A Rhetorical Analysis of the Scientific-Romantic Synthesis in the Popular Scientific Writings of Lewis Thomas.

Donald Paul Lee

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A rhetorical analysis of the scientific-romantic synthesis in the popular scientific writings of Lewis Thomas

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The Louisiana State University and Agricultural and Mechanical Col., 1990
A Rhetorical Analysis of the Scientific-Romantic Synthesis
in the Popular Scientific Writings of Lewis Thomas

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Speech Communication, Theatre,
& Communication Disorders

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May 1990
Acknowledgements

I wish to express gratitude to my major advisor, Dr. Kenneth S. Zagacki, whose astute understanding of the rhetoric of science, helpfulness in guiding me toward sources, excellent editorial skill, and personal friendship were invaluable to me as I pursued this study. I am also grateful to Drs. Andrew A. King, Mary Frances HopKins, Harold Mixon, and John C. Merrill for graciously serving on my doctoral committee and for enhancing the quality of my study with their sound professional advice.

My family was also instrumental in helping me to complete this project. I especially thank my aunt and uncle, Margaret and Bill Groenendyke, for their generous financial and emotional support. A very special thanks goes to my wife, Monica, the most gentle, kind, and loving person whom I have ever known; my young daughter, Caroline, age one, also deserves mention, for her very presence motivated me to complete this study.

Finally, I wish to dedicate this dissertation to my parents: to the memory of my mother, Eileen, whose remarkable life taught me the value of hard work and commitment; and to my father, Kenneth, whose passion for poetry inspired me, at an early age, to believe in the possibility of ideas.
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Abstract

As physician, educator, former medical administrator, and member of the National Academy of Sciences, Lewis Thomas has been one of the most eloquent spokespersons for the scientific community.

This dissertation analyzes twenty-four of Thomas' popular scientific essays. These essays reveal a union of traditional scientific values and popular romantic themes, what is called here a rhetorical synthesis. The term synthesis is understood as the putting of two or more things together to form a whole, particularly suggesting a reconciliation of two philosophically opposing forces. Thomas' essays reflect a synthesis insofar as they merge what have traditionally been thought to be two opposing philosophical views of reality, science and romanticism. This synergistic reconciliation of two opposing philosophical forces is understood to produce a third philosophical view of reality, which combines elements from the two original views of reality yet is a separate, independent philosophical perspective. Thomas' synthesis of traditional scientific values and popular romantic themes produces a particularly humane version of science, and is rhetorical insofar as it is purposefully designed to produce a romantic science capable of mitigating the long-standing dispute between science and humanism and to allay the public's fear about the social consequences of science.
Thomas' romantic orientation toward the world is characterized by six major themes: (1) faith in the unconscious mind, (2) a vindication of the individual, (3) a predilection for diversity, ambiguity, and imperfection, (4) a preoccupation with qualities that are different, remote or mysterious in humans, (5) wonder and awe of nature, and (6) a concern for humankind's moral characteristics. These six romantic tenets are identified as they appear in Thomas' essays; the themes' strategic location, function and rhetorical significance is assessed. In addition, this dissertation examines the scientific world view as it is set against the romantic world view in Thomas' overall rhetorical design. This study also investigates how Thomas' romantic version of science clarifies the moral role of science in society.

This dissertation concludes that Thomas' scientific-romantic synthesis operates as an effective rhetorical form for mediating the traditional controversy between science and humanism, and for establishing a more cooperative relationship between the scientific community and the general public.
Chapter One
Introduction
The present tension between science and humanism can be traced to the renaissance. Yet it was not until the seventeenth and eighteenth century, during the birth of modern science, that the controversy between these two competing modes of thought took its modern form. At the center of the long-standing antagonism are two fundamentally opposite views of human purpose: humanism is essentially value oriented and devoted to the fullest self-realization of the human personality; it emphasizes humans' "moral, intellectual, and the aesthetic capacities." Science promotes rational thought as a means of gaining comprehensive empirical knowledge of the natural world; scientists are best characterized by their concern with material progress and the advancement of knowledge.

Classic nineteenth century formulations of the tension between science and humanism are summarized in the opposing views of Matthew Arnold and his chief antagonist, T. H. Huxley. In "Culture and Education," Huxley argued that "the pretensions of our modern humanists to the possession of the monopoly of culture and to the exclusive inheritance of the spirit of antiquity must be abated, if not abandoned." Huxley believed that science and not
literature must supply the knowledge which is necessary for an age committed to rational truth and material practicality. In his essay entitled "Literature and Science," Arnold answered Huxley's charge by admitting the value of science, noting that science is an "excellent" and "valuable" discipline with which everyone should have some experience; the results of scientific investigation, as Arnold put it, have a "visible bearing on human life," and should have a place in education. Arnold concludes, however, that science does not serve the instincts for conduct or beauty. These instincts are best nurtured by culture, which is not to be thought of strictly as literature or belles lettres, but as comprising all humane intellectual disciplines.

In the twentieth century C. P. Snow's "Two Cultures" rekindled debate regarding the rival claims of humanism and science. Snow believed that the intellectual life of western society was being divided into two uncommunicating and mutually indifferent cultures. Nonscientists, in Snow's estimation, believe that scientists are "shallowly optimistic, unaware of man's condition." Scientists, on the other hand, thought that literary intellectuals were lacking foresight and were in a "deep sense anti-intellectual, anxious to restrict both art and thought to the existential moment." The most significant difference between the scientist and the literary intellectual,
according to Snow, is the attitude with which each responds to the "tragic" nature of the human condition. The essence of life's tragedy lies in the solitary nature of human existence. In Snow's words, "each of us is alone," and "each of us dies." The awareness of humans' tragic circumstances makes a moral trap, "for it tempts one to sit back, complacent in one's unique tragedy," and to ignore the everyday sufferings of fellow human beings. Snow believed that literary intellectuals are more likely than scientists to fall into this moral trap; unlike the literary intellectual, who is resigned to the tragic fate of his or her fellow human beings, the scientist is "inclined to be impatient to see if something can be done, until it's proved otherwise," and has a spirit which is "tough and good and determined to fight it out at the side of their brother men." Offering no solid resolution to the two culture's controversy, Snow concluded that a less specialized educational system, mainly in the primary and secondary schools, but also in the universities, may help to resolve the differences between scientists and literary intellectuals.

Science has enjoyed unprecedented material success in the twenty-five years since Snow delivered his lecture on "The Two Cultures." Nonscientists in American culture cannot ignore the successes of scientific research; they perceive a direct link between the technological advances
of science and a rising standard of living. Furthermore, many nonscientists share the belief that science has great potential for problem solving. The widespread belief in science as the preeminent method of obtaining objective knowledge has led some to "imitate models and approaches of scientific research in the solution of social, political, and ... above all technological and medical problems."11

While science continues to enjoy tremendous material success, the old dialectic between science and humanism is still raging in American culture, and is represented in various forms. For example, Janice Rushing and Thomas Frentz argue that the Frankenstein myth in popular culture symbolizes a repressed fear the culture has about its relationship to technology.12 Noted physicist and Catholic priest, Stanley Jaki, has spoken of the technical limits of science, the debilitating effects of science on public moral reason, and the need for more religious and spiritual insights into human social and moral decision-making.13 Indeed the contemporary debate appears more often than not to focus on the American public's increasing apprehension about the moral and ethical consequences of the scientific enterprise.14 When debating the social consequences of science, humanists and scientists often implicitly address themselves to what the proper disposition of the human mind should be: humanists typically argue that science does not
consider moral consciousness; they perceive the advance of science as a threat and the "scientific utopia as a wasteland void of spirituality." The scientific epistemology usually attempts to divorce science from its consequences. Scientists have often suggested that the advancement of knowledge and the mastery of humankind over fate will somehow lead to the realization of utopian promise. Moreover, scientists seem to agree that the act of rational inquiry is at the essence of humanity and the discovery of new information about nature, at whatever level, should not be impeded. This is not to say that scientists in general are not aware of the moral consequences of their work, but merely that scientists are primarily concerned with the doing of science. More important for present purposes, the public does not perceive scientists as being concerned with public moral argument.

Lloyd Bitzer's conceptualization of the terms rhetoric, exigence, and rhetorical exigence helps to illustrate the persuasive significance of Thomas' essays. Bitzer claims that rhetoric is a "mode of altering reality ... by the creation of discourse which changes reality through the mediation of thought and action." He defines an exigence as an "imperfection marked by urgency ... a defect ... an obstacle, something waiting to be done, a thing which is other than it should be." Bitzer explains that an
exigence is rhetorical "when it is capable of positive modification and when positive modification requires discourse or can be assisted by discourse."20 From Bitzer's rhetorical perspective, the public's maturing awareness of the disturbing consequences of science is a rhetorical exigence which threatens to undermine science's privileged status in modern society.21 The importance of public involvement in scientific and technological issues that may affect society has been well documented in literature on the rhetoric of public science.22 Contemporary communication scholars have examined the tension which occurs when scientific or technical information is disseminated into the public realm. Thomas G. Goodnight, for example, distinguished between the personal, technical, and public "spheres" of argument. "Sphere denotes branches of activity--the grounds upon which arguments are built and the authorities to which arguers appeal."23 Goodnight concluded that the public sphere is being steadily eroded by the elevation of the personal and technical groundings of argument. Thomas Farrell and Goodnight focused on two competing modes of discourse: Technical versus Social reasoning. The authors argue that in an ideal world "each type of reasoning would perform separate, but complementary, functions."24 After completing their investigation of the communication practices surrounding the Three Mile Island incident, however, the authors
determined that technical reasoning and its concomitant communication practices may actually usurp the role of social reasoning and impede public deliberation.\textsuperscript{25} Alan Gross came to a similar conclusion after examining the DNA controversy as a social drama played out between two competing ideologies: the social and the technical. Gross concluded that the recombinant DNA debate highlights the failure of technical knowledge to resolve social, ethical, and political dilemmas.\textsuperscript{26} Michael Calvin McGee and Martha Anne Martin argued that the public's uncritical acceptance of expert advice from scientists and technologists is a result of our culture's faith in the rational model of argument. The authors believe that "a new consciousness of expertise is required, one which is properly skeptical of claims to practical or technical knowledge."\textsuperscript{27} Finally, Walter Fisher proposed the narrative paradigm as an alternative to the traditional rational paradigm of human deliberation and action.\textsuperscript{28} In general, then, communication scholars admit that current technical and social ideologies are inadequate for resolving public controversy; these scholars propose solutions that avoid constricted paradigms and a narrow view of what it means to be rational.\textsuperscript{29}

To summarize, an intellectual division has existed between science and humanism in modern western society. This division is characterized by the differing aims and values with which scientists and humanists approach
reality. Humanism focuses on the complete intellectual capacity and particular experience of the individual, emphasizing his or her moral, intellectual and aesthetic ability. Science emphasizes rational inquiry and is primarily concerned with the acquisition and systematization of knowledge about the natural world. In addition, the highly specialized language of science and technology have proven particularly inadequate to resolve the intellectual tension which exists between citizen and expert when technological matters impinge upon ordinary life. In fact, the general public's increasing apprehension about the social and moral implications of science presents the scientific community with a rhetorical challenge which threatens to undermine science's preeminent role in society.

A number of contemporary scientists, including Robert Jastrow, Carl Sagan, and Stephen J. Gould have defended the sanctity of science and bridged the philosophical division between the scientific community and the general public. The general purpose of this dissertation is to examine selected essays from the "popular scientific discourse" of another scientist, Lewis Thomas. The general argument to be advanced here is that Thomas' popular scientific essays mediate rhetorically the traditional dichotomy between science and humanism, and envision a cooperative
Thus, the significance of this dissertation is threefold. This study attempts to (1) build upon previous research in the rhetoric of science to further our understanding of how scientists use certain rhetorical forms both to share and to legitimate their interpretation of reality along with their vision regarding the cultural role of science; (2) provide insight into how popular scientific discourse can potentially mediate the long standing controversy between science and humanism; and (3) illustrate that the popularization of science should be regarded as an aspect of rhetoric rather than exclusively or simply as an aspect of science or literature.

**Lewis Thomas: A Contemporary Public Scientist**

Lewis Thomas was born in Flushing, New York, November 25, 1913. He graduated from Princeton University and the Harvard Medical School. He has served as Professor of Pediatric Research at the University of Minnesota, as Chairman of the departments of pathology and medicine; he was also dean at the New York University Bellevue Medical Center and Chairman of pathology and dean at Yale Medical School. Thomas has most recently served as president of Memorial Sloan-Kettering Cancer Center in New York City. As physician, educator, former medical administrator, and member of the National Academy of Sciences, Thomas has been
one of the most eloquent spokespersons for the scientific community. He has written three collections of essays: *The Lives of A Cell: Notes of a Biology Watcher*, *Medusa and the Snail: More Notes of a Biology Watcher*, and *Late Night Thoughts on Listening to Mahler's Ninth Symphony*. The essays included in these collections cover a wide range of topics. Yet all have a common goal: to prove that the dichotomy between science and humanism need not exist. Thomas' most recent book, *The Youngest Science: Notes of a Medicine Watcher*, was sponsored by the Sloan Foundation. The Foundation was interested in "the encouragement of a public understanding of science," and wished "to encourage a representative selection of accomplished and articulate scientists to set down their own accounts of their lives in science." Consequently *The Youngest Science* is a personal memoir, an autobiographical account of Thomas' experiences as a medical student, doctor, and senior researcher. This book illustrates how medicine in this century has become more like one of the traditional sciences.

All four of Thomas' books were national best sellers and widely reviewed in respected newspapers and periodicals, such as *Nature*, *Christian Science Monitor*, *New York Times*, *Kirkus Review*, and the *Times Literary Supplement*. Thomas' discourse has captured the attention of members of the academic community as well.
Two dissertations offer a description of the literary qualities of Thomas' essays, focusing primarily upon his essays as literary forms. Diane Dowdey's dissertation, for example, includes an analysis of Thomas' essays in its discussion of the literary scientific essay as a literary form. The study borrows from the Neo-Aristotlian method of criticism to analyze Thomas' work according to the rhetorical canons of invention, structure, and style; it concentrated on the craftsmanship of Thomas' essays while assuming their rhetorical potency. Dowdey's study does not, however, examine the way Thomas' essays employ popular cultural themes strategically both to ameliorate the general public's apprehension about the social consequences of science and to preserve science's privileged position in modern society.36 Laurie White's dissertation argued that as an essayist Lewis Thomas is best understood in the tradition of Montaigne; this tradition reveals Thomas' reliance on self deprecation and lyricism to convey his message.37

In her 1975 study, Barbara Lounsberry recognized the literary/rhetorical significance of Thomas' work. She explained that:

the writings of Lewis Thomas ... revive and expand several of the most fundamental themes to nineteenth century American literature: humanism, interest in the self and society, and confidence in language and rational inquiry as tools for arriving at higher levels of individual and social progress.38
In summary, previous research has given cursory acknowledgement to Thomas' rhetorical skill, while primarily focusing on his writings from the vantage point of literary criticism. No research to date, however, has delineated the rhetorical significance of the popular cultural themes which pervade Thomas' work.

Thomas' first collection of essays, Lives of the Cell, won the National Book award in 1974. Interestingly, there was debate between the Science and Arts-and-Letters panels of the nominating committee in regard to which panel should confer the award. In the end, the National Book award was given to The Lives of The Cell, not as the best book in science, but in arts-and-letters. Still, whether one chooses to include Thomas' writings under the heading of science or arts-and-letters, one point seems clear: Thomas' discourse merges popular cultural themes with traditional scientific values, and thus may help mediate the old dichotomy between science and humanism and allay the public's anxieties about the scientific enterprise. Surely, Thomas is not the only writer in the history of Western Civilization to promote science or humanism in his work, or to enlist literary-rhetorical devices to champion particular scientific or humanistic values. Galileo comes to mind as a scientist using literary (e.g., dialogue) means to espouse Copernican ideas in a strongly religious, anti-Copernican cultural milieu. Similarly, John Milton and
John Donne employed literary means to introduce popular readers to radical scientific shifts in world view. In our own time, Albert Einstein, Neils Bohr and other scientists, not to mention the huge corpus of writing that goes under the title of science fiction, have spoken eloquently of science's place in the cosmos. But Thomas is particularly worthy of attention because throughout his work there is an implicit assumption that values guiding scientific research are compatible with the public's needs; moreover, Thomas' discourse addresses the public's increasing moral and ethical distrust of science in a world where science has gained unprecedented success and status. In essence, Thomas grants science a central role in human affairs; he maintains science's preeminent role in society by discussing a number of timely scientific issues likely to impact the public. Thomas' writing provides the nonscientist with a sympathetic understanding of the process and manner of scientific thinking. Through the creative, persuasive use of cultural themes Thomas is able to legitimate the scientific perspective to nonscientists as a worthwhile intellectual and pragmatic activity. But he does so by enlisting the idiom of the public. As Joyce Carol Oates notes in *The New York Review of Books*:

[Lewis Thomas] ... anticipates the kind of writing that will appear more frequently, as scientists take on the language of poets in order to communicate human truths too mysterious for old fashioned common sense ... 40
More than just utilizing popular forms, though, Thomas effects a merger between the scientific worldview and popular cultural themes. He seems to understand that science may be losing its ability to shape public consciousness and to engage in public moral argument. For this reason, as Oates notes, Thomas' discourse is valuable to our culture, like the work of our most prized poets or artists. He has absorbed innumerable facts from a variety of disciplines, and given us speculative essays in which scientific information is "transcended and something approaching a vision of unity is attempted." What kind of vision--its merits and its limitations--will be the topic of this dissertation.

Review Of The Literature

Traditionally rhetoric and science have been regarded as antithetical modes of human activity. Contemporary scholars have, however, adapted a new perspective on the relationship between rhetoric and science. For instance, philosophers and sociologists such as Thomas Kuhn, Jacob Bronowski, and Michael Polanyi, have examined the social rhetorical implications of science. In addition, contemporary communication scholars have examined the manner in which scientists employ persuasive strategies to legitimate their arguments to fellow scientists within the scientific community. More important for purposes of this dissertation, however, is a survey of literature on
public science. A review of rhetorical scholarship reveals that there is no agreed upon term for discourse which attempts to mediate scientific information for a mass audience. Consequently this dissertation employs one of the more frequently used terms, popular or public science, to describe scientific writings crafted for the nonscientist. What follows, then, is a survey of studies which examine the persuasive strategies scientists use to convey scientific information to the nonscientist.

Essays About the Texts of Popular Science

"In Rhetoric and Science Journalism," Ray Lynn Anderson asserts that in translating complex scientific information into the language of the intelligent nonscientist, "the science journalist guides (invents) his communication by systematically finding what rhetoricians call the common ground."44 Anderson explains that the science reporter carefully grounds his or her explanations with appropriate reference to those "broad aspirations and anxieties which as Americans they jointly hold."45 Anderson claims that Aristotle was the first to explain that materials for rhetorical argument should be drawn largely, although not exclusively, from the common conception of the good, what Aristotle called forms, common places or topoi.46 Anderson discusses the four most common techniques used by the science writer to sell science news, including portraying science as the major vehicle of social and economic
progress, projecting science as an object of entertainment, emphasizing science's relation to domestic ills or the cold war struggle, and focusing on the personalities of prominent scientists.47

John Angus Campbell has written several insightful essays which attempt to explicate the rhetorical nature of Charles Darwin's *On The Origin of Species*.48 In "Charles Darwin and the Crisis of Ecology: A Rhetorical Perspective," the author suggests that Darwin's contemporaries understood *The Origin* as a justification of philosophy of competition in nature. Campbell explains that Darwin does not describe nature in neutral, dispassionate language; nor did he view nature simply as a "technical system in which means are intricately adapted to ends."49 Rather, Darwin viewed nature with an attitude of awe and wonder. Yet Darwin's attitude toward nature departs somewhat from his immediate rhetorical tradition. Unlike his nineteenth century predecessors, Darwin does not justify nature's wondrous beauty through praise of a supreme being. Campbell states that Darwin's attitude of awe "remains with the natural phenomena themselves, investing them with a ... sanctity which is inherent within them."50 Perhaps the essay's most valuable conclusion, then, is that Darwin's attitude toward nature provides a more hopeful legacy for the present age than was previously thought.
Campbell's "The Polemical Mr. Darwin" identifies three persuasive strategies employed by Darwin to explain his ideas, including the use of conventional language, conventional religious categories of popular thought, and his own credibility. These findings suggest that the conventional image of Darwin as a dispassionate and detached investigator may not be accurate.\(^{51}\)

In "Scientific Revolution and The Grammar of Culture: The Case of Darwin's Origin," Campbell argues that Darwin cleverly exploited Baconianism by invoking piety, relying on the method of inductionism, employing the language of natural theology, and pressuring readers to accept his analogies and metaphors as literal statements. As a persuasive text, The Origin's genius derives from its ability to "encourage the advancement of science, while at the same time ... protecting religion from skepticism, materialism, and atheism."\(^{52}\)

John Lyne and Henry Howe's essay, "Punctuated Equilibria: Rhetorical Dynamics of a Scientific Controversy," provides a case study of how a theory originating in paleontology called "punctuated equilibria" found audiences in other scientific disciplines and eventually the public at large. The authors suggest that the notion of distinct technical and social spheres generally at odds with one another is not always sufficient apparatus for explaining what happens when scientific
arguments are presented to different audiences. The authors conclude that the persona of the scientific writer significantly affects the way a particular audience receives a scientific discourse; scientific theories generated within a particular scientific discipline sometimes elicit responses beyond that original discipline; different scientific disciplines have different vocabularies, so that "special tools and methods" are not the only "unities within a scientific discourse;" the use of "metaphors and imagery" may also determine the interpretive frameworks within the various sciences; and rhetorical analysts should understand that "new scientific theories gain attention partly because of the contrast they pose to existing theories." 83

In "Science and The Sacred Cosmos: The Ideological Rhetoric of Carl Sagan," Thomas Lessl argues that popular scientific discourse satisfies two purposes: "the practical purposes of maintaining the privileged status of science in society and the religious purpose of grounding faith in an unimpeachable body of knowledge."54 Lessl attempts to understand the television series Cosmos as an example of public science and employs Burkean terms to enumerate four characteristics particularly salient to popular treatments of science, including consubstantiality, division, identification, and substance.55 In discussing these terms, Lessl notes that the subject matter of science is little
understood by the nonscientist. Thus, to establish a common ground the scientist must often step outside science. To deal with division from the rest of the culture, scientists must persuasively enter the political arena to lobby for the financial support of research programs which are increasingly expensive. On another level, scientists are forced to make non-scientific justifications for their work, and to struggle with other interest groups over control of the educational system. Divisions are resolved by the presentation of symbols of identification, such as natural objects of inquiry (i.e. stars, living organisms), through which people can mediate reality and organize their actions. These objects of scientific inquiry are already invested with a sacred quality for the general public, and act as common symbols uniting the scientific community with the general public. Finally, Lessl explains that "in acting together, people share a common substance; they share common sensations, concepts, images, and ideas that unite them in attitude and spirit." Mediational rhetoric, to be successful, must symbolically allow the nonscientist to participate in the scientific enterprise; rhetoric which bridges the division between the scientific community and the public at large must allow the nonscientist to "view himself metaphorically as if he were a scientist." 

Lessl's "The Priestly Voice" divides public communication into fundamental priestly and bardic
categories and examines the problems and significance of priestly communication, focusing particularly on its implications for critical exploration of the public discourse of scientists. A bard is described as a poetical symbolist whose messages speak to "the world of common sense experience already integral to its audience's identity." Priestly rhetoric, the main category of discourse focused upon, is referred to as "that rhetoric which crosses the boundaries between a particular elite subculture and the broader social groups within which it is nested as priestly." Simply put, priestly rhetoric promotes and maintains the specialized values of a closed system. The essay explains that the priestly scientist interprets a technical scientific vocabulary for the nonscientist, brings interpretations of established scientific theory and method to the general public, encourages public acceptance of orthodox science and, at the same time, stands as a rhetorical bulwark against oracles of pseudo-science, communicates his/her insights through oral rather than a written means, conceptualizes all phenomena from a scientific vantage point, and views the world through a veil of evolutionary mythology related to scientific evolutionary theory. In short, public science offers a variation of scientific evolutionary theory which includes an explanation for all varieties of change.

In "Heresy, Orthodoxy, and The Politics of Science"
Lessl explains that public scientific rhetoric is often aimed at maintaining control of the symbolic and material resources that have already been entrusted to it. The study provides an example of such rhetoric through an analysis of the scientific community's response to the rhetorical efforts of religious fundamentalists to legally sanction the teaching of scientific creationism.61

In summary, contemporary rhetorical analysts have developed a fairly sophisticated understanding of the rhetorical strategies embedded in popular scientific discourse.62 For example, Campbell's examination of The Origin of Species reveals that Darwin did not describe nature in neutral, dispassionate language, but used several persuasive strategies to explain his ideas to the nonscientist, including a use of language which reflected an attitude of wonder and awe toward nature, and conventional religious categories which protected religion from the skepticism, materialism, and atheism which might result from the advancement of science. Lyne and Howe conclude that the persona of the scientific writer influences the way a particular audience responds to a scientific discourse. Anderson notes that the science writer often draws his or her rhetorical arguments from the common conception of the good, what Aristotle called forms, common places or topoi. Lessl observed that the subject matter of science is little understood by the
nonscientist and that, as a result, scientists must step outside science to establish common ground with the larger culture. He identified rhetoric that crosses the boundaries between an elite subculture (e.g., the scientific community) and the broader social groups within which it is situated as priestly. Priestly rhetoric promotes and maintains the specialized values of a closed system but is directed toward an open and plural society. Lessl also noted that popular science satisfies two purposes: the practical purpose of maintaining science's elite status in society and the religious purpose of grounding faith in an unimpeachable body of knowledge. In essence, the rhetorical analyst's present understanding of the persuasive strategies found in popular scientific discourse provides him or her with a solid base from which to evaluate the social, economic, and political impact of science on society. The analyst should be aware, however, of the potential for change in the rhetorical dynamic between science and the general public, and of the possibility that scientists may develop new rhetorical forms both to share and to legitimate the scientific mindset with the nonscientist. For example, the present research on public science does not examine the rhetorical impact of the merger of popular cultural themes and traditional scientific values which pervades the public scientific essays of Lewis Thomas. As a result, the author of this
dissertation asks: Is there a particular rhetorical form reflected in Thomas' popular scientific writings? If so, what popular cultural traditions does it draw upon? If there are a number of traditions, how are they accommodated in the discourse? If a particular rhetorical form is reflected in Thomas' essays, how might it provide the general public a greater role in establishing criteria for judgment for private and public decision-making? How might it highlight the general public's capacity to respond to aspects of the world inaccessible to the interpretive framework of science and ordinary rational thought? How might other scientists respond to the version of science proffered by Thomas? If a rhetorical form is reflected in Thomas' discourse, does it draw upon the broad values and aspirations of the general culture, from what Aristotle called topoi? Do Thomas' writings strive to maintain science's privileged status in society?

Methodology

In defining rhetoric, this dissertation draws upon the work of three contemporary rhetoricians: Lloyd Bitzer, Douglas W. Ehninger and Donald C. Bryant. As noted previously in this chapter, Bitzer defines rhetoric as "a mode of altering reality ... by the creation of discourse which changes reality through the mediation of thought and action." Following Kenneth Burke, Ehninger argued that rhetoric "is the art of symbolic inducement" and that
"rhetoricians should study all of the ways in which men may influence each other's thinking and behavior through the strategic use of symbols."64 This study is sympathetic to Bitzer and Ehninger's view of rhetoric; it agrees that rhetoric is a mode of altering reality through the manipulation of symbols. Yet this study understands the term symbols in the delimited or narrow sense of language. Communication scholars have acknowledged that the limits or boundaries of rhetoric are imprecise, and that rhetoric includes not only written or spoken language, but a wide range of symbolic human behaviors such as film, art, social protest, music, and architecture.65 For purposes of this study, an understanding of rhetoric as the strategic use of language provides a critical advantage since the persuasive success of Thomas' essays depends strictly on the use of language. Thus, this study agrees with Bryant's claim that "rhetoric is the function in human affairs which governs ... the phenomenon of the designed use of language for the promulgation of information, ideas, and attitudes."66 Speaking more generally, this study agrees with Bryant that the "rhetorical function is the function of adjusting ideas to people and people to ideas."67 With an understanding of rhetoric as the strategic use of language, this dissertation employs a rhetorical analysis as a method for discovering and evaluating the persuasive strategies in the popular scientific writings of Lewis Thomas.
To proceed, two additional definitions are necessary. First, a survey of rhetorical scholarship reveals that there is no agreed upon term for discourse that attempts to mediate scientific information for a mass audience. Consequently, this dissertation employs one of the more frequently used terms, popular or public science, to describe scientific discourse crafted for the nonscientist. Thomas' writings mediate scientific information for a mass audience and are, to that extent, an example of popular or public science. Of course, not all popular scientific rhetoric is alike. One subsidiary purpose of this study is to speculate about how Thomas' rhetoric differs from that of other public scientists, like Carl Sagan and Steven J. Gould. Second, the term rhetorical analysis is understood herein as the systematic inspection of persuasive language strategies of invention and organization of ideas. Through a close reading of Thomas' discourse, this author will attempt to understand how Thomas uses language strategically to mediate the traditional controversy between science and humanism and to accommodate the aspirations and values of both scientists and the general public. More specifically, this author's rhetorical analysis proceeds through three interrelated steps.

First, Thomas has published eighty-three popular scientific essays. This dissertation will examine twenty-four of these essays. The essays chosen for analysis
reflect themes that recur in all of Thomas' writings. Second, initial examination of Thomas' essays revealed an emphasis on certain romantic themes. Thus, this study will utilize the term "romanticism" to help explain certain humanistic themes in Thomas' writings, and to define the prevailing tensions between science and humanism reflected in his popularization of science.

More than six hundred books and articles published during the first half of the twentieth century attempt to define romanticism. This enormous body of literature reflects a consensus among scholars that the word "romanticism" can be defined in a great many ways. For example, The Handbook To Literature explains that romanticism does have a fairly definite meaning for the student of literature:

[Romanticism] designates a literary and philosophical theory that tends to see the individual at the very center of all life and experience, and it places the individual, therefore, at the center of art, making literature most valuable as an expression of unique feelings and particular attitudes...and valuing its accuracy in portraying the individual's experience, however fragmentary and incomplete, more than it values its adherence to completeness, unity, or the demands of genre.

In his classic work, The Great Chain of Being: A Study of the History of an Idea, Arthur Lovejoy contends that the word romantic has meant many different things in different countries and that even in a single country romantic is often used in conflicting senses. In "The Rise of
Modern Science and the Genesis of Romanticism," Hans Eichner notes that "... romanticism is not a technical term...invented to name a precise concept, but a word with a long, complicated history."\(^7^1\) In "Science and Romanticism," Edward Proffitt states that the word "romantic is generally associated with the vaguely spiritual, with the flabbily aspirational, with everything at odds with science and the inductive method ..."\(^7^2\) In "Toward a Theory of Romanticism," Morse Peckham adds that although the word romanticism refers to any number of things, one of its primary referents is "a specific historical movement in art and ideas which occurred in Europe and America in the late eighteenth and early nineteenth centuries."\(^7^3\) The essence of this historical movement is reflected in a shift in American and European thought against the spirit and implications of modern science. Proffitt explains that what the romantic reacts to "is not so much a procedure as an underlying view of life based on a mechanistic model."\(^7^4\) Eichner provides a cogent summary of the mechanistic philosophy of early modern science:

The new science that began with Copernicus and Galileo sought to explain the world rationally in terms of the laws of nature, and these laws, like reason itself, were thought to hold uniformly at all times and places. It seemed natural that human beings, the most rational of creatures, should be equally timeless in their essence.\(^7^5\)
Eichner suggests that there was an intimate connection between mechanistic assumptions and faith in reason and observation. "If nature worked like a great engine, human beings, who built engines, could unriddle its secrets, using the same thought processes that they used building engines." 

In other words, early modern science developed a series of natural laws which applied to the cosmos uniformly; these laws helped create and sustain a mechanistic philosophy which conceived the cosmos as a static mechanism (a perfectly running machine is the most common metaphor of this metaphysic). Viewing the cosmos as static meant that "all possibilities of reality were realized from the beginning, and that these possibilities were arranged in a complete series, a hierarchy from God down to nothingness ..." The assumptions undergirding the mechanical philosophy helped shape the prevailing neoclassical value system of the seventeenth and eighteenth centuries. The neoclassical value system included an emphasis on perfection, changelessness, uniformity, and rationalism.

The romantic movement represented a radical change from the classical episteme which preceded it; romanticism replaced the mechanistic assumptions associated with modern science with organicism. The organic reality model assumes a cosmos infinitely more complex than the one described by mechanistic science; it conceives the cosmos as an
organism, not a machine. Furthermore, the romantic epistemology understands that:

the way in which we know what it is like to be a living being is fundamentally different from the way we know how a [machine] works, ... we know about our own existence by introspection.\textsuperscript{78}

While recognizing the limitations of using any one definition of romanticism, the literature in general suggests at least the following recurring themes: the creative imagination, intellectual intuition, the unconscious, a preoccupation with what is different, remote, mysterious, awe-inspiring, a return to nature, a reaction against the scientific method, diversity, change, imperfection, and a vindication of the individual.\textsuperscript{79} This dissertation, then, understands romanticism as the complex cluster of themes mentioned above. It will be argued that Thomas' romantic orientation toward the world is characterized by six major themes: (1) faith in the unconscious mind, (2) a vindication of the individual, (3) a predilection for diversity, ambiguity, and imperfection, (4) a preoccupation with qualities that are different, remote, or mysterious in humans, (5) wonder and awe of nature, and (6) a concern for humankind's moral characteristics. This author will proceed to identify these romantic themes as they appear in Thomas' discourse; the themes' strategic location, function, and rhetorical significance will be assessed. In addition, the author will examine the scientific world view as it is set against the
romantic world view in Thomas' overall rhetorical design. Thus, it will be shown how the scientific world view is symbolically merged with a romantic orientation in Thomas' essays to create what in chapter two is described as a scientific-romantic synthesis.

Finally the rhetorical analyst, in this case, the author of this dissertation, also contributes to the act of analysis. That is, this analyst "conceives of himself as a kind of sensitive instrument," and will impose certain interpretive frameworks on the object under rhetorical scrutiny. For example, this author will draw upon his knowledge of science as well as information gathered from a literature review on the rhetoric of science and of cultural history to aid in the interpretation of Thomas' writings. In general, this dissertation is consistent with the three-stage critical format outlined by Karlyn Kohrs Campbell.

Campbell claims that descriptive analysis, the first stage in the critical process, is entirely intrinsic. In other words, the analyst focuses mainly upon the discourse, making "descriptive statements solely on the basis of the content of the discourse itself." In the same vein, the first stage of this author's analysis will involve a close reading of Thomas' essays, focusing primarily upon the language of the included essays. Campbell states that in historical-contextual analysis,
the second stage in the critical process, the rhetorical analyst "... acquires information about the historical-cultural context, the rhetorician, the audience, and the persuasive forces operating in the scene ..."\textsuperscript{82} Furthermore, Campbell asserts that "a discourse is the rhetorician's solution to a problem he perceives in a particular context, that is, the rhetorician's attempt to encompass a situation."\textsuperscript{83} In similar manner, this dissertation profiles Thomas' background as a scientist and examines how Thomas' discourse operates within a particular context to respond to certain historical-cultural forces. More specifically, this author will analyze how Thomas' popular scientific essays are crafted for the nonscientist, to make Thomas' vision of science more palpable to the general public. In short, the author's investigation will focus upon how Thomas, as a public scientist, responds to certain historical-cultural problems arising from the practice of science.

Finally, Campbell claims that interpretative analysis, the third stage in the critical process, focuses on the analyst, "reflecting his interests and biases."\textsuperscript{84} Campbell says that the analyst should use his intrinsic descriptive analysis, and investigation of the historical-cultural context, as standards for judgment in evaluating the quality, worth, and consequences of the discourse.\textsuperscript{85} In much the same fashion, this author will utilize an
intrinsic analysis of the language Thomas uses to delineate certain romantic and scientific values. Information acquired concerning the traditional controversy between science and humanism, and the general public's perception of science will be used to aid the interpretative analysis. This dissertation utilizes an interpretive critical analysis, focusing primarily upon the language and message of Thomas' essays. This study is not effects centered, and thus makes no claim to offering a formal measure of public reaction to Thomas' essays. This study will speculate, however, about the effect Thomas' message might have on different audiences. Particularly, the author will speculate about how the general public is likely to interpret Thomas' popular scientific essays and also consider the effect Thomas' discourse is likely to have on the continuing dialogue between scientists and humanists.

Ultimately, this author is of the view that the study of public discourse provides an important intellectual measure for evaluating the ideas, values, and aspirations of a particular culture. In sum, this author agrees with Ernest J. Wragge's claim that "from the study of [public discourse] may be gained additional knowledge about the growth of ideas, their currency and vitality, their modifications under the impress of social requirements, and their eclipse by other ideas with different values."
Organization of Data

The remaining four chapters of this dissertation will be arranged in the following fashion.

Chapter Two: This chapter analyzes essays from Lewis Thomas' popular scientific discourse; an attempt is made to explicate two romantic themes: (1) faith in the unconscious mind, and (2) a preoccupation with qualities that are different, remote, or mysterious in humans. The chapter attempts to explain and evaluate the rhetorical impact these two themes have as part of the larger scientific-romantic synthesis reflected in Thomas' discourse.

Chapter Three: This chapter analyzes essays from Lewis Thomas' popular scientific discourse in an attempt to explicate two romantic themes: (1) a predilection for diversity, ambiguity, and imperfection, and (2) a vindication of the individual. The chapter attempts to explain and evaluate the rhetorical impact these two themes have as part of the larger scientific-romantic synthesis reflected in Thomas' discourse.

Chapter Four: This chapter analyzes essays from Thomas' popular scientific discourse in an attempt to explicate two romantic theme: (1) wonder and awe of nature, and (2) a concern for humankind's moral characteristics. The chapter attempts to explain and evaluate the rhetorical impact these two themes have as part of the larger scientific-romantic synthesis reflected in Thomas' discourse.
Chapter Five: This chapter provides conclusions about the rhetorical nature and effectiveness of the scientific-romantic synthesis as a method for (1) mediating the long standing controversy between science and humanism, (2) allaying the general public's concerns over the potential ethical and moral implications of science. The author will examine how other scientists might respond to the version of science proffered by Thomas. The author will also speculate about why the popularization of science should be regarded as an aspect of rhetoric rather than exclusively or simply as an aspect of science or literature. Finally, chapter five will provide conclusions regarding how this dissertation's research findings contribute to previous scholarship on public scientific communication. The author will suggest avenues for future research concerning romantic public science specifically, and public scientific communication generally.
Chapter Two

In chapter one it was suggested that Thomas' essays reveal a union of traditional scientific values and popular romantic themes. This union shall be called here a "rhetorical synthesis." The term synthesis as it is used here has two defining characteristics. First, in a general sense, the word synthesis, used here synonymously with the words merger, orientation, and perspective, is understood as the "putting of two or more things together so as to form a whole."87 More specifically, the term synthesis is used to suggest a reconciliation of two philosophically opposing forces. Thomas' essays reflect a synthesis insofar as they merge what have traditionally been thought to be two opposing philosophical views of reality, science and romanticism. Second, this synergistic reconciliation of two opposing philosophical forces is understood to produce a third philosophical view of reality, which combines elements from the two original views of reality yet is a wholly separate, independent philosophical perspective. Thomas' synthesis of traditional scientific values and popular romantic themes produces a particularly humane version of science. The synthesis reflected in Thomas' essays is rhetorical insofar as it depends on the strategic use of language to attempt a reconciliation between science
and romanticism, and is purposefully designed to produce a romantic science capable mitigating the long-standing dispute between science and humanism and to allay the public's fear about the social consequences of science. The degree to which Thomas may succeed or fails in this rhetorical synthesis shall be a topic for discussion in the final chapter of this dissertation.

Two themes which are consistently found in definitions of romanticism are faith in the unconscious mind, and an emphasis on qualities that are different, remote, or mysterious in humans. These two core romantic tenets serve as the romantic axiology undergirding much of Thomas' discourse. The rhetorical function of these themes in the construction and justification of Thomas' scientific-romantic synthesis will be explored. The author will also examine how the rhetorical merger enables Thomas to articulate a vision that accommodates the general public's increasing apprehension about the social consequences of science, while simultaneously maintaining science's privileged status in society. Finally, ways in which the rhetorical synthesis allows Thomas to recognize that the aims of science and humanism may be compatible are investigated.

Scientific Rationality Vs. Romance

Early modern science, beginning with Copernicus and Galileo, claimed to have discovered a series of natural
laws that uniformly applied to the cosmos; from these laws was derived a mechanical philosophy that conceived the cosmos as a static mechanism (a perfectly running machine is the most common metaphor of this mechanistic philosophy). Moreover, there existed in modern science an intimate connection between the mechanical philosophy and faith in rationality.88

Twentieth century science has moved beyond an orthodox mechanical philosophy to a more sophisticated view of the cosmos. Scientists no longer use the machine as a heuristic model to explain the nature of the universe, but, as Eichner argued, "the basic heuristic assumption of science is still that the phenomena of the world are causally determined in conformity with the laws of nature."89 Furthermore contemporary science, unlike romanticism, is still characterized by an allegiance to rationality; scientists typically believe that "all things are possible to reason in the form of a high developed science."90 Philosophical debates over the nature of rationality notwithstanding, the most significant part of the scientific ethos as constituted by scientists is the rationalistic attitude which supports their practice. In fact, a number of scholars have attempted to explain the importance of rationality to the scientific ethos. In The Sociology of Science, Robert K. Merton sought to identify the complex of values and norms that inform the scientific enterprise.
Merton argued that the value of organized skepticism instructs the scientist to temporarily suspend judgment in order to scrutinize beliefs against empirical and logical criteria. In *Science and the Social Order*, Bernard Barber states that "science exists only when rational thought is applied to ... empirical ends." In *Science as a Cultural process*, Maurice N. Richter Jr. contends that scientific methods rely on "quantified observations under controlled conditions" to acquire systematic knowledge of the natural order. In "Science as a Rhetorical Transaction: Toward a Nonjustificational Conception of Rhetoric," Walter Weimer asserts that logic became an essential tenet of traditional scientific method in "inference ... assessment, and explanation." In short, while twentieth century science is closer than nineteenth century science to romanticism in its philosophical commitment to organicism, major differences between these two movements remain.

The romantic movement, in the late eighteenth and early nineteenth centuries, reacted against the spirit and implications of the scientific episteme which preceded it; for many poets and philosophers, romanticism replaced the mechanical philosophy associated with modern science with an organic reality model. Romantic organicism assumed that humans perceive truth in nature, not through rational investigation of natural phenomena, but through the
unconscious and creative mind. In essence, organicism assumes a cosmos decidedly more complicated than the one described by mechanistic science. The romantic epistemology rejected mechanistic science's assumption that the universe is permanent, never changing, and operates in principle like a perfect machine. To the contrary, romanticism posited a cosmos that is "living and growing, not a perfect machine." \(^\text{95}\)

For those in literature and philosophy for whom organicism replaced the mechanical philosophy, the power of humans' unconscious and creative imagination, rather than reason, became the accepted way to higher truths. In fact, scholars have documented the predominance of imagination over reason in the romantic value system. For example, Peckham has argued that for the romantic reason is inadequate:

... truth can only be apprehended intuitively, imaginatively ... from the deep sources of the fountains that are within. The unconscious is really a postulate to the creative imagination ... It is that part of the mind through which novelty enters into the personality and hence into the world in the form of art and ideas. \(^\text{96}\)

The Encyclopedia of Philosophy references the romantic movement's "exaltation of intuition, spirit, sensibility, imagination, faith, the unmeasurable, and the infinite." \(^\text{97}\)

Eichner suggests that the Romantic poet or philosopher never wholly rejected reason, but assigned it only menial services. To attain higher truths Romantics relied on the
"irrational faculties of the mind... unmediated insight... intellectual intuition, and the imagination." The Norton Anthology of English Literature added that the romantic philosophy emphasised "the free activity of the imagination... and the feelings of the heart to supplement the judgments of the purely logical faculty."

Another popular theme manifested in the romantic epistemology is an interest in the remote, the mysterious, the unknown. In Rhetoric, Romance, and Technology: Studies in Interaction and Culture, Walter Ong notes that definitions of romanticism invariable include reference to mysterious phenomena:

... whatever way one defines [romanticism], one of the movement's characteristics--more or less central depending on the particular definition--a preoccupation with otherness, with what is different, remote, mysterious, inaccessible, exotic, even bizarre.

Virtually all scholarship, according to Ong, falls back on this theme to distinguish the romantic movement from the neoclassicism which preceded it.

The popular scientific essays of Lewis Thomas celebrate these two core romantic tenets. They may be explicitly stated as: (1) a faith in the unconscious mind and the creative imagination, and (2) a preoccupation with qualities that are different, remote, or mysterious in humans. Thomas merges these two themes with an emphasis on scientific rationality to produce a scientific-romantic orientation toward the human mind and natural phenomena.
Thomas on the Unconscious Mind and Rationality

In "The Attic of the Brain," Thomas draws a metaphorical relationship between the attic of a house and the human unconscious. The attic is a "mysterious space" serving as the memory of a house, "filled with unidentifiable articles too important to be thrown out ... but no longer suitable to have at hand."¹⁰¹ A modern house or apartment, however, rarely includes an attic. Today whenever we "grow tired of a memory, an old chair, a trunkful of old letters, they are carted off to the dump for burning."¹⁰² Thomas suggests that the human unconscious serves as a comfortable part of the mind, much like an attic to a house, "to hide away the things we'd like to keep but at the same time forget."¹⁰³ His primary argument is that modern psychiatry has erred in its attempt to expose the darkest recesses of the human unconscious, and its efforts to demystify the so called "functionless, untidy, inexplicable" notions of the unconscious mind should be abated. Much like a romantic, who would highlight the essence of what it means to be human, Thomas asserts that "it is in our nature as human beings" to retain a proportion of thought in our unconscious.¹⁰⁴ In fact, Thomas welcomes the mystery of the unconscious mind, and encourages the repression of certain thoughts and dreams. He understands that through their unconscious minds humans remain in possession of a vital aspect of their humanity:
This quote is revealing. The romantic epistemology puts great faith in the spontaneity and intuition of the unconscious. Thus, Thomas' willingness to protect the sanctity of the unconscious against scientific probing is in keeping with the romantic tradition. Science, on the other hand, relies on the rational mind, is methodical, and does not "feel" that two ideas are somehow connected unaccountably. Rather, science searches for causal connections, or statistical correlations, in nature, and attempts to prove, through experimentation and the accumulation of evidence, that two ideas are related. Thomas' belief in the ability of the unconscious to put humans in "possession of real memory" also underscores what is perhaps romanticism's quintessential criticism of science: science relies strictly on humans' logical faculty and therefore cannot recognize the significance of human emotion. The human unconscious, however, has the inexplicable ability to understand that emotions are triggered by items such as "... forgotten furniture, old photographs [and] fragments of music." A person's emotions may, as Thomas' suggests, invoke a recollection of events, people, or places in his or her past, in a manner
that rational recollection cannot. In other words, a recollection triggered by emotion might unexplainably, even mysteriously, provide a person with insight into his or her personality or being, in a way that science and the power of rational thought cannot. Thomas understands that psychiatry’s effort to "straighten out and tidy up" the human unconscious may be "one of the great errors of our time." He suggests that the unconscious mind should remain free from the influence of rational thought:

The [unconscious mind] is not meant to be governed ... it is supposed to run itself, and [humans] are obliged to follow it along, trying to keep up the best [they] can. It is all very well [for humans] to be aware of [their] awareness ... but never try to operate it.107

Thomas admits that he is not sure what the unconscious is built to contain. Yet as a biologist he believes "the unconscious [mind] ... should be regarded as [a] normal [structure], installed wherever [it is] for a purpose."108 Thomas would take for granted that the unconscious is a "useful, probably indispensable organ of thought."109

This essay illustrates Thomas' romantic-scientific orientation toward the unconscious. On the one hand, as a biologist, he relies on a rational scientific perspective which assumes that all natural phenomena can be explained, and these phenomena serve a useful function in the perfectly ordered universe. Particularly, Thomas claims to be "impressed by the usefulness of everything alive," and suggests that the unconscious, though presently beyond the
scope of scientific understanding, is likely to serve a useful function in human psychology. As a romantic, on the other hand, Thomas fears that science's effort to unravel the mystery of the unconscious may eventually destroy the essence of human psychology. Specifically, he views the unconscious as "a mysterious apparatus," whose continued exposure to the rational exploration of psychiatry might cause humans to "lose, ultimately, the marvelous conviction that being human is the best thing to be." In summary, he seems to be saying that to reduce the mind to the status of machine removes a sense of individuality and mystery from that organ which we take to be the center of our being. Thus, Thomas understands that the unconscious mind represents a distinguishing and perhaps essential element of the human species.

In "Humanities and Science" Thomas admonishes science to respect the integrity of the human mind in a characteristically romantic fashion, and distinguishes science from technology in order to defend science's primary purpose of gaining a comprehensive knowledge of nature.

In this essay Thomas refrains from drawing a distinction between the unconscious and the rational mind. Nevertheless, he manifests a romantic disposition when claiming to be "made nervous by assertions that human consciousness will someday be unraveled by research, laid
out for close scrutiny like the workings of a computer..." Moreover, Thomas is "deeply disturbed by any prospect that [science] might use the new knowledge in order to" improve consciousness. In a romantic vein, he proclaims that "the ... human mind is too marvelous an instrument ever to be tampered with by anyone, science or no science." Notwithstanding, Thomas defends science's aim to gain a comprehensive knowledge of nature even while he maintains a romantic disposition toward the human mind. He defends scientific discovery of new information about nature (e.g., human psychology) by assuming a fundamental difference between science and technology:

Technology relies and depends on science ... but is nothing like the first justification for doing research, nor is it necessarily an essential product to be expected from science. Public decisions about ... technology are ... different from decisions about science, and the two enterprises should not be [confused]. The central task of science is to arrive...at a clearer comprehension of nature, but this does not mean ... a search for mastery over nature. These remarks provide rationale for the claimed merger of romantic and scientific values in Thomas' philosophical orientation to the human mind. His distinction between science and technology accommodates both a scientific and romantic disposition toward human consciousness. As a scientist, Thomas suggests that the sole motivation of science is to understand nature, not alter it. He argues that science, as an enterprise distinct from technology, should not be held responsible for technological
application of scientific research that attempts to control human consciousness. In other words, Thomas is suggesting that, unlike technologists who might seek to alter and control the human mind, scientists are simply motivated to comprehend how the mind operates. Thus, in addition to defending scientific research, Thomas' distinction between science and technology also echoes a romantic perspective; that is, much like a romantic, Thomas is opposed to technology that would alter human consciousness; he seems to suggest that technological intervention into the mysteriousness of the human mind would attempt to strip the individual of his or her uniqueness.

In "On Warts" Thomas offers a discussion of warts as one "of the great mystifications of science," and is particularly interested in the way "warts can be ordered off the skin by [the] hypnotic suggestion" of the unconscious. He is also astonished that the unconscious can rid the body of a virus with the apparent permanence and toughness of a wart. As a scientist, Thomas was trained to regard the unconscious as an impediment to rational thought:

... as a sort of private sanitarium walled off somewhere in a suburb of [the human] brain, capable only of producing such garbled information as to keep [the mind], [the] proper mind, always a little off balance.\(^1\)\(^2\)

Within the scope of Thomas' scientific training the "proper" mind and the rational mind appear to be synonymous; as a scientist, he has been trained to put
complete trust in the powers of the rational mind, and to view the unconscious as capable only of producing "garbled information." This traditional scientific perspective views the unconscious as a hindrance, serving to keep the rational mind "a little off balance." In spite of his scientific training, however, Thomas' recognition of the potential of the unconscious reveals a romantic strain: the apparent ability of the unconscious to reject a wart is proof, for Thomas, that the unconscious mind "is not the sort of confused, disordered" mechanism science has traditionally depicted.\textsuperscript{113}

Nevertheless, Thomas' romantic disposition toward the unconscious is delimited, for he attributes rational characteristics to the unconscious. Thus, he deviates from an exclusively romantic conviction in the inexplicable potential of the unconscious. In other words, Thomas is only partially willing to let the mysterious nature of the unconscious stand as an explanation for its "superintelligence." Instead, as one might expect from a scientist, Thomas ascribes qualities of the rational mind to the human unconscious. For example, he explains that the unconscious has a superintelligence "infinitely smarter and possessed of technical know-how far beyond" science's present understanding:

The unconscious has ... the accuracy and precision of a surgeon. There almost has to be a person in charge, running matters of meticulous detail beyond anyone's comprehension, a skilled engineer
and manager, a chief executive officer...among other accomplishments he must be a cell biologist of world class ...

These remarks suggest that the unconscious is endowed with a problem solving capability equal to that of a surgeon, a skilled engineer, a chief executive officer, or a cell biologist. These professions are, of course, typically noted for their reliance on human rational judgment.

In summary, Thomas is neither a pure romantic nor a pure scientist in his view of the unconscious. Like a romantic, Thomas recognizes that, far from constraining the rational mind, the unconscious possesses a mysterious intelligence; unlike the pure romantic, however, he is not satisfied to revel in the mystery of the unconscious without speculating about the nature and source of its intellectual capability. His propensity to ground the intellectual capability of the unconscious in rational activity is significantly different from the mysterious characteristics a romantic might posit (e.g., spontaneity, intuition, unmediated insight). Thus, while he differs from the traditional scientific perspective in his unwillingness to view the unconscious as an impediment to rational thought, Thomas does maintain a qualified allegiance to the scientific ethos.

The three essays chosen for examination herein exemplify the merger of romantic and scientific values reflected in Thomas’ attitude toward the human unconscious.
The nature of this rhetorical merger is characterized by the ambiguous philosophical middle ground it achieves between science and romanticism. Carole Tallant has provided a discussion on the theory and practice of narrative ambiguity that aids understanding of how ambiguity operates as a rhetorical device in Thomas' persuasive merger. According to Tallant, ambiguity was not generally recognized as a valuable artistic device until 1930 and the publication of William Empson's *Seven Types of Ambiguity.* Tallant notes that unlike past scholars, who identified ambiguity as a lack of clarity, Empson defines ambiguity broadly as "any verbal nuance, however slight, which gives room for alternative reactions to the same piece of language." Tallant explains that Empson's view of ambiguity is valuable for the manner in which it enlarges the reader's understanding of more complex meanings in language, yet has received criticism within the scholarly community for perpetuating a definition that "reduces the precision of critical terminology." Thus, in an effort to provide a more precise definition, Tallant's study suggests classifying ambiguity as either conjunctive or disjunctive. From Tallant's perspective, conjunctive ambiguity operates when "two or more meanings arise and complement each other so that the reader need not choose between them." Disjunctive ambiguity operates when "the two meanings
mutually exclude each other but are equally tenable. Thus the reader cannot choose."¹²⁰ For present purposes, Tallant's definition of conjunctive ambiguity illuminates the manner in which ambiguity functions as a rhetorical device in Thomas' scientific-romantic synthesis. Specifically, Thomas' romantic science is characterized by an ambiguous philosophical middle ground between science and romanticism, so that these two views, traditionally thought to be in opposition, appear to complement each other's perspective of reality. For example, Thomas' perspective on the unconscious mind, neither purely romantic nor purely scientific, relies for its rhetorical force on an ambiguous equivocation between the two perspectives. In essence, Thomas uses ambiguity strategically to foster more than one viewpoint; paradoxically, ambiguity serves as a rhetorical tactic in his essays to promote unified diversity between scientific and romantic perspectives concerning the unconscious.¹²¹ In other words, Thomas' equivocal view of the unconscious seems designed to maintain the philosophical integrity of both science and romanticism, while simultaneously accommodating the long standing differences between these two modes of thought.

In "The Attic of the Brain," for example, Thomas recommends that psychiatry refrain from its attempts to expose all aspects of the unconscious to rational
exploration. He understands that the unconscious' spontaneity and intuitiveness may provide humans with the capacity to respond emotionally, as opposed to merely rationally, to environmental stimuli. Thomas suggests, ultimately, that emotional experience may provide a person with clues to his or her individuality and to what it means to be human.

In "Humanities and Science," Thomas draws a distinction between the aims of science and those of technology, explaining that the sole aim of scientific research is to gain comprehensive knowledge about nature, while technology attempts mastery over nature. Thomas' distinction between scientific and technological perspectives on nature seems designed, from a scientific viewpoint, to advance science's understanding of how the mind operates. On the other hand, his opposition to technology that harnesses scientific research to control nature, and particularly the human mind, supports a romantic disposition.

In "On Warts" Thomas recognizes that the unconscious has a mysterious, and perhaps in the short-term inexplicable, intellectual ability to remove warts. Yet unlike a romantic, Thomas is not satisfied to rejoice in the unconscious' mysterious ability for its own sake. Rather, echoing a scientific perspective, Thomas speculates about how the unconscious might operate in the removal of
warts: he explains that an understanding of the instructions issued by the unconscious mind in the removal of warts is "... a wonderful problem, in need of solving."\textsuperscript{122}

The merger of romantic and scientific values reflected in his attitude toward the human unconscious is an important part of the larger scientific-romantic synthesis found in Thomas' public science. As such, the rhetorical impact of this merger deserves evaluation in respect to three research questions proposed in chapter one: Might the merger of romantic and scientific values reflected in the language Thomas uses to discuss the human unconscious, as part of the larger scientific-romantic synthesis embodied in his writings, (1) mediate the traditional dichotomy between science and humanism? (2) mitigate the general public's apprehension about the social consequences of science? and (3) highlight the general public's capacity to respond to aspects of the world inaccessible to the interpretive framework of science and ordinary rational thought?

The equivocation between scientific and romantic values reflected in Thomas' orientation to the human unconscious provides a rhetorical middle ground capable of mitigating the long standing controversy between science and humanism. Humanists, eager to defend self-realization of the human personality, should welcome Thomas' implicit
recognition that the human unconscious complements the rational mind in exploring areas of experience presently inaccessible to science; humanists may find hope in Thomas' perception of the unconscious as a sensitive organ of thought, capable of triggering human emotion, and potentially valuable for its aesthetic capacity to understand "human" truths too profound for the rational mind to comprehend. Scientists, on the other hand, may find satisfaction in Thomas' professed allegiance to science's primary goal of gaining a comprehensive knowledge about nature. Thomas' willingness to learn more about the actual mechanics of the unconscious mind is also consistent with the scientific world view. Scientists may, however, dismiss Thomas' inclination to invest the unconscious with mysterious superintelligence. The scientific perspective is likely to be uncomfortable with the word "mysterious" as a descriptive term for the intellectual ability of the unconscious. More specifically, from a scientific perspective, Thomas' use of the word mysterious may come unacceptably close to ascribing transcendental qualities to the unconscious. Science, of course, would assert that ultimate physical reality is knowable; it would assert the primacy of the empirical and the material over the spiritual. Thus, science is likely to view its limited understanding of the unconscious as temporary, remaining confident in its search for empirical information aimed at
providing a more complete naturalistic understanding of brain processes.

Embedded within Thomas' attempt to distinguish science from technology is an implicit argument designed to divorce the scientific enterprise from its consequences. Thomas suggests, for example, that the general public should support scientific efforts to learn more about the human unconscious. In this way, science might understand the nature of the unconscious mind's reaction to certain diseases. Yet Thomas argues against technological application of scientific research that might alter or control the unconscious. Thus, his distinction between science and technology seems a rhetorical attempt to respond both to science's appetite for knowledge and to the general public's apprehension about scientific exploration of the unconscious mind. Ultimately, while Thomas' artificial distinction between science and technology may obtain among scientists in a laboratory, it appears tenuous and lacks credibility when set forth in the public arena. The general public is, after all, well aware of instances where scientific research was used to develop technologies which were ultimately harmful to humankind. They are therefore likely, along with humanists, to remain apprehensive about science's continued exploration into the human unconscious.
Finally, Thomas' scientific-romantic approach to the unconscious mind underscores the general public's capacity to respond to aspects of the world inaccessible to the interpretive framework of science and rational thought. His recognition of the unconscious' capacity for problem solving and aesthetic experience encourages laypersons to depend on intuitive and emotional judgment along with logical processes for problem solving. This dependence may result in a more well balanced and complete utilization of an individual's intellectual resources. A more accurate self-appraisal may, perhaps, provide a person with valuable information about his or her personality, along with a deeper understanding about what it means to be human.

Thomas on the Mysterious and the Naturalistic

This chapter also attempts to explain and evaluate the rhetorical impact of a second romantic theme evidenced in Thomas' public scientific writings: a preoccupation with qualities that are different, remote, or mysterious in humans.

Science has traditionally criticised the pretensions of superstition and pseudoscience, choosing instead to explain human existence in terms of naturalistic explanation, without recourse to mysterious or unaccountable forces. For example, in *Permanence and Change*
Kenneth Burke notes science's general skepticism of nonscientific methods of explanation:

The mystics are condemned for failing to abide by established canons of positivistic science ... there are certain fixed Marquis of Queensbury rules for scientific combat, and anyone who would turn his skepticism against these vested interests of scientific rationalization is suspected of a hankering to sink back into the Dark Ages of human thought.123

Romanticism, though, is typically preoccupied with "otherness, with what is different, remote, mysterious, inaccessible, exotic, even bizarre.124 Lewis Thomas' recognition of ineffable and remote aspects of human existence is best exemplified in his essays on the creative imagination and on music.

The idea of the creative imagination, according to Peckham, is derived from dynamic organicism. "If the universe is constantly changing in the process of creating itself, the mind of man, his imaginative power, is radically creative."125 In "An Apology" Thomas offers a wry, ironic, even humorous, juxtaposition of science and the creative imagination's ability to shape reality. He explains that in modern physics "the observer, and his apparatus, create the reality to be observed ... The reality to be studied by [the physicist's] instruments is not simply there; it is brought into existence by the laboratory."126 Thomas claims to have "been doing some physical observing on [his] own, without formal training and with only a pencil point as instrument ..."127
Specifically, Thomas has imagined that by holding a pencil point in the middle of "a yellow lined pad" he can make "the sun revolve" around his office in New York:

It takes a bit of heaving to get it started, but after a few minutes of hard thought you can hold East Sixty-ninth Street as the still, central point, and then you can feel the sun rolling up behind you ... making the great circle around. Once you’ve got the sun started, it is not too difficult to organize the rest of the solar system, so that the whole apparatus is ... spinning around the central point on the upper East Side of Manhattan ...\(^{128}\)

Thomas is concerned about the effect his imaginative power may "have had on the cosmologists, who may be looking at things in Pasadena, or Puerto Rico, or Palomar, or Pittsburgh, or wherever."\(^{129}\) Thomas adds that his "manipulations may not be the only ones going on." Other individuals may be using their imaginative ability to swing the universe from its normal course. Finally, Thomas admits to being very sorry for having tampered with the universe, but claims that he cannot be sure of stopping:

Once you have held the pencil point with all that precision, on a single fine point, and swing the whole whistling universe around that point, shrinking celestial masses of matter to nothing at all in the necessary speed, feeling the whole thing yaw and heave and almost spin off beyond control, but still holding it there, spinning, it is hard to stop.\(^{130}\)

Thomas does not intend readers to accept the notion that he, or anyone else, has the ability "with only a pencil point as instrument" to shape a particular reality: any literal interpretation of this essay would miss the
rhetorical significance of Thomas' reflections. More appropriately, Thomas' view of the creative imagination is best characterised as intentionally enigmatic. Moreover, the perplexity of his thoughts seems designed precisely to signify the mysteriousness of the human imagination. Thus, Thomas has effected a rhetorical merger of romantic and scientific values: he has recognized simultaneously the scientist's ability to shape reality and the romantic's high esteem for the imagination's creative function. In short, Thomas has persuasively suggested that the creative imagination may be as powerful as modern physics in its ability to construct reality.

Thomas' essays on music also reflect an even more romantic preoccupation with remote or mysterious aspects of human existence. Thomas indicates that music's ability to evoke emotion may be inextricably linked to the human thought process; he typically identifies the connection between music and human psychology as a mysterious aspect of human nature. Thomas' recognition of music's potential to spark human emotion is not a revelation. In fact, a number of scholars have referred to the influence of music in producing aesthetic experience. In The Psychology of Music: The Influence of Music on Behavior, Charles M. Diserens and Harry Fine note that language is intimately connected with human emotion:

Music is a form of language ... older than articulate speech ... it is the speech of the
antique, half buried soul of the race ... In music man may dimly revive the most ancient elements and experiences in the history of the soul ... In short, music is the language of the emotions.\textsuperscript{131}

In Esthetics of Music, Carl Dahlhus explains that knowledge of the ability of music "to represent and arouse affections is a commonplace, rooted ... deeply in history."\textsuperscript{132} He adds that "music acts directly on ... the listener's emotions, passions, and affections, quickly elevating or even transforming them ...\textsuperscript{133}" In Music the Art and Ideas: Patterns and Predictions in Twentieth Century Culture, Leonard B. Meyer claims that human emotion arising out of music is as important as emotion emanating from language:

Music may be meaningful because it refers to things outside itself, evoking associations and connotations relative to the world of ideas, sentiments, and physical objects. Such designative meanings are often less precise and specific than those arising in linguistic communication. This does not, however, make them less forceful or significant.\textsuperscript{134}

Thomas, too, recognizes music's intimate nexus with creative imagination, along with its concomitant potential to arouse human emotion. Moreover, his recognition of music's ability to heighten human awareness may be a more persuasive topos than simply acknowledging the ways in which rational, empirical data enhance perception. In "Late Night Thoughts on Mahler's Ninth Symphony," for example, Thomas experiences melancholy as a result of a perceived association between the mood evoked in Mahler's Ninth Symphony and the threat of "thermonuclear bombs exploding"
throughout the world. Thomas' use of this type of aesthetic experience as a rhetorical warning against thermonuclear war is more typical of the poet or novelist than the scientist. For instance, Thomas used to hear Mahler's Ninth Symphony as recognition of nature's natural order:

as an open acknowledgement of death and at the same time a quiet celebration of the tranquillity connected with the process. [He] took this music as a metaphor for reassurance...that the dying of every living creature, the most natural of all experiences, has to be a peaceful experience. [He relied] on nature.\textsuperscript{135}

The cruel reality of thermonuclear weapons, however, in the form of government brochures and television newscasts, constantly impinges on Thomas' consciousness. He talks, for example, of a pamphlet on his desk, "published by the Congressional Office of Technology Assessment ..." This document discusses strategies for "placement and protection" of MX missiles, "each capable of creating artificial suns to vaporize a hundred Hiroshimas, collectively capable of destroying the life on any continent."\textsuperscript{136} At another point in his essay, Thomas claims to listen to a "man on television" explain the advantages of civilian defense:

Instead of the outright death of eighty million American citizens in twenty minutes...we can, by careful planning and practice, get the number down to only forty million, maybe even twenty ... of course [the man] adds, [the Russians] have the capacity to kill all two hundred and twenty million of us if they were to try real hard.\textsuperscript{137}
Daily reminders of this type have shaken Thomas' confidence in the continuity of life; he is not as certain as he once was that humanity will survive into the Twenty-first century. Thomas can no longer listen to the Mahler Ninth "without a door-smashing new thought: death everywhere, the dying of everything, the end of humanity." Mahler's symphony no longer comes to Thomas as "old, familiar news of the cycle of living and dying." All through the last notes Thomas' mind swarms with images of a world in which thermonuclear bombs have begun to explode, "in New York and San Francisco, in Moscow and Leningrad, in Paris...In Oxford and Cambridge, in Edinburgh." Thus, Thomas now listens to the Mahler Ninth as a meditation on death. The influence of music in producing states of melancholy or pleasure is, of course, in a strict sense, tangential to the scientific-romantic synthesis. More importantly, music's emotional impact, along with its ability to sharpen human perception, is precisely the type of mysterious phenomenon a romantic would accentuate. Thomas' public science, then, persuasively merges aesthetic and rational perspectives on the power of music and empirical data to emphasize the gravity of thermonuclear weapons.

The romantic theme of music's mysterious nature and inexplicable link to human psychology is not unique to "Late Night Thoughts on Mahler's Ninth Symphony." This theme is considered in a number of Thomas' essays. In "On
Thinking About Thinking," for example, he offers a speculative, quasi-scientific, explanation of the stages in the development of human thought. This exposition about the "nature of thought" is intended to illuminate the "nature of music." In the end, Thomas is not satisfied with this approach and decides instead to determine what music might reveal about the sensation of thought:

Music is the effort we make to explain to ourselves how our brains work. We listen to Bach transfixed because this is listening to a human mind. The Art of the Fugue is not a special pattern of thinking ... the whole piece is not about thinking about something, it is about thinking ... If you want, as an experiment, to hear the whole mind working, all at once, put on the St Matthew Passion and turn the volume way up ..."140

Thomas' impression that music represents human thought patterns suggests a mystic union of the mind with music's transcendental or mysterious reality. This type of romantic mysticism is evident also in Thomas' "The Corner of the Eye." His discussion of certain notes in a Bach fugue leads to the conclusion that "The real meaning of music comes from tones only audible in the corner of the mind."141 In "Ceti" Thomas ruminates about how humans might best represent themselves to "others in space:

... music would give a fairer picture of what we are really like than some other things we might be sending [into space] ... we could send science ... but think of the wincing at this end when the polite comments arrive two hundred years from now. Whatever we offer as today's items of liveliest interest are bound to be out of date and irrelevant, maybe even ridiculous. I think we should stick to music."142
Hence, Thomas suggests that music may be humans' most representative characteristic. In fact, Thomas indicates in "The Music of this Sphere" that humans may be genetically coded for music:

The need to make music, and to listen to it, is universally expressed by human beings. I cannot imagine, even in our most primitive times, the emergence of talented painters to make cave paintings without there having been, near at hand, equally creative people making song. [Music] is ... a dominant aspect of human biology. 

The merger of romantic and scientific values reflected in his orientation toward mysterious or remote aspects of human existence is a component in the larger scientific-romantic synthesis evidenced in Thomas' writings. As such, the persuasive impact of this merger is examined in regard to two research questions set forth in this dissertation: Might the rhetorical merger of romantic and scientific values reflected in Thomas' attitude toward the imagination and music (1) mediate the traditional dichotomy between science and humanism, and (2) provide the general public a greater role in establishing criteria for judgment for private and public decision-making?

Thomas' perspective on creative imagination and music as mysterious aspects of human existence may help mitigate the controversy between science and humanism in two ways. First, Thomas' recognition of the mind's imaginative power implicitly reveals a sort of sensitivity, emotionalism, and eagerness for novelty characteristic of romanticism.
Thomas, while not seeking to dethrone rationalism, does revolt against the dullness, narrowness, and literal mindedness that rationalism is, at worst, capable of producing. Humanists may be satisfied with Thomas' rhetorical perspective on creative imagination and music as mysterious aspects of human existence. Scientists, on the other hand, may welcome Thomas' overt reference to science's ability to shape reality. Moreover, while perhaps not content with Thomas' thoughts on creative imagination, scientists may find a certain satisfaction in the witty, humorous tone with which these ruminations are offered. Indeed Thomas seems to be using the rhetorical strategy of valorizing music over scientific data by offering a mock insult of science. This insult recognizes and valorizes the underlying assumption of scientists that all of their knowledge may potentially be subject to modification or even become obsolete as they discover new knowledge. Furthermore, scientists may find a pleasant irony in Thomas' employment of a rational voice to highlight mystic experience.

Second, humanists may welcome Thomas' persuasive recognition of music's essential connection with human thought patterns, along with its accompanying ability to incite emotion. This perspective suggests that music may potentially stimulate associations that correspond to objects in the natural world. In other words, music may
have the ability to heighten one's sense of reality. This power may be derivative of the creative imagination, transcending intellect and ordinary logical processes. Scientists, however, may be uncomfortable with Thomas' near mystical description of nature, assuming, as they do, that reality is knowable. Thus, the scientist would attempt to offer a naturalistic account of so called mystical experience.

Thomas' preoccupation with mysterious phenomena provides the general public a greater role in establishing criterion for judgment in private and public decision-making. The romantic mysticism evident in Thomas' public science suggests that there are certain aspects of human existence inaccessible to science. These facets, by virtue of remaining outside of science's grasp, give the general public an increased confidence to evaluate certain matters, independent of science. In other words, the individual layperson comes to the recognition that science is incapable of providing a complete explanation of humankind's position in the universe. Consequently, Thomas provides the way for an individual to turn to other forms of authority or aids for judgment in both private and public decision-making, such as theological explanation. In addition, Thomas clears the path for issues of morality to be given a more significant voice in public deliberation of scientific or technical information. In short, Thomas'
merger of romantic mysticism and scientific rationality encourages the public to adapt a more circumspect view of the expert advice of scientists and technologists. And this synthesis, finally, provides a less constricted, more sophisticated view of what it means to be rational.

**Conclusion**

This chapter has identified two popular romantic themes in Lewis Thomas' public science: faith in the unconscious mind, and a predilection for mysterious aspects of human existence. The chapter assessed the way these two themes are developed in essays selected to illuminate these themes and the way they are merged with scientific rationality to produce a vision of popular science, capable of mediating the old controversy between science and humanism. In addition, it examined the persuasive impact this scientific-romantic synthesis might have in mitigating the general public's apprehension about the social consequences of science. Chapter three will proceed to identify and evaluate two more popular romantic themes evident in the larger scientific-romantic synthesis that serves as an underlying axiology of Thomas' writings.
Chapter Three

Chapter two contains the argument that the popular scientific essays of Lewis Thomas merge two central romantic tenets--faith in the unconscious mind, and a high evaluation of qualities that are different, remote, or mysterious in humans—with scientific rationality to produce a scientific-romantic synthesis. It was suggested that the rhetorical merger between science and romance may help both to reduce the general public’s anxiety about the social consequences of science and to mediate the traditional dispute between science and humanism. The purpose of this chapter is to analyze two additional romantic themes pivotal to much of Thomas’ essays—a predilection for diversity, ambiguity, and imperfection, and a vindication of the individual. The rhetorical function of these themes in the construction and justification of Thomas’ scientific-romantic synthesis, and how the rhetorical merger accommodates the aspirations and values of two audiences—scientists and the general public—will be investigated.

Scientific Universalism Vs. Romantic Diversity

The creators of modern science conceived the universe as a perfectly ordered machine; they claimed that underlying the infinite variety of nature was a series of immutable natural laws that govern the cosmos. These laws,
uniformly applied to the cosmos, assumed determinacy in nature: all things were believed to fit perfectly together. From science's perspective, apparent imperfections in nature were not viewed as imperfections at all; rather science construed these phenomena as temporarily beyond the grasp of human understanding. In short, the formation of every part of nature was assumed to contribute to a perfectly ordered, universal pattern in the universe. Thus, as Peckham argued, early modern science placed supreme emphasis on a value system that included "perfection, changelessness, [and] uniformity ..."\textsuperscript{144}

Contemporary science has developed an understanding of the cosmos more comprehensive and sophisticated than the mechanical philosophy associated with its modern counterpart. Notwithstanding, as a number of scholars have noted, contemporary science is still characterized by an allegiance to values which assume an ordered universe, susceptible to explanation through rational inquiry. For example, in Theory and Research In The Communicative Arts, Ernest G. Bormann contends that one of the primary features of the scientific method is "that it searches for universal agreement about invariable relations such as those expressed in the laws of nature."\textsuperscript{145} In The Structure of Science: Problems in the Logic of Scientific Explanation, Ernest Nagel asserts that science is motivated by a desire for explanations "which are...systematic and controllable
by factual evidence ..." Nagel adds that "the sciences seek to discover and formulate in general terms the conditions under which events of various sorts occur, the statements of such determining conditions being the explanations of the corresponding happenings." In *Science as a Cultural Process*, Maurice N. Richter, Jr. argues that "the goal of science ... involves the acquisition of systematic, generalized knowledge concerning the natural world; knowledge which helps man to understand nature, to predict natural events and to control natural forces." The *Encyclopedia of Philosophy* claims that science practices "fidelity to empirical evidence and simplicity of logical formulation." Finally, most scholars of science seem to agree with Stephen W. Littlejohn's claim in *Theories of Human Communication*, that "... science is consistent with the philosophical position that the world has form and structure apart from the differences between individual observers."

The romantic movement, in the late eighteenth and early nineteenth centuries, rejected the mechanistic assumptions associated with early modern science and the values which continue to characterize contemporary science, for an organic model which provided a new, decidedly more complex system that would explain the nature of reality. Particularly those in literature and philosophy, for whom organicism replaced the mechanical philosophy, rejected the
mechanistic science's assumption that the universe is permanent, never changing, and designed like a perfect machine. Rather, for many poets and philosophers organicism posited a constantly changing and imperfect cosmos. Peckham provides a cogent explanation of romanticism's philosophical commitment to organicism:

[For a romantic] ... the first quality of organicism is that ... the universe is alive...not something made, a perfect machine; it grows. Therefore change becomes positive value, not a negative one ... Anything that continues to grow, or change qualitatively, is not perfect, can, perhaps, never be perfect. Imperfection becomes a positive value ... with the intrusion of each novelty, the fundamental character of the universe ... changes. We have a universe of emergents.150

In addition to explaining the quality of organicism as a characteristic part of the romantic epistemology, Peckham notes that some of the definitions of romanticism that have been widely used over the past fifty years include "... a love of the exotic ... a vindication of the individual ... [and] a reaction against the scientific method..."151 Eichner asserts that romanticism rejected early modern science's conceptions of both a static universe and unchanging human nature. As a result, romanticism abandoned science's preoccupation with, and admiration for, the "timeless [and] the universal." In fact, romanticism emphasises the "temporal, the local, and the individual."152 Eichner suggests that unlike modern science, which assumed determinacy in nature and attempted
to establish timeless, universal laws, romanticism focuses on the "... unique, time-bound, and unrepeatable." The Encyclopedia of Philosophy explains that romanticism revels in "disorder and uncertainty," and is "insistent on the uniqueness of the individual to the point of making a virtue of eccentricity." The Handbook To Literature contends that romanticism designates a literary and philosophical theory that places the individual at the center of all life and experience; for the Romantic, the individual is the focal point of art, "making literature most valuable as an expression of unique feelings and particular attitudes ..." In The Great Chain of Being: A Study of the History of an Idea, Arthur Lovejoy claims that the Romantic believes "not only that in many, or in all, phases of human life there are diverse excellences, but that diversity itself is of the essence of excellence ..." the Romantic celebrates "the fullest possible expression of the abundance of differentness that there is, actually or potentially, in nature and in human nature ..." In summary, virtually all scholarship agrees that the romantic movement refused to be confined within the materialistic concepts of the orthodox scientific theory; in fact, romanticism promoted an aesthetic antipathy to standardization, a distrust of universal formulas, cultivation of individual peculiarities, and a sense of glory in the imperfect.
Definitions of romanticism do not always differentiate these core romantic characteristics; though the essential spirit of these characteristics helps define two central romantic tenets celebrated in the popular scientific essays of Lewis Thomas. They may be explicitly stated as: (1) a predilection for diversity, ambiguity, and imperfection, and (2) a vindication of the individual. Thomas merges these two themes with an emphasis on scientific rationality to produce a scientific-romantic orientation toward human disease, human ability for error, computers, and language.

Thomas on Universalism and Diversity

In "The Deacon's Masterpiece," Thomas explains that his "brightest" and most "optimistic" presentiment about the future of human health is that biomedical science will eventually have the knowledge base necessary to intervene and prevent the "finite list of major diseases that now close off life prematurely or cause prolonged incapacitation and pain." In essence, Thomas claims that human disease mechanisms will eventually become "nonmysteries, accountable and controllable," and that humans will "someday be a disease-free species." Thomas remarks that some "intelligent listeners" might feel resentment and dismay at the prospect of science eradicating all human disease, and might view disease as a natural part of the human condition and scientific attempts to manipulate disease out of existence as violations
against nature. Thomas records a series of questions (What on earth will we die of? Are we to go on forever, disease-free, with nothing to occupy our minds but the passage of time? What are the biologists doing to us?) that those opposed to the scientific elimination of human disease might ask of science; he is particularly concerned, however, with answering what he considers the most difficult question posed by those critical of scientific advancement against human disease: "How can you finish life honorably, and die honestly, without a disease?" In attempting to answer this question, Thomas equivocates between a romantic and scientific orientation toward nature: initially, he suggests that science is incapable of responding to this inquiry and recommends poetry, a persuasive form typically associated with romanticism, as a source of direction. Specifically, Thomas examines Oliver Wendell Holmes's "The Deacon's Masterpiece," a poem which might be read on two levels. On a literal level, Holmes's verse seems to concern the disintegration of a well-made carriage:

Now in building of chaises, I tell you what
There is always somewhere a weakest spot--
In hub, tire, felloe, in spring or thill,
In panel, or crossbar, or floor, or sill,
In screw, bolt, thoroughbrace--lurking still...
And that's the reason, beyond a doubt,
That a chaise breaks down, but doesn't wear out.\textsuperscript{160}

A detailed anatomy of Holmes's carriage might, however, on a more profound figurative level, be read as a metaphor
"for a live organism--or...a cell." Thus, according to Thomas, Holmes's assumption that a carriage always has a "weakest part, as though foreordained," implies a nineteenth century view of disease and human death, which provides a troublesome myth for the modern mind. This perspective assumes that the living body is a "vulnerable, essentially ramshackle affair, always at risk of giving way at one point or another." Thomas argues against this so called nineteenth century myth regarding human disease; essentially he does not view disease as an ingenerate aspect of nature, and thus disagrees with the assumption that the human body is destined for imperfection in the form of disease. Moreover, he uses both the language of science and the language of romanticism to advance the claim that disease is a breach of nature, which denies the human body a life of sustained physical and mental perfection, and, ultimately, the opportunity to age respectably and experience an orderly, natural death. First, drawing upon the rhetoric of science, Thomas notes recent advances in cellular biology that indicate that the human body is a perfectly arranged system:

... with what is being learned about cellular biology, especially the form and function of subcellular structures and their macromolecular components, and the absolutely flawless arrangement for drawing on solar energy for the needs of all kinds of cells, the most impressive aspect of life is its sheer, tough power.
Hence, from a scientific perspective, Thomas is aghast to realize that a disorder of one part of the human body can "bring down the whole amazing system." In short, Thomas' scientific orientation suggests that disease is an unnatural and, in fact, egregious violation of nature.

To support his scientific view of disease, Thomas examines Holmes's verse as a means for answering criticisms of science's ability to understand the ethical and moral consequences involved in the eradication of human disease. Thomas explains that exposure to a limited nineteenth century scientific vision may have cultivated Holmes's skepticism about the possibility of a disease-free life; on the other hand, Holmes was able to imagine the possibility of sustained human perfection. In other words, through the language of poetry and the power of creative imagination—the language of romanticism—Holmes moved beyond the restricted possibilities of nineteenth century science. Specifically, Holmes imagined a carriage (understood as a metaphor for a live organism) that lived an "unblemished hundred years of undiseased life, each perfect part supported by all the rest." Holmes's carriage did experience aging:

... but it was a respectable, decent, proper sort of aging ... and then [at] the hour of death...No tears, no complaints, no listening closely for last words. No grief. Just ... total fulfillment."
This essay illustrates Thomas' scientific-romantic orientation toward human disease as a phenomenon in nature. As a biologist, Thomas assumes that apparent imperfections in nature, in this instance human disease mechanisms, are not imperfections at all; rather, he explains these phenomena as temporarily beyond the grasp of scientific understanding. Hence, in maintaining a rhetorical allegiance to the scientific ethos, Thomas claims that all human disease will eventually become controllable. But Thomas' attempt to answer criticisms of scientific efforts to eliminate human disease also appropriates certain aspects of romanticism. He admits that the language of science (i.e., the scientific method) is neither strictly concerned with nor equipped to respond to this essay's central question: "How can you finish life honorably, and die honestly, without a disease?" This inquiry is imbued with romantic values, and as Thomas persuasively observes, more appropriately answered in poetry, which appeals to the human creative imagination as well as to the intellect. Thomas does not employ poetry, however, as the exemplary language for expressing a romantic orientation toward nature. Rather, he uses poetry as a persuasive tool to support a scientific perspective on human disease. More particularly, he invests rhetorical significance in the poet's creative imagination as a means for advancing biomedical scientific research: Holmes's imaginative
visualization suggests that human aging and death are more likely to be griefless, ordered, fulfilling experiences when disease is eliminated. In other words, Thomas has persuasively appropriated the language of romanticism to support a scientific value system emphasizing changelessness and perfection in nature. Furthermore, Thomas never explicitly rejects romanticism's general predilection for imperfection and diversity, but merges poetic form with a scientific perspective to demonstrate that the phenomena of human disease is not an imperfection in nature; that is, Thomas never mentions the possibility and potential value of other types of imperfections in nature. Finally, the subtext of Thomas' remarks concerning human disease suggests that science shares romanticism's interest in protecting humans' individual dignity and integrity. Thomas' rhetorical treatment of science's solicitude for the individual is, however, ironical: he does not challenge romanticism's assumption that the essence of human freedom is found in human diversity and uniqueness. Yet, he integrates poetry and science to demonstrate that human disease is an appalling mistake, and not a diverse and unique aspect of nature contributing to the preservation of individual dignity.

In "Autonomy" Thomas demonstrates a characteristically romantic concern for the diversity and imperfection inherent in humans' unconsciously coordinated acts, and
cautions experimental psychologists against using instrumental techniques of operant conditioning to control humans' visceral organs.

First, Thomas praises the individual's capacity for choice and change in tasks involving practical skills (e.g., working a typewriter by touch, riding a bicycle); these acts, though best coordinated through the unconscious mind, are ultimately subject to rational judgment: an individual possesses the option of whether or not to engage in a particular activity. Accordingly, Thomas rejoices in human diversity and imperfection:

If [humans] were born with all these knacks inbuilt, automated like ants, we would surely miss variety. It would be a less interesting world if we all walked and skipped alike, and never fell from bicycles. If we were all genetically programmed to play the piano deftly from birth we might never learn to understand music.167

These remarks suggest a synthesis of romantic and scientific values. As a scientist, Thomas recognizes the primary importance of rational thought in choosing to engage in a task involving practiced skills. As a romantic, he understands that genuine progress is predicated upon human error and imperfection. In fact, Thomas intimates that our ability to appreciate music's intellectual and emotional aspects is a result of the inevitable human error involved in learning to master a musical instrument.

In this essay Thomas distinguishes external tasks (e.g., playing the piano) from internal biological
functions. The rational mind, in other words, can decide whether to engage in an external activity or not, but has no authority over the skilled manipulations performed by visceral organs. Thomas explains, however, that our interior domain, once regarded as inviolate, has recently come under more intense scientific scrutiny. Experimental psychologists have found, for instance, that viscera can be taught to perform various functions by the instrumental techniques of operant conditioning. Thus, with the proper technological application an individual might be taught to "change [his] rate of urine formation, raise or lower blood pressure, change ... heart rate, write different brain waves, at will." Thomas' response to scientific attempts at self-control and self operation of humans' interior domain is characterized by the ambiguous philosophical middle ground it achieves between science and romanticism. From a scientific viewpoint, Thomas adheres to a value system that accentuates natural perfection; he explains that our interior domain operates as a perfect biological system:

[Humans] smooth-muscle cells are born with complete instructions ... The arrangement is that of an ecosystem, with the operation of each part being governed by the state and function of the other parts. When things are going well, as they usually are, it is an infallible mechanism.

Moreover, Thomas does exhibit an appreciation for the scientific ethos which motivates attempts to control our interior structures. For instance, he claims that
controlling humans' automatic functions is an "extremely important" prospect for which "one ought to feel elated." He admits that scientific attempts at self-operation present a "temptation," and he considers the prospect of changing certain aspects of his brain, with which he has "never really been satisfied," along with altering the operation of certain cells.\(^{170}\) On balance, however, Thomas is opposed to scientific attempts to improve the operation of our visceral organs. In a romantic vein, he suggests that regulating viscera would present the individual as well as science with "exhausting" and "debilitating" responsibilities. He claims that this technology would "consume" so much of one's energy that one would "miss the main sources of the sensations of living."\(^{171}\) Ultimately, Thomas would "rather leave all...automatic functions with as much autonomy as they please, and hope for the best."\(^{172}\)

These remarks contain three implications regarding Thomas' scientific-romantic view of the humans' internal domain. First, like a romantic, Thomas shows that our internal biology functions as an infallible mechanism, in spite of potential imperfections. In other words, he shares the characteristically romantic, and perhaps from a scientific viewpoint, paradoxical notion, that humans are perfect in their imperfection. As a scientist, though, Thomas is rhetorically sensitive to a scientific value system which emphasizes perfection. More precisely, he
recognizes that scientific intervention in nature is motivated by an axiology which venerates perfection. Second, as a romantic might, Thomas argues that scientific efforts to teach humans to communicate with their internal environment would burden the individual as well as science with "exhausting" and "debilitating" responsibilities. Science, according to this view, does not possess the moral and ethical language necessary to prepare the individual for the potential consequences accompanying the regulation of the interior domain. Moreover, Thomas intimates that the individual is presently ill equipped to withstand the added emotional and intellectual responsibility attending the control of internal biology. Third, Thomas' contention that operant conditioning techniques might effectively estrange humans from their external environment echoes a romantic concern for individual freedom and personal development. In other words, scientific efforts at self-control might serve to restrict human autonomy and to deny an individual a deeper appreciation of his or her humanity. Thus Thomas indicates that authentic individual autonomy is achieved when one surrenders rational control of internal, automatic biological functions.

In "To Err is Human" Thomas reveals that the quality of infallibility, typically ascribed to computers, contributes to the popular perception of computers as a dehumanizing technology. To combat this perception, and
possibly to allay fears about humans' increased dependence on computers, he offers a rhetorical synthesis of romantic and scientific viewpoints regarding human progress. This synthesis is persuasively expressed in three interrelated ways. First, as a romantic, Thomas celebrates the human faculty for error as a uniquely human gift, necessary for solving our most difficult problems. Unlike a romantic, however, Thomas is unwilling to revel in the mystery of human tendency toward error, and thus grounds an explanation for human error in quasi-scientific language. For example, he asserts that our ability for error may be "stipulated in our genetic instructions," and that humans may have "DNA sequences for making mistakes as a routine part of living." He adds that the process of exploration, occurring when there are more than two choices available, is based on fallibility resulting from human brain structure:

If [humans] had only a single center in [their] brains, capable of responding only when a correct decision was to be made, instead of the jumble of different, credulous, easily conned clusters of neurones that provide for being flung ... along wrong turnings ... [humans] could only stay the way [they] are today, stuck fast.

Second, Thomas explains that computers, as products of human intellect, share an intrinsic human-like ability for error, and are therefore capable of realizing limitless possibilities for the future of humankind. Specifically, Thomas admits that computers are not capable of "real
thinking and dreaming;" yet, he asserts that computers possess "something like" an unconscious, equivalent to that of humans, and are, in effect, extensions of the human brain, "constructed with the same property of error, spontaneous, uncontrolled, and rich in possibilities."175

Third, Thomas' veneration of the human ability for error, and ascription of that ability to computers, is strategically designed to promote the increased use of computers and the power of rational thought as preeminent tools for human progress. Thus Thomas remarks that error is not as important to achieving human progress as "the move based on error"; more particularly, he suggests that cognitive ability for error, seemingly intrinsic to human thought patterns, is indispensable for executing a higher, more inspired level of rational thought. Accordingly, the persuasive nexus between the human faculty for error and higher levels of rational thought is critical to understanding Thomas' effort to mollify fears associated with our increased dependency on complex computers:

... [a] computer can make calculations in an instant which would take a lifetime of slide rules for any of us ... Think what we could gain from the near infinity of precise, machine made miscomputation ... What we need, then, for moving ahead, is a set of wrong alternatives much longer and more interesting than the short list of mistaken courses that any of us can think up right now.176

Thomas is claiming that computers, as extensions of the human brain, possess a vastly improved upon though
nonetheless human-like faculty for problem solving and error. This perspective's ascription of human-like qualities to computers challenges the popular perception of computers as a dehumanizing influence: specifically, computers are no longer viewed as a cold, sterile, oppressive technological influence, serving to restrict human autonomy and accentuate human inadequacies, but are portrayed as a liberating force, imbued with a vital human-like facility for error, and capable of providing solutions to difficult problems which will, ultimately, afford humans a splendid freedom. Thus Thomas' direct celebration of human error, and more obscure though nonetheless determined concern for individual freedom, manifests a clear romantic orientation toward imperfection and individual status in an increasingly technological society. In the end, however, Thomas' allegiance to these popular romantic themes seems calculated to gain wider acceptance of a scientific appreciation for computers: in short, according to a scientific perspective, computers are designed to overcome human fallibility and methodological imprecision, and thereby make possible the type of perfection and material progress which science has traditionally, and most ardently, sought to achieve.

In "Computers" Thomas acknowledges computers' significant though limited role in managing human affairs, and is rhetorically sensitive to the popular concern that
computers' extraordinary capability for problem-solving will result in a computer-dominated world where human intellect ceases to be important. He also asserts that computers have a significantly different effect on human collective behavior than more common technologies such as radios, televisions, and telephones.

Echoing a scientific perspective, Thomas indicates that computers possess a remarkable faculty for problem-solving which might complement human logical processes in our quest for material and intellectual progress. For example, Thomas claims that in some respects computers have a "superhuman" ability to "... beat most [humans] at chess, memorize whole telephone books ... compose music ... write obscure poetry, diagnose heart ailments, [and] send personal invitations to vast parties ..." Thomas notes, however, that a computer is at best only a "single individual," in spite of its ability "to do everything we recognize as human." In addition, Thomas claims that efforts to develop a computer to match humans' collective behavior would be enormously expensive and involve a great deal of technical difficulty. In essence, to equal humans' collective behavior, technologists would have to build and sustain three billion computers, "all ... wired together, intricately and deliberately, as [humans] are, communicating with each other, talking incessantly, listening." Thomas describes human collective thinking
as an "urgent biological function" characterized by the need to exchange information; he claims that certain technologies--telephones, radios, televisions, airplanes, satellites--are forging a human "circuitry around the earth," and that eventually, as a result, humans might become a computer to end all computers, capable of fusing all the thoughts of the world into a syncytium." Thomas suggests that human collective thought is necessary to the process of social evolution:

Effortlessly ... we are capable of changing language, music, manners, morals, entertainment, even the way we dress, all around the earth... we simply think our way along, pass information around, exchange codes disguised as art, change our minds, transform ourselves ... computers cannot deal with such levels of improbability ...

Thomas' remarks regarding computers, more common technologies, human collective behavior, and social evolution reflect a rhetorical tension between science and romance in three ways. First, from a scientific perspective, Thomas recognizes that computers possess a facility for problem-solving which, though unable to prescribe human behavior, contributes greatly to human material progress. More important, he seems to be suggesting that, unlike computers, more common technologies (e.g., televisions, radios, telephones) connect human minds without destroying the unpredictability and improbability of human thought. He intimates that technology is a principle agent for the unification and organization of
collective human behavior, yet ultimately serves a passive role subject to human control. As such, according to Thomas, technology will continue to provide the opportunity for human collective behavior, but will never regulate the essential content and humanness of the collective thought necessary for social evolution. Thus Thomas is rhetorically sensitive to the popular fear that computers will diminish the importance of, and perhaps dominate, human intellect, and he is able, at the same time, to preserve technology's privileged status in society.

Second, in a romantic vein, Thomas indicates that the future is too "interesting and dangerous" to be entrusted to computers, which are predictable, reliable agencies, not equipped with the levels of improbability required to "keep open all [human] options." In other words, he claims that the process of social evolution would "grind to a standstill" if humankind appointed computers to develop long range societal plans. Like a romantic, Thomas venerates diversity and imperfection: he understands that human fallibility and unpredictability sustain the collective thought necessary for social evolution.

Finally, Thomas' perspective on technology and human collective behavior manifests a scientific-romantic orientation toward individualism: in a romantic fashion, Thomas is keenly concerned about the loss of individual freedom in an increasingly technological society, and is
particularly vigilant to defend the integrity of human intellect against computers' sovereign influence. Thomas' view regarding how best to achieve individuality, however, is characterized by the ambiguous philosophical middle ground it achieves between science and romanticism. Specifically, Thomas indicates that a person is best able to realize his or her individuality and human potential in interaction with other persons, and that human interaction is made possible largely through the use of technology. In essence, Thomas' orientation toward individualism, neither purely romantic nor purely scientific, relies for its rhetorical power on an equivocation between the two perspectives.

Thomas' Perspective: Science Vs. Humanism

"Humanities and Science" and "On Matters of Doubt" represent Thomas' most explicit discussions of the historical tension between science and humanism. In "Humanities and Science" Thomas argues that traditional scientific pedagogy has made two basic errors contributing to disagreements between humanists and scientists; division between the two groups centers on the "importance of science in a liberal-arts education, and the role of science in twentieth-century culture." First, according to Thomas, the sciences have been taught as a vast array of immutable, hard facts to be learned as fundamentals; and second, scientific facts have been taught as "somehow
superior to the facts in all other scholarly disciplines..." Moreover, Thomas claims that these errors in the teaching of science, along with science's efficacy for gaining information and comprehension about nature, have created two popular misconceptions among the general public—that science is simply a matter of translating observations about nature into quantitative measurements, and that science has a virtually complete understanding of the material universe. Thomas uses the language of romanticism to challenge traditional scientific pedagogy as well as popular misconceptions about the accuracy and extent of scientific knowledge. Despite conventional wisdom, Thomas argues that the sciences and humanities do not represent fundamentally different kinds of learning, and might actually complement each other's efforts to acquire a more complete understanding of nature.

Thomas' recommendation for changes in the way science is taught places a characteristically romantic emphasis on what he views as the inherent tentativeness, incompleteness, and strangeness in scientific learning. For example, Thomas asserts that introductory courses in science, at all levels, should leave so-called fundamental scientific facts aside and "... concentrate the attention of all students on the things that are not known." He claims that preliminary scientific training should stress the "still imponderable puzzles of cosmology," and declares
that there are "... some things going on in the universe that lie beyond comprehension ..."¹⁸⁵ Like a romantic, Thomas explains that the "very strangeness of nature" should be at the core of scientific education. Moreover, he departs from the traditional view that science involves an orderly, systematic inspection of nature which results in firm scientific conclusions about the natural world. Rather, as a romantic might, Thomas emphasizes the incompleteness and tentative nature of scientific knowledge; he wants to dispel the popular perception that the sciences are an academic collection of unambiguous, unalterable facts which need only to be learned to achieve a complete understanding of nature. Indeed, Thomas claims that scientific facts are not "... more fundamental, more solid, less subject to subjectivism, [and] immutable" than the facts that underlie other scholarly disciplines.¹⁸⁶ Thomas does acknowledge that science has sophisticated instruments for quantitative measurement which can provide a deep understanding of nature, but admonishes that science must first know when and how to use quantitative measurement (i.e., science must understand when and how to convert observations into numbers), and second realize that even the most precise scientific measurements are unlikely to explain all there is to know about nature.

Unlike many other public scientists (e.g., Carl Sagan), Thomas does not emphasize the extraordinary capacity or
even the impressive record science has for explaining natural phenomena; rather, in a romantic vein, he celebrates science's ability to provide revelations of human ignorance about nature. Essentially, Thomas attributes romantic characteristics to science that are more typically ascribed to humanistic study. He reverses the traditional view regarding the conclusive nature of scientific data and the tentative quality of humanistic knowledge. For example, Thomas claims that science has more than "seven-time-seven types of ambiguity," and that the "poetry of Wallace Stevens is crystal clear along side the genetic code." In other words, Thomas is suggesting that scientific facts can potentially be more complex and difficult to understand than the most opaque poetry.

Moreover, he notes that what appear to be solid scientific judgments are always more conditional and subject to revision than are most conclusions of humanistic scholarship:

The hard facts [of science] tend to soften overnight, melt away, and vanish under the pressure of new hard facts ... The conclusions reached in science are always ... far more provisional and tentative than are most assumptions arrived at ... in the humanities. Thomas explains the nature of scientific learning and the potential influence science education has on individual intellectual development in much the same fashion that a romantic might characterize the essence of humanistic learning and the possible effect humanities education has
on the quality of individual thought. For instance, he does not advance the traditional view of science as a rigorous, potentially tedious and routinized activity primarily concerned with establishing and systematizing facts, principles, and methods; nor does he express science's conventional praise for the significant technological applications and material progress that might result from scientific research. Rather, he describes science as "an endless frontier," "high adventure," and the "wildest of all explorations ever undertaken by human beings;" furthermore, he suggests that the study of science is "a good in itself," and ought to provide an individual the "cast of thought" needed both to appreciate inexplicable aspects of nature and to live into the twenty-first century. Thomas' description of science as a type of romantic pursuit and a scholarly discipline capable of providing instruction in the art of living is, of course, a characterization more commonly used to depict humanistic study. In short, science has historically represented a mode of thought antithetical to the spirit of romanticism; humanistic study, on the other hand, has traditionally provided an aesthetic experience compatible with popular romantic values.

In summary, Thomas uses the language of science and romanticism to construct a persuasive merger of scientific and romantic values: his portrayal of science includes a
characteristically romantic preoccupation with ambiguity in nature along with an abiding romantic concern for individual development. The strategic attribution of these romantic characteristics to science enhances the scientific ethos. Science is not pictured as an intimidating, inaccessible, esoteric discipline studied by the privileged elite, but rather as a humane area of learning open for participation to the nonscientist. Finally, Thomas' romantic-science admits to being an incomplete field of inquiry, baffled by certain ambiguities in nature, and thus actively solicits the aid of traditional humanistic viewpoints to gain a more complete understanding of the natural world.

In "On Matters of Doubt," Thomas returns to a discussion of the historical tension between science and humanism, claiming that the viewpoints expressed by C. P. Snow, on the side of scientists, and F. R. Leavis, on the side of humanists, embody the quintessential and still unsettled argument between science and humanism. Thomas provides a summary of the positions taken by Snow and Leavis with a view toward achieving a rhetorical accommodation between their competing perspectives.

At the one polemical extreme, Leavis claims that scientists are a "bright but illiterate lot, well read in nothing except science ... [and] incapable of writing good novels." On the other side of the argument, Snow insists
that humanists have an "antiscientific prejudice," and that the humanities are made up of "imagined unverifiable stories cooked up by poets and novelists." Snow claims, moreover, that the sciences deal with "hard data, incontrovertible theories ... the unambiguous facts of life." Thomas' persuasive mediation between these two perspectives is predicated on a scientific-romantic orientation toward nature. As a scientist, he suggests that every aspect of nature fits together harmoniously to form a perfect whole, and that any question to be asked about nature or about humans will eventually be answered; as a romantic, Thomas places great importance on ambiguous facets of human existence and on the general ignorance both the sciences and the humanities have of nature. He uses this merger of scientific and romantic perspectives to accentuate the "human meaning of contemporary science" and to thereby mediate the rival claims of science and humanism. For example, Thomas' romantic-science includes the claim that all scholars share a single underlying view of nature best characterized as "bewilderment." This view suggests that the more the sciences and the humanities learn about nature and about human beings the less each group comprehends. Though Thomas adds that scientists and humanists alike, when confronted with ambiguity in nature, typically choose to deny their bewilderment and to take refuge in whatever "fixed knowledge" is available:
Like a romantic, Thomas takes a deep satisfaction in the recognition that humans still have a great deal to learn about nature, that they are, or should be in fact, bewildered by nature. He admonishes scientists and humanists to refrain from presenting the body of human knowledge as a vast structure of coherent information capable of explaining every aspect of nature; instead, he encourages both groups to admit that the corpus of human learning, enormous though it may be, is still a "very modest mound of puzzlements that do not fit together at all." Finally, Thomas' veneration of natural ambiguity is strategically designed to recognize scientists' and humanists' potentially deep ignorance of nature, and to raise the idea of bewilderment to an intellectual value.

Thomas' romantic emphasis on ambiguity is also reflected in his essays on language. In fact, several of his essays merge scientific and romantic perspectives to explain the nature of language. In "Information," for example, this rhetorical synthesis is clearly evident. From a scientific perspective, Thomas assumes that language is a genetically determined mechanism; he suggests that "human beings are all born with a genetic endowment for
recognizing and formulating language. Accordingly, Thomas is sympathetic to the view that language is a biologic system for communication, and that the framework for meaning in language is built into the human mind at birth. Ultimately, however, Thomas finds this view too mechanistic and restricting to explain fully the rich and complex nature of language. Thus, not completely satisfied with a scientific approach to understanding language, Thomas draws upon romanticism for a more comprehensive explanation. More specifically, he places a characteristically romantic emphasis on language's capacity for ambiguity. In essence, his celebration of ambiguity in language has two rhetorical implications. First, he suggests that the property of ambiguity distinguishes language (i.e. as a biologic system) from biologic systems for communication used by speechless animals: the genetically determined communication mechanisms of speechless animals are limited to "single-stage transactions;" these mechanisms are designed to "stick precisely" to the matter at hand, and are simply not programmed to "drift away in the presence of locked-on information." Thomas describes a bee in search of sugar, among other examples, to illustrate the limited (i.e. ambiguity-free) manner in which these mechanisms search for biologic information. He explains that... "when a bee is tracking sugar by polarized light, observing the sun
as though consulting his watch, he does not veer away to
discover an unimaginable marvel of a flower."\textsuperscript{196}

Second, Thomas suggests that ambiguity is an essential
element for transferring information among humans. He
claims that "if it were not for the capacity for ambiguity,
for the sensing of strangeness, that words in all languages
provide, [humans] would have no way of recognizing the
layers of counterpoint in meaning..."\textsuperscript{197} Thomas adds that
"it is often necessary, for meaning to come through, that
language have] an almost vague sense of strangeness and
askewness."\textsuperscript{198} Thus, unlike a scientist who might claim
that precision in language is necessary for the acquisition
of knowledge, Thomas indicates that the most important
human knowledge may result from the uncertain meanings in
language. Like a romantic, Thomas revels in the mysterious
complexity of language; he views language as something more
than a purely static, preset biological property of the
human mind. In fact, in a number of essays Thomas compares
language to a living organism. For example, in "Small Talk"
he claims that "language, once it comes alive, behaves like
an active, motile organism ... the underlying structure
simply grows, enriches itself, expands."\textsuperscript{199} In "Living
Language," Thomas returns to a comparison of language to a
living organism:

\[ ... \text{language is simply alive, like an organism. We tell each other this, in fact, when we speak of living languages, and I think we mean something more than an abstract metaphor. We mean} \]
Thomas' suggestion that the element of ambiguity is responsible for, or at least closely linked to, the evolution of language contains an important epistemological implication concerning his view of the human mind. Thomas seems to be saying that the human mind is actually designed to handle ambiguity in language. Thus, Thomas does not view the human mind as a passive entity, programmed to focus exclusively on one piece of information at a time. Rather, in a romantic fashion, he acknowledges that learning new information, through the use of language, involves an initial creative capacity of the mind itself. As Thomas states, the human mind is able to "drift away in the presence of locked-on information, straying from each point in a hunt for a better, different point." The implication of this view is that the mind is an active system, which while not able to control the ambiguities of language, is at least able to respond to them.

In summary, Thomas' romantic emphasis on language's capacity for ambiguity suggests that scientific investigation may be unable to fully explain the nature and origin of language. To be clear, Thomas is not opposed to the method or findings of linguists who have determined, after examining language as a biologist might scrutinize live tissue, that the universal attributes are genetically set; in fact, as a scientist, Thomas seems comfortable with
the language of genetics. Nevertheless, Thomas persuasively underscores the importance of ambiguity in language. He argues that the ambiguous and uncertain meanings in language may actually account for the diverse range of human behavior. Finally, Thomas' suggestion that language is a uniquely human trait, partly beyond the grasp of scientific investigation, exemplifies a romantic orientation toward humankind. He has, in short, persuasively identified language as a human characteristic inaccessible to scientific definition, thus contributing to the type of human freedom a romantic readily embraces.

Thomas, Science, and the Public Good

The merger of romantic and scientific values reflected in Thomas' orientation toward ambiguous and imperfect aspects of human existence, as well as toward individual freedom, is a constituent in the larger scientific-romantic synthesis found in Thomas' public science. As such, the rhetorical impact of this merger deserves evaluation in respect to four research questions set forth in this dissertation: Might the rhetorical merger of romantic and scientific values reflected in the language Thomas uses to discuss human disease, human ability for error, computers, and language help to (1) mediate the traditional dichotomy between science and humanism? (2) envision a cooperative relationship between the scientific community and the general public? (3) provide the general public a greater
role in establishing criteria for judgment for private and public decision-making? and (4) highlight the general public's capacity to respond to aspects of the world inaccessible to the interpretive framework of science and ordinary rational thought?

The equivocation between scientific and romantic values found in Thomas' orientation toward human disease, human ability for error, computers, and language provides a rhetorical middle ground capable of mitigating the long standing dispute between science and humanism. Scientists, eager to eliminate disease and to promote a value system emphasizing changelessness and perfection in nature, should welcome Thomas' suggestion that apparent imperfections in nature, and particularly human disease, are not imperfections at all, but rather phenomena temporarily beyond the grasp of scientific understanding. In essence, scientists should find satisfaction in Thomas' claims that the human body is not destined for imperfection in the form of disease, and that all human disease will eventually become controllable. Humanists, on the other hand, while perhaps not content with Thomas' support for the eradication of all human disease, should find a certain satisfaction in Thomas' use of poetry to answer potential ethical and moral criticism of scientific attempts to control nature. For example, humanists might claim that Thomas' use of Holmes's verse as a persuasive tool to
support a scientific perspective on human disease does not enhance the scientific ethos but, in fact, reveals one of science's fundamental shortcomings: namely, that the language of science is ill equipped to respond to ethical and moral meanings in the world. Thus humanists would be pleased with Thomas' aesthetic appreciation for, and rhetorical dependence on, poetry as a persuasive means for promoting the scientific enterprise, and would claim that Thomas' use of a poem to support a scientific perspective on nature actually validates the usefulness of a humanistic approach to understanding nature.

The subtext of Thomas' remarks regarding human disease suggests that scientists and humanists have a shared concern for maintaining humans' individual dignity. The two groups appear, however, to have widely differing perspectives concerning the effect disease has on the quality of human life. Thomas, on the side of science, suggests that the elimination of disease will allow the individual to live a life of sustained mental and physical perfection, age respectably, and experience an orderly, natural death; essentially, he suggests that a disease-free life would reduce the burden of human suffering, thereby contributing to individual freedom and the quality of human life. Humanists, on the other hand, though likely to recognize sincerity in his concern for human welfare, are likely to disagree with Thomas' rhetorical perspective on
human disease. From a humanistic viewpoint, disease is a necessary part of the human condition, serving to remind the individual of his or her mortality. The physical and mental suffering accompanying disease helps to define the human condition, and the elimination of disease would, in effect, alter the individual's understanding of what it means to be a person.

Thomas' claims that humans' internal biology functions as an infallible mechanism, in spite of potential imperfections, and that experimental psychologists should refrain from using operant conditioning techniques to control humans' visceral organs, are also consistent with the humanistic orientation. In addition, humanists should find satisfaction in Thomas' admission that science does not possess the ethical and moral language necessary to prepare an individual for the potential consequences accompanying the ability to regulate his or her interior domain. Scientists, on the other hand, may appreciate the subtle irony of Thomas' romantic emphasis on imperfection. For example, his opposition to scientific attempts to improve the operation of humans' visceral organs is based on the paradoxical belief that humans are perfect in their imperfection. Thus, Thomas' celebration of imperfection is designed to legitimate a scientific vision of nature emphasizing perfection.
Thomas' is also sensitive to humanists' fear that computers are diminishing the importance of human intellect; in fact, Thomas' ascription of human-like qualities to computers may allay the apprehension that computers are a dehumanizing influence, incapable of error. He illustrates that, rather than restrict and devalue the importance of human intellect, computers will provide solutions to difficult problems, affording humans greater individual freedom. Finally, humanists are likely to applaud Thomas' belief that cognitive ability for error, intrinsic to human thought patterns, is indispensable for executing an advanced level of rational thought. Scientists, on the other side of the argument, may be willing to overlook Thomas' romantic emphasis on humans' cognitive ability for error, particularly since Thomas' underlying motivation is to promote the increased use of computers and the power of rational thought as preeminent tools for human progress.

Thomas' discussions of the historical tension between science and humanism suggest that the sciences and the humanities do not represent fundamentally different kinds of learning. In general, humanists may be more willing than scientists to accept Thomas' claim that all scholars share a single underlying view of the world best characterized as bewilderment; specifically, many traditional scientists are not likely to agree with Thomas' claim that scientific
knowledge is always more conditional and subject to revision than are most conclusions of humanistic scholarship. They are likely to interpret Thomas' failure to underscore the conclusive nature of scientific data, as well as to emphasize the impressive record science has for explaining natural phenomena, as a challenge to the objectivity of scientific thought. In fact, scientists might argue that Thomas is rhetorically naive for not stressing the success of science in formulating and testing theories that explain phenomena in the natural world. Nevertheless, Thomas' strategic depiction of science as a humane area of learning, capable of providing revelations of human ignorance about nature enhances the overall ethos of scientists. Finally, Thomas' rhetorical perspective on ambiguous facets of human existence, and on the potentially deep ignorance both the sciences and humanities have of nature, encourages scientists and humanists to be more cooperative with one another and to be more careful in their knowledge claims.

The merger of romantic and scientific values reflected in Thomas' orientation toward ambiguous and imperfect aspects of human existence, as well as toward individual freedom, envisions a cooperative relationship between the scientific community and the general public. In the twentieth century, science has gained enormous respect among the general public as a means for explaining natural
phenomena and for increasing humans' overall standard of living. In the past fifty years however—particularly since the dawning of the nuclear age—the public's enthusiasm for science has been tempered: they have begun to realize that science is incapable of providing solutions to all human ailments and is even responsible for creating additional ones. Thomas' dymystification of science is important, then, because it relocates the role of the public in relation to science. Thus, members of the general public who have read Thomas' essays should appreciate his claim that experimental psychologists ought to refrain from attempts to control humans' visceral organs; they are likely to agree with Thomas' assertion that operant conditioning techniques might effectively estrange humans from their external environment and, rather than lead to greater human autonomy, deny an individual a deeper appreciation of his or her humanity. Moreover, Thomas is sensitive to public fears of science in his suggestion that the individual is not prepared for the emotional and intellectual responsibility that would accompany the ability to control his or her internal biology: serious attempts to control internal biology may cause the individual to miss the "main sources of the sensations of living." In essence, Thomas' work is designed to demonstrate to the general public his opposition to
scientific attempts to control our internal domain as a persuasive defense of individual freedom.

The psychological, emotional, and financial burden that disease places upon the afflicted individual is experienced, to a lesser degree, by his or her family and the larger community. In fact, the high cost in human lives exacted by diseases such as cancer, heart disease, and more recently to AIDS, is of continuing concern to society. On the other hand, the general public is probably cognizant of the emotional and financial cost likely to accompany the elimination of disease, for the individual as well as society. For instance, the financial cost associated with a significantly increased life expectancy is potentially enormous; additionally, twenty or thirty added years of daily living may present an individual with novel and unanticipated problems. On balance, however, the general public is likely to find Thomas' explanation for scientific attempts to eradicate disease quite persuasive. For Thomas uses the idiom of the ordinary citizen, rather than science, to discuss the manner in which scientific issues, like the study of disease, impact upon the individual human being. In short, the public may agree with Thomas' rhetorical perspective on disease, particularly, with his claim that the elimination of disease will reduce unnecessary incapacitation and prolonged human suffering
and thus enhance individual freedom and the quality of human life.

Thomas' persuasive depiction of science as a humane area of learning, capable of providing instruction in the art of living, has educational value in so far as it encourages the general public to be less wary of the scientific enterprise as an arcane discipline studied by a select group, and to view science as a method of learning open for participation to the nonscientist.

Furthermore, Thomas' rhetorical preoccupation with imperfect and ambiguous facets of human existence provides the general public a greater role in establishing judgment in private and public decision-making. For example, Thomas' claim that faculty for error is a uniquely human trait, necessary for solving our most difficult problems, encourages the individual layperson to be more self-reliant in his or her judgments about the world. The individual can recognize that human error invests human experience with emotional and intellectual meaning. Additionally, Thomas' persuasive recognition of the potentially deep ignorance of nature common to both the sciences and the humanities inspires confidence in the individual layperson to develop his or her own criteria for judgment in private and public decision-making, independent of counsel from scientists or humanists.
Finally, Thomas' persuasive identification of language as a human characteristic inaccessible to scientific definition fosters an impression that certain aspects of the world are inaccessible to the interpretive framework of science and ordinary rational thought. As a result, the individual layperson may be more willing to turn to other authorities or aids for judgment in both private and public decision-making.

Conclusion

This chapter has identified two popular romantic themes in Lewis Thomas' public science: a predilection for diversity, ambiguity, and imperfection, and a vindication of the individual. The chapter evaluated the way these two themes are developed in essays selected to illuminate these themes and the way they are merged with scientific rationality to produce a vision of popular science capable of mitigating the traditional division between science and humanism. The chapter also examined the persuasive impact this scientific-romantic synthesis might have in establishing a more cooperative relationship between the scientific community and the general public. Chapter four will proceed to identify and evaluate two final popular romantic themes evident in the larger scientific-romantic synthesis that serves as the underlying value system for Thomas' popular scientific essays.
Chapter Four

It was argued in chapter three that Thomas merged two popular romantic themes—a predilection for diversity, ambiguity, and imperfection, and a vindication of the individual—with scientific rationality to produce a scientific-romantic synthesis. The ways in which this persuasive merger of science and romance helped both to mitigate the general public's apprehension about the social consequences of science and to mediate the long standing controversy between science and humanism were examined. The purpose of this chapter is to analyze two additional romantic themes that undergird much of Thomas' discourse. The two themes—wonder at and awe of nature, and a concern for humans' moral characteristics—serve as integral components in the romantic axiology in his essays. The rhetorical function of these themes in the construction and justification of Thomas' scientific-romantic synthesis will be explored. Finally, ways in which the persuasive merger accommodates the aspirations and values of two audiences—scientists and the general public—shall be addressed.

Dominance, Wonder and Awe in Science and Romanticism

The creators of modern science developed a mechanical philosophy that placed supreme emphasis on rational thought and observation as human tools instrumental in explaining
the nature of the physical universe; they assumed that natural phenomena are causally determined in conformity with a series of immutable natural laws that govern the cosmos. In essence, the mechanical philosophy guiding modern science designated human rationality as the most efficient means to acquire scientific knowledge of the natural world; the accumulation of scientific knowledge was primarily designed to afford greater understanding of, and control over, the processes of nature.

Contemporary science has acquired a more sophisticated view of the physical universe than the mechanical philosophy associated with its modern counterpart. As a number of scholars have noted however, contemporary science is still characterized by a need to understand and control nature through rational inquiry. For example, in The Scientific World View, William Kay Wallace suggests that the long-range activity of science as a collective enterprise has played a significant role in the conquest of nature and the development of our present system of industrial organization. In Conceptual Foundations of Scientific Thought: An Introduction to the Philosophy of Science, Marx W. Wartofsky contends that "the activity which science represents ... involves ... the power of [scientific] knowledge as an instrument of human use, for control over nature." In The Domination of Nature, William Leiss asserts that "modern science represents the
highest possible development of [humans'] drive for power, for it strives to covert the entirety of nature into a field of operation for exclusively human purposes ..."207

Traditionally, in attempting to control nature, science has focused exclusively on observably measurable phenomena to the exclusion of humans' spiritual needs. In fact, a number of scholars have commented upon science's devaluation of knowledge acquired through human introspection and human sensations. For example, Leiss noted that "one means of understanding the mode of abstraction which guides modern science is to realize that it devalues the cognitive significance of all those things (e.g., sense qualities, final causes, aesthetic values) which do not aid in [humans] domination of things ..."208 Leiss also noted that in terms of scientific knowledge "a proposition makes no sense whose affirmation or denial would not result in a difference that could ultimately be expressed in some measurable form."209 In Art and Human Values, Melvin Rader and Bertram Jessup claim that "in science ... man is observer--ideally, an instrument--intent on knowing what things are apart from human desires, wishes, hopes, fears."210 In Movements of Thought in the Nineteenth Century, George Herbert Mead stated that mechanical science "did not deal with the values which objects directly have in [human] experience--those of sensation ... color, sound, taste, and order ... and
perhaps more important, [science] did not deal with the characters which belong to living organisms."

Essentially Mead maintained that science "reduces the world simply to a congeries of physical particles, atoms, and electrons ... [and thereby] takes all the meaning out of it." In The Pentagon of Power, Lewis Mumford claimed that the ultimate effect of mechanistic science was "to devaluate every aspect of human experience that could not be" directly observed; and the "[scientific method's] final result was to eliminate all other products and by-products of the human personality ..." In summary, the mechanical philosophy associated with early modern science sought to comprehend and to transform nature for human purposes. Indeed, the underlying philosophical impulse to understand and to master nature has remained constant within the scientific community for over three centuries--even until the present day. As Mumford observed, "the world picture of the [contemporary] scientist ... still remains without 'blue, yellow, bitter, sweet, beauty, delight, sorrow--in short, without the most vivid reports of human experience.'

The romantic movement, in the late eighteenth and early nineteenth centuries, rejected the philosophical foundations of early modern science as well as the values which still characterise contemporary science. One important aspect of the philosophical conflict between
modern science and romanticism, still evident in criticisms of contemporary science, centered upon their opposing responses to nature. Rather than seek to dissect and control nature, in the manner of both modern and contemporary science, romanticism demonstrated a love of nature and especially a sense of awe and wonder in the presence of nature. The Encyclopedia of Philosophy noted that one of the great romantic themes was "the continuity of life and flow, growth, development; a process, to the romantic, always denatured, indeed destroyed, by the dividing analytical mind ..." The romantic epistemology posited a cosmos significantly more complex than the static universe depicted by mechanical philosophy. Essentially, romanticism rebelled against science's fidelity to empirical data as the only valid means for acquiring knowledge about the physical universe and, in fact, what it means to be a living being. Typically romanticists claimed to be concerned with the moral knowledge that might be derived from human experience, and they often viewed nature as a source of profound spiritual truths about the essence of human existence. Indeed, nature has supplied a significant part of the imaginative subject matter for romantic literature, especially poetry. A Handbook To Literature claims that "the greatest attention to nature in English literature came in the Romantic Period, when the revolt against conventionalities of neoclassic fashions
lead to much theorizing about the relations of human beings to external nature ..."\textsuperscript{16} For example, a romantic poet such as Wordsworth "turned to nature ... in the hope of finding a realm comparable with his spiritual needs."\textsuperscript{17} In essence, romanticism emphasised individual introspection, intuition, and an emphatic approach to nature to generate a metaphysical knowledge of the senses. This metaphysical knowledge, derived from human interaction with, and imaginative speculation about nature, was thought by many poets and philosophers to minister to the human spirit in a way that purely scientific knowledge could not.

Definitions of romanticism do not always differentiate these core romantic characteristics; though the essential spirit of these characteristics helps to define two central romantic tenets in the popular scientific essays of Lewis Thomas. They may be explicitly stated as: (1) wonder at and awe of nature, and (2) a concern for humanity's spiritual needs. Thomas merges these two themes with an emphasis on scientific rationality to produce a scientific-romantic orientation toward certain life processes in nature, literature, a human cell, beavers and otters, and human altruism and honesty.

**Thomas on the Dominance of Nature**

In "Natural Man," Thomas first explains that a revolution in human thought has redefined humanity's relationship to nature: humans, experiencing a new
awareness about the degree to which they are involved in the earth's life, have begun to react against the old human impulse, embodied in the scientific method, to master nature. Second, Thomas offers a persuasive proposal, merging scientific and romantic values, for resolving the cognitive dissonance we experience when recognizing, on the one hand, that we are an integral part of nature and should strive to protect and maintain the natural environment, and realizing, on the other hand, that humankind is apparently bound to continue subjugating nature.

Thomas claims that we have begun to reject the view that we are separate and qualitatively different from nature, and that the earth is our "... personal property ... placed at [our] disposal to be consumed, ornamented, or pulled apart as [we] wished."

According to Thomas, the present consensus "almost everywhere" is that humankind is intimately connected to and dependent for survival upon nature--is actually linked in symbiosis with nature--and therefore humans should aim to preserve rather than control nature.

Thomas asserts that our contemporary perspective on nature suggests that we are "neither owners nor operators" of nature, but may be "motile tissue specialized for receiving information--perhaps ... functioning as a nervous system for the whole [earth]."

Thomas adds that humans' new view of nature "has been strong enough to launch ... movements for the sustenance of wilderness, the
protection of wildlife, the turning off of insatiable technologies, [and] the preservation of the whole earth." Thomas' use of scientific language to describe humans' contemporary view of their relationship to nature—a view virtually indistinguishable from a romantic orientation toward nature—is typical of the rhetorical tension between science and romance found in Thomas' writings. Romanticism, after all, recognized our mystical relationship to nature and sought to maintain nature's delicate balance. In fact, romanticism reacted against the human impulse, most often manifested in the scientific method, to dissect and control nature.

Thomas claims that humans are likely to experience dissonance upon the realization that their new found kinship to nature will have to remain subordinate to their impulse to dominate nature. Thomas assumes that twentieth-century humankind, much like their nineteenth-century predecessors, will continue to walk "boot-shod over the open face of nature, subjugating and civilizing it," for two primary reasons. First, Thomas explains that humankind has become too deeply involved in nature to extricate themselves:

[humans] have become, in a painful, unwished for way nature itself. [humans] have grown into everywhere, spreading like a new growth over the entire surface, touching and affecting every other kind of life, incorporating [themselves] ... [humans] are now the dominant feature of [their] own environment ... [they] are now in charge, running the place, for better or worse.
Second, Thomas argues that humans are biologically compelled to dominate nature. He states that our drive to control nature is "the most natural of natural events," and that humans simply "developed this way...are this kind of species." In essence, Thomas' depiction of these two conflicting orientations toward nature seems symbolic of the traditional dichotomy between a scientific and romantic view of the world. From a romantic perspective, humans have become cognizant of the degree to which they are involved in the natural world, and have begun to view themselves as an indispensable part in nature's fragile equilibrium, not masters of nature, but dependent on the rest of life for their own survival. In short, humans have begun to display (i.e. in movements to sustain the wilderness, to preserve wildlife, and to refrain from using certain technologies) a characteristically romantic wonder and reverence for the natural world. On the other hand, from a scientific perspective, humans have an equally determined impulse to control nature. We seem determined to advance material progress, even with the knowledge that the systematic destruction of the natural world is likely to result from our efforts. Thomas asserts that "if there were such a thing as a world mind, it should crack over" these two conflicting orientations toward nature. Thus, Thomas draws upon the language of science and romanticism to construct a persuasive synthesis of scientific and romantic
value orientations toward nature. This rhetorical merger may be capable of accommodating the two competing views of the natural world. Specifically, Thomas' scientific-romantic view suggests that we may be able to advance material progress, through the use of science, without sacrificing the knowledge that they are an integral part of the earth's life system and should, as a result, take wonder and delight in every aspect of nature, especially ourselves. Thomas, as one might expect from a scientist, uses a life process in the natural world as a metaphor to describe our relationship to nature. He explains that "certain animals in the sea live by becoming part-animal, part-plant." For example, he claims that a giant clam usually "engulf[s] algae, which then establish themselves as complex plant tissues, essential for" both the life of the plant and the clam. Thomas states that humankind's domination of nature might be a natural process similar to that which occurs when certain sea animals, such as a giant clam, incorporate plant life. In addition, he argues that humans' subjugation of nature may serve a natural function in the earth's evolutionary development:

[humankind's mastery of nature] might turn out to be a special phase in the morphogenesis of the earth when it is necessary to have something like [humans], for a time anyway, to fetch and carry energy, look after new symbiotic arrangements, store up information for some future season, do a certain amount of ornamenting ... be a handyman for the earth.
Thomas' scientific-romantic vision of humankind's relationship to nature is revealing in two ways. First, Thomas argues that the human impulse to control nature and to advance material progress, most notably through the use of science, is a natural, biological manifestation in the earth's evolutionary development. In effect, this perspective persuasively defends science's central role in our relationship to nature. Second, Thomas' scientific explanation of humankind's impulse to dominate nature persuasively responds to our contemporary, essentially romantic perception that we are an indispensable part of the natural world and should therefore strive to preserve nature's delicate balance. Thomas concludes that our incorporation of nature, as a natural biological process, may lead us to discover in one another "sources of wonderment and delight that [we] have discovered in other manifestations of nature." In a romantic vein, he also notes that our new attitude toward one another might lead to movements for the protection of humans "as a valuable, endangered species." In sum, Thomas' scientific-romantic orientation toward nature serves as a rhetorical solution to humans' dissonance concerning how best to live in the natural world. He employs the language of science to countenance human efforts to control nature, suggesting that humans are biologically compelled to dominate the natural world. Yet, Thomas uses this scientific perspective
concerning humans' drive to incorporate nature to justify a characteristically romantic disposition toward the natural world. He suggests that humans' mastery over nature serves to support the romantic perception that humans are an important part of the earth's life system and should, as such, view the natural world, and especially themselves, with wondrous pleasure.

In "Things Unflattened by Science," Thomas employs the language of science and romanticism to construct a rhetorical synthesis of scientific and romantic perspectives concerning humankind's relationship to nature. This persuasive merger has two components. First, using the language of science, Thomas describes the essential quality of earth's life. He claims that the first photographs taken from the moon indicate that the earth is a delicate and fragile organism, and that the regulatory homeostasis of earth's life exists as complex systems which survive by "endless chains of regulatory messages and intricate feedback loops." Thomas also claims that an understanding of earth's life as a complex of intricate systems assumes the "existence of close linkages of interdependency involving all existing forms of life, after the fashion of an organism." Thomas uses this scientific view of earth's life, however, to reject the notion that human beings should be relieved of responsibility for the earth's environment "on the ground
that [the earth] runs itself and has done so, implacably, since long before [humans] arrived on the scene." Rather, Thomas' scientific explanation of earth's life embraces a characteristically romantic value orientation. Particularly, he argues that viewing humankind as a life system intimately connected with all of earth's other life systems "should impose a new feeling of anxiety for the environment everywhere." Much like a romantic, Thomas asserts that "if [humans] become convinced that [they] exist as part of something that is itself alive, [they] are more likely to take pains not to do damage to the other vital parts around [them]." Thus, Thomas' scientific explanation of the earth's life substantiates a traditional romantic view of humans' relationship to nature. In essence, his argument that rational scientific investigation documents humans' intimate connection to all other forms of life supports the romantic notion that humankind is an indispensable part of the natural world. In addition, Thomas' concern for the environment, though based on scientific findings, affirms the romantic view that humans should strive to preserve rather than control and ultimately destroy nature.

The second component in Thomas' scientific-romantic synthesis involves the merger of science and literature to develop a better understanding of the earth. For example, Thomas claims that photographs taken from the moon, showing
the earth to be a large organism "... and at the same time
... delicate and fragile ...," have enabled him to find
meaning in Wallace Stevens' poem, "Man with the Blue
Guitar." Thomas' interpretation of Stevens' poem is,
however, ambiguous. Thomas claims that Stevens' "Man with
the Blue Guitar" is a "... a long poem, alive with
ambiguities ...," and admits that he has no idea whether
Stevens intended his poem to serve as an explanation for
the earth's fragility and delicateness. Yet, Thomas
concludes (after merely quoting two lines from the poem)
that Stevens' poem "... can be read ... as a tale of the
earth itself." Thomas' reading of Stevens' poem is, in a
strict sense, tangential to the scientific-romantic
synthesis found in his essays. More important to Thomas'
rhetorical merger is his use of poetic language to explain
nature--poetry, of course, being a linguistic form more
closely associated with romanticism than with science--and
the ambiguous manner in which he integrates science and
romance. In fact, Thomas' orientation toward nature depends
for its rhetorical effect on the ambiguous philosophical
middle ground it achieves between science and romanticism.
Essentially, his ambiguous integration of scientific and
romantic language, to explain our relationship to nature,
maintains the philosophical integrity of both science and
romanticism, while simultaneously accommodating the
fundamental differences between these two modes of thought.
In other words, Thomas' ambiguous merger of science and poetry serves as a rhetorical tactic to legitimate both scientific and romantic explanations of the natural world. At another point in the essay, however, Thomas argues that scientific findings validate, and even provide meaning for, poetic interpretations of nature. For example, he claims that science is responsible for discovering that the earth is "... by far the most interesting, engrossing, and puzzling object in the solar system--maybe even the whole galaxy ..." He states that while scientific investigation of the earth should continue, humanists and poets ought to contemplate the new found understanding of the earth that science has already provided:

[The earth needs more research, huge-scale and at the same time delicate, highly reductionist work, but in the meantime [the earth] is there for humanists to think about, a free gift from science and technology, a nice piece of bewilderment for the poets ...]

These remarks indicate that Thomas, much like a romantic, recognizes the importance of a humanistic evaluation of nature. Ultimately, however, as one might expect from a scientist, Thomas seems to subordinate a humanistic interpretation of the natural world to a rational scientific explanation. In short, he seems to be suggesting that science, more so than poetry, has the ability to appreciate and to explain earth's mystifying presence in the universe.
In "The Lives of a Cell," Thomas uses the language of science, not only to reject the view that humankind is separate and qualitatively different from nature, but to support the traditionally romantic notion that humans are an integral part of the natural world. Thomas explains that humankind's "... most consistent intellectual exertion down the millennia ..." has been to "... invent an existence that [they imagine] to be above the rest of life ..."). He is particularly concerned with human beings' most recent efforts to remove themselves from nature:

... Modern Man ... sits in the topmost tiers of polymer, glass, and steel, dangling his pulsing legs, surveying at a distance the writhing life of the planet. In this scenario, Man comes on as a stupendous lethal force, and the earth is pictured as something delicate ...

These remarks suggest that science has played a critical role in determining our present relationship to nature. Specifically, the scientific impulse to dissect and control the natural world seems embodied in recent human efforts to detach themselves from nature. In other words, Thomas is suggesting that humankind has an innate, fundamental desire to withdraw from nature, which, in modernity, has manifested itself in scientific efforts to gain an empirical understanding of nature and to promote material progress. In fact, Thomas' remarks indicate that science has provided the most efficient means (e.g., polymer, glass, steel) for humankind to fulfill their need to exist apart from nature. In essence, the implication of Thomas'
comments is that science has enabled humans to create an existence in which they are able reasonably to imagine themselves as "a stupendous lethal force," "above the rest of life," presiding over the "writhing life of the planet." Ultimately, however, Thomas concludes that the material progress made possible through the use of science has merely created the illusion that humans can live apart from nature. In fact, Thomas argues that "the biologic science of recent years ..." has demonstrated that "[humankind] is embedded in nature." More specifically, he explains that the interior of the human cell is occupied by a number of symbionts, including mitochondria, centrioles, and basal bodies, which possess their own DNA and RNA and exist, in a strict sense, as entities separate from the human cell. Thus, human cells are not the "pure line entities" that biologists once assumed, but rather are complex ecosystems. In other words, Thomas argues that the cell, which biologists had long held to be the human body's fundamental unit, is itself occupied by separate creatures which exist independent from one another and from the cell within which they live. More importantly, Thomas merges this biologic information with a romantic sense of awe and wonder to accentuate humankind's mystical, interlocked relationship with nature:

[Thomas likes] to think that [the separate living creatures existing within his cells] work in [his] interest, that each breath they draw for [him], but perhaps it is [they] who walk through
the local park in the early morning, sensing [his] senses, listening to [his] music, thinking [his] thoughts. Thomas' ruminations concerning the extent to which the human body's fundamental unit, the cell, is permeated by other life forms is characteristic of the mystical speculation about humans' relationship to nature that one might expect from a romantic. Indeed, his reflections lead to the strange conclusion that human thought and action may be controlled by symbionts which exist within human cells. In the end, however, Thomas does not intend readers to accept the notion that organisms living within human cells have the ability to govern human thought and action. Any literal interpretation of Thomas' musings would miss their rhetorical significance. More appropriately, Thomas' view of the effect certain organisms have on human life is best characterised as intentionally enigmatic. Moreover, the perplexity of Thomas' thoughts seems designed precisely to signify our intimate relationship to other natural life forms. In sum, Thomas is "... grateful for differentiation and speciation..." within the human cell, but says that "... [he] cannot feel as separate an entity as [he] did a few years ago," before biologists discovered the extent to which the human cell is occupied by independent organisms. Finally, Thomas' scientific-romantic perspective on the human cell illustrates that human beings are inextricably connected to other natural life forms and cannot therefore,
even with the aid of science, remove themselves from nature.

In "The Tucson Zoo," Thomas asserts that the general public is fearful that science "... may forever be overlooking the whole [of nature] by an endless, obsessive preoccupation with ... [its] parts." Thomas offers a rhetorical synthesis of romantic and scientific value orientations toward the natural world that allays this fear while still defending science's reductionistic approach. This persuasive merger is reflected in the language Thomas uses to describe an experience he had viewing otters and beavers at the Tucson Zoo. Drawing upon the language of romanticism, Thomas claims that upon first viewing the otters and beavers he was "transfixed" and felt only "pure elation mixed with amazement at such perfection." Thomas remembers wanting no part of the science of beavers and otters:

... [He] wanted never to know how [beavers and otters] performed their marvels; [he] wished for no news about the physiology of their breathing, the coordination of their muscles, vision, endocrine systems, [and] digestive tracts. [He] hoped never to have to think of them as collections of cells.

Like a romantic, Thomas' first reaction was simply to revel at the "... full hairy complexity ... of whole, intact beavers and otters in motion." Thomas' romantic sense of awe and wonder for beavers and otters lasted, however, for only a few moments; then he adopted a more scientific,
reductionist attitude and began to wonder—not about the
details of beavers and otters—but rather about the effect
that viewing them might have had on him. He states that in
the instant he began to examine his behavior toward beavers
and otters he "... lost all the wonder and the sense of
being overwhelmed [by them]." 252

Moreover, as one might expect from a scientist, Thomas
argues that humans are endowed with genes which code their
reaction to nature. For example, humans are genetically
stamped with unalterable patterns of response, ready to be
released in the presence of beavers and otters. Thus,
Thomas claims that when he stood "flabbergasted, feeling
exultation and a rush of friendship" while watching beavers
and otters at the Tucson Zoo, he was merely exhibiting
instinctive behavior. Thomas also notes, however, that an
individual's mechanistic response of surprised affection
for beavers and otters can be avoided if he uses the full
power of his conscious mind. In other words, Thomas argues
that an individual can circumvent his genetically
programmed response to nature through the act of rational
thought. This essay exemplifies the merger of romantic and
scientific values reflected in Thomas' view of humankind's
relationship to nature. The language Thomas uses to
describe his reaction to beavers and otters (e.g., He was
"transfixed," felt "pure elation mixed with amazement," and
was "flabbergasted, feeling exultation and a rush of
friendship" for them.) expresses a characteristically romantic wonder and reverence. In essence, Thomas' initial reaction to beavers and otters—his wanting only to behold their complete, unspoiled beauty and to know nothing about their details—persuasively underscores the general public's fear that the process of scientific reductionism has resulted in science's general failure to appreciate the whole of nature. Thomas' romantic affection for beavers and otters, in effect, legitimates the public's admiration for nature's pure, undissected elegance. Unlike a romantic, however, who might attribute our abiding affection for nature to an inexplicable mystical force, Thomas explains our affinity for the natural world in scientific language.

Moreover, he seems to reject the romantic notion that an individual may find nature a source of profound inspiration for discovering, usually in a moment of sudden, intuitive understanding, what it means to be a living being. Rather, from a scientific viewpoint, Thomas argues that humans are biologically compelled to feel a special kinship to nature, but are only able to acquire significant knowledge about the essence of human existence through the act of rational inquiry. Thus, Thomas learned about his relationship to beavers and otters, and to nature generally, not as a romantic might have—through introspection, intuition, emotionalism, or even mysticism, though he never discounts these modes of knowing—.
through the process of scientific reductionism. In other words, as one might expect from a scientist, Thomas dissected his reaction to the beavers and otters into its smallest possible details, before extending his investigation to encompass the whole of his experience. But a pure romantic would argue that an individual’s interaction with nature is part of the continuity of life and must, as such, be viewed as an irreducible organic experience. In fact, from a romantic viewpoint, the dividing analytical mind actually destroys the substance of individual interaction with nature.

In sum, Thomas’ scientific-romantic view of humans’ relationship to nature recognizes the general apprehension that scientific reductionism may cause scientists to ignore the whole of nature’s beauty and complexity. Yet, Thomas’ persuasive merger also approves of science’s proclivity to reduce nature to its smallest parts.

Thomas and the Moral Dimensions of Science

In "Altruism" and "The Lie Detector" Thomas discusses two areas of human behavior—altruism and honesty—more likely to concern a romanticist than a scientist. Unlike a romantic, however, who might explain these two categories of human expression in purely mystic, spiritual terms, Thomas merges the language of biology with a public nonscientific vocabulary to argue that human altruism and
honesty are genetically determined moral behaviors. In essence, much like a romantic, Thomas views the affection and trust humans display for one another as valuable moral characteristics of the human personality. Yet, unlike a romantic, he does not use mystical or metaphysical language to explain human altruism and honesty, but rather argues, from a scientific perspective, that these are genetically programmed behaviors.

In "Altruism," Thomas claims that humans are biologically compelled to behave altruistically toward one another for their continuing survival as a species. Accordingly, he asserts that "altruism is based on kinship; by preserving kin, one preserves one's self." Thomas illustrates humans' instinctive urge to sustain their species in two ways. First, he claims that individual altruistic acts among humans, which help to maintain the survival of humankind, are similar to the singular acts of self-sacrifice found among other species in nature; though he principally compares human altruism to the self-sacrificing behavior of social insects. For example, Thomas offers a vivid description of how a honeybee is likely to sacrifice his own life to protect the hive:

When a worker bee, patrolling the frontiers of the hive, senses the nearness of a human intruder, the bee's attack is pure, unqualified suicide; the sting is barbed, and in the act of pulling away the insect is fatally injured.
Thomas is mindful that humanists and others may object to his use of the term altruism—a word typically used to depict an unusual aspect of human behavior—to describe the behavior of what, in their view, are mindless automata. He notes that critics may claim that "a honeybee has no connection" to humans, "no brain for figuring out the future, no way of predicting the inevitable outcome of the sting." In spite of potential objections to his view, however, Thomas argues that "... the meditation of the 50,000 or so connected minds of a whole hive is not that easy to dismiss." He asserts that "a multitude of bees can tell the time of day, calculate the geometry of the sun's position, [and] argue about the best location for the next swarm." Indeed, Thomas claims that bees "do a lot of close observing of other bees," and may in fact understand the fatal consequences that follow the stinging, yet do it anyway.

In addition to recognizing acts of self-sacrifice among other species in nature, and most notably among social insects, Thomas also identifies an expression of human altruism which, in his estimation, exemplifies humankind's biological compulsion to preserve their species. Particularly, he claims that the "... combat marine [who] throws himself belly-down on the live grenade in order to preserve the rest of the platoon ..." is acting from an instinctive urge to protect the human species. Thomas
recognizes, of course, the vigorous opposition his scientific view of altruism may encounter from critics, who might argue that altruistic behavior among humans has nothing to do with genetics:

... [Critics might claim] that there is no such thing as a gene for self-sacrifice, not even a gene for helpfulness, or concern, or even affection. These attributes are learned from society, acquired by cultures, taught by example.\(^{260}\)

These criticisms notwithstanding, Thomas maintains that the sharing of similar genes imposes a biological responsibility on humans to sustain each other. Moreover, he asserts that everything alive on the planet, including human beings, fish, sea grass, sandworms, dolphins, hamsters, and soil bacteria, "roll [themselves] along through [their] generations by replicating DNA and RNA, and although the alignments of nucleotides within these molecules are different in different species, the molecules themselves are fundamentally the same substance."\(^{261}\) Thus Thomas reasons that, since humans share genetic similarities with all other creatures, they should be concerned about all forms of life—indeed the entire earth—"on solidly scientific, reductionist, genetic grounds."\(^{262}\)

Thomas also claims that, in addition to their genetically based altruism, humans are biologically programmed to be truthful to each other. In "The Lie Detector," for example, he explains that the lie detector
indicates that the human body's physical reaction to lying is similar to its responses to various kinds of stress:

... [A lie sets off] a kind of smoke alarm somewhere deep in a dark lobule of the brain, resulting in the sudden discharge of nerve impulses, or the sudden outpouring of neurohormones of some sort, or both. The outcome, recorded by the lie-detector gadgetry, is a highly reproducible cascade of changes in the electrical conductivity of the skin, heart rate, and manner of breathing...

Thus, from a scientific perspective, Thomas relies on the technology of lie detection to illustrate that lying is an unnatural act, causing severe stress to an individual's central nervous system. Moreover, he claims that if science had "better instruments, designed for profounder probes, we might see needles flipping, lines on charts recording quantitative degrees of meanness of spirit, or a lack of love." Thomas does not, however, wish for such instruments, but rather claims, in a romantic vein, that technological devices designed to measure the human spirit would "somehow belittle the issues involved." In other words, he is glad to know that humans are genetically programmed for honesty, but would not welcome additional scientific investigation of human moral characteristics. In short, much like a romantic, Thomas would rather leave the source or motivation for human morality open to speculation. Finally, then, Thomas argues in these two essays that humans are a moral species by compulsion, at least in the limited sense that they are biologically
designed to behave altruistically and honestly toward each other.

**Thomas, Science, and Humankind's Relationship to Nature**

The merger of romantic and scientific values reflected in his orientation of wonder and awe toward nature, as well as in his attention to humankind's moral characteristics, is a component in the larger scientific-romantic synthesis found in Thomas' writings. As such, the rhetorical impact of this merger deserves evaluation in respect to four research questions set forth in this dissertation: Does the rhetorical merger of romantic and scientific values reflected in the essays reviewed here help to (1) mediate the traditional dichotomy between science and humanism? (2) envision a cooperative relationship between the scientific community and the general public? (3) provide the general public a greater role in establishing criteria for judgment for private and public decision making? and (4) highlight the general public's capacity to respond to aspects of the world inaccessible to the interpretive framework of science and ordinary rational thought?

The equivocation between scientific and romantic values found in Thomas' orientation toward certain life processes in nature, literature, a human cell, beavers and otters, and human altruism and honesty provides a rhetorical middle ground capable of mitigating the long standing dispute between science and humanism. Scientists,
eager to continue scientific exploration of nature, should welcome Thomas' view that our impulse to dominate nature and to advance material progress, through the use of science, is a natural, biological manifestation of the earth's evolutionary development. Thus, in keeping with a scientific perspective which encourages human intervention in nature, scientists may find satisfaction in Thomas' claim that humans may be motile tissue specialized for receiving information, perhaps operating as a nervous system for the entire earth. Scientists may also appreciate Thomas' assertion that our domination of nature is a natural process similar to that which occurs when certain sea animals, such as a giant sea clam, incorporate plant life. Finally, Thomas' claim that the most efficient means for acquiring information about nature, and thus about the essence of human existence, is through the process of scientific reductionism is consistent with the overall program of science. In short, Thomas' rhetorical perspective defends science's pivotal role in humankind's relationship to nature.

In contrast, humanists should welcome Thomas' claim that humans are an indispensable part of nature's delicate equilibrium, not masters of nature, but dependent on all other forms of life for their own preservation. Though he seems to subordinate a humanistic interpretation of nature to a rational scientific explanation, Thomas' recognition
that poets are capable of making significant contributions to humankind's understanding of the universe is important. Thomas' mystical speculation concerning the extent to which a human cell is permeated by other life forms is also consistent with humanism, for Thomas' biologic explanation of the human cell illustrates the intimate, mysterious nature of our relationship to other living creatures. Finally, humanists are likely to be pleased that Thomas describes the affection and trust humans display for one another as valuable characteristics of the human personality, but disagree with his claim that we are genetically programmed for altruism and truthfulness. In fact, Thomas seems correct to assert that humanists and others may object to his claim that altruistic acts among humans are similar to acts of self-sacrifice among other species in nature. Humanists might argue, for instance, that Thomas is incorrect to claim that the combat marine who offers his life in order to preserve the rest of the platoon is acting purely from an instinctive urge to protect the human species, and assert that the marine is engaging in an act of heroic individualism. Essentially, they might claim that the emphasis Thomas places on genetics when seeking to explain human behavior unduly diminishes the significance of individual free-will. In short, humanists might object that words about society and human relationships, such as altruism and honesty, should
be used to express moral rather than scientific truths. On balance, however, humanists are likely to be pleased with Thomas' recognition that humankind is intimately connected with other life forms and should work to preserve the natural environment.

The merger of romantic and scientific values reflected in Thomas' orientation of wonder and awe toward nature, as well as in his attention to humankind's moral characteristics, envisions a cooperative relationship between the scientific community and the general public, particularly in Thomas' admission that upon first viewing the otters and beavers at the Tucson Zoo he was transfixed and felt pure elation mixed with amazement. Thomas' initial response of wanting simply to behold the beavers and otters' complete, unspoiled beauty, and to know nothing about their details, works to alleviate the general public's fear that the process of scientific reductionism has resulted in science's general failure to appreciate the whole of nature's beauty and complexity. Indeed, there is wisdom in the way Thomas' support for scientific exploration of nature is tempered by his understanding that the material progress made possible through the use of science has merely created the illusion that humankind can live apart from nature. Perhaps Thomas' recognition that scientific reductionism may potentially harm our delicate equilibrium with nature will encourage the general public
to take a greater role in establishing criteria for evaluating scientific projects which may damage the natural environment. Moreover, Thomas' claim that humankind is not separate and qualitatively different from nature invites the public to adapt a more circumspect view of technologies designed to insulate humans from the natural world. Finally, Thomas' initial awe and wonder for the beavers and otters at the Tucson Zoo should reinforce an increasing awareness that the whole of nature possesses an ineffable beauty inaccessible to scientific reductionism. As a result, perhaps through direct interaction with nature, independent of the interpretive framework of science, the individual layperson is directed to be more open to intuitive insight about the quality of human existence and his or her relationship to the natural world.

**Conclusion**

This chapter has identified two popular romantic themes in Lewis Thomas' public science—a wonder at and awe of nature, and a concern for humankind's moral characteristics—which are merged with scientific rationality in Thomas' essays. The chapter also examined the persuasive impact this scientific-romantic synthesis might have in establishing a more cooperative relationship between the scientific community and the general public. Chapter five offers a summary of the preceding chapters, and speculates about the overall meaning of Thomas' writing
for the rhetoric of public science and for the relationship between science and culture in general.
Chapter Five

This dissertation analyzed twenty-four essays from the popular scientific writings of Lewis Thomas. The author focused upon how Thomas, as a public scientist, depicts science as a worthwhile intellectual and pragmatic activity and responds to certain historical-cultural problems arising from the practice of science. A review of the literature on romanticism, information gathered from writings on the rhetoric of science and scientific rationality, and an examination of cultural history were used to aid interpretation. A close reading of Thomas' essays reveals that his romantic orientation toward the world is characterized by six major themes: (1) faith in the unconscious mind, (2) a vindication of the individual, (3) a predilection for diversity, ambiguity and imperfection, (4) a preoccupation with qualities that are different, remote or mysterious in humans, (5) wonder at and awe of nature, and (6) a concern for humankind's moral characteristics. These six romantic tenets were identified as they appear in Thomas' essays; the themes' strategic location, function and rhetorical significance was assessed. The author concluded that Thomas persuasively merges these popular romantic themes with traditional scientific values. The result is a scientific-romantic
synthesis that functions rhetorically to make Thomas' version of science palatable to the nonscientist. This chapter will provide conclusions about the rhetorical nature and effectiveness of Thomas' scientific-romantic synthesis as a method for mediating the traditional controversy between science and humanism, and establishing a more cooperative relationship between the scientific community and the general public. Conclusions regarding how this dissertation's research findings contribute to previous scholarship on public scientific communication will be suggested.

Science Vs. Humanism

The dialectic found between science and humanism in C.P. Snow's "Two Cultures" provides a useful intellectual framework for evaluating the rhetorical impact of Thomas' merger of scientific and romantic language. Snow argued that the modern intellectual life of Western society was being divided into two mutually exclusive cultures: the literary and the scientific. According to Snow, literary culture is composed of novelists, poets, playwrights and literary scholars; scientific culture is made up of physical scientists. Snow claimed that a gulf of mutual incomprehension, and in some instances hostility and dislike, exists between these two groups.266

The intellectual division which Snow finds between science and humanism, while perhaps not universal, clearly
exists in contemporary Western culture. Writers seeking to explain the intellectual division between science and humanism often emphasize that science and art approach reality with sharply different methods of inquiry, each of which provides a distinct contribution to humankind's understanding of nature. For example, Ernest G. Bormann notes that the "scientific method furnishes us with knowledge about the world that consists of generalizations and specific statements of fact," while art depends upon an intuitive approach to knowledge and can be a "stimulus to generate a kind of knowledge of the senses." The British Poet, C. Day Lewis, claims that "poetry deepens our insight into the qualitative domain of feeling and value, whereas science explores the quantitative domain of measurement and regularity." Melvin Rader and Bertram Jessup assert that science and art are different in aim and value:

Science seeks truth to fact, art gives truth to felt fact and felt imaginary things. In science, we can say, man is observer--ideally, an instrument--intent on knowing what things are apart from human desires, wishes, hopes, fears. In art, man is, in part, of the very substance of what he shows, tells, imagines.

The differing aims and values of scientific objectivism and artistic subjectivism create the potential for tension between the artistic world and the legions of science. Scientists may be inclined to emphasize the unprecedented material success afforded by scientific research, underscoring the direct connection between the
technological advances of science and the rising standard of living. Indeed, given science's superior method for problem solving, scientists may potentially claim a monopoly of knowledge and intellectual preeminence over humanists. At the least, scientists may display hubris as a result of the fundamental inequality of citizenship which exists between science and the humanities in American culture.270

Humanists typically acknowledge science's success in understanding the physical universe, while also recognizing serious limitations in the scientific paradigm. For example, Ernesto Grassi's examination of the historical tension between Italian Humanism and the scientific tradition suggests that the scientific method is concerned only with universals (i.e., with claims that are valid for all times and places) and thus ignores the particular experience of the individual.271 Grassi remarks that humanism places great importance on literature as a means for understanding and explaining the human condition. Particularly humanists argue that literature, unlike scientific reductionism in which the individual element is lost, "is a way of forming meaning without losing the details and emotions of an event. The fable, the tale, the narrative have a universal meaning, but this meaning is achieved through the relating of particular events and qualities."272 Like Grassi, the American novelist, Walker
Percy, who is trained as a physician and who maintains a continuing interest in science, also recognizes limitations inherent in the scientific method. Percy argues that scientific reductionism provides generalizations about the similarities between one person and another, but is unable to explain the individual himself.\textsuperscript{273} He claims that science "stop[s] short at the very point where it matters to [the individual] man," which is "what he is in himself."\textsuperscript{274} Percy contends that art--and particularly the novel--illuminates areas of human experience inaccessible to science, and is therefore, as an instrument of truth, potentially as valuable as the scientific method.\textsuperscript{275}

This dissertation has contended that Thomas' public scientific writings persuasively mediate the traditional tension between science and humanism. Previous research, however, has given only cursory acknowledgement to Thomas' rhetorical skill, and has ignored whether Thomas' public science mediates the long standing controversy between science and humanism. For example, Barbara Lounsberry suggests that Thomas' essays revive several humanistic themes fundamental to nineteenth century American literature and, though recognizing his essays as a model of lucid science writing, concludes that posterity may regard Thomas' greater contribution to be in literature rather than science.\textsuperscript{276} This dissertation has argued that Thomas' popular scientific essays do more than resurrect
humanistic themes important to a nineteenth century American literary tradition, and should be regarded as an aspect of rhetoric rather than exclusively or simply as an aspect of science or literature. In other words, Thomas' essays deserve recognition not only as an exemplary model of science writing crafted for the nonscientist, or as an example of science writing which happens to possess a certain aesthetic, literary value, but also as a persuasive response to the ongoing dispute between science and humanism. Specifically, Thomas' merger of scientific and romantic language is strategically designed to locate humanistic values within the context of contemporary science, and suggests that human potential is best realized in a single, well balanced culture, wherein scientists and humanists recognize the unique value of each other's epistemological perspective on nature. Hence, Thomas' scientific-romantic synthesis serves as a rhetorical form to encourage scientists and humanists to work cooperatively to combine science's efficacy for increasing human knowledge and power with humanism's appreciation for individual human freedom, moral development, and aesthetic spontaneity.

As a scientist, Thomas has great confidence in the scientific method as a means for acquiring a comprehensive knowledge about nature and for solving human problems. Indeed, he professes that science will eventually answer
any questions to be asked about nature or about humans. In maintaining a rhetorical allegiance to the scientific ethos, Thomas adheres to a value system that emphasizes human rationality, natural perfection and changelessness, a willingness to view technology as a tool for human progress, and an appreciation for attempts to control nature. Yet, Thomas' underlying fidelity to these core scientific values, and recognition of the extraordinary capacity or even impressive record science has for explaining natural phenomena, is expressed with a sense of humility for all that science has yet to learn about nature. Unlike other public scientists (e.g., Carl Sagan) who typically exult science's substantial, increasingly sophisticated body of knowledge, Thomas celebrates science's ability to provide revelations of human ignorance about nature. In other words, rather than glorify science for the significant strides it has made toward understanding nature, as other public scientists usually do, Thomas celebrates science as an incomplete field of inquiry, perplexed by certain ambiguities in nature; he cautions against presenting the corpus of scientific learning, impressive though it may be, as a prodigious structure of coherent information capable of explaining almost every aspect of nature. In essence, Thomas views science as an indispensable means for helping humankind understand and control nature, but does not regard science
as humankind's savior. In fact, his romantic version of science recognizes that science simply ignores, or is presently incapable of explaining, certain fundamental facets of human existence, and acknowledges that humanistic criticism of science, particularly for neglecting the complete intellectual capacity and particular experience of the individual, is a rhetorical exigence which threatens to undermine the sanctity of science in American culture.

The Mediational Effect of Romantic Public Science

Yet, specifically how does the scientific-romantic synthesis in Thomas' popular scientific essays mediate the traditional tension between science and humanism? And how is this dissertation's examination of Thomas' popularization of science relevant to the study of the rhetoric of popular science? One way to conceptualize the mediational effect Thomas' romantic science has concerning the dispute between science and humanism, and to understand how this study interfaces with previous scholarship on popular scientific communication, is to recall Lessl's explanation of priestly rhetoric. As noted in the survey of literature on popular science in chapter one, Lessl claims that priestly rhetoric characteristically promotes and maintains the specialized values of an elite subculture, but is directed toward the broader social groups within which it is situated. He contends that priestly communication "reminds people of what they might become,
attempting to change the identity of its intended audiences by nudging them gradually into the symbolic environment of an elite social group."277 One important place to look for priestly rhetoric, Lessl observes, is in the public discourse of contemporary scientists. Accordingly, given Lessl's theoretical perspective, Thomas' popular rendering of science is an example of priestly communication.

As priestly rhetoric, Thomas' romantic science shares and legitimates the specialized values of an elite scientific subculture, but is directed toward reducing the philosophical differences between scientists and humanists, and toward encouraging the general public to appreciate science's ability to cultivate the full measure of human potential. Lessl reminds us that public scientific efforts to mediate science's division from the rest of the culture often must step outside science to establish common ground with a nonscientific audience, using symbols of identification through which the nonscientist can mediate reality and organize his or her actions.278 Anderson expresses a similar notion when explaining that the science reporter often draws materials for rhetorical argument from the common conception of the good, what Aristotle called forms, common places or topoi.279 Like other public scientists, Thomas moves beyond a strict fidelity to scientific orthodoxy in order to appeal to the broad aspirations and values of the nonscientist. But his public
science raises issues relevant to the common good and particularly to the enduring and troubling moral/scientific issues of our time. For example, his romantic science combines scientific and humanistic symbols of identification, particularly merging a scientific emphasis on human rationality with a humanistic concern for literature, human moral development, creative imagination, the unconscious mind, and for important public issues such as the threat of thermonuclear war, and the preservation of the natural environment. On balance, this persuasive union is characterized by a sense of ambiguity, and even, to a lesser degree, irony and paradox, which promotes a unified diversity between these traditionally divergent scientific and humanistic topoi. In other words, Thomas' scientific-romantic synthesis shares a perspective on nature and the substance of human existence which equivocates between the symbolic world of science and humanism. The result is a persuasive merger that upholds the philosophical integrity of science and humanism while accommodating the long standing differences between these two modes of thought.

An important characteristic of Thomas' rhetoric, then, is that it deliniates the topoi with which the public might understand science and begin to reason through techno-scientific disputes. Specifically, Thomas suggests that deliberation of social, ethical, and moral issues in the
relationship between science and the general public ought to invoke certain scientific-romantic structures which help to adjudicate conflicting versions of public moral action. For example, Thomas would probably view genetic engineering as an example of scientific inquiry that is likely to arouse debate over the social, ethical and moral consequences of science. Given his scientific-romantic perspective, Thomas might urge us to adopt a cautious open-mindedness when attempting to resolve conflicting public moral views regarding the extent to which societal concerns should govern genetic engineering research. He might encourage the scientific community to measure the value of individual human dignity against the benefit of scientific advance and to be ever mindful of the potentially grave consequences of altering natural evolution of the human species. On the other hand, Thomas might remind the public that successful scientific inquiry usually depends upon freedom of investigation and that genetic engineering, while not without risk, is potentially valuable as an avenue for curing such common illnesses as cancer and heart disease.

**Romantic Science Vis-A-Vis The General Public**

In addition to appealing to the social and imaginative concerns of humanists, Thomas' romantic science should allay the general public's concerns over the potential ethical and moral implications of science. Communication
scholars have observed that the highly specialized language of science and technology have increasingly usurped the role of ordinary language in public policy debates over social, ethical, and political questions, and have proven particularly inadequate to bridge the intellectual division which exists between expert and citizen when scientific or technological matters impinge upon ordinary life. In short, the scholarly consensus seems to be that technical reasoning effectively denies citizen equal status with expert in discussion of public policy and is therefore an insufficient means for resolving public controversy in a democratic society.280

An intellectual tension is likely to exist, then, between the scientific community and the general public when scientists enter the public arena to argue on behalf of a scientific agenda. Hence several important questions are raised concerning the possible rhetorical effect of Thomas’ public science: How might Thomas’ romantic-scientific synthesis address the general public’s increasing concern over the ethical and moral consequences of science? How might his persuasive merger provide the public a greater role in establishing criterion for judgement for private and public decision-making? How might Thomas’ scientific-romantic orientation highlight the general public’s capacity to respond to aspects of the world inaccessible to the interpretive framework of science
and ordinary rational thought? One way to approach these questions, and to determine generally whether Thomas' scientific-romantic synthesis persuasively responds to the lay person's apprehension about the role of science in American culture, is to recall Fisher's explanation of public moral argument.281 Fisher explains that public moral argument, unlike reasoned discourse occurring in specialized communities, "is a form of controversy that inherently crosses fields," and is "not contained in the way that legal, scientific, or theological arguments are by subject matter, particular conceptions of argumentative competence, and well recognized rules of advocacy."282 He claims that public moral argument is "made available for consumption and persuasion of the polity at large," is aimed "at what Aristotle called untrained thinkers," and is "moral in the sense that it is founded on ultimate questions—of life and death, of how persons should be defined and treated, of preferred patterns of living."283

Fisher's perspective on public moral argument provides a useful framework for understanding the rhetorical force of Thomas' efforts to defend the sanctity of science and to bridge the philosophical division between the scientific community and the general public. Thomas seems to understand that the specialized language of science may be losing its ability to shape public consciousness and to engage in public moral argument. In fact, his romantic
science is not confined by the technical reasoning and subject matter of science, but employs ordinary language to discuss scientific and technological issues which directly effect the individual citizen and are pivotal to defining science's role in the culture. Yet in addition to sharing scientific information in the relatively nontechnical idiom of the general public, as all public science must do, Thomas' scientific-romantic merger operates in a manner unique to the current body of public scientific discourse, particularly to combine an emphasis on human rationality with a moral and aesthetic vision for individual freedom and a sound social order. The result is a romantic science that shares a scientific interpretation of reality while still envisioning a cooperative relationship between the scientific community and the general public. The complementary relationship Thomas conceives between the field of science and the ordinary citizen is particularly evident when he defends the process of scientific reductionism as the most efficient means for acquiring information about nature, yet recognizes the public's fear that science's proclivity to dissect nature into its smallest parts is responsible for science's general failure to appreciate the whole of nature. His argument that our subjugation of nature may be a natural function in the earth's evolutionary development persuasively reduces the dissonance that we are likely to experience upon the
realization that our kinship to nature will have to remain subordinate to our impulse to dominate nature. In essence, his scientific-romantic view of nature suggests that humankind may be able to advance material progress, through the use of science, without sacrificing the knowledge that we are an integral part of the earth's life system.

Philip Wander has observed that "so long as talk about science locates itself in the hypothetical space of... modes of thought which make a virtue out of being detached from human history and the everyday world, it will remain possible for scientists to enjoy the comforts of consulting secure in the belief that all is right with the world." Unlike most traditional scientists, who continue to locate science in abstract modes of discourse, such as mathematics or logic, Thomas articulates a scientific perspective in the idiom of the intelligent lay person. Rather than strive to be a neutral and dispassionate observer, Thomas is filled with a sense of awe and wonder for the complex beauty of the human species and for nature's deep degree of mystery. In this sense, he gives voice to what most scientists probably feel but rarely express publicly. He understands that the world has a great many serious problems, some of which endanger humankind's very existence, and that "the dissociation of science from morality, ethics, and politics is no longer possible." For example, Thomas' romantic-scientific perspective is
passionately concerned that the prospect of thermonuclear war threatens the continuity of human civilization. Yet unlike a traditional scientist, who is likely to rely solely on empirical data to emphasize the gravity of thermonuclear weapons, Thomas persuasively merges aesthetic and rational perspectives to warn against danger of atomic genocide. For instance, he recognizes that music's ability to heighten human awareness may be a more persuasive topos than simply acknowledging the ways in which rational, empirical data enhance perception. Hence, as a means for increasing awareness of the horrors of nuclear war, Thomas recognizes an emotional link between the melancholic meditation on death evoked in Mahler's Ninth Symphony and the image of thermonuclear bombs exploding over the great capitals of the world.

Thomas' effort to mediate potentially disturbing social, ethical, and moral issues in the relationship between science and the general public extends beyond the problem of thermonuclear war. For example, he is sensitive to the popular fear that technology, and particularly computers, will destroy the unpredictability and improbability of human thought that is necessary to the process of social evolution. While recognizing that computers possess an excellent facility for problem solving and are, along with other technologies, important agents for the unification and organization of collective human
behavior, Thomas also suggests that computers, and technology generally, will always serve a passive role subject to human control. Essentially Thomas preserves technology's privileged status in society while still responding to the public's concern that computers will diminish the importance of, and perhaps dominate, human intellect. Thomas' concern for the sanctity of the individual vis-a-vis the potentially dehumanizing effects of science is also evident in his caution to experimental psychologists to refrain from attempts to control humans' visceral organs. Indeed, the general public is likely to agree with Thomas' assertion that scientific attempts to teach humans to control their internal biology might present the individual with exhausting and debilitating responsibilities; in Thomas' view, the individual is not prepared for the emotional and intellectual responsibility that would accompany the ability to regulate his or her internal domain. Rather than lead to greater autonomy, this type of scientific investigation might effectively estrange humans from their external environment and deny an individual a deeper appreciation of his or her humanity. In essence, the public is likely to view Thomas' opposition to scientific efforts to regulate viscera as a persuasive defense of individual freedom.
Romantic Science: A Comprehensive View Of The Cosmos

The modern scientific world view has removed human meaning and moral value from our relationship with nature and from our conception of the cosmos. As Janice Rushing notes, the progress wrought by the Enlightenment and the Scientific Revolution has left many with an undeniable "sense of fragmentation and separation--from their world, their fellow human beings, and themselves." In The Return To Cosmology, however, Stephen Toulmin observes that the scientist's traditional posture as "theoros" or spectator whose task is simply to report objectively on the workings of nature, and to abide by a belief in the value neutrality of science, cannot be maintained. Toulmin claims that "... the expansion of scientific inquiry into the human realm is compelling science to ... develop a more coordinated view of the world, embracing both the world of nature and the world of humanity." In short, Toulmin states that scientists have to consider the "moral significance of the actions that comprise even the very doing of science." Similarly Lessl argues that "the moral neutrality that scientists wish to claim for their work does not obtain in the public world where the artificial distinction between scientific works and its consequences become invisible." Lessl adds that, as the negative consequences of science become more apparent, "... a rhetoric of science that is successfully to maintain
a working relationship with the larger public that supports science must respond to the moral meanings of science in the world.\textsuperscript{290} From Lessl's perspective, "such a response moves scientific discourse from its traditional realm of the epistemic into the realm of the ethical, which means in effect into the narrative arena of public dialogue."\textsuperscript{291}

Lewis Thomas seems to understand that science's strict reliance on rationalism and naturalistic explanation ignores certain ineffable, though nonetheless important, aspects of human existence. In fact, while still emphasizing the scientific method, his romantic-scientific perspective adapts a more comprehensive view of the cosmos than traditional science, restoring a "sense of unity, order, and proportion" to humanity's relationship to nature.\textsuperscript{292} For instance, Thomas' preoccupation with mysterious phenomena, such as the operation of the unconscious mind, the importance of human error and imperfection in leading to advanced levels of rational thought, and the significance of language in defining the human species, suggests that certain facets of human existence are presently beyond the purview of scientific explanation. Thomas' recognition of the scientific model's limitations encourages us to depend on intuitive and emotional judgment along with logical processes for problem solving, and to be more willing to turn to other forms of authority in both private and public decision-making.
Indeed Thomas' preoccupation with mysterious phenomena, in addition to encouraging our emotional and intuitive capacities, also delineates the bounds of science from metaphysics, suggesting perhaps that every astute public scientist is also a metaphysician. Thus Thomas' romantic science strives to fulfill what Rushing has termed our "yearning for wholeness" in the cosmos, and to heal our sense of fragmentation and separation from nature.\textsuperscript{293} Thomas' effort to reinsert humanity into the scientific worldview, while apparent in all his essays on nature, is particularly evident in his description of an experience he had while viewing otters and beavers. He claims to have been filled with a sense of awe and wonder for these creatures, yet at the same time to have been compelled to adopt a scientific reductionist attitude in order to speculate about the effect that viewing them had on him. Thomas reaction to the beavers and otters exemplifies the dissonance we experience when recognizing, on the one hand, that we are deeply and perhaps mysteriously connected to the natural world, and realizing, on the other hand, that humankind possesses a seemingly innate drive to dissect and control nature.

While generally optimistic about science's role in human affairs, Thomas recognizes that the fruits of scientific and technological advance in the twentieth century have been bitter-sweet. He notes, for instance,
that as science has learned to cure disease, develop computers which possess a vastly improved upon though nonetheless human-like faculty for problems solving, and harness the forces of nature for human prosperity, so also has it developed the capability to restrict human autonomy, lay waste the natural landscape, and extinguish civilization. Thomas' enthusiasm for the prospects of science is tempered, then, by an appreciation of science's potentially destructive force. Certainly Thomas is in favor of science as a most effective means for solving human problems, yet recognizes that science's increasingly disturbing consequences jeopardize public confidence in the scientific enterprise. In essence, Thomas seems to understand that popular distrust of science is likely to exist so long as scientists ignore the ethical and moral results of their work. Consequently, he portrays a moralistic vision of science that is likely to strengthen public trust in the scientific enterprise. For example, while generally opposed to scientific investigation of human moral characteristics, Thomas' romantic science merges the language of science with a public nonscientific vocabulary to argue that certain categories of expression, such as human altruism and honesty, are genetically determined moral behaviors. In other words, while generally opposed to scientific efforts to determine the genetic roots of humans' basic moral characteristics, Thomas relies
nevertheless on scientific language to demonstrate that humans are a moral species by compulsion, at least in the limited sense that they are biologically designed to behave altruistically and honestly toward one another. In sum, Thomas' romantic-scientific orientation persuasively accentuates a humane science, capable even of identifying and reinforcing virtuous characteristics of the human personality. In doing so, Thomas' public science aids in establishing a more cooperative relationship between the scientific community and the general public.

Generally speaking, scientists who enter the public narrative arena to seek identification with a nonscientific audience encounter a rhetorical dilemma, particularly since, as Lessl notes, "the material of science is intrinsically foreign to the uninitiated layman, and to step outside of science to find common ground is to betray the ethos of the scientific community." Thus, as Lessl adds, "one should not be surprised to find the popularizer of science regarded by his professional peers as an outcast or heretic." On balance, the most serious limitation of Thomas' synthesis is that it may not resolve the basic tension between science and humanism; science and humanism may, in essence, be logically and philosophically incompatible. Notwithstanding Thomas may have gone as far as possible to resolve the fundamental tension between the two perspectives. Ultimately, the ever present ambiguity in
Thomas' work may reflect his own uncertainty about the compatibility between science and humanism. This being the case, the scientific community is likely to regard Thomas' popular rendering of science with ambivalence. Particularly, scientists would probably prefer that Thomas advance a more traditional view of science as a rigorous, routinized activity largely concerned with establishing and systematizing facts, principles, and methods; scientists are likely to wish that Thomas placed greater emphasis on science's ability to clarify ambiguity in nature and to establish solid, fundamental conclusions about the natural world. In short, scientists probably wish that Thomas placed greater emphasis on the impressive record science has for explaining natural phenomena, and are likely to view Thomas' romantic portrayal of science as a violation of the scientific ethos. Despite their potential misgivings, however, scientists should be satisfied that Thomas' public scientific essays show a significant degree of fidelity to scientific orthodoxy, and use the language of romanticism primarily for the rhetorical purpose of depicting science as a humane discipline able to serve human instincts for conduct and beauty. In fact, scientists are probably aware that the public's increasing apprehension about the social consequences of science could jeopardize financial support for certain types of scientific research, and that Thomas' romantic portrayal of
science offers persuasive commentary on a range of timely scientific issues in a manner likely to encourage public support for the scientific enterprise. Finally, scientists may appreciate that Thomas' public scientific perspective manages a realistic, sensitive and discriminating balance between science's unrelenting quest for knowledge and the general public's escalating acknowledgment that science is incapable of solving all human problems and is, to an increasing extent, responsible for creating additional ones.

Conclusion

In the twentieth century science has had a pervasive intellectual influence on the life of western society. The scientific method, as the predominant paradigm for problem solving, has been hugely successful as a means for unraveling the mysteries of nature and for furnishing humankind, not only with its most basic needs, but with a standard of material comfort unthinkable only a century ago. Yet, despite the progress wrought by scientific investigation, the general public has become deeply skeptical about the ethical, social, and practical price that must be paid for the fruits of scientific advance. Furthermore, the intellectual dichotomy which Snow finds between science and humanism, while perhaps not ubiquitous, is still evident in American culture. Lewis Thomas' public scientific essays reflect a persuasive effort to identify
and to mitigate the intellectual tensions that exist between science and the rest of society. In fact, Thomas’ scientific-romantic synthesis operates as a sophisticated rhetorical form for acknowledging both the hope and despair that science has given us. His persuasive merger defends the sanctity of science while still recognizing the need to reinsert human meaning into science’s orientation toward the natural world. In other words, Thomas’ romantic science embraces both the world of science, where the pursuit of knowledge about nature, at whatever level, is considered a priority which should never be impeded, and the world of humanity, where concern for the individual is of utmost importance. In essence, Thomas’ persuasive synthesis provides scientists with a new ethic, by suggesting that scientists who wish to maintain a preeminent role for science in American culture can no longer afford to view themselves strictly as observers of nature, but must consider themselves as agents capable of rearranging the natural world and of reconstituting the substance of human existence; indeed, Thomas’ public science intimates that the potential social consequences of scientific activity necessitate that scientists contemplate the social and moral significance of their work. In other words, Thomas seems to agree with Toulmin’s claim that contemporary scientists are having to rejoin the rest of humanity and participate once again in the "moral quandaries...that
arise for us all," in our attempts to reconcile the values of action and reflection.297

Finally, Thomas' merger of popular romantic themes and traditional scientific values facilitates constructive dialogue between the scientific community and the general community, and in so doing serves as an important intellectual measure for evaluating the ideas, values, and aspirations of our culture. This study, however, provided but one example of how the scientific-romantic synthesis functions in public scientific discourse. It remains to be seen whether Thomas' provocative use of this persuasive merger will stand as an isolated example among the corpus of public scientific literature, or whether other public scientists, recognizing Thomas' rhetorical accomplishment, will eventually use the language of romanticism in their own efforts to share and legitimate a scientific interpretation of reality. In any event, Thomas' effective use of the scientific-romantic synthesis should alert researchers that public scientists, who understand the challenge to science from other interest groups, are capable of developing sophisticated rhetorical strategies to protect science's privileged status in society, and to clarify science's moral role in this society.
Notes


2. Ibid., p. vii.

3. William Leiss, The Domination of Nature, (New York: George Braziller, Inc, 1972). This text provides a valuable account of the historical and philosophical basis for science's use of rational inquiry both to understand nature and to control nature for human purposes.

4. Ibid., p. 46.

5. Ibid., p. 33.


7. Ibid., p. 5.

8. Ibid., p. 6.

9. Ibid., pp. 6-7.

10. Ibid., p. 7.


19. Ibid., p. 6.

20. Ibid., p. 7.


25. Ibid., p. 273.


31. See, for example, Elizabeth Walker Mechling and Jay Mechling, "Sweet Talk: The Moral Rhetoric Against Sugar," Central States Speech Journal, 34 (1983): In discussing popular books about sugar, the authors explain that "there is no agreed upon term to describe the present texts, though popular science, science writing, and science journalism, may be appropriate labels, in that all recognize the author is mediating scientific information for a mass audience," p. 21.


35. Ibid., pp. xi-xii.


39. Ibid., p. 7.

41. Ibid., p. 3.


47. Ibid., p. 361.


50. Ibid., p. 445.


56. Ibid., P. 176.

57. Ibid., p. 177.

58. Ibid., p. 177.


60. Ibid., p. 184.


67. Ibid., p. 27.


74. Proffitt, "Science and Romanticism," p. 57. Also, Arthur Lovejoy's The Great Chain of Being: A Study of the History of an Idea describes the decades from 1770 to 1830 in terms of the monumental change which took place in American and European thought. Lovejoy details how the classical episteme, which prevailed in the seventeenth and eighteenth centuries, gave way to the organic model of reality.


76. Ibid., p. 16.


82. Ibid., p. 19.

83. Ibid., p. 19.

84. Ibid., p. 21.

85. Ibid., pp. 21-22.


89. Ibid., p. 20. See also, Werner Heisenberg, Physics and Philosophy (London: Allen and Unwin, 1963), p. 82. Heisenberg states: "When we make an experiment we have to assume a causal chain of events that leads from the atomic event through the apparatus finally to the eye of the observer; if this causal chain was not assumed, nothing could be known about the atomic event."


96. Ibid., p. 13.


100. Walter Ong, Rhetoric, Romance, and Technology: Studies in Interaction of Expression and Culture, p. 255. For additional discussion of romantic mysticism see, for example, Holman and Harmon, A Handbook to Literature, pp. 441-43.


102. Ibid., pp. 138-9

103. Ibid., p. 140.

104. Ibid., p. 140.

105. Ibid., pp. 140-41.

106. Ibid., p. 141.

107. Ibid., p. 141.

108. Ibid., p. 141.

109. Ibid., p. 141.


111. Ibid., pp. 151-2.


113. Ibid., p. 63.
114. Ibid., p. 64.


116. Ibid., p. iv.


118. Ibid., pp. 6-8.

119. Ibid., p. v.

120. Ibid., p. v.

121. Eric M. Eisenberg's, "Ambiguity As Strategy in Organizational Communication," *Communication Monographs*, 51 (1984), pp. 227-242. also provides a valuable discussion of the philosophical context for understanding ambiguity as a communication strategy.


127. Ibid., pp. 71-2.

128. Ibid., p. 72.

129. Ibid., p. 73.

130. Ibid., p. 74.


133. Ibid., p. 42.


135. Thomas, "Late Night Thoughts on Listening to Mahler's Ninth Symphony," Late Night Thoughts On Listening To Mahler's Ninth Symphony, p. 164

136. Ibid., p. 166.

137. Ibid., pp. 167-8.

138. Ibid., p. 165.

139. In Esthetics of Music, Carl Dahlhaus explains that "Music is transitory. It goes by, instead of holding still for inspection. Because of its perishable, fleeting nature, music was conceived by Adam of Fulda, in 1490, as a meditation on death, meditatio mortis."


151. Ibid., p. 6.


153. Ibid., p. 25.


158. Ibid., pp. 107-8.

159. Ibid., pp. 108.

160. Ibid., p. 109.

161. Ibid., p. 109.

162. Ibid., p. 109.

163. Ibid., p. 109.

164. Ibid., p. 110.

165. Ibid., p. 110.

166. Ibid., p. 111.


168. Ibid., p. 77.

169. Ibid., p. 76.

170. Ibid., p. 78.

171. Ibid., p. 79.
172. Ibid., p. 79.


174. Ibid., p. 31.

175. Ibid., p. 30.

176. Ibid., p. 32.


178. Ibid., pp.130-1.

179. Ibid., p. 131.

180. Ibid., p. 132.

181. Ibid., p. 132.

182. Thomas, "Humanities and Science," _Late Night Thoughts On Listening to Mahler's Ninth Symphony_, p. 147.

183. Ibid., pp. 147-8.

184. Ibid., p. 151.

185. Ibid., p. 152.

186. Ibid., p. 148.

187. Ibid., p. 150.

188. Ibid., pp. 148-9.

189. Ibid., pp. 154-5.


192. Ibid., p. 157.

193. Ibid., p. 163.


195. Ibid., p. 111.
196. Ibid., p. 111.

197. Ibid., p. 111.

198. Ibid., p. 111.


208. Ibid., p. 110.

209. Ibid., p. 111.


212. Ibid., p. 260.


214. Ibid., pp. 59-60.


217. Ibid., p. 325.


219. Ibid., p. 122.

220. Ibid., p. 122.

221. Ibid., pp. 122-123.

222. Ibid., p. 123.

223. Ibid., pp. 123-124.

224. Ibid., p. 123.

225. Ibid., p. 123.

226. Ibid., p. 124.

227. Ibid., p. 124.

228. Ibid., p. 124.

229. Ibid., p. 125.

230. Ibid., p. 125.

231. Thomas, "Things Unflattened by Science," *Late Night Thoughts On Listening To Mahler's Ninth Symphony* p. 75.

232. Ibid., p. 75.

233. Ibid., pp. 75-76.

234. Ibid., p. 76.

235. Ibid., p. 75.

236. Ibid., p. 75.

237. Ibid., p. 75.

238. Ibid., p. 76.

239. Ibid., p. 76.
240. Ibid., p. 76.


244. Ibid., p. 1.

245. Ibid., p. 2.

246. Ibid., p. 2.

247. Ibid., pp. 2-3.


249. Ibid., p. 6.

250. Ibid., p. 7.

251. Ibid., p. 7.

252. Ibid., p. 7.


254. Ibid., pp. 101-102.

255. Ibid., p. 102.

256. Ibid., p. 102.

257. Ibid., p. 102.

258. Ibid., p. 102.

259. Ibid., p. 102.

260. Ibid., p. 104.

261. Ibid., p. 105.

262. Ibid., p. 105.

263. Thomas, "The Lie Detector," Late Night Thoughts On Mahler's Ninth Symphony, P. 128.
264. Ibid., pp. 129-130.

265. Ibid., p. 130.


270. One facet of the unequal emphasis placed on the sciences and the humanities in American culture is reflected in the significantly different levels of federal funding each enterprise receives. See, for example, *Digest of Education Statistics 1988*, U.S. Department of Education, Office of Research and Improvement, P. 288. In thousands of dollars, the National Endowment for the Humanities received 125,190 in federal support in 1988, while the National Science Foundation was awarded 1,471,417.


272. Ibid., p. 131.


274. Ibid., p. 27.


277. Lessl, "The Priestly Voice," p. 188.


281. In "Reagan, Romance and Technology: A Critique of Star Wars," Communication Studies, 40 (1989), pp. 1-12., Kenneth S. Zagacki and Andrew King note that the role romantic discourse might play in articulating a nation's techno-scientific agenda is at the essence of the discussion over the "narrativity" of public moral argument. The authors remark that no genuine consensus exists concerning which "narrative form, if any, is best suited for the expression of contemporary moral and technical disputes."


283. Ibid., p. 12.


286. See, for example, Janice Hocker Rushing's "E.T. As Rhetorical Transcendence," Quarterly Journal Of Speech, 71 (1985), P. 188.


288. Ibid., p. 256.


290. Ibid., p. 185.

291. Ibid., 185.

292. Rushing, "E.T. As Rhetorical Transcendence," p. 188. Thomas' romantic science seems to operate within the worldview of post-modern philosophy, at least to the extent that it reinserts humanity into the overall scientific
world picture. Following Toulmin, Rushing notes that the worldview of post-modern philosophy unites value and science, contemplation and action, returning us to a sense of unity, order, and proportion. For an extended discussion of the post-modern philosophy see Toulmin's *The Return To Cosmology: Postmodern Science and the Theology of Nature*, pp. 237-256.

293. Rushing, "E.T As Rhetorical Transcendence," p. 188.


295. Ibid., p. 176.

296. See, for example, Larry Thompson, "Genetic tests raise major ethical issues," *The Morning Advocate*, 15, October 1989, p. 23A. Thompson offers a description of one line of scientific research that has already raised public concern about the ethical nature of scientific inquiry. Thompson explains that present research in genetic engineering is attempting to identify every human gene and to thereby give doctors the ability not only to predict who will be born with one of the known four thousand inherited disorders but also which infants will be born with more common illnesses involving several genes, such as cancer and heart disease. Thompson notes that genetic testing could affect decisions on everything from jobs to insurance coverage to whom a person picks to marry. In short, as Thompson notes, present research in genetic engineering has aroused public anxiety that new forms of discrimination might occur based on an individual's genetic make-up.

Vita

Donald Paul Lee was born in New York, New York, on 6 December 1959, and completed his elementary and secondary education in Catholic Schools in Queens, New York. Donald received his Bachelor of Arts in Government from Southeastern Louisiana University, Hammond, Louisiana, in 1981 and earned his Master of Journalism degree from Louisiana State University, Baton Rouge, Louisiana, in 1983. His teaching career includes three years as a graduate teaching assistant for Louisiana State University and one year as an Instructor at Southeastern Louisiana University.
DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Donald P. Lee

Major Field: Speech

Title of Dissertation: A Rhetorical Analysis of the Scientific-Romantic Synthesis in the Popular Scientific Writings of Lewis Thomas

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Date of Examination:

February 28, 1990