Darwinism, Doxology, and Energy Physics: The New Sciences, the Poetry and the Poetics of Gerard Manley Hopkins

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> In our day grand generalisations have been reached. The theory of the origin of species is but one of them. Another, of still wider grasp and more radical significance, is the doctrine of the Conservation of Energy.[1]

The scientific revolution of the mid nineteenth century in its double aspect provided a matrix for the poetry of Gerard Manley Hopkins which nurtured his development as a poet responding to nature and as a religious poet. The scientific context of Hopkins' work, firmly established by Gillian Beer, Daniel Brown, Jude V. Nixon, and Tom Zaniello, makes manifest the challenge and the opportunities offered to the poet by the new sciences. In a recent article for *Victorian Poetry*, Nixon has stressed the significance for Hopkins' poetry of energy tropes drawn from thermodynamics: the anxiety as well as the attraction that the new physical science created for the poet. The tropes are described as admitting a dialogue between the domains of science and literature, across the vast distances which contiguity does not allow.[2] The dialogue between literature and science in Hopkins' writing forms a broad debate that crosses cultural as well as temporal barriers, creating new syntheses and paradoxes as the claims of modern science are placed against those of classical philosophy, scholasticism, and aesthetics, while all are set against the demands of religion. In what follows, I will argue that the effort and energy generated by Hopkins' response to the new sciences, to energy physics and to evolutionary biology, produced not only a polarity between attraction and reaction within his work but also a subtle counter-challenge to the perceived hegemony of scientific materialism which transformed not only his poetry but also his poetics.

The theories of Darwinian evolution and thermodynamics together imply a dynamic world of constant change, of flux, of new relations within nature; it is a world that provided Hopkins with both image and energy. The

"grand generalisations," spoken of by John Tyndall, offered new perspectives to his generation as Lyell's geology had done to an earlier one when it opened up alternative viewpoints to Darwin and to Tennyson. In the evolutionary theories of Darwin an "unknown plan of creation" was replaced by a visible "community of descent," a richly diverse, highly individuated, and self-sustaining material world: a biological continuum in which all of animate nature is closely linked in an "inextricable web of affinities."[3] The science of thermodynamics developed from a growing awareness in the nineteenth century that various forces were not separate and distinct but manifestations of a single force. Its first law, developed by Hermann Helmholtz and Rudolf Clausius in Germany and by James Joule and William Thomson in Britain, stated that the total energy of a system or a body could neither be increased nor decreased though it could be transformed.[4] The fluency of its transformations was described by Tyndall: "Light runs into heat; heat into electricity; electricity into magnetism; magnetism into mechanical force; and mechanical force again into light and heat. The Proteus changes, but he is ever the same" (2:4). The second law, the dissipation of energy, discovered by Thomson and formulated by Clausius, who renamed the process entropy, stated that the availability of energy decreases as it is degraded and wasted in nature (Cropper, p. 101). The gradual dissipation of useful energy throughout the universe was seen to set its limits; it could be perceived to be "running down." The first law of thermodynamics created little general anxiety, seeming to uphold the idea of divine superintendence of the universe; the second law of entropy was more unsettling, appearing to give material substance, through scientific corroboration, to apocalyptic claims (Nixon, p. 132). The second law not only seemed to exclude design but to eliminate "the possibility of human intervention in its relentless processes."[5] The temporal limits of the material world set down in hard figures, obtained through calculation, now seemed less negotiable through image and parable.

In his poetry, Hopkins engages with the dense materiality and diversity of the evolutionary world and with the energy and transformations of the dynamic universe as he struggles with the flux of phenomenal life. Searching for pattern and form, he desires to affirm a sense of man's special place in nature and to sustain a sense of nurture in the face of Darwin's apparently random and ruthless theory of natural selection. He maintains the viability of a caring Creator in a Darwinian world where "a grain in the balance will determine which individual shall live and which shall die" (*Origin*, p. 378). Hopkins' poetry responds to the fundamental unity in nature inherent in the conservation of energy, and to its dissipation in entropy, but finds the explanation to lie beyond mechanics. Hopkins' carefully observed scientific approach to the natural world complements and works with an aesthetic and artistic response that is held in tension with deeply held religious beliefs. His

poetry reveals sensitivity to changing attitudes toward human nature and to the place of humanity within nature. It reflects a new sense of kinship but charts the stresses placed by the new sciences on human relations, within the natural world and with God.

I

Hopkins' prose reveals an exploration of the natural world that is multifaceted and driven by a complex response, which includes at once a scientific distance, a romantic involvement, and a religious intensity. Hopkins' early diaries and journals reveal a sensitive and precise observer of natural phenomena. His later letters to *Nature* concerning recent eruptions of Krakatoa include an argument for the objectivity of science. His careful accounts of unusual manifestations of light and color in English evening skies following the eruptions show, as Zaniello has observed, a poet "with a keen and rigorous scientific eye."[6] Hopkins' scientific interest complements and extends an aesthetic and artistic response to the natural world that is equally well delineated. In 1863 Hopkins described his sketching from nature as adopting "a Ruskinese point of view."[7] In his writing, he shares with Ruskin a keenness of visual perception, an intensity of observation, a feeling for the dynamic nature of form and for the processes of material change. Importantly, he has in common with Ruskin a sense of the divine in nature: a sense of reverence and awe. Ruskin's view that the use and function of man is to be "the witness of the glory of God" seems very close to Hopkins.[8]

In his early diaries Hopkins details the world. He notes the precise difference in hue between the green of wheat and that of long grass; both blue-green, one is silver and one azure. He notes that the color of the wheat is nearest to emerald and is the "exact complement to carnation." "Lucent," it has "perhaps" the bloom of chryrsoprase, an apple green variety of quartz with a wax like lustre.[9] In this last observation the artist's and the geologist's interests meet in a union of scientific and aesthetic interests. He makes links between microcosm and macrocosm, recognizing similar processes at work. He watches the evaporation of moisture in clouds and compares this with the steaming of hot chocolate. His questions about changes of state at its surface are scientific in nature, as he queries whether the films "contain gas or no" (*Journals*, p. 203). He observes the pattern of water flowing through a lock (p. 8) and of waves striking a sea wall, registering their order and their shape. He notes that it is mechanical reflection which is the same as optical. "All nature is mechanical," he observes, but contains that which is "beyond mechanics" (p. 252). That nature's laws are to be recognized, acknowledged, and respected seems clear from Hopkins' writing, but it is equally to be understood that there is for him something above and beyond them. Hopkins' response to the bluebell captures this parallel approach to natural phenomena.

Studied from a botanical perspective, the exact structure, color, and form are noted (p. 199), but his observations also draw a deeper response, which for him transcends material nature. Bluebells, when drawn through the fingers, struggle "with a shock of wet heads" and baffle with inscape "made to every sense" (p. 209). The inscape has a strength and grace that reveals to him the beauty of Christ (p. 199).

II

Evolutionary theory, with its attempt to redraw nature's boundaries and to reposition humanity within them, presented a general challenge to Hopkins as well as a particular challenge to his Catholic orthodoxy. His notebooks and letters show him to be sensitive to the evolutionary debate. In an essay, written at Oxford in 1867 on the probable future of metaphysics, he writes of the prevalent philosophy and science that regards nature as "continuity or flux," a string of chromatic differences with its points only randomly positioned on an arbitrary scale, with species arbitrarily fixed. Opposed to this "philosophy of flux," Hopkins looks to a new "realism" that might show the species to be mathematically fixed as the roots of chords on a musical scale. Certain forms, he notes, have always had a great hold on the mind, possessing an imperishability that cannot be explained by pure chromaticism or continuity (*Journals*, p. 120).

In 1874 Hopkins read an account of Tyndall's "Belfast Address" in *The Academy*. This outlined Darwinian evolutionary theory and the doctrine of conservation of energy; it also claimed that questions of cosmogony were solely in the charge of science. Fixity of belief, Tyndall claimed, was impossible; each age had to fashion its own mystery according to its needs (2:303). Hopkins' reaction to Tyndall, expressed in a letter to his mother, was ambivalent. He found the article "interesting and eloquent" but it made him "most mad." He found particularly disquieting the fact that Tyndall looked to an "obscure future" as well as to "an obscure origin." The only direct comment about Darwin is equivocal; the common ancestor implied, Hopkins notes, need not have been repulsive. He recommends to his mother the work of St. George Mivart, a Catholic evolutionist who "combats downright Darwinism." Hopkins' interest in the "Belfast Address," and his acknowledgement of Mivart, suggests a more than passive interest in the evolutionary controversy.[10] That Hopkins took Darwin seriously can be seen in a letter to Robert Bridges, written in 1888, by which time he agrees that "everything is Darwinism." Hopkins discusses the cell-making of hive bees, mentioned by Tyndall in the "Belfast Address," which by this time has become a central issue.[11] The instinct of the beehive was regarded by Darwin as acquired by natural selection, though he acknowledged that its complexity represented a serious difficulty for some of his readers (*Origin*, p. 169). In the letter to Bridges, Hopkins questions

Darwin's explanation, suggesting instead a special instinct, specific as the song of a cuckoo or a thrush: some principle of uniformity or symmetry that went beyond mechanical necessity. In his *Journals* he notes the song of the woodlark is more definite than the skylark's, and "gives the link with that of the rest of birds" (p. 138).

Evolution at this time was a contested area. Lamarckian evolution, suggesting purposeful adaptation rather than the random process of natural selection, continued to be a force after *The Origin of Species*. Beer has argued that Darwin's theory itself was multivalent and could be read as "plenitude or muddle."[12] St. George Mivart attempted to reconcile Darwinian evolution with Christian theology. He found a place for natural selection in helping to explain the complex instincts of the cuckoo, the bee, and the ant, the brilliancy of the humming-bird, and the melody of the nightingale. Natural selection, however, he argued, had to be supplemented by some other law not yet discovered. "Genesis," he found to take place mainly through "special powers" existing in each organism and only partly through interaction of organism and environment, in which "the survival of the fittest" takes only a subordinate part.[13]

The doctrine of conservation of energy was similarly contested, despite its appropriation by Tyndall for scientific materialism as a doctrine that "binds nature fast in fate" (2:182). For William Thomson, later Lord Kelvin, physicist and a formulator of the doctrine, the laws of nature were instruments of the divine will, which alone had power to alter or destroy.[14] "The energies of nature" were for him the Creator's gifts, which offered to humanity opportunities to direct the universe (p. 123). The doctrine of universal dissipation, however, set its temporal limits. As the sun expended its non-renewable energies, an ageing and cooling world was proceeding, inevitably it seemed, toward extinction (p. 125). Thomson makes entropy consistent with a Biblical perspective of change and decay (p. 111). In his argument, the idea of God as architect or designer, as in Natural Theology, is replaced by the idea of God as the source of all power in nature.

With the new science, a new language was created. In the early 1850s Thomson coined the term thermodynamics and, with Macquorn Rankine, began replacing the older language of mechanics with terms such as "actual" and "potential" energy. The term "kinetic energy" was introduced by Thomson and Tait to describe the energy of the motion of a body (Smith, p. 186). Thermodynamics produced a model of the universe as a dynamic continuum, in which energy is constant, never created and never destroyed, but continually transferred and transformed; it is a universe of matter in motion in which animate and inanimate nature are inextricably linked. It represents not creation but infinite conversion. The ideas emanating from the new science of energy, with its apparently contradictory laws, helped to create, together

with the debate surrounding evolution, a context for Hopkins' poetry that was vibrant, rich, and diverse.

III

Although he made no detailed pronouncements on Darwinism, Hopkins reveals a strong awareness of it in his poetics and in his poems. The poems that deal with nature are subtly responsive to the diversity, the rich materiality, and the intricate interrelatedness of the Darwinian world; they are, as Nixon has described them, "orchestrated responses" to the Darwinian debate.[15] The poems also capture the translations and transformations of nature's forces suggested by energy physics. An early poem, dated 1866, "The earth and heaven, so little known" (no. 74) evokes a world full of energy, movement, and change.[16] The evanescent image of vapor in the wind shaping itself in "taper skeins," caught once by the eye then lost to the rain, suggests the subtle interplay of the energies of nature in delicate transformations (ll. 17-20). Clouds "with breathing edges white" are pulled against a blue sky, while below full streams flow as "millbrook-slips with pretty pace / Gallop along the meadow grass" (ll. 23-26). Inanimate nature is linked with animate life in the image of a swallow. The bird is linked inextricably with the air. The swallow manipulates its plumage in the wind, riding the gale; its motion offers no "permanence in the solid world" (ll. 9-16). The focus of this dynamic world is the still "all-accepting fixèd eye" of the human observer: the geographical center of "earth and heaven" from which east and west take their bearings. The human eye is made the unchanging register of change (ll. 1-6). This poem, dated early in the poet's career, proposes a human significance at the heart of nature: a primacy increasingly challenged by Darwinian biology.

In *The Origin of Species* nature is envisioned as wonderfully diverse, with the fine degree of individuation resulting from the processes of natural selection and adaptation. Natural selection acts by preserving and accumulating small inherited modifications, each profitable to the preserved being. Adaptation to its conditions gives each organism its special place in nature's economy; its own part in a complex interdependency "by which all living and extinct beings are united by complex, radiating, and circuitous lines of affinities into one grand system" (p. 369). Hopkins' poetry responds to the plenitude, the diversity, the individuation of the Darwinian world and also to a sense of its kinship, but it reacts against the arbitrariness, the disorder, and "the muddle" it also implies. Primarily, it resists the blending of humanity into the rest of nature, its retreat from God.

In "As kingfishers catch fire" (no. 115) the opening scene is individuated by the placing of each thing in a specific place, in a single moment in time, creating a set of relations that represent a unique event in nature. There is a sense of the reciprocity of life, of growth and action like that which emerges

from Darwin's description of the "entangled bank" in *The Origin of Species*: "clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about and with worms crawling through the damp earth" (p. 395). Each has its own place in nature's economy: a multitude of life forms follow independent lives in a complex and mutual interdependency. In Hopkins' poem each thing has its own particularity and its own niche. The plumage of the kingfishers and the wings of the dragonflies are transfigured by light into their own very distinctive colors. Stones tumbling into wells have no less significance than kingfisher and dragonfly. The simultaneity of the moment is caught precisely through eye and ear. The poem, as Brown suggests, is both a "Darwinian tableau" and a "celebration of distinctive form or inscape."[17] There is kinship within nature: "Each mortal thing does one thing and the same" (l. 5). For Hopkins each thing importantly has not only its own specific being but its purpose, its individual self and integrity, its own cry: "*What I do is me: for that I came*" (l. 8). This uniqueness of being, of purpose, is set against the merging of the biological continuum; man's place in nature is differentiated by moral and spiritual obligations not shared with the rest of nature. Transfigured by Christ, as the natural world is by light, the just man must "justice" and keep grace (ll. 9-12).

"Pied Beauty" (no. 121) rejoices in the distinctive individuation of evolved nature, which produces unusual, adapted rather than static, forms of beauty: dappled things, the "rose-moles all in stipple upon trout that swim" and "finches' wings" (ll. 3-4). Praise is given to things that go against the grain: "All things counter, original, spáre, stránge . . . fickle, frecklèd" (ll. 7-8). Glory is given for a humanity that has adapted to the land "plotted and pieced" and developed a technology to work it (l. 5). The poem suggests the diversity of an evolved nature but this is seen as essentially mysterious, subject perhaps to a law like Mivart's not yet understood: "(who knows how?)" (l. 8). "Pied Beauty" belongs to a world made by a Creator who "fathers-forth whose beauty is pást chánge": an immutable God who holds and engenders all that is mutable (l. 10). Against the vagaries of natural selection, the evolutionary process is firmly placed within the Mosaic cosmogony and the Christian tradition.

The fecundity of Darwinian nature, its energy and its activity, is evoked in "Spring" (no. 117). A simple observation of the incomparable beauty of spring explodes into a vigorous depiction of rich new growth: "weeds, in wheels, shoot long and lovely and lush" (l. 2). Nature's activity is seen in its wild and uncontained growth and expanse. There is an intimacy between animate and inanimate nature. The song of the thrush enlivens the ear as it renews relation with the shock and surprise of lightning. There is a delicate interrelation as tree and sky strain toward each other: "The glassy peartree leaves and blooms, they brush / The descending blue; that blue is all in a rush / With richness" (ll. 6-8). The domes of the blue eggs of the thrush mimic the

heavens. New life partakes of the activity as lambs race about and have "fair their fling" (l. 8) as all of nature is connected in the surge of energy the new season brings. Spring also creates for Hopkins a sense of primal innocence, of Eden before the Fall which soured nature through sin.

The significance of the human presence in nature, its distinctive role that sets it apart from the rest of creation, is central in "Ribblesdale" (no. 149). "[M]an" is nature's witness: its "eye, tongue or heart" (l. 9). The earth is described in a double aspect; it has a fragrant fertility but is subject to corruption and decay, given over to "rack or wrong" (l. 8). The earth has no feelings or language to plead its own cause; it can only be and stolidly endure. Man alone, with eyes to notice, heart to feel, and language to speak can take its part: "where / Else, but in dear and dogged man?" (ll. 9-10) Human neglect and exploitation have led to its impoverishment. The duty of mankind is to care for the earth and to give praise: to give back beauty to God in a doxology for Creation. In "Ribblesdale" Hopkins again affirms human primacy; against the Darwinian merging of human life into the rest of nature, he reasserts a unique position for mankind which sets it apart but gives it responsibilities as well as tenure.

IV

Drawn to the power in all things that connects animate and inanimate nature, Hopkins recreates in his poems the transformation and the dissipation of energy implied in the new physics; the dynamic but unified universe compared by Tyndall to a single organism:

> It is as if the body of Nature were alive, the thrill and interchange of its energies resembling those of an organism. The parts of the "stupendous whole" shift and change, augment and diminish, appear and disappear, while the total of which they are the parts remains quantitatively immutable. (2:342)

Hopkins draws from the science of thermodynamics images that are dramatic, vital, and powerful; there is a marked use of energy tropes, of heat, fire, and light.[18] In their scientific context, these tropes offer new resonance to traditional Christian themes of Creation, Resurrection, Pentecost, and Revelation, all associated with fire or light. Both the first and the second law of thermodynamics find their place in Hopkins' poetry where they challenge, modify, and ultimately strengthen the religious experience. The energetic universe is powerfully demonstrated in "God's Grandeur"; its entropic degradation vividly evoked in "The times are nightfall" and in "Spelt from Sibyl's Leaves." "That Nature is a Heraclitean Fire and of the comfort of the Resurrection" images the dynamic processes of natural forces, and the transmutation of matter, and finds in them a paradigm for the Resurrection.

"God's Grandeur" (no. 111) creates a powerful evocation of nature's forces in the various manifestations of its power. The energy plenum and the encroaching darkness are placed within the Mosaic cosmogony and the Christian tradition, outside a purely materialist philosophy. It is a thermodynamic model of the universe in which energy is "never spent" but finds form in the explosive, brilliant release of an electrical storm or in the slow oozing of oil. For Hopkins, as for the physicist William Thomson, the source of all power in the universe is the Creator. The opportunities offered to direct nature's energy are seen in "God's Grandeur" to have been squandered by a down-treading, degraded humanity, which has exploited nature and distanced itself from the earth. Hope appears to lie within the indestructible nature of energy, a force associated by Hopkins with Creation, and with the Paraclete who broods like a mighty bird over the "bent [w]orld," with "warm breast" and with "bright wings" (ll. 13-14). The image recalls the dove of Genesis which hovered over the deep; it implies the creative energy of God, still present in the darkening world.

Later poems focus more distinctly on the dissipation of nature's energy, with a darkening of human experience, when, as Beer suggests, Hopkins increasingly draws in the implications of thermodynamics' second law.[19] The language of entropy is used in "The times are nightfall" (no. 152) to suggest both the contemporary social and political situation and a mood of frustration and despair at a lack of personal achievement. The poem depicts a world growing dark as a dwindling of light and energy turns it to winter. Dissolution is shown to be evolution's complement.[20] It is a world unravelling, "a world undone," with things reverting to former, simpler states (l. 2). Verbs of degradation, "waste," and "wither" suggest the processes of decay and universal dissipation. There is disintegration: "All is from wreck" (l. 6). Time, as it runs down, brings distress but no fulfilment; it makes forgetfulness desirable and death welcome. The entropic theme with its negativity is abruptly halted, however, as the macrocosm of the unwinding, darkening universe is rejected for the microcosm of the "world within" (l. 9), a divinely willed universe, where the individual can look for dominion to root out corruption and fear.

In "Spelt from Sibyl's Leaves" (no. 167) the earth's own being "has unbound." An entropic movement leads to a loss of differentiation. The evening sky is not drawn through visual perceptions but through abstract qualities that distance the scene and foreground the emotion of the speaker: "Earnest, earthless, equal, attuneable, | vaulty, voluminous, . . . stupendous." Its somber vastness is considered apart, disconnected from the rest of nature. The evening stretches toward night, toward death: "to be time's vast, | womb-of-all, home-of-all, hearse-of-all night" (ll. 1-2). Night is the womb from which all life emerges and to which it returns. Human life becomes involved in nature's decline, in nature's dissipation. The self becomes detached, self-absorbed, or crushed,

losing hold of memory or dismantling the past, as night with its lack of definition overwhelms: "self ín self stéepèd and páshed — quíte / Disremembering, dísmémbering | áll now" (ll. 6-7). The only pattern now to be discerned, as visual perception loses its definition, is black against grey, dark boughs against a darkening sky: "beakleaved boughs dragonish | damask the tool-smooth bleak light; black, / Ever so black on it" (ll. 9-10). Against the unravelling, the disintegration, is placed a yearning for a simple ordering: "lét life wínd / Off hér once skéined stained véined varíety | upon, áll on twó spools." This desire for reduction is accompanied by a desire for judgment: to "párt, pen, páck" all into "twó folds — bláck, white; | ríght, wrong" (ll. 10-12). Without an unambivalent moral ordering, placed in jeopardy by the multiplicity of the Darwinian world, there is a sense of human nature overwhelmed, of the self tortured with doubt: "selfwrung, selfstrung, sheathe- and shelterless" (l. 14). Entropy provides a powerful trope for the disintegration, loss of identity, and energy that accompanies a crisis of faith.

In "That Nature is a Heraclitean Fire and of the comfort of the Resurrection" (no. 174) the profusion, the transmutations and the ceaseless energy of the natural world are recreated. Clouds are described in strongly physical terms: "puffball," "tufts," "pillows"; they draw their shape and texture from the wind as they are "torn" and "tossed" in the air currents. Their movement makes manifest nature's transforming power as they transport the earth's moisture. The play of light signifies the sun's energy as it transfigures nature: casting light and shadow, interacting with the phenomenal world, creating definition, color, and pattern, with the movement of the wind, the "bright wind" which partakes of the sun's light (ll. 1-4). The strength of the wind "ropes," "wrestles," and "beats" the earth bare remolding its surface from dough to crust to dust as moisture is evaporated. The sun's combustion feeds the huge variety of nature, which nevertheless is subject to decay (ll. 5-9). Within this dynamic, material universe "man" is seen as unique: nature's "clearest-selvèd spark," without whose "mark on mind" space is a blurring vastness and time undifferentiated (ll.10-11).

In this poem, Hopkins challenges the philosophy of flux of Heraclitus who saw the whole world as everlasting fire, subject to ceaseless change, the product of strife. Hopkins is also confronting the prevailing philosophy of his own day that saw all things as "'souls of fire and children of the sun.'" (Tyndall, 2:72). The idea of flux signified for Hopkins, as Nixon has observed, "a Platonic sequence of movement" from God and returning to God, as in the poem "Thee, God, I come from, to thee I go" (no. 161).[21] In "That Nature is a Heraclitean Fire" Hopkins attempts to steady the flux with a single word "Enough!" and with the image of the Resurrection. He demands a spiritual space apart from physical nature and its laws. Through his Resurrection, Christ is seen as a beacon, a bonfire, to be contrasted with nature's bonfire

and the world's "wildfire" that leaves only ash. As the fire of the earth transmutes carbon, the element essential to all organic life, into its most enduring form diamond, so the divine fire of Christ will transform common, broken humanity into precious immortality. The material will at last be subsumed into the divine.

Transmutation was the subject of an earlier poem, "The Alchemist in the city" (no. 60). Alchemy, with its vain attempts to make perfect imperfect matter, as in turning base metal into gold, provides the central analogy. A subject of fascination for earlier scientists, its mystery was eroded during the nineteenth century by the development of the verifiable empirical methods which led to modern chemistry. The poem reveals the enduring attraction of alchemy as a metaphor for the creative process, as the poet strives to transmute common urban experience into poetic form. The description of the cityscape remains generalized and largely inert as the poet in frustration looks to isolation, to separation, and a return to the simple elements of earth, air, and fire. This contrasts with "That Nature is a Heraclitean Fire" where the location and the prevailing conditions are constructed with fine precision, and changes of state are carefully analyzed; in the later poem the alchemic process of poetry becomes more empirically wrought, more highly organized, closer in approach to modern chemistry than to alchemy.

V

At a time when traditional religious views were challenged by scientific advances, when natural theology and Christian doctrine were felt to be under specific threat from Darwinism, as a religious poet Hopkins was particularly affected by the impact of scientific change. The Bishop of Oxford, reviewing *The Origin of Species*, found it irreconcilable with "man's fall and man's redemption; the incarnation of the Eternal Son; the indwelling of the Eternal Spirit."[22] The Mosaic cosmogony was controversially challenged in *Essays and Reviews*, in 1860, as a possible scientific construct rather than divinely inspired truth: "the speculation of some Hebrew Descartes or Newton."[23] Whereas in his sermons Hopkins maintains an orthodox theology, in his poems he offers an interpretation that is deeply sensitive to the new sciences. Energy physics, as Brown persuasively argues, provided Hopkins with a means of resituating God, of re-establishing monism, as he developed "his peculiarly dynamic version of natural theology."[24] God is envisioned in Hopkins' poetry not as an architect or designer, removed from creation once its laws were set in motion, but as the source of all power, the matrix of nature's energy, ceaselessly holding all creation in being. The concept of benevolent nature, of a sense of nurture removed from the Darwinian world by natural selection, finds presence in Hopkins' poems in the idea of God's sustaining presence in the world and in the image of the Blessed Virgin, his chosen mediatrix. The primacy of

Milton's narrative of Creation and Fall is replaced by that of Incarnation and Redemption. In acknowledging the central mystery of the Christian tradition, Hopkins places himself outside the aegis of physical science and accepts a law beyond the material. His poetry expresses, as Beer observes, "the energies of the material world funnelled and focused to break through to a world beyond, or a world within" (*Open Fields*, p. 242).

The conception of God as the source of all power and the center of dynamic relationship is most fully realized in "The Wreck of the Deutschland" (no. 101). God's power in creation is made manifest in matter and force: He is "giver of breath and bread," the "Wórld's stránd" as well as the "sway of the séa" (ll. 2, 3). He masters and sustains the universe of matter in motion implied in the new physics, controlling the movement of the earth's waters and all that resists their force. He steadies an "ócean" of mental energy (ll. 251-254). The fundament and the bedrock of existence, He is the intimate Creator of each individual being, the physical and paradoxical maker who binds bones and fastens flesh only to almost unmake it again "with dréad" (ll. 5-6). The creative act is shown continuously sustained by the "fire of stress" (l. 16). "Man" of himself, is "sóft sift / In an hourglass": formless particles of matter held together in time, subject to its dissipation (ll. 25-26).

The God of Creation who sustains life is also the God of "wrecking and storm" who destroys life, as the narrative of the shipwreck so vividly enacts. Strong emotion betrays a deep ambivalence running through the poem; feelings released by the vivid details of the suffering, the dying and the helpless, work against a desire to find, in the darkness, God's justice and mercy. Hopkins looks to find in the particular tragedy the consolation of conversion or salvation. Beyond this he looks to Christ, human and divine, "heart-fleshed" and "heaven-flung" (l. 267) to redeem the darkness. Christ is to be found "Not a dóomsday dázzle in his cóming nor dárk as he came," but "A released shówer, let flásh to the shire, not a lightning of fíre hard húrled" (ll. 270-272). Associated not with nature's pyrotechnics but with the slow, steady sustaining natural cycles of the earth, Christ's "gift," "préssure," or "príinciple" is seen to bring poise or equilibrium, like water kept level in a well by streams feeding it from the hillsides (l. 32). The image presents an opposing human parable to that presented by the entropic image of sand in the hourglass. The forces of equilibrium and dissipation displayed in these images create a moral and spiritual distinction for human nature nourished by grace, which is formless without it.[25]

The Incarnation was for Hopkins the central event in human history, when God entered time and the material universe by taking on human nature. The impulse toward the divine, for Hopkins, was not immediately experienced as a response to the eternal being of God but to his incarnate humanity which participated in the mutable world, riding time "like ríding

a river ("Wreck," l. 47). Accepting the doctrine of Duns Scotus, Hopkins believed that Christ possessed material form, substance without extension, before his Incarnation which made him subject to successive, chronological time and to the double process of growth and decay, of assimilation and dissolution, described by Herbert Spencer: the integration of matter following loss of motion, the disintegration of matter due to its gain (pp. 281-283). As man, Christ was subject to the forces of time, the flux of human experience; divine, he belonged to the eternity of God which co-existed with historic time.[26] He entered the evolutionary world as the perfection of the species, the completion of human nature, and its ideal: perfect man free from defects of inheritance because "not born in nature's course."[27] Theological authority was borrowed from Scotus who saw Christ's humanity as a perfect "'unbroken' whole" whereas the rest of humanity was a "'broken light'" of the ideal species in God's mind (*Sermons*, p. 278 n. 37). Christ's material presence in the world, in the flux of time, was supported, for Hopkins, by the Catholic doctrine of transubstantiation: the corporeal and the divine presence of Christ in the Eucharist. The Incarnation was for Hopkins, as Brian J. Day has observed, an "ever-present reality re-enacting itself sacramentally through the Eucharist."[28] It was a doctrine that drew Hopkins to Rome when he felt that the Tractarian ground had "broken to pieces" under his feet, a doctrine he recalls in the third stanza of "The Wreck of the Deutschland."[29]

In "The Blessed Virgin compared to the Air we Breathe" (no. 151), Hopkins argues the significance of the Incarnation through an elaborate analogy which draws much of its strength from its scientific understanding. As the mother of God, the Virgin is depicted offering physical shelter to "God's infinity," at a single point in time; as the mother of mankind, she is shown continuing to create new "Nazareths," nourishing and sustaining humanity, a mediatrix between God and man. In an elaborate metaphor with the complexity of a metaphysical conceit, the Blessed Virgin is compared to the earth's air and to its atmosphere. She is described as an all-enfolding presence, inextricable and intimate like air, which girdles each eyelash and hair: essential like air to human life (ll. 1-6). Like the layers of the atmosphere, which guard the earth from the fierce attack of the sun, she sifts God's light whose "glory bare would blind" (l. 108). The image of the Blessed Virgin, earthly and ethereal mother and spiritual guardian of humanity, seems to sustain for Hopkins the beneficence and nurture under threat from Darwinism.

The poem's central analogy is refined by recent scientific discoveries. Beer has noted the significance to the poem of Tyndall's explanation for the azured sky (*Open Fields*, pp. 264-266). Tyndall, in his "Scientific Use of the Imagination," a discourse delivered in 1870, refutes the hypothesis that the air is blue, by arguing that the hue is caused by a scattering of solar light waves by particles. Although, collectively, the solar waves give an impression of white-

ness, when separated or mixed in various proportions they "yield all the colours observed in nature and employed in art" (Tyndall, 2:111). The liberation of a disproportionately large number of the shorter waves at the violet end of the spectrum produces the blue or azured sky. In Hopkins' poem this insight is absorbed as the Virgin is likened to the azured sky which "sapphire-shot" does not "Stain light," a clear sky, a perfect medium for light, which allows each color to glow, each shape and shadow to be defined without distortion (ll.79-85). In the poem human perception, particularly acute on a fine clear day, is refined further by a scientific understanding of the spectrum that exceeds the reach of the visual sense. The fine spectral gradations were discovered in the 1850s, by Kirchhoff and Bunsen, who proved that each chemical element produced its own definitive wavelength of light.[30] Spectroscopy vastly increased the number of its hues, and this finds presence in the poem:

> this blue heaven
> The seven or seven times seven
> Hued sunbeam will transmit
> Perfect, not alter it. (ll. 86-89)

The delicate ordered beauty of the firmament, invisible to the human eye, is conveyed by Hopkins in his image of finely modulated light which translates for him the perfection of nature.

In a sermon on "Divine Providence," given in 1880, Hopkins illustrated God's munificence by describing the universe as a "million-million fold contrivance" planned for human use and patterned for admiration. At the same time he acknowledged the world to be "full of fault, flaw, imperfection": something had made of providence "a shattered frame and a broken web" (*Sermons*, p. 90). This paradox, underlying and challenging faith, is centrally dramatized in Hopkins' poetry where natural theology is placed under stress as human aspiration and spiritual longing comes into conflict with a flawed nature. Darwinian evolutionary theory feeds the fears of imperfection and fragmentation; conservation of energy offers new possibilities for the realization of the divine, while religious faith seeks to interpret the second darker law of entropy in terms of divine power and mercy.

VI

As well as altered concepts of nature and energy, new ways of regarding perception and language, uncovered by science, are drawn into Hopkins' poems. Developments in physiology, optics, and acoustics altered understanding of perception and suggested unique relations existing within nature. New theories of sound, like optics based on wave theory, suggested each vibration had its own precise location on a finely graduated scale, its own unique pitch. This specificity reinforced Hopkins' own understanding of distinctive being,

captured by him in his highly original concepts of "inscape" and "instress." Language for Hopkins, as James Milroy has described, had its own laws, patterns, and inscapes which could be discovered and observed like natural phenomena.[31] Hopkins had a keen interest in words, their ancient roots and their onomatopoeic potential for poetry. Recognizing a close relationship between perception and language, he observed that the multiple perceptions raised by a single object encouraged a density in language. "The various lights under which a horn may be looked at," he instanced, "have given rise to a vast number of words in language" (*Journals,* p. 4).

In his philological interests Hopkins was probably influenced by Max Müller who regarded the study of language as a science, a part of natural history (Milroy, pp. 50-52). Müller stressed the material nature of language and its connection with the phenomenal world. For Müller, as for Hopkins, language brought order to flux: the roots of words "stand like barriers between the chaos and the cosmos of human speech."[32] Language for him had its hidden depths: "There are chronicles below her surface, there are sermons in every word" (p. 3). As Hopkins, in a poem such as "Ribblesdale," differentiates man from the rest of nature through his language, so Müller establishes a linguistic barrier or frontier between mankind and the natural world (p. 15). Müller's researches into comparative grammar provided alternative structures for ordering language. His discussion of Chinese with its use of the predicative root as noun, verb, adjective, or adverb, it has been suggested by Milroy, may have contributed to the syntactical freedom of Hopkins' poetry (Milroy, p. 59). Müller's theory that each substance in nature has its own peculiar ring when struck may also have contributed to the development of Hopkins' ideas of distinctive being, as in "As kingfishers catch fire" where "Stones ring; like each tucked string tells, each hung bell's / Bow swung finds tongue to fling out broad its name" (Millroy, pp. 65-66). The specificity of the kingfisher and dragonfly is caught in the defining flash of light; the uniqueness of the stones is registered by the specific sounds they make. As Brown observes, "the optical spectrum has come to parallel the musical scale."[33] The analogy in this poem between sound and color, as Beer has shown, is part of a larger debate on physiology, optics, and acoustics based on the work of Helmholtz and popularized by Tyndall.[34]

The particular nature of each thing was, for Hopkins, captured in its distinctive inscape and instress in which matter and energy are inextricably linked.[35] It was a concept grown from intense observation of individual structures and forms, and from a strong affinity with nature: "What you look hard at," he noted in his journal, "seems to look hard at you" (*Journals,* p. 204). He finds in swelling buds a world of inscape: the male ashes have a bud that is "a short smoke-black pointed nail-head or beak pieced of four lids or nippers. Below it, like the hollow below the eye or the piece between

the knuckle and the root of the nail, is a half-moon-shaped sill" (p. 206). The description draws on poetic metaphor, particularly related to parts of the body, but is scientifically exact in the precision of its observations. Exquisite analogies are drawn between natural phenomena as in, for example, a streamer of cloud that resembles foliation in wood and stone that exhibits "beautiful changes" as it grows into ribs of branched coral (pp. 204-205). It is beauty that lies all around but sadly is missed by many (p. 221). Hopkins developed the concepts of inscape and instress when reading the early Greek philosopher Parmenides who challenged the Heraclitean concept of flux by denying that anything could come from non existence.[36] It was a philosophy translated by Hopkins in his own way: "all things are upheld by instress and all are meaningless without it" (*Journals*, p. 127). Instress created the vital link without which there would be no resistance, no integration, only non-being. Hopkins' stress on unique individual being found its doctrinal authority in the theology of Duns Scotus, specifically in his individuating principle derived from God's creative love (Devlin, p. 8). Responding to the individuation of the Darwinian world and to the dynamics of modern energetics, inscape and instress became central to Hopkins' poetry as an answer to atomism and as a means of containing, ordering, and shaping the multiplicity of phenomena, the flow of sense impressions.

Nature, conceived as densely material and dynamic, made particular demands on Hopkins' language. Words were for him both material and dynamic: "things or relations of things." A word was the contraction or meeting point of all its definitions; it had depth as well as potential, a power to produce "passion," "prepossession," or "enthusiasm" (*Journals*, p. 125). It consisted of image and energy. Hopkins' virtuosity in creating an image that is at once powerfully material and dynamic can be seen in "Inversnaid" (no. 146), the vivid evocation of a Scottish burn. The waterfall is given the physical characteristics, the color, the body movements, and the strength of a stallion. Its energy is suggested by the power of the horse. The metaphor illustrates the forces within nature as a single energy flowing through all things. Brown stallion and burn are fused in a complex image where at once is imaged the dark peaty water flowing furiously over the rocks and the strong muscular movement of the animal creating spray in powerful motion. The process of keeping together two images at once in the mind is described by Hopkins, in his journal, as the holding together simultaneously what is seen by the eye and the "belonging images of our thoughts" (p. 194).

Hopkins constructs language that creates the synchronicity, the complexity, and the materiality of immediate experience. With a rich use of concrete detail and a strong use of verbs, he creates compression or distillation, cutting words that have nothing positive to offer image or energy, in a bold reorganization of syntax. This can be well illustrated in one of Hopkins' last poems,

"That Nature is a Heraclitean Fire and of the comfort of the Resurrection" (no. 174) where he recreates at once a fragment of the natural world and a microcosm of the universe. The profusion of natural images and the movement of the opening lines detail a precise location and specific conditions while simultaneously conveying the materiality and dynamic energies of the larger world. He abandons conventional syntax to catch the immediacy he experiences in nature. Images are lightly drawn, juxtaposed with complementary or contrasting images rather than dwelt upon or expanded. An imaginative and lively choice of verbs animates the scene. Words joined in unusual combinations compress their meaning; their coinciding and contracting definitions creating startling new relations. The syntactical freedom, as for example of nouns and verbs being used adjectivally, creates wordscapes that surge with energy. The sprung rhythm with its insistent pattern of stresses creates an urgent, energetic pattern of sound, given greater intricacy and vibrancy by alliterative phrases, internal rhyme, assonance, and dissonance. In the sonnet, Hopkins has chosen a poetic form that constrains and disciplines thought and language. In the poem, the form is stretched well beyond its usual limits. Even within the octave and sestet the energy is hardly contained as the octave spills over into the sestet, leaving the rhyme scheme to mark the distinction. The coda expands the sonnet and allows for a new context away from the material world, giving space for a parallel spiritual dimension and the idea of Resurrection.

Hopkins regarded Wordsworth's refusal to make much distinction between the diction of poetry and prose as a corrective for his age. For Hopkins the structure of verse, meter, rhythm, and rhyme "necessitate[d]" and "engendere[d]" a difference both in diction and in thought, producing concentration and a "vividness of idea." The structure of his verse forces attention to every syllable (*Journals,* pp. 84-85); the rhythm "fetches out" the strength of the syllables, the feeling as well as the meaning of the words.[37] The process is organic: the further the organization is carried out in a work of art, he notes, the deeper the form penetrates (*Journals,* p. 126). In his own poems, the organisation penetrates form in an unprecedented manner; poetic orthodoxy is abandoned as he breaks down the usual patterns of order, constraint, and restraint in language to confront experience in its complex and dynamic materiality, transforming established poetic forms.

In breaking with poetic orthodoxy Hopkins moves toward a fragmentation of context that becomes modernism but it is a modernism intimately related to his involvement with the scientific ideas of his own age. He engages with Darwin's multiform, individuated, and diverse world but characteristically draws back in his desire for order, design, and unity, positing a power beyond the purely mechanical. He is attracted to and recoils from the universe created by thermodynamics, with its seemingly contradictory laws. A struggle

between polarities, intensified by the challenge of the new sciences, is central to his work. The boldness of Hopkins' poetics argues an innovator ahead of his time; the image and the energy of his poetry, acutely sensitive to the current of contemporary scientific thought, implies a poet of his time, a writer of the scientific revolution: a subtle chronicler of the ideas, the excitement, and the anxieties of a generation faced with startling new ways of regarding nature and the natural world.

Notes

1 John Tyndall, *Fragments of Science: A Series of Detached Essays, Addresses and Reviews*, 6th ed., 2 vols. (London, 1879), 2:182.

2 Jude V. Nixon, "'Death blots black out': Thermodynamics and the Poetry of Gerard Manley Hopkins," *VP* 40 (2002): 131.

3 Charles Darwin, *The Origin of Species*, ed. Gillian Beer (Oxford: Oxford Univ. Press, 1996), pp. 340, 351.

4 William H. Cropper, *Great Physicists: The Life and Times of Leading Physicists from Galileo to Hawking* (Oxford: Oxford Univ. Press, 2004), p. 41.

5 George Levine, *Darwin and the Novelists: Patterns of Science in Victorian Fiction* (Cambridge: Harvard Univ. Press, 1988), p. 161.

6 Thomas A. Zaniello, "The Spectacular English Sunsets of the 1880s," *Victorian Science and Victorian Values: Literary Perspectives*, ed. James Paradis and Thomas Postlewait (New York: Academy of Sciences, 1981), pp. 265, 257. Hopkins argues that any perceived increase in sunpower "ought to be both felt and measured by exact instruments, not by the untrustworthy impressions of the eye" (p. 265).

7 *The Further Letters of Gerard Manley Hopkins*, ed. Claude Colleer Abbott, 2nd ed. (London: Oxford Univ. Press, 1956), p. 202 (July 10, 1863).

8 John Ruskin, *Modern Painters*, 5 vols. (London, 1873), 2:4.

9 *The Journals and Papers of Gerard Manley Hopkins*, ed. Humphry House (London: Oxford Univ. Press, 1959), p. 20. Further references to this edition are given in the text.

10 *Further Letters*, p. 128 (September 20, 1874).

11 *The Letters of Gerard Manley Hopkins to Robert Bridges*, ed. Claude Colleer Abbott (London: Oxford Univ. Press, 1935), p. 281 (August 18, 1888). For a discussion of Hopkins' response to Darwin on the cell making of bees, see Jude V. Nixon, "'From Pap to Poison': Gerard Manley Hopkins and the Poetics of Darwinism," in *Gerard Manley Hopkins and Critical Discourse*, ed. Eugene Hollahan (New York: AMS, 1993), pp. 99-100.

12 Gillian Beer, *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot and Nineteenth-Century Fiction*, 2nd ed. (Cambridge: Cambridge Univ. Press, 2000), p. 7. Beer notes Darwin's distress at Sir John Herschel's description of his theory as "'the law of higgledy-piggledy,'" which nevertheless expressed the dismay felt by many Victorians at this time.

13 St. George Mivart, *On the Genesis of Species* (New York, 1871), pp. 9-10, 5, 20.

14 Crosbie Smith, *The Science of Energy: A Cultural History of Energy Physics in Victorian*

Britain (Chicago: Univ. of Chicago Press, 1998), p. 84.

15 Nixon, "'From Pap to Poison,'" p. 98. Here, Nixon argues the case for considering the play of Darwinian elements previously neglected in Hopkins' poetry.

16 *The Poetical Works of Gerard Manley Hopkins*, ed. Norman H. Mackenzie (Oxford: Clarendon, 1990), p. 86. All references to Hopkins' poetry are taken from this edition and the number of each poem is given in parentheses.

17 Daniel Brown, *Hopkins' Idealism: Philosophy, Physics, Poetry* (Oxford: Clarendon, 1997), p. 248.

18 See "'Death blots out black'" for a discussion of these tropes. Nixon observes that Hopkins' scientific interest was intensified at Stonyhurst with its cadre of scientists; poems written after this, he argues, exhibit a more direct engagement with thermodynamics (p. 134).

19 Gillian Beer, *Open Fields: Science in Cultural Encounter* (Oxford: Oxford Univ. Press, 1996), p. 263.

20 Herbert Spencer, *First Principles* (London, 1875), p. 558. Spencer stated that universal evolution must be followed by universal dissolution due to the persistence of force. He saw the phenomena of dissolution and the phenomena of evolution as manifestations of the same ultimate law under opposite conditions.

21 Jude V. Nixon, *Gerard Manley Hopkins and His Contemporaries: Liddon, Newman, Darwin and Pater* (New York: Garland, 1994), p. 157.

22 D. F. Bratchell, *The Impact of Darwinism: Texts and Commentary Illustrating Nineteenth Century Religious, Scientific and Literary Attitudes* (Amersham, England: Avebury, 1981), p. 89.

23 C. W. Goodwin, "On the Mosaic Cosmogony," in *Essays and Reviews* (London, 1860), p. 252.

24 Daniel Brown, "Victorian Poetry and Science," in *The Cambridge Companion to Victorian Poetry*, ed. Joseph Bristow (Cambridge: Cambridge Univ. Press, 2000), p. 155.

25 In "Death blots out black," p. 137, Nixon describes Hopkins employing phases of energy as a religious trope in order to draw a distinction between grace and sin. Tropes of boiling and freezing or evaporation thus convey spiritual states of conversion.

26 Christopher Devlin, S.J., *The Psychology of Duns Scotus* (Oxford: Blackfriars, 1950), p. 6.

27 *The Sermons and Devotional Writings of Gerard Manley Hopkins*, ed. Christopher Devlin, S.J. (London: Oxford Univ. Press, 1959), p. 36.

28 Brian J. Day, "Hopkins' Spiritual Ecology in 'Binsey Poplars,'" *VP* 42 (2004): 187.

29 *Further Letters*, p. 92 (October 20, 1866).

30 Brown, "Victorian Poetry and Science," p. 153.

31 James Milroy, *The Language of Gerard Manley Hopkins* (London: André Deutsch, 1977), p. 52.

32 Max Müller, *Lectures on the Science of Language,* 5th ed. (London, 1866), p. ix.

33 Brown, "Victorian Poetry and Science," p. 154.

34 Beer, *Open Fields*, pp. 247-250. The importance of Helmholtz's influence on Tyndall was later effaced, according to Beer, so obscuring the sources of the Victorian conflict which remain intense in the poetry and journals of Hopkins.

35 Isobel Armstrong in *Language as Living Form in Nineteenth-Century Poetry* (Totowa, New Jersey: Barnes and Noble, 1982), p. 14, characterizes inscape as "the unique, individuating particularity of the object which creates not only its identity but its unity," and its instress as "the specific energy with which its being is charged and which renders a particular emotion to the perceiver."

36 G.E.R. Lloyd, *Early Greek Science* (London: Chatto and Windus, 1970), p. 38.

37 Author's note on the rhythm in "The Wreck of the Deutschland," *Poetical Works*, p. 118.