborated version of nonjustificationism or critical rationalism: "...we accept any doctrine

which (a) admits the inability to support or justify any belief, and (b) allows any faith on the condition that it be held tentatively." which means open to a possibly fatal criticism (470). Two lines of criticism of these theses are considered: (1) Isn't such a view as (b) too indiscreet? Aren't there some views we should not hold, even tentatively, if we wish to retain our rationality? Agassi suggests that many beliefs, such as the fantasies of paranoiacs and certain religious doctrines, which may be "impervious" to criticism, raise such a problem, and he suggests Popper's proposal that "publicly we should hold only the most criticizable theories" as an additional restraint while admitting this to be an "open question" for critical rationalism (*ibid*). (2) Yet, on the other hand, there are certain views which do not seem fatally criticizable in the sense that they are truisms of common sense or axioms, and which seem unreasonable to deny: Agassi's own choice is the Biblical "I am a man born of a woman" (476). Does such an admission support the claim of critics who would deny either the possibility of a comprehensively critical attitude, or of completely dropping justification from our epistemology or both? Agassi rejects any such corollaries of these claims to certainty, admitting as correct only the following "last word" on the subject: "...that it is very difficult to criticize claims at certain times, but that we are in a tradition of criticism that at times makes progress and so raises the degree of rationality" (*ibid*).

Is this view incompatible with Polanyi's theory of science? Agassi says it is, and both in theory and in blocking the social reforms which make "boldness and flexibility more acceptable and experiment more rewarding" and "science [that is] free for all" (100). Moreover, it is ironic that although Agassi also sees two very different yet valid readings of Polanyi as possible (97), he claims they both attempt to offer a legitimation for science which is detrimental to its growth (82).

It appears that Agassi does polarize philosophies of science and brands "all justificationism as conservative" (100). If Apczynski's claims are true this polarization is falsified by the work of Polanyi which would present a more rational, democratic and progressive philosophy than Agassi can see. If so, I think Agassi would appreciate such a correction and I would join him in welcoming such a broadened base for the effort to democratize science and scholarship.

III

In light of this exchange, what, finally, might students of Polanyi find of value in this work dedicated to his memory? On a less direct level Agassi's tome contains a wealth of information dealing with the scientific and intellectual history of modern times, all of it spiced with his provocative analyses. In my estimation, however, the more immediate significance of Agassi's study is precisely his dislocating reading of Polanyi that pictures him as an irrational rationalist.

Why would this be so? Consider the following questions. Is it possible for a student of Polanyi to derive an extrinsicist or authoritarian reading of Polanyi's thought? If Agassi is any indication, then clearly this is a possibility. Would a student of Polanyi be tempted so to short-circuit his theory of personal knowledge? I think we must acknowledge the possibility, particularly for those of us engaged in developing his thought for philosophy and religion. There is more than a tinge of fideism in the academic climate of today and what amounts to variations of the tu quoque argument is rampant among our students and is found often enough even in the professional literature. I believe that when it is examined closely, Polanyi's thought never succumbs to the temptation that would truncate the quest for truth by the acceptance of an easy dogmatic posture. Joseph Agassi's tribute to Polanyi stands as a powerful reminder to assist us in our own reading of Polanyi.

J. Apczynski and
Michael Chiarello

SUBSCRIBERS PAID FOR 1986

- H.R. Amis, The Coach House, Avening, Nr. Tetbury, Glos. GL88H.
Rt. Rev. B.C. Butler, St. Edmunds College, Old Hall Green, Ware, Herts SG11 1GS.
Rev. Martin Conway, President's House, Selly Oak Colleges, Birmingham B29 6LQ.
Joan Crewdson, 12, Conliffe Close, Oxford OX2 7BL.
Dr. R. Gelwick, Religion and Philosophy Dept., Stephens College, Columbia, 65215.
Robin Grove-White, 102, Tennyson Rd., London, NW6.
Prof. C. Gunton, Faculty of Theol. and Religious Studies, King's College, Strand.
Robin Hodgkin, Bareppa House, Near Falmouth, Cornwall, TR11 5EG.
Dr. J. Labia, La Vergee, Mont Gras D'Eau, St. Brelade, Jersey.
Dr. McHarg, 33, Hazel Avenue, Dundee.
J. Moorman, Crane Publishing, Box 90155, San Diego, Ca. 92109.
Prof. H.P. Nebelsick, Presbyterian Seminary, 1044, Alta Vista Rd., Louisville, Kentucky, 40205.
W.J. Neidhardt, Institute of Technology, 323, High St., Newark, New Jersey, 07102, USA.

Prof. R. Niblett, Garden Flat, 7, Bleinham Rd., Westbury Park, Bristol BS6 7JL.

Prof. J. North, Interfaculty of Philosophy, State University of Groningen, Westersingel 19, 9718 CA Groningen, The Netherlands.

Oxford University Extra-Mural Dept., Wellington Square, Oxford OX1 2JM.

Mrs. M. Polanyi, 31, Maytree Avenue, Findon Valley, Worthing, West Sussex.

Mr. H. Popper, 7, Mirador Crescent, Uplands, Swansea SA2 0QX.

Dr. G. Price, Dept. of Liberal Studies in Sc., Manchester University, M13 9PL.

Mr. E.S. Robbins, 61, Abbey Lane, Sheffield, S8 0BN.

Dr. G.M. Sutherland, 75, Falcon Close, Knights Manor, Dartford DA1 5SA.

Mr. C. Thorman, 115, Pickford Hill, Harpenden Herts. AI5 5HJ.

Ms. Von Kahler, 10 Lucas Place, Meadow Lane, Iffley, Oxford.

Dr. N. Wetherick, Dept. of Psychology, King's College, Old Aberdeen, AB9 2UB.

Keith A. Wilson, P.O. Box, 3096, Cape Town 8000, S. Africa.

Rev. Dr. K. Wilson, Westminster College, Oxford.

Wisconsin Memorial Library, 728, State St. Madison, Wisconsin, 53706 USA.

Brian Woolnough, Dept. of Education, Norham Gardens, Oxford.

Sent out by Joan Crewdson, 12, Cunliffe Close, Oxford OX2 7BL. (0865 53661)

Annual Subscription, due January: Minimum ~~£5~~5; Overseas, Surface ~~£6~~6, Air ~~£7~~7.
Sterling only. Note: Overseas subscribers who have problems in sending
sterling should note that we now have a ~~£3.50~~3.50 bank charge for changing other
currencies into sterling.

4-60