"THE PASSWORD PRIMEVAL": WHITMAN'S USE OF SCIENCE IN "SONG OF MYSELF"

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SEEMINGLY REVERSING SHELLEY'S DICTUM that "poets are the unacknowledged legislators of the world," Walt Whitman, in the preface to the 1855 edition of Leaves of Grass, asserted that scientists are "the lawgivers of poets and their construction underlies the structure of every perfect poem." Rejecting the image of antagonism usually thought to characterize their relationship, Whitman used sexual imagery to depict a harmonious and productive coming together of poet and scientist: "No matter what rises or is uttered, the scientists "sent the seed of the conception of it . . . of them and by them stand visible proofs of souls . . . . always of their fatherstuff must be begotten the sinewy races of bards. If there shall be love and consent between the father and the son and if the greatness of the son is the caressing of the greatness of the father there shall be love between the poet and the man of demonstrable science. In the beauty of poems are the tuft and final applause of science." Typically, the Whitman persona characterizes himself as a virile impregnator of women, but here the poet gives that function to the scientist, who stands first in the order of conception. Out of his "fatherstuff" are born the "sinewy races of bards." The conceptions of the scientist provide the poet with the originating ideas or "seed" of poetic ideas. Still, the poet completes the process; his art transmutes scientific conceptions so that in the aesthetic realm of poetry they have their most complete realization, their "tuft and final applause."

As if to declare that he had remained true to this conception of poetry throughout his career, Whitman, in one of his last poems, "L. of C.'s Pulpit" (1891), defined in cosmological terms the essential purpose of his life's work, "Born in ripe'd youth and steadily pursued":

Haughty this song, its words and scope,
To span vast realms of space and time,
Evolution—the cumulative—growths and generations.
Here Whitman identifies evolution as the central idea in his poetry. The theory of evolution—or the development hypothesis as it was known in the years before Darwin—touched on fundamental questions of the origins of the chemical elements that make up the earth, the nature of man, and the relationship of both to a universe whose unimaginable dimensions, its "vast realms of space and time," were just being realized through the work of such scientists as Lyell in geology and the two Herschells in astronomy. While evolution was central to Whitman, his poetry, as Joseph Barrows has shown, demonstrates a remarkable knowledge of the full range of contemporary scientific ideas, particularly of astronomy. And in "Whitman and the Body Beautiful," Harold Aspiz has shown how Whitman drew from a wide variety of scientific and pseudoscientific medical sources in creating his powerful poetic persona. Yet, although he used them extensively, scientific ideas do not abide in Whitman's poetry, but form an integral part of a unified poetic vision. His friend and early critic John Burroughs appropriately praised his "thorough assimilation of the modern sciences, transmuting them into strong poetic nutriment." Sharing in the wonder occasioned by the revolutionary discoveries of the day—in astronomy, geology, biology, physiology, energetics, and other fields—Whitman made use of scientific ideas to support his extraordinary conception of the scope and power of the poet. "Great is the faith of the flush of knowledge and of the investigation of the depths of qualities and things," he wrote in the 1855 preface. "Cleansing and uniting here swells the soul of the poet yet is president of itself always" (p. 13). Despite Whitman's numerous testimonies to their centrality, many scholars have discounted the importance of scientific ideas in his work. For instance, in his thorough review of Whitman's sources, The Foreground of Leaves of Grass, Floyd Stovall concludes that "there is no evidence in the poems of the 1855 edition that anything more than the romance of science had interested him seriously." Here I will proceed from the opposite assumption and take the poet at his word. In asserting that science provided the "seed of the conception" of poetic ideas, Whitman established an essential context for understanding his work. To expand our knowledge of the broad range of scientific ideas available to Whitman, I will consider his relationship with Edward Livingston Youmans (1827–87), who came to be recognized as the prominent expositor of science during the thirty-year period beginning in the mid-1850s. My purpose will be to investigate some of the ways that Whitman in "Song of Myself" was able to make use of the leading scientific concepts which Youmans expounded and with which he came to be identified.

Near the end of his life, in conversation with Horace Traubel, the mention of Youmans' name brought from Whitman a fine appreciation of the scientific habit of mind: "I like the scientific spirit—the holding off, the being sure but
And as Whitman urged the young men to seek knowledge and avoid the evils of gambling and drink.

In 1851, with the sight of one eye at last partially restored, Youmans published a surprisingly successful text, *The Glass Book of Chemistry*, which emphasized the importance of the experimental method. At this time he began his career as a lecture to demonstrate the wonders of science to a broad audience. Whitman's use of prescriptive imagery similar to that of Whitman's *1855* preface to describe Youmans' work as lectures: "I believe it is safe to say that few things were done in all those years of more vital and lastling benefit to the American people than this broadcast-sowing of the seeds of scientific thought.""}

Not an original investigator, Youmans nevertheless possessed a true genius for synthesizing the work of leading scientists and cogently presenting their leading ideas to the public at large. Fiske credited him with the ability to move

... on a plane so near to that of the originators that he seized at once upon the grand scheme of thought as it was developed, made it his own, and brought to its interpretation and diffusion such a happy combination of qualities as one seldom meets with. ... Youmans [could] grasp the newest scientific thought so surely and firmly that he seemed to have entered into the innermost mind of its author and speak to the general public in a convincing and stimulating way that had no parallel. This was the secret of his power, and there can be no question that his influence in educating the American people to receive the doctrine of evolution was great and widespread."


Both as editor and regular essayist, he developed the magazine into a major instrument in the "crusade for scientific autonomy and respectability" that he led in those years. In large part through his efforts, the Appleton firm became the country's leading publisher of scientific works.

A free-thinker religiously, Youmans sought to liberate Americans from the imprisoning theological orthodoxies of the time. But while separating himself from conventional religious worship, he celebrated science almost as a new revelation, giving rise to a force capable of once of improving man's lot on
earth through the application of rational principles in such areas as agriculture, education, industry, and mental illness, and expanding his appreciation of the sublime workings of the Creator by opening to him stupendous insights into the orderly working of the cosmos. In his tireless campaign for educational reform, he was conscious of speaking for a new class of intellectual leaders, men who did not have the benefit of formal education with its rigid classical curriculum: “The numerous instances of self-made men, who, with no external assistance, have risen to intellectual eminence, testify to the power of the spontaneous and self-determining tendencies of human character.” Whitman had made a similar point in his Daily Eagle leader in urging the young men of Brooklyn to continue their studies, even if they did not have the advantages of formal schooling. Whitman too was such a “self-made” and self-educated man and on one level “Song of Myself” may be read as a testimony to the “spontaneous and self-determining tendencies of human character.”

Yet, early in the 1830s Youmans became the chief American disciple of Herbert Spencer, whose work he brought to the Appletons. There can be little doubt that, as he devoted himself to promoting Spencer’s rigid, all-embracing system, he was less willing to trust the “spontaneous and self-determining tendencies” of his own character. Eventually, the careers of the two writers took different directions: Professor Youmans, as the responsible editor of Popular Science Monthly and editor of the prosperous Appleton publishing firm, moved toward conservative respectability. Whitman, of course, refused to repudiate anything, but, as in “Song of Myself,” proclaimed his willingness to “beat the song of revolt, and stop with fugitives and them that plot and conspire” (p. 50).

As might be expected, at some point the two parted company; and with a great deal of bitterness on Youmans’ part. Fiske wrote that “in later years Youmans always maintained that Walt was an ardent bumpkin, and that his ‘barbaric yawp’ and effusive filthiness were assumed purely for pelf, after he had found that polite writing would not pay his bills.” No doubt in referring to Whitman’s “inability to pay his bills,” Fiske had in mind the unfortunate Parton affair. But Whitman’s alleged defalcation would occur in 1857, some fifteen years after the first two became acquainted at Mrs. Chipmans establishment, and in the small, heady world of New York writers and reformers of the 1840s and 1850s there would have been ample opportunity for the two to come together and share ideas.

Both, for instance, were active in the temperance movement. Youmans’ first book, The Scientific Basis of Prohibition, appeared in 1846, the same year that Whitman reprinted Franklin Evans, his temperance novel of 1842, in the Daily Eagle, where he wrote: “We consider temperance one of the grand regenerators of the age; and that all who, in truth of heart, labor in its promulgation, deserve well of heaven and men.” Youmans’ 1854 temperance pamphlet, Alcohol and the Constitution of Man, was published by the phrenological firm of Fowler and Wells, which distributed Leaves of Grass the next year. Youmans, like Whitman, would come to disavow his commitment to temperance, but like Whitman, he continued to advocate the principles of sound nutrition and physical hygiene, and he lectured and wrote on these subjects.

The involvement of both writers in such reforms as temperance and diet should be seen in the context of the extraordinary social optimism of those pre-Civil War years in New York. It was a time when, to use the title of an 1854 address by George Bancroft, “The Necessity, the Reality, and the Promise of the Progress of the Human Race,” was widely believed in. Observing the manifold benefits of free institutions, many Americans, as Russell Nye has written, were convinced that the “whole force of history...pointed toward the United States as the climax of a divinely-ordained march toward human betterment.”

In this environment the questions to be debated centered on how best to arrange social institutions and realize other reforms so as to accelerate the grand march of progress. Youmans participated in these discussions, attending meetings in Brooklyn “where the subject of the reorganization of society was a leading topic of conversation. At these gatherings questions of reform were presented in a broader light and involved more fundamental changes than the antislavery and temperance discussions to which Edward was accustomed...” [He formed lasting friendships... . In those enthusiastic days when the immediate and indefinite educability of everybody, mentally and morally, was believed in without reserve—when generous zeal believed that a new heaven and a new earth were at hand.” Surprisingly for one who would become the chief American disciple of Spencer, Youmans was for a time attracted to the socialism of Fourier, becoming a member of a commune, the North American Phalanx, founded on the principles of Fourier. Whitman apparently remained unconvinced by Fourierism, writing of it critical in the New Orleans Daily Crescent. However, as Gay Wilson Allen has written, “in basic ideas and imagery,” the “democratic idealism” of Whitman resembles the “social optimism” of The Social Destiny of Man (1840) by Albert Brisbane, the leading American advocate of Fourier.

In this visionary atmosphere Youmans came to see science as the means for realizing that “new heaven and...new earth” thought to be “at hand.” One student of his career has written that his “glowing enthusiasm for science is understandable only by setting it against a period wherein science progressed by leaps and bounds. Youmans fought for the dissemination of scien-
tific ideas, constantly directed people's consciousness towards them, battled tooth and nail with older cultural traditions of theologians and conservatives, and shared the mystic belief that science would lead to eventual perfection. A channel through which science was diffused to the common man was Edward Livingston Youmans, rationalizer of the common mind. 57 Similarly, Whitman created a poetic persona who could directly communicate to the reader a visionary faith in man's creative power. It is likely that Whitman, who sought to keep abreast of the astounding developments in science, followed closely the career of his once-blind former associate on the Aurora as he courageously set out to reveal the new science to the people.

In fact, one scholar, Joseph Jay Rubin, has speculated that Whitman is the author of a letter published in the New York Times on 23 February 1853, praising Youmans' lectures and urging that he be brought to Brooklyn to speak. In those lectures, one on "Chemistry of Vegetable Growth" and one on "Chemistry of Foods and Digestion," Youmans "talked of ideas from the recently translated Kosmos of Baron von Humboldt." 58 While there is no conclusive proof that the letter to the Times, which was signed "W" and sent from Brooklyn, was written by Whitman, its enthusiastic style and largeness of vision might well be described as "Whitmanesque," as this excerpt suggests: "It is difficult to comprehend how the least cultivated mind can be made acquainted with the beautiful harmonies that pervade every department of nature without being excited to the highest degree of wonder and admiration. There is so much in those divine laws by which Omniscience governs the universe, so much in the attention, the thoughts, and incite to the profoundest admiration all thinking minds, that it is a wonder there can be one rational being indifferent to the revelations of science." 59

For the author of the letter—as for Youmans—the "revelations" of the new science led naturally to a sublime and spiritual wonder at the scientific principles, the "divine laws," by which the Creator "governs the universe." There could be no conflict between science and religion. As Youmans wrote, "For the view long held as religious [the Mosaic account of creation] science has substituted a view that is more eminently religious (evolution) . . . And may it not be that the constructors of the philosophy of evolution are entitled to a leading place among the evangelists of our time?" 60 Since evolution assumed such a large place in the work of both writers, it will be useful, before treating Youmans' career as lecturer and writer, to investigate his immediate sources for evolution.

II. EVOLUTIONARY THEORY

Fiske has written that well before the publication of Darwin's Origin of the Species in 1859 evolution burst upon this generation as

an idea of the first magnitude . . ., the greatest thought of science. By showing Nature to be a family it gave to classification genetic relationship as its true basis. To education it indicated a new way and the best. It made it possible to write Nature's history backwards to the primitive chaos—as wonderful in all its dormant possibilities as the cosmos contained. It made the universe one in a new sense, for it bound together, in a single web of causation worlds, continents, life, mind. To have lived when this prodigious truth was advanced, debated, established, was a privilege rare in the centuries. The inspiration of seeing the old isolating mists dissolve and reveal the convergence of all branches of knowledge is something that can hardly be known to men of a later generation, inheritors of what this age has won. 61

For a generation that experienced the loss of traditional religious faith, evolutionary theory came with the force of a new revelation, one which brought startling unity to the universe, for it "broadened together" the physical world and "mind."

Unmistakably, the work that first brought a coherent theory of evolution to Youmans' attention was Robert Chambers' Vestiges of the Natural History of Creation, published anonymously in London in 1844. We know that not long after its publication it was read to the blind Youmans at home in Saratoga Springs and "was much talked of in the family." 62 Written by an amateur in science (Chambers was an Edinburgh publisher and writer), Vestiges contained many superficial errors, making it an inviting target for orthodoxy experts in science and theology. The fortunate result was that evolution became a subject of public controversy in England and America.

In the fall of 1847 the subject was very much on the minds of the general public when the distinguished Harvard naturalist Louis Agassiz came to New York to deliver a series of lectures. Agassiz was expected to offer the decisive word on this vexing question. At last in the sixth lecture, Fiske wrote, "he felt constrained to turn aside from his systematic exposition" and courageously attacked Vestiges as "entirely unworthy of notice by any serious scientific man." Then Agassiz proceeded to "illustrate his favorite conception of the truths of science as the thoughts of God." Youmans was so roused up in the proceedings that he not only attended the lectures but also requested that the full transcript, as published in the Tribune, be read—and re-read—to him. The thinness of Agassiz's attack and the patent weakness of his arguments for direct divine intervention at successive stages of the process of creation confirmed in Youmans' mind the truth of the development hypothesis. 63

If, then, Youmans did inspire Whitman's treatment of evolution, it is likely that it was the interpretation suggested by Chambers. And there is independent evidence—both internal and external—for recognizing Chambers' importance for Whitman. His involvement in the controversy is indicated by
his clipping of several articles dealing with Hugh Miller, whose *Footprints of the Creator* (1849), attacked Chambers. And as one scholar has written, "by Vestiges—and, for some fifteen years, by Vestiges alone—evolution was kept for the Victorian reader in the air." In view of Whitman's strong interest in science, he would have been familiar with certain of Chambers' concepts, particularly in astronomy. But in *Vestiges* he would have found something he could have found nowhere else: integration of the separate fields of inquiry around the concept that came to mean most to him, evolution.

Chambers' great achievement was precisely one of integration and synthesis. As Loren Eiseley has written, he put together the "separate pieces of the lost [evolutionary] chart" of previous scientists and "came up with the idea that organic as well as cosmic evolution was a reality."

Similarly, one of the distinguishing features of Whitman's treatment of the concept is his ability to bring together evidence from the separate sciences and present an integrated vision of startling force, one which demonstrates the indivisibility of the cosmic and terrestrial processes. Wrong as Chambers certainly was in many of the details of his theory, he was brilliantly right in its essentials. Youmans may well have discussed *Vestiges* with Whitman and helped him separate the sound from the absurd in the book. Also, the highly charged controversy in the periodicals exposed many of Chambers' faulty arguments. The essential point is that in its broad outline and essential features "Song of Myself" is entirely consistent with *Vestiges*.

A summary of Chambers at this point may be useful. *Vestiges* begins with two chapters devoted to proving that evolution is a cosmic process. After explaining such weighty matters as the great age of our solar system, its position within the Milky Way, the movement of the heavenly bodies, and Laplace's nebular hypothesis, Chambers reached the conclusion that creation is a dynamic and on-going process throughout the cosmos. "The formation of bodies in space is still and at present in progress. We live at a time when many have been formed, and many are still forming."

Chambers then argued for the unity of the cosmic and terrestrial realms. After explaining the composition of the earth out of the fifty-four or fifty-five chemical elements then known to exist, he exclaimed, "Now infinitely is the knowledge increased in interest, when we consider the probability of such being the materials of the whole of the bodies of space, and the laws under which these everywhere combine, subject only to local and accidental variations." The case with which the Whitman persona moves between the earth and the farthest reaches of heaven is one consequence of the discovery of the chemical unity of the two realms. Such ideas led Chambers to speculate on the probable existence of intelligent life in other solar systems. Neither man nor the earth should be seen as unique.

After explaining the geological processes by which the earth was formed, Chambers developed his major argument for evolution; the "vestiges of creation," the fossils of the species that had been found in sedimentary rocks, display a progressive complexity that corresponds to the age of the strata. He pointed out that the fossils from the earliest strata were confirmed to have come from extinct species. He then related the process of developing complexity to the evolution of all living creatures, with man at the top of an unbroken chain which rises from the most elementary organism. "The tendency of all these illustrations is to make us look to development as the principle which has been immediately concerned in the peopling of this globe, a process extending over a vast space of time, but which is nevertheless connected in character with the shorter process by which an individual being is evolved from a simple germ." Chambers cited the most recent work in embryology, of Meckel, Tiedemann, and others, to give added proof to his theory. "It is only in recent times that physiologists have observed that each animal passes, in the course of its germinal history, through a series of changes resembling the permanent forms of the various orders of animals inferior to it in the scale."

In other words, ontogeny resembles phylogeny; through the development of his embryo, the individual recapitulates the entire evolutionary process of the species. The challenge which Whitman, as the poet of evolution, accepted was to recall that evolutionary process from deep in his subconscious and find the "voice" to express it.

Chambers' interpretation of the evolutionary process was decidedly optimistic. Since atmospheric conditions for life on the earth were gradually becoming more favorable, he expected to see continuing progress in the development of the human species, with the gradual emergence of more complex beings, "a nobler type of humanity, which shall complete the zoological circle on this planet, and realize some of the dreams of the purest spirits of the present race." Conceding that his theory was fundamentally opposed to the Mosaic account, Chambers emphatically proclaimed his belief that the concept of organic evolution, the gradual emergence of intelligent life out of matter, with each species giving rise to the next higher, was not inconsistent with the wise workings of the Creator: "I contemplate the whole phenomena as having been in the first place arranged in the counsel of Divine Wisdom, to take place, not only upon this sphere, but upon all the others in space, under necessary modifications, and as being carried on . . . here and elsewhere, under immediate favour of the creative will or energy." Chambers conceded that he had no certain theory to explain the mechanism actually responsible for evolutionary development, although he cited the work of Quetelet on the application of statistical theory to human behavior as allowing for the gradual appearance of small changes in a large number of instances. And he referred as well to the work of Babbage on computational
theory to explain the possibility that God had "programmed" minute changes into the pattern of the universe. By no means was Chambers the purposeless universe sometimes erroneously associated with Darwin.

At the same time Chambers argued quite openly that man's character did not stem from a spiritual quality marking him off from the animals, but was a direct extension of faculties that had been developing throughout the evolutionary process. 44 To explain man's superior intelligence Chambers discussed the evolution of the brain as an organ of the mind. He was influenced by phrenology, and although he submerged it, there is a definite phrenological cast in Chambers' concluding chapters, especially where he attempts to account for differences in development between individuals and races. No doubt this dimension of the Vestiges of Creation was intriguing to Whitman, whose interest in phrenology is well known.

For the young Whitman the controversy over Vestiges in the years 1846 and 1847 could not have come at a more opportune time. Chambers opened for his readers a seemingly limitless vista of man's place in an expanding cosmos. In the notebooks dating from these years, in which Whitman experimented with ideas that he would later develop in Leaves of Grass, he expressed a vast cosmic yearning, a desire to identify his life with the timeless life of the cosmos. As Gay Wilson Allen has written, what the young Whitman "wanted most in his life of the imagination was to immerse, to bathe, to float (these were to become key images in his poems) in the eternal stream of existence. Having attained these mystical insights and intellectual concepts, Whitman was emotionally and mentally equipped to write the great book he had been dreaming of since his Sundown Papers from his schoolmaster's desk." 45

In one entry he wrote, "I think the soul will never stop, or attain to any growth beyond which it shall not go. — When I walked at night by the seaside and looked up at the countless stars, I asked of my soul whether it would be filled and satisfied when it should become god-gnawing all these, and open to the life and delight and knowledge of everything in them or of them, and the answer was plain to me . . . No, when I reach there, I shall want to go further still." 46 Evolutionary theory as presented by Chambers could help the poet take such feelings and give them structure and direction within a dynamic theory of the universe. And it enabled Whitman to confront the two problems which, as Asselineau has written, deeply troubled him at this time: death and sin. 47 There are more than "vestiges" of Chambers' book to be found in "Song of Myself"; the concept of cosmic evolution pervades Whitman's epic. But in showing the extensive use which Whitman made of this book, it might be well to begin with the person's discovery, in Section 31, that the "vestiges" of creation have become an inseparable part of his being, a clear and direct reference to Chambers:

In asserting that he "incorporates" extinct species, such as the mastodon, later stages of the creation, such as quadrupeds and birds, and such inanimate matter as "gossip, coal, long-threaded moss," the speaker explicitly defines man as a being who has evolved by passing through those stages and forms. Employing his remarkable powers of language, the speaker uses the development hypothesis to "call anything close again" and make real the intimate connection between the human and that from which it evolved. It is now impossible for the prehistoric forms to escape close inspection, by scientist or poet. Whitman playfully and comically awakens these long-sleeping vestiges, and shows the role they have played in determining human identity. And it was precisely here, in arguing that man is a creature whose identity has been formed through the natural process of evolution, not through the direct intervention of the Creator, that Chambers and Whitman were so disturbing to the orthodox thought of the day. It would no longer be possible to think of man as a purely spiritual being, fashioned by the Creator in His image, but as an animal whose superior attributes had been developed gradually, in the course of the evolutionary process. Whitman wisely approaches a subject of bitter controversy with a gentle, ironic humor. His persona admits to descent from quadrupeds and birds.

Whitman's most consistent and fully worked-out exposition of Chambers appears in Section 44, which is a creation story told from the perspective of cosmic evolution. It celebrates the emergence of man, but along the way accounts for the creation of the cosmos itself. The story is exciting, the poet describing the perilous escape of his embryo from the lurking dangers of "soul carbon" and dramatizing the work of "monstrous sauroids" in protecting it. Yet, wonderful, miraculous as the story is, its true hero is not supernatural but natural: the established physical laws of the universe which nevertheless operate with transcendent cosmic power.

Appropriately, the section begins with a formal announcement:
It is time to explain myself... let us stand up.

What is known is strip away... I launch all men and women forward with me into the unknown.

(p. 79)

The speaker asserts that he will explain both the mystery of his own existence and the even more fundamental question of human existence in space and time. The “unknown” into which the reader is launched is the cosmos itself, treated from the perspective of the innumerable dimensions of time as revealed by the new astronomy and geology:

The clock indicates the moment... but what does eternity indicate?

Eternity lies in bottomless reservoirs... its banks are rising forever and ever.

They pour and they pour and they whirl away.

We have thus far exhausted millions of winters and summers;

There are billions ahead; and trillions ahead of them.

(p. 79)

Such is the great age of the earth—and the promise of the future—that time may be said to be infinite, as revealed through the brilliant metaphor of “bottomless reservoirs.” Whitman then linked this perception of time, of the great age of the universe and of the infinite expanse of the future, to the development hypothesis. Out of the endless years will come new forms: “Births have brought us richness and variety. And other births will bring us richness and variety” (p. 79). The evolutionary process is ongoing, as did Chambers, Whitman here looks ahead to the continual emergence of yet higher forms of life. Whitman’s vision, like that of Chambers, is of a dynamic, constantly changing, open-ended universe.

Even while looking ahead to the development of more complex forms of life, the poet is careful to insist on the principle of equality: “I do not call one greater and one smaller; that which fills its period and place is equal to any” (p. 79). It may seem to the reader that Whitman is simply imposing his preference for political democracy and social equality on the material universe. But Chambers took a similarly egalitarian approach to the physical universe in *Vestiges*. In responding by implication to accounts of creation that placed the earth in a unique position, Chambers argued for an equality among heavenly bodies: “There is nothing at all singular or special in the astronomical situation of the earth... it is strikingly—if I may use such an expression—a member of a democracy. Hence, we cannot suppose that there is any peculiarity about it which does not probably attach to multi-

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In effect the poet repudiates the Christian concept of Original Sin associated with the Fall of Adam and Eve and the moral sins of Cain and his descendants, which the reference to murder and jealousy calls to the mind of the reader. Nothing in Chambers’ progressive evolutionary perspective requires a myth accounting for man’s sinful nature, nor does the poet’s own experience, which, he claims, has been “gentle,” require it. For Whitman the aesthetic significance is clear: he refuses to take up the mode of lamentation, but signifies instead his desire to continue to celebrate—both himself and the entire creation, the note on which he had begun.

For in the context of Chambers’ exposition of the development hypothesis, such celebration is entirely warranted. As the representative man, the poet occupies the highest point in the continuing process of evolutionary development: “I am an acme of things accomplished, and I an encloser of things to be” (p. 79). Just as each man contains within himself the full history of evolutionary development, so does he possess or “enclose” the spermatic fluid out of which future growth will come. To picture that growth, the speaker instantaneously transforms himself, becoming that which, in the long evolutionary perspective, man will become:

My feet strike an apex of the spaces of the stairs,

On every step bunches of ages, and larger bunches between the steps,

All below duly traveled—and still I mount and mount.

(p. 79)

The image of climbing cosmic stairs brilliantly combines—and compresses—the interrelated concepts of distance and time. As the new theory of evolu-
tion opened to Whitman a perception of the great age of the universe, so it suggested the immemorial ages to come. The poet's effortless mounting of the cosmic stairs serves to project the human presence forward into those extraordinary reaches of time. The sexual associations of "mounting" are appropriate to the process of generation and development. This arresting image is also reassuring in that it implies a kind of cosmic immortality, for both the species and the individual.

Remarkably the concept of evolution enables the poet to move both forward and backward in cosmic time. In the next passage he reverses the process, and travels back, to retrace the origins of the universe:

 Rise after rise bow the phantoms behind me,
Also down I see the huge first Nothing, the vapor from the nostrils of death,
I know I was even there . . . . I waited unseen and always,
And slept while God carried me through this lethargic mist,
And took my time . . . . and took no hurt from the foetid carbon. (pp. 79-80)

The references to the "vapor from the nostrils of death," the "lethargic mist," and "foetid carbon" are to the carbonic gas said by Chambers in the sixth chapter to have dominated the earth in its early stages that it was incapable of supporting life in land animals. The gradual dissipation of this gas, in Chambers' explanation, made possible the emergence of simple forms of organic life. Here Whitman introduces the concept of God, of a Divine presence which has so directed the process from the outset that human life has been allowed to emerge. Yet, this is not a God who intervenes directly in the creation; rather, He operates entirely through impersonal natural laws. The references in this passage to the "rings" of stars and their "influences" are to Newtonian laws of gravitation. Although these laws are impersonal, Whitman presents them as operating with a wise—"even maternal—presence. The speaker's embryo has long been "hugged close" and protected by "Faithful and Friendly . . . arms," and his "cradle" has been protected by "eyes" which are likened to "cheerful batmen" (p. 80). Whitman treats evolution as a warm, nutritive mother.

In the concluding stanza of this section Whitman brings together his earlier references to the separate sciences and shows how, working together, the manifold "forces" of the universe, have contributed to the creation of the speaker himself:

Before I was born out of my mother generations guided me,
My embryo has never been torpid . . . . nothing could overlay it.

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For it the nebula cohered to an orb . . . . the long slow strata piled to rest it
on . . . . vast vegetables gave it sustenance,
Monstrous saurids transported it in their mouths and deposited it with care.

All forces have been steadily employed to complete and delight me,
Now I stand on this spot with my soul.

(pp. 80)

For the 1881 edition Whitman added the adjective "robust" to modify "soul" in the last line. But this adjective is hardly necessary. The dynamic energy of the speaker's soul is contained within the matter out of which he emerged, a process that had been set in motion by an interconnected series of natural laws or "forces." Through an imaginative use of the concept of the embryo, Whitman recapitulates the entire process. The "embryonic" development of the speaker took place both inside his mother and during the immense expanse of time since the "huge first Nothing." The assertion that his "embryo has never been torpid" is a reference to the idea that ontogeny recapitulates phylogeny, an idea that Whitman almost certainly learned from Chambers.22 Whitman's imaginative use of the idea of recapitulation enables him to dramatize the broad evolutionary process. In this sublime, yet compressed and wonderfully comic-creation story, the poet effortlessly activates and animates vast movements and forces. Even extinct saurids have been given a job to do in transporting the speaker's endangered embryo, and they work in harmony with the early strata and "vast vegetables." Appropriately, the culminating event is the birth of the poet, who is able to step onto the cosmic stage and through language take his place as a conscious participant in the grand evolutionary process. As promised, he has "stood up" and "explained himself" as a product of the evolutionary process. The section, a summary of the essential features of Vestiges, is a brilliant verbal recapitulation of the immense stages of human development. Whitman has transformed the "seed" of Chambers' scientific conception, and created a myth which offers ample reason for celebration.

III. "THE LINKS UNITING THE REALMS OF MATTER AND MIND"

Evolutionary theory, in binding together, in Fiske's words, "in a single web of causation worlds, continents, life, mind," would seem to offer the poet a most useful new cosmology.48 But it also raises some difficult questions: Precisely how could these diverse realms be bound together? And how is mind to be understood? If man is not the handiwork of a God who created him in His own image, then how did he develop those qualities which seemed to set him apart from the other animals? Could he still be said
to possess a soul? If man's superior intelligence is a function of increased brain size, then how is brain to be understood in physiological terms? Were the explanations of phrenology, which seemed, for a time, so attractive to Chambers, Whitman, and many others, adequate? Just how are mind and body related?

In his pre-1855 notebooks, Whitman wrestled with many of these questions, particularly that of the nature of the soul and its relationship to the material realm. In one of the first entries in the earliest surviving notebook (dating, most likely, from the years 1846 or 1847), he begins with the concept of soul, asserting that "The soul or spirit transmits itself into all matter—into rocks, and can live the life of a rock—into the sea, and can feel itself the sea into the oak . . . into an animal, and feel itself a horse, a fish, or bird—into the earth—into the motions of the suns and stars." Here the 'soul or spirit' is an entity which exists apart from the material world and is in some senses superior to it, because it can penetrate any aspect of the material world and live its life at will. Similarly, a little later, he cautioned himself to "speak of the soul only in the highest terms, as intrinsically great," and to use adjectives which "always testify greatness and immortality and purity." Soul, then, would seem to have an independent and superior existence. But in the next entry he qualifies this notion of the autonomy of the soul by asserting that its "effusion or corporation . . . is always under the beautiful laws of physiology—I guess the soul itself can never be anything but great and pure and immortal; but it makes itself visible only through matter." From this perspective we can appreciate the crucial importance to Whitman of physical health, for, "a perfect head, and bowels and bones to match is the easy gate through which it [the soul] comes from its embowered garden." Conversely, the imperfect body ("twisted skull, and blood-watery, or rotten by ancestry or glutony, or rum or bad disorders") is the "darkness toward which the plant will not grow." We can understand, then, why Whitman sought so assiduously to comprehend the principles of good health, a subject of Youmans' early lectures and writings.

In a later diary entry Whitman wrote of having been taught "that mind is greater than matter," but rejects this notion: "I cannot separate them, and call one superior and the other inferior, any more than I can say my sight is greater than my eye." Since he admitted to himself that "I cannot understand the mystery of the relationship of body and soul, he resolved to consider them as equal, and to make the question of their relationship a subject of his poetry." Among the first trial lines for "Song of Myself" are the following: "I am the poet of the body / And I am the poet of the soul." In the 1853 Preface he spoke of the rightful expectation of readers that the true poet would "indicate more than the beauty and dignity which always attach to dumb real objects . . . they expect him to indicate the path between real-
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by plants and animals. He then grew rapturous in describing the agency of
the sun in controlling the earth's atmosphere and insuring a life-promoting
balance of gases. "It has been stated that the two worlds of organization
[plant and animal] are condensations from the intangible gases with which our
planet is enshrouded. If thus all living beings are derived from these fleeting
airs, which are so rare and ethereal that they seem almost designed to con-
nect the worlds of matter and spirit, it is fit that the forces which control such
changes should have a celestial origin." 62 Youmans' prose can be described
as scientific in its description of physical processes, aesthetic in its celebration
of the beauty and harmony of these processes, and spiritual, as when, a little
later, he refers to the sunbeam as the "divine effusion of the stars," the
force of antagonization by which all life and beauty and glory upon the
earth are perpetually called into being. 63 In reading such passages or listen-
ing to the inspired Youmans speak them, Whitman would be justified in
assuming, for the purposes of his poetry, that the "fleeting airs" did indeed
"connect the worlds of matter and spirit." Concerned with discovering the
metaphoric possibilities of scientific concepts, Whitman would have found
Youmans' language suggestive. From this perspective, the physical breath
"surging and surging" through the speaker could be thought of as connecting
the "worlds of matter and spirit," and so become the traditional poetic
afflatus.

Paradoxically, then, Whitman's use of the latest scientific concepts restores
to him the most ancient power of poetry, that of "the password primeval,"
giving him entry into a world that had been barred and restricted. In basing
his art firmly in the body, the poet is able to uncover and possess the hidden
dimensions of the physical world, and through the concepts of science, dis-
cover the links joining the material world to mind. He can then speak the
"password primeval," use language with original force. In one of his first
notebook entries Whitman wrote that "in the earliest times... everything
written at all was poetry." 64 Paradoxically, the new science enabled the poet
to recover the original power of poetry. For this reason Whitman could write
in the 1865 Preface that "exact science and its practical movements are no
checks on the greatest poet but always his encouragement and support"
(p. 15). In learning how to use the concepts and vocabulary of the new scien-
te metaforically, Whitman turned to his advantage the threat to poetry
which modern science, with its positivism, seemed to present.

The poet who possesses "the password primeval" can interpret the pulses
surging within his own body and give voice to the things and people of the
external world and find their true meaning. For Whitman, as had been true
for Chambers, that meaning has a democratic dimension. Immediately after
speaking the "password primeval," the poet gives the "sign of democracy."
He gladly becomes the voice of those who have not been able to articulate
their own meaning: slaves, prostitutes, the diseased, thieves, and the deformed. For all share with the poet “on the same terms” in the dynamic currents of the material world, and that gives the poet access to them. The poet is demonstrating that their existence also is worthy of being celebrated. Aware of the many connections uniting mind and matter, body and soul, the speaker makes use of physical concepts to become himself articulate, intelligent link in a most complex and wondrous network.

On the other hand, some readers may recall the passage in Section 23 in which the speaker, rather than using science as a “password,” seems instead to place a barrier between himself and the scientist: “Gentlemen, I receive you, and attach and clasp hands with you; / The facts are useful and real / they are not my dwelling... I enter by them to an area of the dwelling” (p. 49). The passage has been interpreted as a polite but firm rejection of science; the poet and scientist—it seems to say, go their separate ways. Certainly the speaker asserts that his method is not that of “positive science” and “exact demonstration.” He does not employ the experimental method to test hypotheses, something that Youmans insisted was the essential condition of science. Since science is not his “dwelling,” he does not feel obligated to emulate the methods of the scientist in working with the natural world. Nevertheless, the passage explicitly testifies to the importance of the work of the scientist for the poet. For the “facts” discovered by the scientist make it possible for the poet to “enter” his “area of the dwelling.” Figuratively, the two—poet and scientist—are housed under the same roof.

The poet’s starting point—and the first line of Section 23—is “A word of reality... materialism first and last imbuing” (49). The speaker accepts the challenge of finding in the real world, both as he has experienced it and as it is revealed to him by the “facts” (and concepts) of the scientist, the “password” which will enable him to “enter” his “area of the dwelling.” As Emerson wrote in “The Poet,” the facts become “vehicular and transitive, good... for conveyance.” Whitman here asserts that the poet employs the “facts” of the scientist so that they become a vehicle which enables him to enter his portion of the “dwelling,” to enter the imaginative realm. In “Song of Myself” Whitman uses these facts so that the persona becomes the link, a force, connecting the realm of material fact with that of imaginative realization: “I am less the reminder of property or qualities, and more the reminder of life” (p. 49). Where the scientist uses the “facts” of the material world so that he can develop abstract theories about its “properties or qualities,” the poet employs these facts for their own sake and suggests their living significance, particularly through connecting mind and matter. Paradoxically, while pointing out that the poet does not use the methods of “exact demonstration,” Whitman has written a remarkably precise statement of the differing procedures of poet and scientist, one which reveals just how cru-}

icularly important the “facts” of the scientist are in enabling the poet to “enter his area of the dwelling.” Although they live in different parts of the “dwelling,” they certainly inhabit the same universe of discourse.

IV. THE POETRY OF THE BODY, OR MAN AS A “VORTEX OF FORCES”

The area of Whitman’s artistic “dwelling” that Youmans ruled out of bounds was that where the poet treated human sexuality. Implicitly he denied the poet’s claim that he had “clarified and transfigured” the “voices of sexes and lusts,” the “voices indecent,” which are heard in his work (p. 50). Youmans may not have dealt directly with human sexuality in his own work. But at the same time Youmans was one of the leaders in the 1850s in urging that human identity be defined not in spiritual terms. Youmans argued forcefully that as a product of evolution, man is a physiological being whose essential nature is to be found not in some remote abstraction called spirit, but in his organic capacities. He saw human growth and development as a function of the organism’s dynamic interaction with the material world. Throughout his writings he, like Whitman, called for “A word of reality... materialism first and last imbuing.”

In his Chemical Atlas, for instance, he asserted that even the most exalted and refined activities of man—his triumphant achievements in the creative arts and in science—are grounded in matter, both as subject and as medium of expression. Like the agricultural worker, the mechanic and other laborers, the “cultivators of art, though their pursuit be deemed divine,” are “chained to matter by the inevitable necessities of [their] vocation.” Youmans explicitly challenged the common assumption that the high creative endeavors are valuable because they lift man out of a corrupt world of matter to the spiritual realm. On the contrary, the process of creation, the process by which the most valuable visions are realized, consists in a “circle... of explorations into the several departments of matter.”

In this book he defined man as a “vortex of forces” in constant and dynamic interaction with the external world:

It is the destiny of man that the life-period of his being shall be passed in a world of matter. Not only is he born into a material universe, but he is born of it; not only is it to be his time-residence, but he is part and piece of its fabric, created of its elements, and participating in its constitution. But the simple fact that man’s body is composed of matter, by no means indicates the intrinsic or extent of his alliance with material nature... The system of man is less a mere physical body of a certain bulk and weight, than it is a vortex of forces, of which matter in a rapid state of transition is but the means of manifestation... So vital is the relationship which subsists between the living man and the world of
physical nature, that he cannot cease the introduction of surrounding matter into his system, even for a few moments, except upon the penalty of death. 60

In this volume Youmans lucidly explained just how the chemical elements interact to sustain life. Since chemical reactions are not visible to the naked eye, he made use of color-coded drawings so that their intricate wonder could be visualized by the non-scientist. Youmans' purpose in this volume is to depict from a chemical perspective, the full range of man's interaction with the material universe.

Whitman also presented man as a "vortex of forces," although his image of him is more sensual and delightedly less tidy than that presented by Youmans. "One of the rouges, a cosmos," the speaker of "Song of Myself" is "fleshly and sensual . . . . eating, drinking and breeding" (p. 50). Throughout the poem he explores the interaction of his body with the forces of the external world, speaking of "the smoke of my own breath," and his "respiration and inspiration . . . . the beating of my heart . . . . the pushing of blood and air through my lungs" (p. 57). Like Youmans, Whitman warns of the imminent danger to man if he should cease the introduction of surrounding matter into his system: "Dazzling and tremendous how quick the sunrise would kill me, / if I could not now and always send sunrise out of me" (p. 52). Metaphorically, the "sunrise" that the speaker returns to the external world is his poetic vision, but the image has its basis in physiological fact. It is another metaphorical description of the poetic process which has its origin in the life of the body. In Chemical Atlas Youmans described the many ways in which the sun is essential to the continuation of life on this planet, and, as we have seen, came to speak metaphorically in describing the sunbeam as "the divinest influence of the stars." During his early lectures on the solar ray, Youmans explained "the links uniting the realms of matter and mind.

While recognizing the fact that man "possesses an intelligent and immortal spirit" as the "grandest fact" of his existence, Youmans argued that man's soul can have no development or even existence apart from "the material universe" which is its "sphere of . . . evolution and education." He piled phrase upon phrase to demonstrate the dynamic process of man's growth through his sensory interaction with the physical world: man's spirit "comes into being as a thought-germ planted in the soil of matter; that by an exquisite apparatus of material senses, it is put into connection—brought as it were into universal contact—with the physical world; that it grows and expands by impressions poured in from the outward universe through the channels of sense; and that power is thus acquired by which the developed soul reacts upon external nature." 61 Youmans here divides man's growth into two stages. The first, the stage of childhood, is a process of absorption; the individual is receptive to the rich sensory life around him. While outwardly passive, the individual in receiving impressions from the external world, is active. For, through the process of absorption; the individual develops the "power" which enables him to enter the second stage in which he acts "upon external nature."

"Song of Myself" describes an analogous process. Particularly in the first half of the poem the speaker is remarkably receptive to the full range of sense impressions poured upon him from the external world. Almost exactly halfway through the poem, in Section 25, immediately after the speaker mentions his need to "send sunrise out of me," he celebrates the creative power which he is now conscious of possessing:

My voice goes after what my eyes cannot reach,
With the twist of my tongue I encompass worlds and volumes of worlds.

Speech is the twin of my vision . . . . it is unequal to measure itself.
It provokes me forever,
It says sarcastically, Walt, you understand enough . . . . why don't you let it out then?

In later editions, Whitman would alter the last line to read, "Walt you contain enough, why don't you let it out then." The verb "contain" implies a process of filling up, of receiving. "Understand" implies a process of intellectual comprehension. Together, the lines suggest that through a process of receiving impressions from the external world and of comprehending those impressions, the poet has completed an action. He has developed "power," and now is prepared for the second stage. He is now prepared to act upon the external world, to "let out" or express the creative power which he has developed through his absorption of sensory impressions. For the poet, that new "power" is the imagination, which enables him to capture even that which he cannot see; through his art, the "twist of my tongue," he has the power to encompass "worlds and volumes of worlds."

Perhaps the most important consequence of Youmans' attempt to understand man in physiological terms, as a product of the evolutionary process, was his exploration of the brain as an organ of mind. In an essay published in The Culture Demanded by Modern Life (1867), he condemned the Cartesian dualism, which resulted in the denigration of the body at the expense of mind, as presenting the greatest possible obstacle to a true understanding of man:

The method of regarding man which tradition has transmitted to us from the earliest ages, is, at the outset, to cleave him asunder, and substitute the idea of
two beings for the reality of one. Having thus introduced the notion of his double nature—mind and body as separate, independent existences—they grew up a series of moral contrasts between the disjoined powers. The mind was ranked as the higher, or spiritual nature, the body as the lower, or material nature. The mind was said to be pure, aspiring, immortal; the body gross, corrupt, and perishable; and thus the feelings became enlisted to widen the breach and perpetuate the antagonism. Having divided him into two alien entities, and sought all terms of applause to celebrate the one, while exhausting the vocabulary of reproach upon the other, the fragments were given over to two parties—the body to the doctors of medicine, and the spirit to the doctors of philosophy, who seem to have agreed in but one thing, that the partition shall be eternal; and that neither shall ever intrude into the domain of the other.  

Both Youmans and Whitman devoted themselves—but in different ways—to healing this destructive "breach" and "antagonism" between two realms of man's being, which were universally believed to be discrete. Both writers insisted on "intruding" from one realm into the other and back again. Whitman's persona asserts simply, "I believe in you my soul . . . the other I am must not abuse itself to you, / And you must not abuse to the other." And in the ecstatic experience of Section 5, he captures the "peace and joy and knowledge that pass all the art and argument of the earth" when body and soul come together and are blissfully experienced as one (p. 30).

Youmans was also forceful in his efforts to heal the destructive division in man's understanding of mind. He summarized for his readers recent advances in neurophysiology. Noting particularly the work of English physiologists, he explained how science now "proceeds at the outset to reunite the dispersed fragments of human life, and reconstitute the individual in thought as he is in life, a concrete unit—the living, thinking, acting being which we encounter in daily experience." Youmans wrote of his hopes for a radical change in the methods of treating the mentally ill and feeble-minded. If their afflictions were understood organically and not as a sign of spiritual infirmity, then they would receive the respect and dignity that all human beings deserve. And only then could medical science proceed to discover causes for the underlying physical problems. Youmans' was an enlightened voice in an area which, because of problems within his own family—four of his six siblings were afflicted with various mental illnesses—was a sensitive one to Whitman. And Youmans argued forcefully for a complete revision of educational methods at the levels. He rejected the rote learning then practiced and called for an experimental and experiential approach, one which was based on a recognition of the organic capacity of the individual at different stages of his development. Conditioned his ability to learn. Abstract learning should be introduced only gradually. For instance, he observed that "the whole plastic power" of the brain of the child is "devoted to the storing up of perceptions, while the vigour of cerebral growth insures the highest intensity of mental adhesiveness." He recognized the educational value of natural childhood experiences, writing that as the child observes and-absorbs "the aspects, properties, and simple relations of the surrounding objects of Nature," then the "climate" of childlike pleasure and exuberant activity furnish the objects of thought. Youmans' comments on the value of such learning may be read as a gloss on Whitman's great poem of childhood development, "There Was a Child Went Forth." In education, too, Youmans' was a voice for enlightened reform.

Further, Youmans' investigation of the physiology of the brain led him to a recognition of the existence of the subconscious mind. Again he drew heavily on the work of English researchers, particularly Thomas Laycock, who was one of the "first to apply the theory of evolution to the development of the nervous systems in the animal kingdom and in man." Recognizing that "consciousness and mind are far from being one and the same thing," Youmans focused on those dimensions of mental activity of which man is only partially aware. What happens when ideas or feelings pass out of consciousness?

Science affirms an organ of mind, and demands an explanation, in terms of its action. As the thought passes from consciousness, something remains in the cerebral substratum, call it what you will—trace, impression, residue. What the precise character of these resedua may be, is perhaps questionable, but it is impossible to deny their existence: in some form consistent with the nature of cerebral structure and activity. All thoughts, feelings, and impressions, when disappearing from consciousness, leave behind them in the nerve substratum, their effects or resedua, and in this state they constitute what may be termed latent or static mind. They are brought into consciousness by the laws of association, and there is much probability that, in this unconscious state, they are still capable of acting and reacting, and of working out true intellectual results.  

Youmans credited a physiological mechanism in the brain with the ability to store both ideas and feelings. Potentially, none of the individual's prior experience is lost to him, for under the "laws of association" even long-forgotten experiences may be brought back into consciousness and be responsible for "true intellectual results."

Youmans recognized the significance of this insight for scientific and artistic creation. In fact, he asserted that the subconscious is the source of the very greatest artistic achievements: "It is said of eminent poets, painters, and musicians, that they are born, and not made; that is, their genius is un
endowment of nature.— a gifted organism which spontaneously utters itself in high achievements, and they often present cases of remarkable automatism." He cited the testimony of Mozart among others on the wisdom for the artist of allowing the work to shape itself.

If he had not been so troubled by Whitman's "obtrusive filthiness," Youmans might have recognized that in such works as "The Sleepers," "Out of the Cradle Endlessly Rocking," and "Song of Myself," his contemporary had created poems which are excellent examples of the shaping power of the subconscious mind, the expressions of "a gifted organism which spontaneously utters itself in high achievements." Clearly Youmans was not prepared to face the fact that the subconscious may also be the repository of powerful emotional experiences which, as in Whitman's "Spontaneous Me," may become the shaping force of art. Yet, Youmans' insight into the subconscious took him to the doorstep of such insights.

Obviously, I am not suggesting that Whitman's courageous exploration of the subconscious was made possible by Youmans' intellectual discovery of its existence. Whitman's work demonstrates that he, like poets before him, found his own way to explore the subconscious. Also, I do not know just when Youmans arrived at his theory. I have quoted from an essay that was published in 1887. Nevertheless, his discussion of the artist's process in the context of the subconscious does display a sensitivity and understanding which may have been helpful to Whitman. Perhaps, in ways that he was not prepared to admit even to himself, Youmans was influenced by his friendship with the poet. But leaving aside the question of influence, it is remarkable that these two writers, though working in different ways, were pioneers in America in unearthing the subconscious and revealing its shaping power.

Even while approaching the brain physiologically, as an organ of mind, Youmans came to express an unbounded, even spiritual appreciation of its creative power. He described the brain as "that most sacred of the things of time, the organism of the soul." The paradoxical phrase "organism of the soul" implies that the brain itself serves as a link between the realms of mind and matter. Further, the brain of man, despite its size, is more wondrous even than the immense reaches of the universe. "We speak of the glories of the stellar universe; but is not the miniature duplicate of that universe in the living brain more transcendental marvel?" For the brain of man, although a material product of the evolutionary process, is capable of comprehending the vast reaches of the universe in space and time. "Geological revelations carry us back through durations so boundless, that imagination is bewildered, and reason reels under the grandeur of the demonstration; but through the measureless series of advancing periods, we discover a stupendous plan. Infinite Power, working through infinite time, converges the mighty lines of causality to the fulfillment of an eternal design,—the birth of an intellectual and moral era through the development of the brain of man, which thus appears as the final term of an unfolding world." The point of convergence of "Infinite Power" and "infinite time," the mind of man takes on heroic stature. A "miniature duplicate" of the universe, it participates in its creative power. If we substitute for "brain" the term "imagination," we can see how serviceable for a cosmic poet like Whitman such an understanding of mind might be. It enables the poet to bring together in his imagination "infinite time" and "infinite power." Since his imagination contains in small the larger workings of the universe, the poet is able to explore his intimate connections with the created universe, and he may be said to possess the origination, creative power to conceive of new worlds. For Whitman the manifestation of that "infinite power" is "voice," which, as we have seen, "springs from what my eyes cannot reach, / With the twist of my tongue I encompass worlds and volumes of worlds" (p. 52). Contemporary science, as interpreted by Youmans, was capable of opening to the poet with Whitman's cosmic reach the ascending dimensions—in space and time—of the universe. In its heroic concept of mind as an "organism of the soul," it provided him with a link between the material and spiritual realms, a link which enabled him to write a poetry firmly grounded in the body and the material realm, even while capturing the largest possible meanings of the converging of "Infinite Power" and "infinite time" in the mind.

V. THE CORRELATION AND CONSERVATION OF FORCES

Two complementary physical principles—once ancient and modern—came to have great importance for both Whitman and Youmans in explaining the fundamental principles of the natural world: the "laws" of correlation of force and conservation of matter. These principles, which in their modern guise Youmans introduced into America, fully supported the implications of evolutionary theory. The law of conservation of matter held that the basic elements of the universe could not be destroyed. In the introduction to Correlation and Conservation of Forces (1854), his edited collection of essays on the new physical principles by such distinguished European scientists as Helmholtz, Grove, and Liebig, Youmans cited the development of the chemical balance by Lavoisier as providing empirical evidence for this astounding law. Lavoisier's experiments demonstrated that "never an atom is created or destroyed; that though matter changes form with protein facility, traversing a thousand cycles of change, vanishing and reappearing incessantly, yet it never wears out or lapses into nothing." Here was an idea, established by Lavoisier and then confirmed independently by a number of
and Epicurus in recognizing another fundamental idea: the universality of
change. Metrodorus explained that it is "the different disposition of these
eternal and unchangeable atoms that produces all the varieties in the
substances constituting the great material whole, of which we form a part.
Those particles, whose peculiar agglomeration or arrangement, we call a
vegetable to-day, pass into, and form part of, an animal to-morrow; and that
animal again, by the falling asunder of its constituent atoms . . . is trans-
formed into some other substance presenting a new assemblage of quali-
ties." 58 Needless to say, the fact that this ancient theory of change within
a deathless universe was confirmed by the rigorous methods of modern sci-
ence seemed to lend it particular authenticity.

Fiske reports that at the start of his lecture career in the early 1850s,
Youmans gave two talks setting forth "the debt due by chemist and astro-
omer to alchemist and astrologer; and here he took occasion to point out how
the guesses of Democritus and Lucretius [whose De Rerum Natura is built
on Democritus' ideas] had been borne, noting with their shrivelness,
from their not having married experiment to speculation." 59 Although Fiske
does not identify the particular "guesses" of the ancients that Youmans
discussed, it is clear from the context that he treated Democritus' atomic
theory. For in his next lectures Youmans focused on the modern versions of
this idea. In "The Masquerade of the Elements" he presented in glowing
outlines the phenomena of protein chemical transformation. And the related
lecture, "New Philosophy of Forces," was "the first popular exposition of the
correlation of forces given in America." 60 Unfortunately, Fiske does not rep-
port the exact dates of these lectures. Were they delivered before 1855? Did
Whitman, as is entirely possible, discuss these ideas with Youmans in the
years before 1855? Were there other sources? I doubt that we shall ever
know with any certainty. But especially striking is the similarity of Youmans'
interpretation of the significance of these ideas with Whitman's treatment of
them.

For, as Youmans described them, these ideas served to reveal yet another
link joining the realms of mind and matter. The law of conservation and cor-
relation of force, he asserted, could be found in operation throughout the
universe, binding together all orders of existence, from the mind of man to the
outermost reaches of the cosmos. It is the

highest law of all science—the most far-reaching principle that an ever-
longing reason has discovered in the universe. Its stupendous reach spans all orders of exis-
tence. Not only does it govern the movements of the heavenly bodies, but it

presides over the genesis of the constellations; not only does it control those
radiant floods of power which fill the eternal spaces . . . but it rules the actions
and relations of men, and regulates the march of terrestrial affairs . . . It pro-

scientists, which could replace the traditional concepts of immortality. Man
was part and parcel of a deathless universe. As I shall demonstrate, this idea
figures prominently in "Song of Myself."

The second principle, "correlation of forces" or interconversion of energy,
is implicit in the idea of conservation. The new science revealed a world
where nothing is lost, but where all is in a constant state of change, motion,
and transformation: "Heat, light, electricity, and magnetism are now no
longer regarded as substantive and independent existences—subtle fluids
with peculiar properties, but simply as modes of motion in ordinary materi-
forms of energy which are capable of mutual conversion. Heat is a mode of
energy manifested by certain effects. It may be transformed into electricity,
which is another form of force producing different effects. Or the process
may be reversed." 57 Living in a universe of constant motion and change, man
could no longer think in static or material terms. He must adjust to a dy-
namic, active universe, one of forces constantly interchanging with—trans-
forming, and being transformed by—other forces. In responding to those
who charged that science was bent on substituting an entirely materialist
view of the universe for the spiritual concepts of religion, Youmans re-
sponded that science had demonstrated that a "pure principle forms the
immaterial foundation of the universe." In comprehending the "universal im-
material force," science had revealed "a truth of the spiritual world, of so
exalted an order that it has been said 'to connect the mind of man with the
Spirit of God.'" 58

Here was a point where ancient and modern theories of nature seemed to
converge. For the new principles of conservation of matter seemed to con-
firm the concept of Democritus that since the atoms which make up matter
are indestructible and unalterable, no change of any sort can occur in their
shape, size, weight or internal nature, either spontaneously or from their
collisions with one another. Democritus held the idea "that matter is inde-
sstructible and unalterable, both in quantity and quality." 59 As has been
recognized by the historian of science George Sarton, the ancient Greek
concept of the indestructibility of atoms may be considered "as an adumbra-
tion of the principle of conservation of matter." 60

It is likely that Whitman was familiar with the Greek concept from his
reading of Frances Wright's A Few Days in Athens (1829), a semi-fictional
exposition of the ideas of Epicurus, one of the transmitters of Democritus' con-
cepts. As Whitman told Traubel, Wright's "book about Epicurus was daily
food to me. I kept it about me for years." 61 Wright's instrument for expla-
nating Greek notions of the atomic theory is the character of Metrodorus,
who teaches the idea that "everything is eternal," a notion which, as Cary Wilson
Allen has written, is "very important" in Leaves of Grass. 62 Accepting the
principle of permanence in the universe, Wright followed Democritus
vast equal in the world of mind, controlling all the faculties and processes of thought and feeling. The star-suns of the remotest galaxies dart their radiations across the universe; and although the distances are so profound that hundreds of centuries may have been required to traverse them, the impulses of force enter the eye, and impressing an atomic charge upon the nerve, give origin to the sense of sight. Star and nerve tissue are parts of the same system—stellar and nervous forces are correlated. Nay more, sensation awakens thought and kindles emotion, so that the wondrous dynamic chain binds into living unity the realms of matter and mind through measureless amplitudes of space and time.  39

This view of the active part played by mind in a dynamic, expanding universe is consistent with other statements by Younians on the creative power of mind. Again, it places mind at the central point, the intersection, of the uncharted depths of the universe, of space and time. The artist, no less than the scientist, is "charged" with exploring those interconnected realms, and making their meanings manifest. And the law of conservation and correlation of force, combined with the new theory of evolution, seemed to promise unlimited growth and development, and to hold out the promise of underlying order, stability, and purpose beneath the tremendous change and diversity of the universe. In the persona of "Song of Myself" Whitman created a proto being committed to exploring the "surpassing universe" revealed by science: "To me the converging objects of the universe perpetually flow. / All are written to me, and I must get what the writing means" (pp. 45–46).

VI. "THE TANT AND FINAL APPEAL OF SCIENCE"

As we have seen, Whitman's speaker makes use of the "facts" revealed by the scientist so that he can "enter" his "area of the dwelling," his imaginative realm. One of his most distinguishing characteristics is precisely his ability to move constantly—and seemingly in all directions at once—while absorbing and interpreting all, getting "at what the writing means." "I fly the light of the fluid and swelling soul," he tells us, "his course runs below the soundings of plummets." He seems to be both in the air and below the sea at once. In constant motion, "Becoming and filling, appearing and disappearing, / I tread day and night such roads" (p. 63). The speaker effortlessly traverses the realms of outer space as well as the familiar—and not so familiar—byways of the earth. He escapes the usual limitations of matter and becomes an immaterial force capable of moving through and possessing every dimension of space and time. Younians spoke of science as, at last, the study of matter but not of forces; "Indeed, as we know nothing of matter, except through its manifestation of forces, it is obvious that the study of matter itself is at last resolved into the study of forces."  37 The new science provided Whitman with a model of immaterial force capable of moving through every dimension of space and time.

And the principle of correlation of force, through which, as Younians asserted, the material of the universe "changes form with protein facility, traversing a thousand cycles of change, vanishing and reappearing incessantly," provides a scientific basis for the equally pseudochar branch of the personality.  38 Throughout the poem the speaker takes on new and diverse identities; he is "of old and young, of the foolish as much as the wise ... maternal as well as maternal, a child as well as a man." He acquires identities characteristic of the diverse regions of the America, and "not merely of the New World but of Africa Europe or Asia, . . . wandering savage." He can take up any occupation, including "farmer, mechanic, or artist," in fact, he admits that "I resist anything better than my own diversity" (pp. 42–43). The new scientific laws opened a world not of rigid fixity, but of change and transformation, and the Whitman persona, recognizing a similar flexibility and diversity in his own character, is encouraged to explore the fluidity of his own identity. The exploratory "flight of the fluid and swelling soul" of the persona is as much into the psychological depths of the mind as it is into the vast expanse of the universe.

As the new scientific concepts provided the means of locomotion for the poet, so they also provided the conceptual building blocks for his imaginative "dwelling." Throughout "Song of Myself" the speaker testifies to the operation of profound natural laws. In Section 14, for instance, he mentions "the same old law" which unites him with the natural world (p. 38). In Section 43, responding to "doubters and sullen moosers," he identifies an omnipresent force which brings reassuring purpose, even to those who have lost and suffered the most:

It cannot fail the young man who died and was buried,
Nor the young woman who died and was put by his side,
Nor the little child that peeped in at the door and then drew back and was never seen again,
Nor the old man who has lived without purpose, and feels it with bitterness worse than gil,
Nor him in the poorhouse tubercled by rum and the bad disorder,
Nor the numberless slaughtered and wrecked . . . nor the brutish kobus,
called the order of humanity,
Nor the sax merely boasting with open mouth to lead to slip in,
Nor any thing in the earth, or down in the oldest graves of the earth,
Nor any thing in the myriads of spheres, nor one of the myriads of myriads
that inhabit them,
Nor the present, nor the least wisps that is known.

(p. 79)
The speaker concedes that the power of prediction eludes him, that he does "not know what is untried and afterward." Still, he can speak of the future in such a way that it takes on the qualities of a natural force which is "sure and alive, and sufficient" (p. 78). It is a natural law universal in scope, extending back in time to the dead, including even those who have brought failure upon themselves, and going forward to the immunities of space. It applies as well to the life of other solar systems, the "myriads of myriads" which inhabit the spheres. (Chambers, as we have seen, spoke of the high probability of life on other planets.) This law comes to have the force of a predictable and reassuring principle governing and ordering the cosmos.

The poet speaks again regarding the operation of a universal law in Section 59. Although he is unable to define its essence completely, he can describe certain of its attributes. It is present in him as a creative force, but cannot be located in any of the usual sources:

There is that in me... I do not know what it is... but I know it is in me.

Wretched and sweaty... calm and cool then my body becomes;
I sleep... I sleep long.

I do not know it... it is without name... it is a word unmade,
It is not in any dictionary or utterance or symbol.

(p. 86)

This nameless presence within the speaker would seem to defy all attempts at definition; he does "not know what it is." It cannot be denominated with any of the conventional signs of human speech. Intensely personal, it is an experience which comes to the speaker much as a difficult birth, leaving him at last "calm and cool." It has the attributes of an ineffable mystic experience, which at best can be suggested, but not defined. Intensely personal, even ineffable, it is an experience which seems to elude the capabilities of language, to say nothing of the categories of science, entirely.

Yet, in the final lines of this section the speaker is able to find some words to describe it:

Something it sways on more than the earth I swing on,
To it the creation is the friend whose embracing awakes me.

Perhaps I might tell more... Outlines! I plead for my brothers and sisters.

Do you see my brothers and sisters?
It is not chaos or death... it is form and union and plan... it is eternal life... it is happiness.

(pp. 86-87)

Here the speaker generalizes and applies what in the first six lines had been an essentially private experience to others, his "brothers and sisters." He has discovered something that gives order and life—not chaos and death—to the universe. He is able to find in his intensely personal experience a larger principle, one which speaks reassuringly of "eternal life" and the existence of "form, and union, and plan" in the universe. The reference to "outlines" suggests that even if there is no definitive external source, then it may at least be found in a sketchy reference elsewhere. While the speaker does not identify the source, he has asserted the presence in both man and the universe of a deathless creative principle which brings order and promises "eternal life" and "happiness." The section suggests that the intuitive, intensely personal knowledge of the first part of the section finds its confirmation in ordering principles of the creation.

In the great law of conservation of force Youmans found such a natural cosmic principle, something "more than the earth I swing on," to use Whitman's language. In discussing this law in the introduction to The Correlation and Conservation of Forces, he too grew rapturous, speaking of the "persistance of force" as the "highest law in physical science," one which has been confirmed by the most rigorous experimental methods. He described a deathless universe, one of evolutionary development and expansion, a world where a "wondrous dynamic chain binds into living unity the realms of matter and mind through measureless amplitude of time." Like the world pictured by Whitman, it is ordered and reassuring, a world in which the creative mind of man is intimately involved in a sublime unfolding plan. The contemplation of its laws led Youmans to write rapturously of the "scion and mysterious worship" he felt at coming into the presence of that "Unknown and Infinite Cause." The speaker suggests, then, that the nameless presence which he had discovered within himself intuitively was somehow connected to the principles or "outlines" which give order to the cosmos, principles which can be known through the investigations of science. In this sense, Whitman could write in the 1855 preface that "exact science and its practical movements are no checks on the greatest poet but always his greatest encouragement and support" (p. 15).

Throughout "Song of Myself" the speaker treats the theme of immortality and ties it closely to the concepts of evolution and conservation of force. Raising the question of the status of the dead in Section 6, he writes confidently that

They are alive and well somewhere;
The smallest sprout shows there is really no death.
And if ever there was it led forward life, and does not wait at the end to arrest it.
And ceased the moment life appeared.
In the concluding section, the speaker asserts that such is his diversity that he cannot be held to a fixed spot in the material world. He becomes, at last, a force in constant motion. Youmans remarked that "though matter changes form with Protean facility, traversing a thousand cycles of change, vanishing and reappearing incessantly, yet it never wears out or lapses into nothing." In the last vision we have of him, Whitman's speaker has become just such a vanishing and reappearing natural force:

I depart as sir ... I shake my white locks at the runaway sun, I diffuse my flesh in eddies and drift it in lazy jags.

I bequeath myself to the dirt to grow from the grass I love, If you want me again look for me under your bootsoles.

You will hardly know who I am or what I mean, But I shall be good health to you nevertheless, And fill and filament your blood.

Ending to fetch me at first keep encouraged, Missing me one place search another, I stop somewhere waiting for you

VII. Conclusion

This paper has been built on the assumption that Whitman, in asserting that scientists "are the lawmakers of poets and their construction underlies the structure of every perfect poem," was providing the reader with an important clue to the meaning and structural principles of his own work. It has identified E. L. Youmans as a scientist and writer who was in an ideal position to introduce Whitman to contemporary scientific thought. Fellow border at Mrs. Climacus in New York and associates on the Aurora, the two knew each other well and would have had ample opportunity to come together and exchange ideas. Even after the sharp rupture in their personal relationship, Whitman witnessed Youmans' emergence as the most important exponent of scientific ideas in America.

In his early lectures and books, Youmans developed scientific ideas which figure prominently in Whitman's poetry. The assertion of Edmund Clarence Stedman that "Professor Youmans inspired Whitman's eloquent passages on Evolution" provides external evidence that Youmans was an important source for Whitman. However, recognizing the imprecision inherent in source studies, this paper has proceeded cautiously, and has avoided categorical
claims for Youmans as a source of particular ideas. It is likely that Whitman drew from Youmans, but he was by no means an exclusive source.

Certainly an understanding of Youmans' work expands our knowledge of the range of scientific ideas available to Whitman. By retracing Youmans' own steps toward evolution in the late 1840s, we identify Chambers' Vestiges of Creation as an essential source for Whitman. Youmans was encouraged by evolutionary theories to understand man as a physical being in constant and dynamic interaction with the material universe. Although he could not abide the "obtrusive selfishness" of Whitman's poetry, he respected his treatment of man as a being whose identity comes from his body and was both consistent with and supportive of this well-known feature of Whitman's poetry. Speaking out against the destructiveness of the Cartesian dualism, Youmans expounded a theory of the enormous power of the subconscious mind, which may well have encouraged Whitman in the development of a poetic persona with such remarkable powers. And it is probable that Youmans, in introducing the conservation theories into America, provided Whitman with two ideas which figure prominently in "Song of Myself." These ideas provide scientific justification for Whitman's poetic persona, capable of moving effortlessly throughout the cosmos.

Youmans sought to uncover the links uniting mind and matter. A fundamental premise of his work is that man is a unified being and that thought is an organic function. One mark of Whitman's genius as a poet is that he recognized the extraordinary implications for poetry in this approach. For in becoming an "index" for the forces "surging and surging" through him, the Whitman persona discovers a firm basis for his art in the natural world. Most importantly Whitman found a "voice" which enabled him to establish the links uniting him with the unsuspected dimensions of the world, including the "threads" connecting the stars, the "cycles of preparation and action," and the dispossessed. Paradoxically, then, while grounding his art in the latest principles revealed by "exact science" and its "practical movements," Whitman was able to discover—or rediscover—the magical properties of poetry, and so speak "the password primeval." In this sense, "Song of Myself" succeeds brilliantly in bringing together man's ancient belief in the mythic power of the word along with the results of the latest experimental science. Whatever the personal disagreements between Whitman and Edward Youmans may have been, "Song of Myself" does demonstrate a "love between the poet and the man of demonstrable science," for the poet makes remarkable use of the "seed" of scientific conceptions. And in "the beauty and turf" of Whitman's poem we may find "the turf and final applause of [contemporary] science."
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23. Fiske, Youmans, p. 35.
32. Chambers, Vestiges, p. 270.
33. Chambers, Vestiges, pp. 203-204.
37. Aschheim discusses these two concerns in The Evolution of Walt Whitman, pp. 56-77.
40. Fiske, Youmans, p. 75.
41. Uncollected Poetry and Prose, 2:64.
42. Uncollected Poetry and Prose, 2:68.
44. Uncollected Poetry and Prose, 2:66.
45. Uncollected Poetry and Prose, 2:80.
48. Fiske, Youmans, pp. 72-73.
52. Aspin, Whitman, p. 149.

Whitman's Use of Science

60. Chemical Atlas, p. II.