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Since the 1980s, the pharmaceutical and biotechnology industries have interacted in a pattern best described as a "helix of rhetorical transformation," with each engaging in a recursive and interactive process of definition, description and ingratiation. The relatively recent emergence of the biotechnology industry has destabilized the older pharmaceutical industry, causing heightened activity of self-evaluation for each, as well as assessment by media, government, economic development agencies, investors, and others.

Although the two industries have much in common, their differences have set in motion a rhetorical helix that winds both toward and away from each other. Both industries have foundations built on the modern scientific method and share a mission to develop new drugs for humans and animals. At the same time, they are also made distinct by size (small biotechs versus "big pharma"), relative age, method of drug development (biology-based versus chemistry-based), product capabilities, and characterization of the employee base (innovative and risk-taking versus traditional and risk-averse).

In the early 1900s, nascent pharmaceutical companies were keen to shed the image of drug manufacturing as alchemy and adopt a new definition that was grounded in scientific methodology. Public ingratiation soared mid-century with the development of life-saving penicillin but declined toward the end of the century, attributable to several high-profile drug failures as well as charges of excessive profiteering and immoral

marketing practices. Meanwhile, public response to biotechnology was rising since the newer industry represented greater potential for transformation—not only of the landscape of drug development, but of communities themselves.

The intricacies of the bio-pharma rhetorical helix—including the play between scientistic and dramatistic approaches to language—can be examined by using the framework of dramatism and specifically Kenneth Burke's pentad of key analytical terms. Burke's concepts serve as a systematic form of inquiry for understanding the biotechnology and pharmaceutical meta-narratives (including the mythology associated with Alexander Fleming, Francis Crick, and James Watson) that have emerged within a complex and volatile cultural environment of shifting modernism and postmodernism. They also provide a basis for predicting future constructions of the "biopharmaceutical" drama.

George Lakoff's work in metaphor (alone, and in collaboration with Mark Turner and Mark Johnson) is useful in understanding the potent imagery of the double helix, and Ann E. Berthoff's observations of the writing process as a helix speaks to the usefulness of this structure in generating exciting and transformational new meaning.

THE RHETORICAL HELIX OF THE BIOTECHNOLOGY AND PHARMACEUTICAL INDUSTRIES: STRATEGIES OF TRANSFORMATION THROUGH DEFINITION, DESCRIPTION, AND INGRATIATION

by

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CHAPTER I

INTRODUCTION

Transformation wields great power. As individuals, we can define who we are and describe those essential characteristics that make us unique. Our view of ourselves, however, may not necessarily align with the opinions of those around us. Thus, the ability to reinvent oneself, to change how others see us and react to us, is critical for the process of ingratiation. If I want to court your approval, to endear myself to you, then I may need to redefine myself or describe differently what I stand for. Politicians are no stranger to this process. Neither are corporations or industries.

This process of defining, describing, and ingratiating oneself has been in play, recursively, for the modern pharmaceutical industry since its emergence in the early twentieth century and for the biotechnology industry since the 1980s. Of particular interest is the phenomenon whereby each industry seeks to reinvent itself in relation to the other, resulting in a kind of helical dance to curry public favor. Inherent in this "rhetorical helix" is the notion that definition and description are always in flux, always informed by culture, and always being negotiated by companies, industries, the media, the government, investors, and others. Some speak on behalf of biotech, others on behalf of "pharma," and others for an amalgamation of the two. The ultimate prize is what rhetorician Kenneth Burke refers to as identification where two people (or two publics) share a way of life, acting together to form "common sensations, concepts, images, ideas,

[and] attitudes that make them *consubstantial*" (ROM 545). Burke explains the concept as follows:

> A is not identical with his colleague, B. But insofar as their interests are joined, A is identified with B. Or he may identify himself with B even when their interests are not joined if he assumes that they are, or is persuaded to believe so. . . To identify A with B is to make A "consubstantial" with B. (ROM 544-545)

In embracing (or rejecting) pharmaceutical or biotechnology industries, we are essentially embracing or rejecting each industry's ability to transform us in some way – to provide jobs for our communities; to bring therapeutics to our medicine cabinets; to make us, by association, innovative and heroic, or greedy and staid. Automobiles, for example, hold a potential for personal transformation that is perceived by the buyer and validated through the rhetoric of advertising and the media. While all cars are designed to get us from one point to another, few will argue that an eco-friendly mini sedan that gets 50 miles to the gallon is equivalent to a custom turbo-charged sports car with all-leather interior and a nine-speaker audio system. As auto manufacturers and advertisers know, the vehicles we choose to purchase can reflect not only who we are, but also who we hope to be. It is no coincidence that we associate James Bond with an Aston Martin and not a Honda Civic.

Just as with cars, communities also hold potential for transformation—for the cities and towns themselves and, by extension, the citizens who live there. Media accounts are filled with stories of towns that reinvent themselves. Architectural historian William Morgan offers Bellows Falls, Vermont as an example of an old, industrial mill town that sought to shake off hard times by building a new historical center and a "monumental and somewhat startling 145-foot-long and 32-foot-high steel bridge arching over the building" (B5). South Amboy, New Jersey, an old and rusty shore town, transformed itself into a "transit-oriented commuter village," thanks to new railway and waterway transports (O'Keefe 67). And when Monterey, California—once the center of a bustling fishing and canning industry—slid into a seedy state of affairs in the early 1950s (infamously described by John Steinbeck in his novel, <u>Cannery Row</u>), it later resurrected itself with upscale restaurants, hotels, and a world-class aquarium.

The three community transformations cited above are not simply examples of successful urban redevelopment, they are also examples of successful rhetorical transformation as community leaders re-defined their cities and towns. As a Cannery Row real estate website puts it: "The Good Life, that perfect combination of environment, treasures and experiences, is the definition of Cannery Row." As Morgan writes, Bellows Falls' steel bridge is not just a bridge, but a "powerful identity symbol" that "declares that Bellows Falls is renewing itself, and with a sense of style." The real value of the bridge, he says, is as a metaphor that captures "the indomitable character of the city" (B5).

But what of declining or stagnant communities that do not have the natural advantage of an ocean or the historical advantage of a Pulitzer-prize setting? For such communities, transformation—both literal and figurative—is possible through the acquisition of new industry. The biotechnology industry, with its perceived aura of youthfulness, innovation, and usefulness, stands out as a prime example.

Since the early 1980s, when it became clear that biotechnology was not just a scientific endeavor but a potentially profitable business enterprise as well, regional thought leaders scrambled to entice biotech companies to their parts of the country. In 1984, for example, the State of North Carolina established The North Carolina Biotechnology Center, whose mission is to "provide long-term economic and societal benefits to North Carolina by supporting biotechnology research, business and education statewide" (2006 Annual Report 1).

From 1984 onward, the rhetoric of transformation through biotech flowed several ways. Development organizations like the NC Biotech Center communicated the benefits of biotechnology to the media, the public, and local leaders. The biotechnology industry touted its capabilities and attributes to the government, the media, and the public. Those in academia and the corporate world weighed in as well. Everyone had an opinion about biotech and it was largely positive. Biotechnology was smart, new, and filled with enormous promise and potential—the key watchwords that surfaced from all sides of the discussion. Biotech, in other words, carried an aura of positive transformation. Particularly when compared to the older, larger, and "greedier" pharmaceutical industry, biotech fared very well indeed. By the end of the twentieth century, "big pharma," as the large pharmaceutical companies came to be known, was suffering from a major image problem as the industry was accused of dishonest marketing practices, shoddy science, callous pricing, and worse.

Big pharma's reputation was not always negative. Like biotech, the pharmaceutical industry was once fresh, bright, and even heroic. And it, too, had the power of transformation. In the early twentieth century, pharmaceutical company founders took great care to distance themselves from the alchemists of centuries earlier.

In many ways, the emergence of the biotechnology industry (also called bio, as a comparable term to pharma) may have exacerbated the public's ill-feeling toward pharmaceuticals. From a rhetorical perspective, pharma was old, whereas bio was young. Pharma was greedy; bio had yet to make a profit. Pharma was rooted in chemistry; bio, in biology. Pharma was a big, old-boy network that was closed to newcomers, whereas bio *was* the newcomer. Bio was accessible, even to a small city such as Winston-Salem, North Carolina, located mid-state in the Piedmont Triad region. At the end of the twentieth century, such a city couldn't realistically hope to newly mint itself as a pharmaceutical hub. But it certainly could aspire to become a biotechnology center. Thus, Winston-Salem—a city once dominated by RJ Reynolds and "big tobacco"—began to lay down its agrarian mantle and pick up the banner of life science technology. It is but one story of many in the United States where a community has looked to biotechnology for change and implemented a transformative process through the deliberate and repeated use of potent biotech rhetoric and imagery.

There is perhaps no image more evocative of biotechnology than the double helix—the structure of DNA first brought to public attention in the 1950s by James Watson and Francis Crick. Since then, the double helix structure has been elevated to icon status, finding its place not only in the halls of science but the galleries of art, fashion, and pop culture. Amy Harmon describes this phenomenon well:

> With its extraordinary symmetry and blend of form and function, the double helix has supplanted the bomb-tainted atom as the standard symbol of science. Its celebrity status and multiple associations, the art historian Martin Kemp wrote in a recent issue of the journal *Nature*, make DNA the "Mona Lisa" of modern biology.
>
> But the double helix also resonates beyond science into the public consciousness. Along with the national flag, a Christmas tree or other venerable symbols, the double helix has become a visual shorthand for a range of emotions and beliefs about the nature of life. (A1)

The double helix, in other words, has become what George Lakoff and Mark Turner would call a "basic conceptual metaphor," whereby there now seems to be a "fixed correspondence between the structure of the domain to be understood" (in this case, new and innovative science) and "the structure of the domain in terms of which we are understanding it" (51). The structure in this case is a ladder of sorts: a tool that allows us to ascend, to reach new heights, albeit in a twisting and complex manner.

In her pedagogical work, The Making of Meaning, Ann Berthoff calls models such as the double helix "picturable analogies that are aids to reflection" (7). She herself uses the double helix as a way to depict the process of written composition that works upward, downward and also in opposition to one another.

For the study at hand, if we consider two strands of DNA, similar in composition but not a mirror image of one another and interacting in a manner that appears simultaneously to unite and divide, we can extend the metaphor to the biotechnology and pharmaceutical industries. The two strands of bio and pharma have wound their way through two separate eras, with the modern pharmaceutical industry emerging at the beginning of the twentieth century and the biotechnology industry several decades later.

Toward the end of the twentieth century, while the two metaphorical strands began winding ever closer toward one another, they were also pushed apart by a volatile and shifting cultural milieu. It is to be noted that discussion of biotechnology and pharmaceuticals in the chapters that follow is primarily reflective of U. S. culture and history.

When pharma came into being, the new industry defined itself and, at the same time, was defined by others. Once defined, pharma (and others) attempted to establish the essential qualities of the industry—that is, its unique character and attributes. While conveyance of positive industry attributes resulted in ingratiation with the public at large, negative perceptions by the public spurred redefinition and/or re-description. Similarly, as the biotechnology industry emerged, it began its own process of definition, description and ingratiation.

Thus, the rhetorical helix can be considered as operating in two ways. First, the rhetorics of definition and description operate as a helix within each industry, recursively functioning to establish and/or maintain ingratiation with the public. Second, the rhetorics of each industry operate as a helix in their competition for ingratiation with the public.

Until bio came into being in the late 1970s/early 1980s, redefinition and re-description for pharma was prompted by the industry's early evolution. The new and young pharmaceutical companies defined themselves as modernists who carefully controlled the chemistry of their medicinal compounds. They were advocates of standardization who employed well-validated scientific processes to manufacture their products. Most important, they produced life-saving therapeutics, such as penicillin and polio vaccine, that achieved near-mythic status. And although the pharmaceutical industry was always designed to be profit-making, its defining narrative for many decades was “deserved wealth.” Many of the early pharmaceutical companies relayed their rags-to-riches tales in which hard work and personal sacrifice was rightly rewarded.

The emergence of the biotechnology industry destabilized the older pharmaceutical industry, forcing it to redefine and re-describe itself in relationship to this new entity. “Biotechnology was a rude shock to big pharma,” George Poste, the former head of research and development for pharmaceutical giant SmithKline Beecham, was quoted as saying (Glaser and Hodgson 240). In the same article, Poste said that action-wise, the pharmaceutical company response was to bring biotechnology in-house, form alliances with biotech companies, or ignore it altogether. From a rhetorical perspective, pharmaceutical companies competed with biotech in the language they used, infusing their texts with words that conveyed vitality and innovation.

For its part, biotechnology, as the second strand of the helix, had to differentiate itself from the pharmaceutical industry. The biotechnology industry’s public rhetoric positioned it as more youthful and risk-tolerant in contrast to pharmaceuticals, but of necessity, several similarities were drawn as well. After all, both industries are rooted in the modern scientific method and both are engaged in the science of health. Both have a professional employee base, a significant investment in research and a necessity for return on investment.

The helix metaphor captures the essence of two industries caught up in a twisting, fraught and complex rhetorical relationship in which many parties play a role. PhRMA (the Pharmaceutical Research and Manufacturers of America) speaks for the pharmaceutical industry, while BIO (the Biotechnology Industry Association) speaks for the biotechnology industry. While these organizations serve as guardian (and frequently author) of their industries' meta-narratives, their roles are increasingly influenced by the cross-population of member companies. Many big pharmaceutical companies (e.g., GlaxoSmithKline, Pfizer) are members of BIO, while some PhRMA members (e.g., Genzyme Corporation, Celgene Corporation) describe themselves as biopharmaceutical companies.

Other players attempt to sway the tenor of the pharma-bio conversation for their own reasons. Media outlets, for example, thrive on the tension of a good story. Consequently, newspaper and magazine articles frequently pit biotechnology against pharmaceuticals as a means of attaining narrative fulfillment. In the financial community, Ernst & Young, a professional services organization, issued its first biotechnology industry annual report in 1986, with the goal of helping to guide "a new industry based on a new technology in a world that is both enthusiastic and apprehensive about what they are doing" (Burrill 1). From the start, the organization asked whether biotechnology would stand alone or "gradually blend in with major pharmaceutical firms" (Burrill 1), a question that lent excitement and drama to the bio/pharma play.

In fact, the biotechnology-pharmaceutical engagement is theater at its best, a real-life drama complete with heroes, villains, scapegoats and a host of other characters. One of the most well known names in the history of pharmaceuticals is Alexander Fleming, who is widely acknowledged for his discovery of penicillin. Fleming was awarded a

Nobel Prize for his discovery, knighted by a king and—half a century after his death—lives on in the popular psyche as a pioneer of health. By contrast, there is Howard Walter Florey, also a Nobel Prize winner for his work in penicillin and also knighted, but whose name lies in relative obscurity.

Why is one name still vital today while the other is dormant? One clue may lie in the rhetoric that surrounds scientific endeavors. Fleming was associated most closely with biology and the concept of discovery through divine Providence. The Fleming story that is most popularly told in literature and in the press notes how the young Scottish researcher saw that *Penicillium* mold spores had fortuitously drifted through an open laboratory window, settled onto a plate of bacteria and killed them. Florey, on the other hand, represented bio*chemistry*, and together with Ernst Chain worked with the government and major pharmaceutical companies to mass produce penicillin antibiotics. Thus, the drama of the penicillin story was marked by a showdown between biology versus chemistry; the single, heroic individual versus an anonymous team of big pharmaceutical scientists; and nature versus invention. Yet while one side of the story resonated with the public, the other did not.

It is possible, and worthwhile, to analyze the intricacies of the penicillin story—and the larger bio-pharma play as well—through the framework of Burkean dramatism and specifically Burke's pentad of key analytical terms. Kenneth Burke saw language as more than a mere conduit for information; language, in his view, *performs*. As Burkean scholar David Blakesley elucidates, "Words act . . . to define, persuade, appease, divide, identify, entertain, victimize, move, inspire, and so on" (5).

Dramatism, for Burke, was a way of understanding the human motives behind the words, with his overarching question as follows: "What is involved when we say what people are doing and why they are doing it?" (GOM xv).

If we lived in a world with no ambiguity, then nothing would exist between the extremes of black and white, good and bad, small and large, or old and new. What people are doing would be obvious, and why they are doing it would be equally obvious. However, we do not live in such a world, and people's motivations for what they do are often hazy. And, more to the point of Burke's question, how we see other people and how we interpret their actions are also fraught with complexity. When we tell the story of Alexander Fleming and, in the doing, ignore or downplay the story of Howard Florey or Ernst Chain, what exactly is involved? Are we trying to persuade people that biology is more valuable than chemistry? Do we feel that a lone hero is more inspirational than a large team? Or is Fleming's story just simpler to tell, or perhaps more entertaining?

Similarly, Francis Crick and James Watson were widely celebrated for unlocking the "secret code" of the double helix and DNA, while Rosalind Franklin—who did much of the groundbreaking work—went largely unacknowledged. Was the suppression of her name (and failure to award her a Nobel Prize) a plot against uppity female scientists? An oversight? A reflection of the times?

And, in the biotech world, what of the well-publicized feud between Francis Collins, head of the government-funded Human Genome Project (HGP), and Craig Venter, founder of a privately funded venture? Both men were committed to identifying all of the genes in human DNA, but one felt that the ensuing knowledge should belong to the public, while the other felt that such knowledge should be the property of its discoverer. How were these men characterized in the popular press, and how does it speak to our values?

Rather than trying to corral the complexity of human motivation, Burke suggests five key terms to set it free. Burke's pentad of terms—act, scene, agent, agency, and purpose—are designed to reveal ambiguity, to unfold the myriad possibilities of how we use language and how we are used by it. According to Burke, these terms can then be examined at length:

> We want to inquire into the purely internal relationships which the five terms bear to one another, considering their possibilities of transformation, their range of permutations and combinations—and then to see how these various resources figure in actual statements about human motives. (GOM xviii)

The concept of transformation is integral to the study at hand. If the pharmaceutical industry has been transformed from hero to villain, then how has language been complicit in this change? If the biotech industry is perceived as an agent of transformation for languid towns, how does language factor in?

I suggest that it is critical to look at rhetorical transformation at each stage of the bio-pharma helix, using Burke as the primary guide and Lakoff and Turner as well as Berthoff as important sources of illumination.

I begin, in Chapter II, by using a provocative statement made by the president of the animal rights group People for the Ethical Treatment of Animals (PETA) to compare the dramatistic approach to the nature of language, which sees language as act, with the scientistic approach, which sees language as definition. Although the two approaches, in

Burke's words, "are by no means mutually exclusive" (LSA 44), they are very different in how they direct one's attention. Whereas the scientistic approach derives its power through a process of naming and definition, the dramatistic view of language openly acknowledges the "suasive nature" of all terminology (LSA 45). Definitions are not neutral, Burke says, even though the definition-makers would have you think they are. He states that "to *define*, or *determine* a thing, is to mark its boundaries," a task he says is "beset by *inevitable* paradox" (GOM 24).

In Chapter III, I proceed to outline the paradoxical attempts at definition that have been made for biotechnology and pharmaceuticals. As one might expect for an emerging industry, definitions for biotechnology are widely varied, depending upon the source and the timeline in which they were developed. There is even a question as to whether biotechnology is an industry at all, as opposed to an application, a trade, an endeavor, or a subset or enabler of other scientific disciplines. This ambiguity is reflected in the government classification systems of SICS and NAICS, which are discussed.

Unlike the term biotechnology, the term pharmaceuticals is rarely defined in general publications, presumably since the industry is now mature. This doesn't mean, however, that everyone necessarily sees pharmaceuticals the same way. As one industry professional writes:

> The well-known Indian fable of six blind men and the elephant reminds one of the way various groups tend to view the industry. In this fable six blind men are asked to describe an elephant to a maharaja who has never seen one. Each feels a different part of the elephant (i.e., tusk, trunk, ear, body, tail or leg) and provides a totally different description of what the elephant looks like. (Spilker 9)

Defining pharma by the products it makes, its research methods, or the manner in which it manufactures its products, necessarily positions it in contrast with bio. Whether that position can be considered more or less favorable is the uncertain issue. When the early pharmaceutical companies defined themselves through chemistry, it was a positive rhetorical move since chemistry bespoke modernity and scientific process. However, definition—with its scientistic is/is not structure—is limiting. When chemistry became viewed more skeptically, the pharmaceutical industry could not disengage itself from this field through redefinition. It had to rely on more subtle and textured nuance through description.

In Chapters IV and V, I move to the process by which the pharmaceutical and biotech industries are described. Burke, of course, would argue that definition and description are both suasive, and I agree. However, unlike definition, description seems to have more overt acknowledgement of its subjective tendencies. A man may be a bipedal primate mammal by definition, but courageous and strong by description. When the bodybuilder Charles Atlas promised to make "a new man" out of a 90-pound weakling, he fed the description of man as big, strong, and unafraid—traits that have ingrained themselves into the collective consciousness and emerged, time after time, in popular media. The paradox here is that given enough repetition, such traits begin to feel and act definitive.

The pharmaceutical industry was able to free itself from rigid definition by ascribing certain traits and attributes to itself that could be changed over time. By playing with language, pharmaceutical companies—and later, biotech companies—could better demonstrate the alignment of their interests with that of the public. In this manner, description allowed for deeper transformative potential than was possible through mere definition.

Burke's dramatistic pentad is a useful tool to demonstrate the permutations of how we *could* talk about any given subject and to compare these hypothetical interpretations with the historic rhetorical record. Is penicillin, for example, a "wonder drug" or is it an impotent antibiotic that is ineffective in the war against germ terrorism? Playing with language pushes and pulls our attitudes, and makes us more or less susceptible to ingratiation.

In biotechnology narratives, the DNA double helix came to represent not only scientific innovation, but life itself. Penicillin was one single drug that sprang from mold spores; it originated from nature "outside the window." DNA, on the other hand, was not external nature, but was the nature inside each of us. DNA presented the potential to open up an entire array of new therapies, using the so-called secrets that lay within our own bodies. That which is secret, however, can also be frightening. The alternative narrative to the promise of DNA was the threat of DNA and the specter of biology gone amok as a result of the sheer hubris of reckless scientists. In the push-pull of biotech dramatism, Watson and Crick could be seen as pioneers and advancers of human knowledge or irresponsible self-aggrandizers. The work of George Lakoff (alone, and in collaboration with Mark Turner and Mark Johnson) is helpful for understanding the helix as a metaphor, and its place as a rhetorical tool for the biotechnology industry.

In Chapter VI, I explore the efforts taken in North Carolina to establish a rhetorical climate that is receptive to biotechnology, using Berthoff to illuminate how meaning is constructed within local communities. Winston-Salem in North Carolina's Piedmont Triad region and Research Triangle Park in Raleigh-Durham are examples of areas that have expended significant money and effort to attract and develop biotechnology companies because they believe the communities' values are consubstantial with that of biotech. In 1982, the North Carolina Biotechnology Center, which was sponsored by the state, became the world's first targeted initiative to bring biotechnology to a local community. In the eyes of many in the state, biotechnology stands for newness, vitality, and innovation. The themes of biotechnology promise and potential underlie much of the language in economic development literature. In Winston-Salem, the biopharmaceutical company, Targacept, illustrates the transformative potential of biotechnology to change a city's entire economic base—in this case, from tobacco to knowledge, science, and health.

In Chapter VII, I conclude by exploring where the bio-pharma rhetorical matrix is headed next. One hundred years after the emergence of the modern pharmaceutical industry, pharmaceutical-biotechnology rhetoric is still rhetoric in flux, with many different players attempting to sway the tenor of the conversation. The story continues to be constructed within a complex and volatile cultural environment of shifting modernism and postmodernism that is influenced by the government, economic development agencies, the media, the investment community, academia and the public at large. While some tout the new biopharmaceutical industry as the direction for the future, others protest such exuberance as errors of enthusiasm.

Keeping this drama going—keeping in motion the rhetorical helix that winds both toward and away from each other—is just how Burke would have it. As Burke expresses the phenomenon,

> Put identification and division ambiguously together, so that you cannot know for certain just where one ends and the other begins, and you have the characteristic invitation to rhetoric. (ROM 549)

CHAPTER II

"A RAT… IS A BOY": UNDERSTANDING BURKE'S SCIENTISTIC AND DRAMATISTIC APPROACHES THROUGH PETA

As outlined in the introduction, the rhetorical helix operates in two ways: first, as interplay between definition and description, and second, as an interactive competition between the pharmaceutical and biotechnology industries. This chapter considers the first sense of the helix by exploring Kenneth Burke's notion of scientistic and dramatistic approaches to the nature of language. At the heart of this discussion is an examination of language that presents itself as solid and unchanging, language that presents itself as fluid and malleable, and the relationship between the two. It is an important helix, this definition/description swirl, because it traverses between the liberating concepts of possibility and change, and the confining concepts of standardization and stasis.

In his 1998 testimony to the Grand Jury about his relationship with Monica Lewinsky, President Bill Clinton infamously rebutted a lawyer's challenge to his testimony by saying, "It depends on what the meaning of the word "is" is. If . . . "is" means is and never has been that is not—that is one thing. If it means there is none, that was a completely true statement" ("Clinton's Grand Jury Testimony").

Clintonian onomastics aside, <u>is</u> is the foundation of definition, a word that aids and abets the philosophy of Modernism with its idea that objective truth exists. <u>Is</u> is complicit with the epistemological philosophy of Descartes, whose famous utterance— "I think, therefore I am"—privileged the human individual and his ability to gain knowledge through Empiricism and the scientific method.

Burke hones in on is by equating it with what he calls the scientistic approach to language which, he says, "begins with questions of naming or definition" (LSA 44). Burke contrasts this with the dramatistic approach, which stresses language as an aspect of symbolic action:

> The "scientistic" approach builds the edifice of language with primary stress upon a proposition such as "It *is*, or it *is not*." The "dramatistic" approach puts the primary stress upon such hortatory expressions as "thou *shalt*, or thou *shalt not*." (LSA 44)

While the scientistic approach supports the notion of logic, the dramatistic culminates more in "the kinds of speculation that find their handiest material in stories, plays, poems, the rhetoric of oratory and advertising, mythologies, theologies, and philosophies after the classic model" (LSA 45).

Traditional dictionaries and encyclopedias take a scientistic approach, seeking to embed definitions in concrete and set them permanently. We are persuaded to believe that a dog is "a highly variable domestic mammal (Canis familiaris) closely related to the common wolf (Canis lupis)" ("Dog" 341) because of the authority of Merriam-Webster. A dog is like a wolf, Merriam-Webster says; thus, a dog is not like a rat.

Although Burke equates the scientistic approach with language as definition and the dramatistic approach with language as act, he does not see them as mutually exclusive since "definition itself is a symbolic act" (LSA 44). For a startling example of the intersection of language-as-definition and language-as-act, one need look no further than to Ingrid Newkirk, president and founder of PETA (People for the Ethical Treatment of Animals) who, in the mid-1980s, said the following:

> A rat is a pig is a dog is a boy. (Barnes 542)

Considered separately, they are just eleven simple words—four nouns, three verbs, and three indefinite articles. Considered collectively, they have the power to define, inspire, incite, attack, and defend. In sum, this small phrase is a perfect example of how words act.

PETA, which calls itself "the largest animal rights organization in the world" ("PETA's Mission Statement"), says that it "operates under the simple principle that animals are not ours to eat, wear, experiment on, or use for entertainment" ("PETA's History"). A major area of concern for the group is the use of animals in scientific laboratories, which places Newkirk and PETA squarely at odds with many in the biotech and pharmaceutical industries.

Since the 1980s, Newkirk's original eleven words have surfaced and resurfaced on web sites; in books, magazines, letters, and pamphlets; and on television, radio, and other media. And unlike conventional theater, the "rat is . . . a boy" drama has enfolded multi-dimensionally over the past three decades—with many stages, actors, audiences, and scripts.

For purposes of studying the biotechnology/pharmaceutical rhetorical matrix, the PETA controversy is helpful on a number of levels. Not only can it help to elucidate Burke's descriptions of scientistic and dramatistic approaches to language, but it can be used as an example to show how motives can be queried in dramatistic fashion. It is also a particularly useful jumping-off point for understanding the rhetoric of definition and its relationship to description and ingratiation.

At its most basic level, a rat is a pig is a dog is a boy is definitional. Just like the editors at Merriam-Webster, Newkirk is attempting to establish a logic of categories and relationships. Human beings need to sort things out for reasons both practical and esoteric. People name things. They group things they think are similar; they compare and contrast those things they think are different. These activities are an attempt to understand the world and to organize disparate bits of information into a coherent whole.

However, definitions are never neutral. They are symbolic, political, and powerful. To Burke, it doesn't matter if it is Merriam-Webster that is doing the defining or People for the Ethical Treatment of Animals:

> Even if any given terminology is a reflection of reality, by its very nature as a terminology it must be a selection of reality; and to this extent it must function also as a deflection of reality. . . . Any nomenclature necessarily directs the attention into some channels rather than others. (LSA 45)

Thus, when Newkirk states that "a rat is a pig is a dog is a boy," her words are not mere definition, but definition-turned-philosophy, with attendant legal, moral, and ethical considerations. The same can be argued for Merriam-Webster, Aristotelian, Darwinian, and other hierarchical definitions as they, too, are neither simple nor straightforward. As Bowker and Star write, categorization always "valorizes some point of view and silences another"—an activity they call an "ethical choice" and therefore inherently dangerous (5-6). They describe how such choices are not always obvious:

> (C)lassification systems are often sites of political and social struggles . . . Politically and socially charged agendas are often first presented as purely technical and they are difficult even to see. As layers of classification system become enfolded into a working infrastructure, the original political intervention becomes more and more firmly entrenched. In many cases, this leads to a naturalization of the political category, through a process of convergence. It becomes taken for granted. (196)

Race classification under apartheid is a particularly vicious example of a political classification system, as Bowker and Star assert. The same can be said of the Nazi treatment of Jews in World War II, or the so-called ethnic cleansing in the former Yugoslavia.

Another attribution of the "rat is . . . a boy" statement to Newkirk was in the August 1986 issue of <u>The Washingtonian</u> magazine. In an article entitled, "Who Will Live, Who Will Die?" freelance writer Katie McCabe interviewed people on both sides of the animal rights issue. McCabe was granted a personal interview with Newkirk, and quotes Newkirk as follows: "Animal liberationists do not separate out the human animal," she [Newkirk] begins, "so there is no rational basis for saying that a human being has special rights. A rat is a pig is a dog is a boy. They're all mammals" (115). This ethic, Newkirk explains,

> shakes the whole grubby system of biomedical research, because if you jeopardize an animal one iota in something that doesn't benefit it, you're doing something immoral. Even painless research is fascism, supremacism, because the act of confinement is traumatizing in itself. (115)

Thus in this interview, Newkirk set out some of her emerging thoughts about animal rights: (a) humans are not special; (b) humans are mammals, just as rats, pigs, and dogs are mammals; (c) research is fascism; and (d) research is supremacism. As the definition-maker, Newkirk is defining what is, and what is not.

Such a scientistic approach to language conveys an attitude that the definition-maker has established the truth. As such, it ends a conversation. One needs look at only a small cross-section of incidents in the past 20 years to observe this distinct pattern in the "rat . . . is a boy" body of rhetoric. When a scientistic-style definition was presented (e.g., animal research is fascism), it would then be rejected by the opposing side of the philosophical argument (e.g., animal research is not fascism; animal rights activists are terrorists). The opposing side would then present an alternate scientistic-style definition, as, for example, when Joseph E. Murray said, "Scientists agree that whenever a cure for AIDS is found, it will be through animal research" (5). Such a statement would then be rejected by the first group, and so on. Each side would be loath to allow a rigid definition at odds with their belief system. In this "is so! —is not!" pattern, scientistic-style discourse created an impasse each time it was attempted.

Even if the very obvious is being defined (e.g., "A rat has four legs and a tail"), the "truth" may not necessarily be conveyed. What about a three-legged rat—is it no longer a rat? Definition is in the eye of the beholder, and not necessarily in the eye of the beheld, a situation that feels undemocratic. If scientistic language is trying to convey truth, then truth should belong to everyone. Some dictionaries have recognized this, and are attempting to level the playing field. The online encyclopedia Wikipedia, for example, allows entries to be modified by anyone, under openly collaborative rules.

Burke states that "to define, or determine a thing, is to mark its boundaries" (GOM 24). As such, it is an activity that favors the definer, and puts all others at a strategic disadvantage. It is no wonder, therefore, that so many people have reacted passionately—that is to say, both positively and negatively—to the definitional phrase that converges rat with pig with dog with boy. For this reason, it is possible to find Newkirk's same eleven words on web sites that celebrate her and on web sites that demonize her. An Internet and media search of "a rat is a pig is a dog is a boy" reveals that the phrase has been appropriated by myriad individuals and organizations, many of whom have widely conflicting philosophies.

For example, one self-professed "rookie animal activist" contributed Newkirk's phrase to an online animal rights forum that was seeking inspirational quotes that support their mission to "preserve, promote and advance animal life" (Bozanich). Newkirk's phrase stands alongside quotes from Charles Darwin, Abraham Lincoln, Mohandas Gandhi, John Stuart Mill, and Leonardo da Vinci, among other notable thinkers.

On the opposite side of the coin is Furs.com, an online magazine providing facts about leather and fur to the industry and consumers at large. On its frequently asked questions page, the organization offers Newkirk's "a rat . . . is a boy" quote—plus those of several other activists—as examples of the "often hidden agenda" of the animal rights movement. They call animal rights activists "fanatics" and state that the imposition of activists' views on others is "fascism." It is a definitional tactic, and a reverse mirror image to Newkirk's statements about scientific fascism.

The fact that there are people on both sides of this philosophical fence who are using the same words speaks to what Burke calls "inevitable paradox" of definitions, and the "unresolvable ambiguity" that resides in the vocabulary and the context of any given statement (GOM 24). Yet instead of feeling anxious about the uncertainty of language or its context, we should embrace its complexity and excitement in what Burke calls "the possibilities of linguistic transformation" or dialectics (GOM 402).

Burke has several definitions for dialectic, which he describes variously as "reasoning from opinion; the discovery of truth by the give and take of converse and redefinition; the art of disputation; the processes of 'interaction' between the verbal and the non-verbal; the competition of cooperation or the cooperation of competition; the spinning of terms out of terms" and more (GOM 403). All of this is certainly occurring in the "rat is a pig is a dog is a boy" social drama, which is fueled by what Burke calls the four basic motives that "are likely to figure in all human association": guilt, redemption, hierarchy, and victimage (P&C 274).

To see these motives more clearly, it is useful to employ the dramatistic approach to language. Whereas the scientistic approach is static and affixed to the notion of <u>is</u> versus <u>is not</u>, the dramatistic approach is local and shifting, allowing for plurality, flux, and change. The dramatistic realm celebrates uncertainty by treating language as a living, breathing, always-changing performance.

Every drama of course has its actors, and the "rat is . . . a boy" drama has an enormous cast of characters. There are those who fervently believe in animal rights, a philosophy that carries the notion of animal liberty to an extent that far surpasses simple animal welfare. There are the scientists who use animals to determine the safety of drugs in development, and there are some extreme animal liberationists who bomb the homes of pharmaceutical workers. There are pet owners, puppy mill proprietors, vegetarians, meat eaters, hunters, people awaiting transplants, ethicists, and more. Each one has an opinion that is based on their particular selection of reality.

These actors, whom Burke calls agents, are but one element of the dramatistic pentad. What the agents do is the act, where they do it is the scene, how they do it is the agency, and purpose is why they do it. The animal rights drama plays out in myriad ways, in infinite combinations and interpretations of agent-act-scene-agency-purpose. Here is one example:

Scene:	Norway, 1994 Winter Olympics
Agents:	Five beautiful female supermodels
Act:	Proclaiming that "I'd rather go naked than wear fur"
Agency:	Posters affixed to the sides of buses throughout the Olympic Village
Purpose:	To protest the killing of animals to make fur coats

What makes the dramatistic approach different to that of the scientistic approach is that dramatism has the ability to manipulate the terms, and to keep the play in action. If any element of the pentad is changed, the drama changes with it. Would a naked-model protest be as effective at a summer Olympics, when temperatures are sweltering and wearing fur would be out of the question? What if ugly people were substituted on the posters? Some viewing the posters might respond by insisting the unattractive models wear more fur! Or what if male supermodels were employed—would that change the tenor of drama? In fact, the whole idea of women baring themselves for this campaign struck a sour note with some feminists.

Some on the animal rights side of the equation complain that Newkirk's quote has been misused. In a series of frequently asked animal rights questions, animal rights advocate Donald Graft writes that the notion that "a rat is a pig is a dog is a boy" is "absurd" when "taken alone and literally." He adds that the quote "has been shamelessly removed from its original context and misrepresented" by animal rights opponents. Graft says that the original context of the quote is: "When it comes to having a central nervous system, and the ability to feel pain, hunger, and thirst, a rat is a pig is a dog is a boy." In this context, Graft says, "the quote is neither remarkable nor absurd."

What Graft appears to be doing is attempting to re-solidify the scientistic aspects of Newkirk's quote. That is, he is reasserting the it is definition, adding a specific qualifier. The problem is, under the scientistic approach, "a definition should have just enough clauses, and no more" with the aim being "to get as essential a set of clauses as possible, and to meditate on each of them" (LSA 3). The more qualifiers that are added, the more potential for language to jump from a rigid scientistic mode to a more open dramatistic mode. Such a jump occurred in 2001, when Newkirk restated her original quote. Writing in Commentary magazine, she said,

> While physiologically we are different from rats (they are used in research because they are small and cheap), when it comes to feelings like hunger, pain, and thirst, a rat is a dog is a pig is a boy. That is a biological fact, not a matter of opinion. (4)

Although Newkirk employed the phrase “biological fact” to establish fixity, the new definitional qualifier (i.e., the physiological difference between people and rats) opened the window to new interpretation. The irony in this statement is that shortly after Newkirk admitted a physiological difference between man and rat, the biotech research community provided evidence of the similarity between man and mouse. In 2002, Celera Genomics compared the mouse genome with human and found that “human and mouse genomes are remarkably similar not only in the structure of their chromosomes but also at the level of DNA sequence” (Winstead). In terms of genome sequences, then, we could say that a mouse is *almost* a boy.

The process of definition is scientistic, but the process of interpretation is dramatistic. “A rat . . . is a boy” can be an argument for the animal rights position that scientists should not consider doing research on a rat (or a mouse) any more than they would on their own child. The dramatistic, or shifting play of motivation is to say that since a mouse (or a rat) is nearly a boy, then it is an excellent and useful model for understanding the fundamentals of human health and disease and should be used in the laboratory.

Thus, when we move from the strictly rigid and scientistic <u>is</u> to the more flexible and dramatistic <u>should</u> or <u>could</u>, we open the door to the transformative process. By forcing a change in the dramatistic pentad (e.g., shifting the scene, characters, or action) we can see events in a different light.

A Rat is (or is not) a Boy; Pharma is (or is not) Biotech

The “rat . . . is a boy” drama provides one small example of the rhetorical tension between two politically differentiated groups (animal rightists and animal researchers, for instance, or animal rightists and fur wearers). In the case of PETA, scientistic-style language appeared necessary for initial self-discovery and self-understanding: we are this; we are not that.

We can learn several things from PETA, the first of which is that newness prompts definition. Defining a new concept, new organization, or new industry is essentially to mark one’s territory. When PETA was formed in 1980 by Newkirk and fellow activist Alex Pacheco, one of the first orders of business was to define the organization and its philosophy of animal rights, which, for most Americans, was a completely unknown concept.

Like animal rights, biotechnology too was largely unknown in the 1980s and several groups of people were very much concerned with defining this new field. Scientists, journalists, entrepreneurs, investors and others all had reasons for wanting to distinguish biotech from other scientific endeavors and particularly to distinguish it from pharmaceuticals.

Even pharmaceuticals were “new” at one time and, as such, in need of definition. Although it can be argued that elements of the pharmaceutical industry existed for thousands of years, the modern industry did not come into existence until the late 1800s and early 1900s. The concept of pharmaceuticals as a homogeneous collective (as opposed to stand-alone apothecary shops) was a new idea that emerged from a commonality of needs and interests at the turn of the twentieth century. The new pharmaceutical industry thus began to define not only itself but the space it occupied.

Their self-definitional language acted in much the same way as a physical wall. When biotechnology—a new concept—began to emerge, its very existence destabilized the pharmaceutical industry because elements of biotech intersected, but did not completely overlap, the self-defined is and is not territory of pharmaceuticals.

Second, the debate on animal rights exemplifies how any given group considers itself and others through the use of language. Is Newkirk a terrorist? A humanitarian? A kook? Are research scientists fascists? Heroes? Hypocrites?

We could call Newkirk, as agent, a freedom fighter for animals who would be cruelly subjected to pharmaceutical testing. Alternatively, we could call her an obstructer to the creation of important, life-saving drugs. Perhaps we could say that Newkirk is a challenger to traditional and outmoded methods of drug testing—or, alternatively, a challenger to legally prescribed, dependable and time-proven methods of drug testing. In other words, querying just one aspect of the dramatistic pentad (i.e., agent) reveals the complexity in language.

Just as Benedict Anderson wrote of nation-building in terms of imagined communities, so too does the imagination prevail in the building of industries and organizations. The language that a group uses to self-define not only paints the characteristics of us but also them. If we, as animal rights advocates, are liberators, then they, as animal researchers, are jailers. Or if we, as animal researchers, are pioneers for new medicines, then they, as animal rights advocates are impediments to the progress of human health. In a similar vein, if an industry such as pharmaceuticals sees itself as a producer of tangible products, then those who deal merely in ideas (as some have accused the biotech industry) will not be us, but them.

Yet another lesson is to be found in the inadequacy of definitional language in the face of change. As new groups emerge, they find their collective voice and then attempt to solidify their version of reality through self-definition. But as is clear from the is—is not impasse, rigid definitional language is not adequate to respond to ever-emerging new circumstances. The animal rights debate, for example, is but one of hundreds of legal and ethical issues faced by drug researchers and manufacturers. Drug pricing, pharmaceutical advertising and promotion, and relationships between doctors and pharmaceutical manufacturers are just some of the issues in the traditional pharmaceutical arena. In the biotech arena, the list gets even longer, with questions about human cloning, eugenics, stem cell research, gene patenting, and so on. All of these issues, with their various opponents and proponents, acts of protest and defense, and multiple locations and chronologies, serve to perpetuate the rhetorical helix.

A final area for consideration is understanding the pattern of "language that acts" and action itself, and the underlying motivation for both. Dramatistic inquiry is useful not only for contemporary understanding of motivation (e.g., Why is PETA publishing this particular advertisement in this particular venue this particular week?) but also for gaining a perspective of motives over time.

As an example, in 2003 PETA launched an ad campaign entitled, "The Holocaust on Your Plate," which equated the murder of six million Jews during World War II to the killing of animals in factory farms and slaughterhouses via a series of side-by-side photographs. One ad juxtaposed a photo of Jewish children behind bars in a concentration camp with a photo of pigs behind the bars of a cage. Another showed fully nude, emaciated Jewish men juxtaposed with an emaciated cow.

Immediately after the ads started appearing, a flurry of letters, ads, and web postings then started to appear, vigorously protesting the use of Holocaust imagery for PETA's animal rights purposes. In a press release, the Anti-Defamation League (ADL) protested the project for trivializing a human tragedy. Abraham H. Foxman, ADL National Director and a Holocaust survivor, called the campaign "outrageous" and "offensive," and wrote:

> Abusive treatment of animals should be opposed, but cannot and must not be compared to the Holocaust. The uniqueness of human life is the moral underpinning for those who resisted the hatred of Nazis and others ready to commit genocide even today" ("ADL Denounces PETA").

Then, on May 5, 2005, Ingrid Newkirk sent an email letter to the Jewish community ("Apology for a Tasteless Comparison") in which she said she realized that the campaign had caused pain. She wrote, "This was never our intention, and we are deeply sorry." (For full letter, see Appendix A).

Why did Newkirk issue the apology? Did the scene (thousands of people offended to various degrees) influence the agent? Did the act (drawing attention to animal rights) not justify the agency (use of Holocaust imagery)? Could it be that one type of agency (visual rhetoric) was more powerful—and more dangerous—than another (verbal rhetoric)? Since PETA had engaged in visual rhetoric for years, broadcasting undercover video of animals being bruised and bloodied, was the Holocaust metaphor, ultimately more horrific than the plight of penned-up, eaten or experimented-on animals? And if so, does the privileging of human over animal in this particular instance mean that PETA's philosophy is bending toward a middle ground?

The point is, by examining the facets of the dramatistic pentad, it is possible to generate several different motives for Newkirk's words (or act) of apology. This is significant because it shifts power from the agents on the inside (in this case, Newkirk and PETA) to those on the outside who are observing the action. Through their interpretation of the pentadic elements, the observers could ascribe motives to PETA that are sympathetic (e.g., "Look at Newkirk's words—PETA must care about people as much as animals"), skeptical (e.g., "Why did Newkirk wait two years to issue the apology? It must be that the publicity was dying down"), or hostile (e.g., "Newkirk's rhetoric is a non-apology; it's a half-hearted mea culpa that doesn't begin to make up for the egregiousness of PETA's attack"). In this manner, it is possible to assign motives in ways that can bring others closer (at least in the interpreter's view) or push them further away.

Dramatism helps us understand the past and why people may have said or done what they did. It also helps us understand what is transpiring in the present. As far as the future is concerned, Burke sees two possible culminations of the action: either dramatistic conflict, which begets victimage and ends in tragedy, or a Platonic dialectic, which "states the *problem* in the accents of an *ideal solution*" (LSA 54-55). One can see potential for either of these in the "rat . . . is a boy" drama.

In the victimage and tragedy scenario, many have pointed an accusatory finger at PETA not only for scripting words that act to incite fear and violence, but also for being complicit with actual violence. PETA would counter that the tragedy in question is a system that allows animals to be made into victims.

The problem with the "ideal solution" scenario is that ideal is in the eye of the beholder. Most biomedical research organizations and laboratories have adopted the solution consisting of the three R's as pioneered by Russell and Burch in 1959 and consisting of the reduction of the number of animals used, refinement of procedures to minimize pain, and replacement of animals with non-animal models when these are available. Some animal rights activists believe that this is not acceptable, and the only "ideal" solution is to completely ban the use of animals in scientific testing. In 1989, Newkirk was quoted as saying, "Even if animal research resulted in a cure for AIDS, we'd be against it" (Barnes 542). In 1992, animal activist Dr. Michael W. Fox wrote how his personal perspective changed from once accepting animal research to denouncing it:

> As a former animal researcher myself, I am no stranger to the altruistic rationalizations of the vivisector. One is that "the suffering of the few for the benefit of the many is justifiable." I now call this biological fascism. The only animal model for human disease is man himself. Vivisection is a disease in itself that no amount of animal research and suffering and killing will ever cure. (93)

In 2002, Roberta Kalechofsky, a feminist and animal rights activist, used even stronger language to denounce the use of animals in research:

> As for animal research, I believe it is satanic. I realize that sounds melodramatic, but I don't use that word lightly. Some things like concentration camps and modern warfare are satanic. Laboratories are places that are as fiendish as

> slaughterhouses. What makes the problem worse in the case of animal research is that the people involved are presumably intellectuals—intellectuals without moral concern or moral awareness. (Kistler 161)

In spring 2007, a group calling itself SAEN (Stop Animal Exploitation Now) called for a national week of protests and media events to halt testing and research on animals. The group writes, "In our brief history SAEN has made a concrete difference for the animals, and we will continue to fight for their freedom until all the laboratory cages are empty."

Modern political scenarios have always viewed an impasse—the inability to reach compromise—as a failure. If language is symbolic action, then rigidly definitional language is the curtain that falls to the stage and signals the end of the play. Self-definitional language appears particularly unambiguous and, thus, impenetrable: "I am what I am, and that is that" and by extension, "you are either with us or against us." There is no possibility of transformation.

By contrast, the language of the biotechnology and pharmaceutical industries has been anything but static. Each industry has posited definitions and descriptions that, over time, have shifted subtly as the result of ongoing interaction and questioning. In fact, such interaction within this rhetorical helix has led to the point at which at least one new term—biopharmaceutical—gives the effect of melding the two separate entities into one. There is logic in this since both industries have foundations built on the modern scientific method and share a mission to develop new drugs for humans and animals.

But even as some language seeks to push biotechnology and pharmaceuticals together, other language seeks to pull them apart. Distinguishing factors between the two groups have included size (small biotechs versus big pharma), relative age, method of drug development (biology-based versus chemistry-based) and production capabilities, and characterization of the employee base (innovative and risk-taking versus traditional and risk-averse).

What is of interest in the next few chapters is to understand how definition has shaped description (self- and otherwise) of the biotechnology and pharmaceutical industries and has fed into the public's perception of the two entities.

CHAPTER III

DEFINITIONAL LANGUAGE OF THE BIOTECHNOLOGY AND PHARMACEUTICAL INDUSTRIES

The very title of this chapter is an example of what Burke would call a terministic screen—that is, a language filter that "necessarily directs the attention into some channels rather than others" (LSA 45) or guides people toward "certain perspectives while eliminating others" (Blakesley 200). When Newkirk stated that "a rat is a pig is a dog is a boy," she was positioning all four beings as equal by definition. In a similar vein, the title of this chapter positions both biotechnology and pharmaceutical entities as industries, thus giving each of them a status worthy of comparison to one another.

In one respect, this rhetorical move is meant to solve the age-old problem of comparing apples to oranges. For starters, biotechnology is a noun, whereas pharmaceutical is largely an adjective. Shifting the two terms to biotech and pharma, as seen in the first two chapters, gives both noun status, but is colloquial and perhaps inappropriate as a starting point for a chapter on definition. Changing the terms to biotechnology, a noun, and pharmaceuticals, also a noun, is problematic since technology connotes processes, methods or knowledge, while pharmaceuticals connotes medicinal drugs.

These difficulties are not trivial. Limitations of language can restrict our thoughts and direct us down rigid and perhaps misleading rhetorical paths.

The linguistic challenges noted above were certainly faced by those who attempted to define the emerging field (or area or concept or industry) of biotechnology and position it in context with the older field (or area or concept or industry) of pharmaceuticals.

Chapter II explored, in general, how a rhetorical helix of definition and description operates by using examples from PETA. The goal of this chapter is to unfold, using a dramatistic lens, many of the existing definitions for biotech and pharma in order to better understand the motivations of the definition-makers—as well as the consequences of their definitions.

For example,

- Agents: Who is defining the biotechnology and pharmaceutical industries?
- Agency: How are they doing so?
- Scene: How do definitions in one era differ from another (e.g., the 1980s versus the early 21st century)?
- Act: What does it mean to call biotechnology an industry – or not call it an industry?
- Purpose: If terms or definitions are being manipulated, then why?

In true Burkean fashion, the objective here is not to find the "answers," but to explore an intriguing rhetorical relationship between two similar-yet-different entities. In so doing, we can discover more about ourselves—the concepts we are attracted to and therefore embrace, the values we express through our language, and the power we derive through rhetorical transformation.

Again, if we envision a helix as a twisted ladder, then the two rungs that appear to twist around each other can be thought of as definition and description. Definition is a critical element of the rhetoric helix because the way something is described feeds into society's perception of it. For biotechnology and pharmaceuticals, definitions serve to differentiate business and the science of one industry from that of the other. "Official" definitions are deemed to be those emanating from a recognized authority (e.g., government reports), while "unofficial" definitions are those found in popular journals and websites. Since unofficial definitions are more readily available to the general public, they may have the greater ability to influence attitude. In any case, definition sets the stage for the establishment of ingratiation with the public at large.

In this chapter, I will begin by focusing on one aspect of definition: classification, or the means by which biotechnology and pharmaceuticals are assorted. In the1930s, the U.S. government developed the SIC (standard industrial classification system) to group businesses. In the 1990s, this system was revised using the North American Classification System (NAICS). Both sets of classifications—SIC and NAICS—would attempt to create a scientistic bedrock in which to embed the relative positions of biotechnology and pharmaceuticals, among other businesses. In so doing, SIC and NAICS established precedents that would later resonate throughout biotechnology and pharmaceutical descriptions.

Classifying Pharmaceuticals and Biotechnology as Industries

In Categoriae, Aristotle delineates ten broad categories that can be used to distinguish one thing from another. Socrates and Plato are examples of different substances; pale and square represent different qualities; and two cubits and three cubits are different quantities. According to Aristotle, things can also be differentiated in terms of relationship (e.g., larger vs. smaller), place, time, position, physical accoutrements, the actions one takes, and the effects of the actions one receives.

Aristotle's work is an attempt to understand the world and to organize disparate bits of information into a coherent whole. Similar endeavors emerged thousands of years before Aristotle's sophisticated environment of 350 B.C. Athens, and continue today. Prehistoric people could distinguish between plants that harm and plants that heal. Modern man can distinguish between plants that exhibit central nervous system cholinergic receptor binding activity and those that do not.

In the U. S., examples of classification and hierarchy can be found to an exhaustive degree not only in the structure of the country's governmental department and agencies (the Louisiana State University library has compiled an excellent hierarchical directory) but also their output.

According to the U. S. Department of Labor Bureau of Labor Statistics, an industry "consists of a group of establishments primarily engaged in producing or handling the same product or group of products or in rendering the same services" ("North American Industry Classification System").

The Federal government classifies industries for purposes of economic analysis. Grouping similar companies into industries can facilitate data retrieval and manipulation. For Standard & Poor's, developer of financial market indices such as the S&P 500, an industry is "a group of firms that share some type of economic relatedness," including "similar production methods, similar products, similar services rendered, similar inputs/raw materials, similar customers and similar stock performance" (Reingold 3-4).

Jay Reingold, Vice President of Library Services at Standard and Poor's says that government classification systems are useful for understanding how the economy is structured, which industries are growing or declining, where jobs are being created, size of the market, and investment risk (5).

In the 1930s, an era when the American economy was driven primarily by manufacturing, the U. S. Government developed the SIC system. Under this system, the classification path to pharmaceuticals was via manufacturing and chemicals, as shown in this OSHA listing, entitled "SIC Major Group 28":

Division D: Manufacturing
- Major Group 28: Chemicals and Allied Products
  - Industry Group 283: Drugs
    - 2833: Medicinal Chemicals and Botanical Products
    - 2834: Pharmaceutical Preparations
    - 2835: In Vitro and In Vivo Diagnostic Substances
    - 2836: Biological Products, Except Diagnostic Substances

It should be noted that the SIC Industry Group 283 classification is based on products. By contrast, the technology required to manufacture those products was classified as "laboratory research," under SIC Industry group 873, per the OSHA listing, entitled "SIC Major Group 87," as follows:

Division I: Services
- Major Group 87: Engineering, Accounting, Research, Management, and Related Services
  - Industry Group 873: Research, Development, and Testing Services
    - 8731: Commercial Physical and Biological Research
    - 8733: Noncommercial Research Organizations

Through the 1990s there were numerous revisions to the SIC system that reflected the emerging high-technology framework of U. S. industry, including provisions for information technology and high-tech health care. The term biotechnology was not included in any updated version of the SIC system, although biological products were included under the major group of chemicals.

The SIC structure revealed several dichotomies: chemical versus biological, products versus research, and commercial versus noncommercial. As with any classification structure, there were problems. Certain industries were not accounted for, codes were not always used correctly, and there was difficulty classifying information from large companies that are involved in many different industries (Boettcher 6-7).

The government felt it needed a new, more logical and more detailed standard to address the enormous number of new industries in the U. S. economy. Thus, in 1997, the Office of Management and Budget (OMB) established an Economic Classification Policy Committee (ECPC) to develop, along with the governments of Canada and Mexico, a new classification system of industries and definitions to be known as the North American Classification System or NAICS (pronounced “nakes”).

Through a six-digit coding system, NAICS classifies all economic activity into twenty industry sectors, as shown in Appendix B. These 20 sectors are subdivided into 100 subsectors (three-digit), 317 industry groups (four-digit), 725 NAICS industries (five-digit) and 1,179 U.S. industries (six-digit). Five sectors (11 through 33) primarily produce goods, while 15 provide services.

Under the new NAICS system, the term drugs was assigned to subsector 422: Wholesale Trade, Nondurable Goods. As shown in Appendix C, the term pharmaceutical became linked with the term medicine, and was assigned to industry group 3254: Pharmaceutical and Medicine Manufacturing. Meanwhile, the new term, Scientific Research and Development, was assigned to industry group 5417, with no distinction made between commercial and noncommercial enterprises, as had previously been the case with the SIC system. And, just as with SIC, the 1997 U.S. NAICS Codes and Titles did not contain the term biotechnology.

In constructing the NAICS classification system, the ECPC had an opportunity to break away from the rigid hierarchy of the SIC system. The committee debated from the start whether their approach should be hierarchical top-down; hierarchical bottom-up; or non-hierarchical, allowing a flexible data structure that could be "aggregated or disaggregated at will" ("Issues Paper No. 2" 11). Ultimately, NAICS retained the same hierarchical top-down structure of its predecessor.

And even though, as the ECPC acknowledged, much of the process was "qualitative and judgmental in nature," the driving force in the development of NAICS was a data-driven approach for which the final decision for identifying economic activity structure was to rest upon "engineering evidence and institutional knowledge" (Gollop 1). Essentially, the government committee chose to reject a more interpretive system—that is, one privileging dramatistic openness—in favor of a rigidly defined and traditional system that is more in line with a scientistic approach. This choice is reflected in the NAICS mission, which is as follows:

> (1) to facilitate the collection, tabulation, presentation, and analysis of data relating to establishments, and (2) to promote uniformity and comparability in the presentation and analysis of statistical data describing the economy. ("NAICS—1987 SIC Replacement, 1997 Final Rule")

Thus the ECPC, through the NAICS classification system, constructed its "reality" of higher and lower levels of economic activity. As a government authorized lens, NAICS serves as a terministic screen to focus the public on what it considers the legitimized order of business. In this case, the terministic screen also acts metaphorically, sifting categories into tinier and tinier lower echelon subcategories. Per this reality, pharmaceuticals is an entity, whereas biotechnology is not.

As the government itself freely admits, there are inherent difficulties in creating classification systems, primarily in "the principles for forming industry aggregations," as it described in the first of several issues papers ("Issues Paper No. 1" 2).

NAICS was intended to be "flexible," with updates incorporated every five years, per the original announcement issued via presidential press release ("Administration Introduces"). It is of interest to note that the first NAICS update, issued in 2002, still did not incorporate the term biotechnology.

In anticipation of the 2007 revision of NAICS, the ECPC engaged in what it called "an extensive process of development and discussions . . . with maximum possible public input" ("NAICS, Updates for 2007").

The absence of biotechnology from the newly created NAICS system disturbed a number of business professionals. Thomas A. Glaze, Chief Executive Officer of Metabolex, a California biotechnology company, was one of those upset by the omission.

He was one of 22 individuals who wrote to the government following a December 27, 2002 Federal Register Notice requesting the creation of new biotechnology industries. As Glaze expressed it, “In science and many other fields it turns out that ‘if you can’t measure it, it doesn’t exist.’ Well, biotechnology does exist and it is meaningful and we need to measure it” (“NAICS Public Comments” Docket No. 07-0023).

Patrick R. Gruber, Vice President and Chief Technology Officer of Cargill Dow, suggested that four categories—medical biotechnology, food, agriculture biotechnology and industrial biotechnology—be added “as a minimum” to NAICS. He wrote:

> The current NAICS system does not adequately capture biotechnology industry activity. Industrial biotechnology will be at least as large as medical biotechnology in the future. Some estimates (McKinsey) indicate a market potential of $470 billion per year. (Docket No. 07-0014)

Prof. Dr. Manfred Ringpfeil, writing on behalf of the German company Bipract, also lobbied for inclusion of biotechnology, suggesting that the ECPC contact BIO, the Biotechnology Industry Organization, to provide advice on which categories of biotech should be applied to NAICS (Docket No. 07-0015).

NAICS serves as an excellent example of the public and private dynamics involved in classification. From the government’s standpoint, changes to classification data can be costly and disruptive. For these reasons, the ECPC says it tries to limit revisions to “essential” changes: that is, those that “account for errors and omissions” or “clarify the content of existing industries.” However, the Commission says it opens the door to “new and emerging industries identified through public comments that are supported by the guiding principles of NAICS” (“NAICS, Updates for 2007”).

In the case of the new biotechnology requests, the ECPC wrote that it "clarified" these as

> proposals to create industries for establishments that use biotechnology inputs, use biotechnology processes, or produce biotechnology outputs. The practical impact of these proposals would be to group a number of establishments that are currently classified in the Agriculture, Forestry, Fishing, and Hunting; Manufacturing; and Professional, Scientific and Technical Services sectors of NAICS. ("NAICS, Updates for 2007")

The ECPC noted that while it "recognized the importance of biotechnology as an emerging technology that should be accounted for in NAICS," it recommended against the proposals it received in response to the Federal Register notice. The primary reason given was that creating the new biotechnology industries would create duplication of production processes that were already classified throughout NAICS. As an example, the ECPC wrote that "growing genetically-modified crops is in farming, production of biotech enzymes is in the chemicals subsector of NAICS, and manufacturing foods classified in food manufacturing" ("NAICS: ECPC Decisions").

Is <u>It Is</u> or Is <u>It Is Not</u>?

In the government's NAICS structure we discover an excellent example of the scientistic approach to the nature of language, with its stress on definition and concern of <u>it is</u> or <u>it is not</u>. Growing genetically modified crops should not be classified under biotechnology, the government says, because this activity is already classified under farming. Thus, growing crops is farming; growing crops is not its own industry. The scientistic approach poses as logic: if a switch is off, it cannot be on.

Although the ECPC voted against including biotechnology as a separate category in the 2007 revision, the committee did strike a compromise of sorts by recommending the creation of a new 6-digit national industry for Biotechnology Research and Development, justifying their decision by writing the following:

> The new biotechnology research and development industry is in conformance with the principles of NAICS because: 1) the new industry will group similar establishments using biotechnology processes in experimental research and development; 2) the new industry addresses a new and emerging activity resulting in the production of advanced technologies, and 3) the new industry is expected to be comparable with a biotechnology research and development industry proposed in the ongoing revision of the International Standard Industrial Classification of All Economic Activities of the United Nations. ("NAICS, Updates for 2007")

From a rhetorical perspective, NAICS communicates several ideas. First, the 6-digit status of Biotechnology R&D positions it lower in the hierarchy than the 4-digit industry group, where Pharmaceutical and Medical Manufacturing is situated. Since the pharmaceutical industry was categorized long before biotechnology existed, it had territorial advantage. When biotechnology emerged, the government's task was to retrofit this new entity into an already-established system. With the exception of the newly created R&D category, the government elected to consider all other biotech processes as support functions rather than meriting their own economic classifications. Biotechnology facilitates the creation of products, but does not create its own products per se. In other words, per NAICS, biotechnology helps other industries; it isn't an industry in itself.

What does it mean that the U. S. Government does not position biotechnology as an "industry"? One could attribute any number of motives. Perhaps it's easier to go with an already-established structure than reinvent the wheel. Perhaps newness is treated more skeptically than maturity. Or perhaps the question of tangibility—that is, the lack of visibility of biotech products—is a factor.

Whatever the motivation, the importance of being an "industry" cannot be understated. Industries have enough critical mass to wield political and economic power and influence key decisions. As a group, an industry can lobby for political decisions favorable to its member groups. Industries are tracked by analysts as areas of investment. Being an industry confers a privileged and validated status. As the U. S. Census Bureau (the sponsor of the ECPC) describes it, "Economic census data are studied and recombined into a vast array of patterns to yield essential information for government, business, industry, and the general public" (Hovland and Gauthier 4). The Bureau also writes that government economic data—collected per the new NAICS classification system—are important for "composite measures such as the Gross Domestic Product (GDP), input-output measures, production and price indexes, and for other statistical series that measure short-term changes in economic conditions" (Hovland and Gauthier 4). Federal agencies use this data to make policy decisions, as do state and local governments.

Yet, as important as the NAICS classification system is, it is only one source of influence. Supporters of biotechnology-as-industry can (and do) establish rhetorical agency through several alternate means, both scientistic and dramatistic. The Biotechnology Industry Organization (BIO) collects its own data and makes it widely available to business and government. The financial services organization Ernst & Young has tracked biotechnology for over 20 years, thus legitimizing biotech "industry" data through an ongoing historical record. On the dramatistic side, biotech-as-industry is established, to use Burke's terminology, through "the rhetoric of oratory and advertising, mythologies, theologies, and philosophies after the classic model" (LSA 45).

The Power of Definition

One of the most powerful ways to position biotechnology as an industry is to define it as such. But definition is a tricky thing, as Burke implies. He writes:

> . . . a definition so sums things up that all the properties attributed to the thing can be as though "derived" from the definition. In actual development, the definition may be the last thing a writer hits upon. Or it may be formulated somewhere along the line. (LSA 3)

In the spirit of this chicken-and-egg conundrum, let us consider BIO—the Biotechnology Industry Organization, which is the largest of its type. BIO says it was formed in 1993 out of the merger of two small biotechnology trade organizations. On the history page of its website, the organization says:

> BIO united the organizations' 503 companies and 18 employees under one umbrella with a representative governing board that reserved one-third of its seats for emerging companies. The goal was to achieve a workable balance of power within the organization between the handful of large multibillion-dollar firms that launched the first wave of biotechnology products and the hundreds of startup and mid-size firms that were at the research and development stage. ("History of BIO")

Did the formation of BIO position biotechnology as an industry (versus a trade) or did BIO simply provide a single focus for what was already clearly an industry? Either way, in describing its history, BIO defines itself as an industry organization, with its mission as follows:

- Advocate the industry's positions to elected officials and regulators.
- Inform national and international media about the industry's progress, contributions to quality of life, goals and positions.
- Provide business development services to member companies, such as investor and partnering meetings.

In fulfilling this mission, BIO uses NAICS data to track industry trends. It also develops much of its own data, as do additional biotechnology associations and councils, including the American Biological Safety Association, Council for Biotechnology Information, Council for Responsible Genetics, CropLife America, the National Agricultural Biotechnology Council, as well as various international and state biotechnology associations. Private reference organizations, such as MedBioWorld, also track biotechnology industry data, as do investment and banking organizations. In 2006, Ernst & Young and Burrill & Company both published twentieth anniversary editions of their annual biotechnology industry reports. Ernst & Young, Burrill and many others state that the modern biotechnology industry is now about 30 years old, having come into being with the founding of Genentech in 1976. As one might expect for an emerging industry, definitions for biotechnology are widely varied, depending upon the source and the timeline in which they were developed.

In 1986, Frank E. Young wrote that it is "not a naïve question" to ask what biotechnology is. Young, who was commissioner of the U. S. Food and Drug Administration at the time, wrote that the "FDA's working definition of biotechnology is the application of biological systems and organisms to technical and industrial processes"—a definition he admitted was "necessarily broad" (10).

Two decades later, the struggle to define biotechnology continued. At the 2005 convention of BIO (the world's largest annual biotechnology industry conference), Philadelphia Inquirer reporter Porus Cooper asked several attendees to provide their definition. The responses he received ranged from "God, I don't know . . . It's hard to define" (this from the director of the stem-cell laboratory at King's College in London) to a vague "Biotechnology is future medicine." One contract researcher said that biotechnology was once defined as "'anything that Amgen and Genentech did' and the big pharmaceutical companies didn't." As Cooper observed, "the answer depended on whom you asked" (C06).

W. Steven Burke, Senior Vice President of Corporate Affairs for the North Carolina Biotechnology Center, said that when he joined the organization in the mid-80s, one of his first orders of business was to gather definitions of biotechnology—an effort that yielded 47 distinct examples.

Biotechnology as Useful, Supportive, Enabling

In its Editors' and Reporters' Guide to Biotechnology, BIO says that if you "break biotechnology into its root words" one finds

> bio—the use of biological processes; and
> technology—to solve problems or make useful products. (1)

BIO discounts the first part of the definition—use of biological processes—as "hardly a noteworthy event" since humankind has "used the biological processes of microorganisms for 6,000 years to make useful food products, such as bread and cheese, and to preserve dairy products" (1).

Rather, it is the concepts of technology and usefulness that are prominent in BIO's language. On its website-based guide to biotechnology, BIO says a more "appropriate" definition of modern-day biotechnology is "the use of cellular and biomolecular processes to solve problems or make useful products," and writes:

> We can get a better handle on the meaning of the word biotechnology by simply changing the singular noun to its plural form, *biotechnologies*.
>
> Biotechnology is a collection of technologies that capitalize on the attributes of cells, such as their manufacturing capabilities, and put biological molecules, such as DNA and proteins, to work for us. ("Biotechnology: A Collection of Technologies")

Whereas BIO stresses biotechnology as creating useful products, the U. S. Department of Commerce, in 1997, clearly differentiated products from technology:

> (B)iotechnology is not defined by its products but by the technologies used to make those products. Biotechnology refers to a set of enabling technologies used by a broad array of companies in their research, development, and manufacturing activities. To date, these technologies have been used primarily by the pharmaceutical industry, but they are being used increasingly by a variety of other industries, such as agriculture, mining, and waste treatment. (Paugh and Lafrance 21)

Similarly, writers for the Arizona Department of Commerce called biotechnology an "enabler of other industries and activities," with applications including the following:

- Pharmaceutical Applications: medicine and drug delivery applications
- Medical Applications: human and veterinary therapeutics and diagnostics
- Agricultural Applications: making plants and crops pest resistant, providing improved seed quality, modulating growth and ripening times, enhancing nutrient content of feeds, providing simple and inexpensive diagnostics for use in field-testing for contaminants and toxic material.

- Industrial Applications: industrial enzymes, waste management. (Nathan and Turvey 4)

Wikipedia, an unofficial but popular website for research, asserts that biotechnology can be defined as "the manipulation of organisms to do practical things and to provide useful products." This is echoed by the Columbia Encyclopedia online, which states, in part, that biotechnology is a "technological solution to a problem."

In his remarks to the Congressional Black Caucus in 2000, USAID Administrator J. Brady Anderson asked how the people of the world can better feed its people. The answer, he said, lies in the "potential of biotechnology," which he then proceeded to define:

> What is biotechnology? I could give you dictionary definition, but for laymen like me, it is easier to understand biotechnology by talking about what it can do. We can, for instance, use biotechnology to develop new crop varieties that tolerate drought, are resistant to insects and weeds, and able to capture nitrogen—an essential fertilizer—from the air. Biotechnology can also make food more nutritious by increasing the amount of Vitamin A, iron, and other nutrients in the edible portion of the plant.

The Columbia Encyclopedia also notes that "biotechnology is a general category that has applications in pharmacology, medicine, agriculture, and many other fields." This statement points to the concept that biotechnology plays a support role for the pharmaceutical industry, at least in terms of its technological applications.

The Labor Market Information Division of California's Employment Development Department says that biotechnology research offers a promise of applications for a number of areas, including "environmental management, biomedical devices, instrumentation, agricultural products, food processing, human and veterinary medicines, and pharmaceutical manufacturing" (Peters and Slotterbeck 1).

Biotechnology as Biology-based

As BIO suggests, the term biotechnology emphasizes the industry's connection to biological processes. Biotech Primer, an educational company, states that "in 1919, Karl Ereky created the term 'biotechnology' to describe the interaction of biology with human technology" (1) and that even in modern usage, biotechnology is still seen as "an industry based on biology—the study of living things" (4). The publication states, "Biotechnology revolutionized drug design and development by using specific scientific knowledge about living organisms, including genetic information that guides development and function" (4).

Access Excellence, an online resource program for teachers managed by The National Health Museum in Washington, D. C., cites biotech author Pamela Peters who writes:

> In its purest form, the term "biotechnology" refers to the use of living organisms or their products to modify human health and the human environment. Prehistoric biotechnologists did this as they used yeast cells to raise bread dough and to ferment alcoholic beverages, and bacterial cells to make cheeses and yogurts . . .

Glick and Pasternak associate molecular biotechnology with "the ability of researchers to transfer specific units of genetic information from one organism to another" (1). This, they say, "relies on the techniques of genetic engineering (recombinant DNA technology)" whose objective "is often to produce a useful product or a commercial process" (1).

Kimball Nill, Technical Issues Director for the American Soybean Association and formerly with Monsanto's biotech research division, developed what he calls, in his preface, a "biovocabulary" of biotech buzzwords and concepts to aid those with "little or no formal training in the bio and chemical sciences." He defines biotechnology as "the means or way of manipulating life forms (organisms) to provide desirable products for man's use" (34) and takes issue with Glick and Pasternak's emphasis on rDNA. He writes:

> A common misconception is that biotechnology refers only to recombinant DNA (rDNA) work. However, recombinant DNA is only one of the many techniques used to derive products from organisms, plants, and parts of both for the biotechnology industry. A list of areas covered by the term biotechnology would more properly include: recombinant DNA, plant tissue culture, rDNA or gene splicing, enzyme systems, plant breeding, meristem culture, mammalian cell culture, immunology, molecular biology, fermentation, and others. (34)

Nill puts it well in his preface to the book when he writes that

> the field of biotechnology is rapidly expanding and evolving, and that new terms are entering the mainstream nomenclature at a rapid pace. In fact, the exact meaning of some of these terms is still under dispute, while the meaning of others will undoubtedly be expanded or narrowed as the technology develops. (34)

From Definition to Description

Definitions can vary depending on historical timeframe, the affiliation of the definition-maker, and other subtle factors related to intent. Oftentimes, what poses as definition (<u>it is</u>, or <u>it is not</u>) can shift to include elements of description. An excellent example of this can be found in the annual reports of the North Carolina Biotechnology Center. In its first-ever annual report (1984-1985), the organization posits an introduction to biotechnology that is half definition and half speculation. The Center writes, "Biotechnology is a frontier of science that will lead to new products and processes effecting (sic) up to 70 percent of the GNP in 30 years" (i).

The word frontier is a powerful symbol of a new horizon, an area open to vast commercial exploitation. And in choosing to use the word will, the NC Biotech Center creates a definitive statement in which the possibility of failure is not present. Later in the report, the NC Biotech Center back peddles on the certainty of success, writing, "As indicated in the Introduction of this report, biotechnology is expected to lead to new products and processes affecting 70 percent of the GNP within the next 30 years" (7).

The discrepancy could be attributed to an editing oversight. However, a look at some of the annual reports that follow shows a deep-seated optimism that consistently moves scientistic definition into the realm of the dramatistic. Consider, for example, the definition offered in the Center's 1990 report, under the heading, "Biotechnology: New Tools for Life":

> Biotechnology is a broad collection of new techniques for influencing the living cells of microbes, plants, animals and people. It is based on our growing understanding of deoxyribonucleic acid, or DNA, the substance of genes and the universal blueprint for living organisms. Major techniques of biotechnology include genetic engineering, cell and tissue culture, and monoclonal antibody technology. The careful use of these and other techniques enables scientists to improve the health, traits, products and applications of living organisms. Biotechnology is giving us new medicines and diagnostics, more nutritious foods, hardier crop plants, more productive livestock, new specialty products for industry, and a cleaner environment. (2)

In one paragraph, the language moves from the scientistic verbs of is, is based on, and include to the dramatistic adjectives of hardier, more productive, and cleaner. This convergence has the effect of making biotechnology itself seem hardier, more productive, and cleaner.

In 1992, the Center had modified its definition of biotechnology. In Table 1, I have noted the differences in direct comparison with the 1990 report and suggest rhetorical reasons for why the language may have changed.

Table 1

Comparison of the 1990 and 1992 Annual Reports of the North Carolina Biotechnology Center

1990 Annual Report	1992 Annual Report	Comment
"Biotechnology: New Tools for Life"	"Biotechnology: Working with Nature to Improve Our Quality of Life"	The 1990 title suggested the Frankenstein concept of Man controlling Nature; the revision suggests Man working in harmony with Nature.
Biotechnology is a broad collection of new techniques	Biotechnology is a collection of new scientific techniques	However, even as the concept of Man and Nature is strengthened, the authors do not want to lose the concept of biotechnology as science.
for influencing the living cells of microbes, plants, animals and people. It is based on our growing understanding of deoxyribonucleic acid, or DNA, the substance of genes and the universal blueprint for living organisms.	that use living cells, or their parts, to make products or solve problems.	"Influencing" the cells sounds ominous, while "using" cells to solve problems sounds helpful. The reference to DNA may have been dropped because, by 1992, the connection between cells and DNA may have seemed superfluous.

Major techniques of biotechnology include genetic engineering, cell and tissue culture, and monoclonal antibody technology.	Major techniques include genetic engineering, cell and tissue culture, bioprocessing, and monoclonal antibody production.	The introduction of bioprocessing (defined by NC Biotech as "A technique in which microorganisms, living cells, or their components are used to produce a desired end product") reinforces the theme of commercial applicability.
The careful use of these and other techniques enables scientists to improve the health, traits, products and applications of living organisms.	These and many other tools of molecular biology allow scientists to improve the health, traits, products and applications of living organisms for human benefit.	Saying that scientists must carefully use the techniques begs the question of what happens if they don't; therefore the phrase is deleted. The phrase for human benefit reinforces the positive contribution of biotechnology.

By the 1995 annual report (Table 2), the definition remained essentially the same, with a few minor exceptions. Of particular note is the last sentence, as shown in Table 2, which had changed substantially from 1992 to 1995.

Table 2

Comparison of the 1992 and 1995 Annual Reports of the North Carolina Biotechnology Center

1992 Annual Report	1995 Annual Report	Comment
These applications are creating new jobs, enhancing traditional industries and generating long-term economic benefits for North Carolina (1).	These uses of biotechnology are creating new jobs, enhancing traditional industries and generating long-term economic and societal benefits for North Carolina (1).	The word uses reinforces the concept of biotechnology as friendly and helpful. The addition of the word societal emphasizes the fact that everyone benefits from biotechnology, not just business enterprises of the State.

By 1997 and 1998, the NC Biotech Center offered a new approach to the definition of biotechnology by invoking the concept of biotechnology as an ancient science. In a section of the 1998 report that defines biotechnology, the authors write the following:

> Working with the bounties of nature to improve the quality of human life is an idea mankind has pursued since the dawn of civilization. Ten thousand years ago, our forefathers' quest for a reliable supply of food and fiber led them to begin selectively breeding plants and animals for superior offspring, and to use microbes such as bacteria and fungi to make cheese, wine, bread and other foods.
>
> In the 20th century we learned to use viruses and bacteria to make vaccines and antibiotics, microbial enzymes to make detergent and food additives, and bacteria to treat sewage and other waste. Also in this century, we gave the ancient science a name: biotechnology. (2)

The meaning of these two paragraphs seems unmistakable. The first message is that although the term biotechnology is new, what biotechnology does is not new. Second, biotechnology is made to be analogous with common, everyday products such as cleansers, clothing and food. The third point is that biotechnology works with nature, not against it. The "definition" of biotechnology in this annual report seems driven by a motivation to make biotech seem helpful, yet benign—an important foundation for the process of ingratiation, and an effective response to descriptions of biotechnology that depict it as frightening, untested, unstable, and nature-adulterating.

Defining Pharmaceuticals and the Pharmaceutical Industry

Unlike biotechnology, the term pharmaceuticals is rarely defined in general publications since the industry is mature and writers presume most people know what pharmaceuticals are.

In Multinational Pharmaceutical Companies Principles and Practices, Bert Spilker attempts a definition of the pharmaceutical industry based on membership and activity, but immediately criticizes it, writing:

> It is possible to define the pharmaceutical industry as the collection of companies that discover, develop, manufacture, and market medicines for human use, but this definition is insufficient for several purposes. Although there is a core group of companies that are research based and fulfill all four of these criteria, many others only meet one, two, or three of the four criteria. (7)

Spilker goes on to say that contract research organizations, consultants, research firms, and other service organizations can also "be considered part of a national pharmaceutical industry" (7). Thus, under Spilker's expanded definition, biotechnology companies could also be considered part of the pharmaceutical industry.

Within reference materials, many sources define the pharmaceutical industry by the products it makes. For example, the Oxford English Dictionary provides a definition for pharmaceutical as an adjective as "of or relating to the manufacture, use, or sale of medicinal drugs" and as a noun as a "pharmaceutical preparation; a medicinal drug."

Encyclopaedia Britannica defines the pharmaceutical industry as a "complex of processes, operations, and organizations engaged in development and manufacture of drugs and medications," and pharmaceutical as a "substance used in the diagnosis, treatment, or prevention of disease and for restoring, correcting, or modifying organic functions."

The Britannica Concise Encyclopedia defines the industry not only by its products, but by its successes, stating that the "pharmaceutical industry has greatly aided medical progress" with "the occurrence and severity of such diseases as typhoid fever, poliomyelitis, and syphilis . . . greatly reduced." This encyclopedia also notes that, "While many drugs, such as quinine and morphine, are extracted from plant substances, others are discovered and synthesized by techniques including combinatorial chemistry and recombinant DNA technology." Thus with this definition, the encyclopedia negates the idea that the pharmaceutical and biotechnology industries are distinguished from one another by the latter's exclusive use of rDNA technology.

Some sources emphasize the manner in which pharmaceutical drugs are produced, making the distinction that pharmaceuticals are chemical-based. The Oxford Encyclopedia of Economic History, for example, says that pharmaceuticals are "products of the chemical industry, intended for use as prescription drugs or as over-the-counter (OTC) medications."

In its history of the pharmaceutical industry, the American Chemical Society (ACS) emphasizes the chemical background of pharmaceutical companies such as Bayer, which in 1913 was "Germany's third largest chemical company" ("Bayer"). The ACS writes that "Bayer's reputation as a major pharmaceutical company is primarily a result of its exhaustive program of chemical analysis" and that "by 1900, Bayer chemists routinely tested all new chemicals for medicinal effects." The organization notes that Bayer's big breakthrough as a commercially viable pharmaceutical company came in 1899, when it marketed acetylsalicylic acid under the trade name Aspirin.

The Environmental Commissioner of Ontario, in its 2004-2005 annual report, sets forth a definition of pharmaceuticals as follows:

> Pharmaceuticals are chemical substances used in medical diagnostics and to achieve therapeutic and other desired physiological responses (e.g., synthetic hormones in oral contraceptives). They are bioactive (having effects on living organisms), and in some cases, toxic by design (e.g., in cancer treatment). Pharmaceuticals comprise a large number of diverse but mostly organic molecules that range in size. They can be grouped according to their general uses—for example, antibiotics, anti-epileptics, anti-inflammatories, cancer treatment drugs and oral contraceptives. Pharmaceuticals are typically formulated to be highly soluble and are not completely broken down by the body. Over 23,000 drugs, comprised of over 3,300 different ingredients, are registered for human use in Canada. (182)

In this case, the definition highlights the essence of pharmaceuticals as chemicals; as abundant; and as substances that can enter (and thus contaminate) the environment.

Pharmaceutical Self-definition

While biotechnology is redefining itself to appear more mature, the pharmaceutical industry is redefining itself to appear newer and more innovative. To a great extent, it is doing this by incorporating attributes of biotechnology into its self-descriptions and by affiliating itself with biotechnology.

Consider, for example, the definition of biotechnology provided by the pharmaceutical industry organization, PhRMA, in its 2005 industry profile. The organization writes:

> Biotechnology is a collection of technologies that capitalize on the attributes of cells, such as their manufacturing capabilities, and put biological molecules, such as DNA and proteins, to work for medicine development and other uses. (8)

After explaining that the pharmaceutical industry has "developed and adopted" a number of new biotechnologies such as bioprocessing, monoclonal antibody technology, molecular cloning, and recombinant DNA technology, the organization writes:

> The convergence of traditional pharmaceutical chemistry and biotechnology has led the pharmaceutical and biotechnology industries, once thought of as being distinct and independent, to become more similar than dissimilar. (8)

In fact, the organization notes that “Biotechnology + Pharmaceutical = Biopharmaceutical” (7), thus emphasizing a new term that seeks to merge the two industries.

Additionally, the very first line of the introduction to Pharma’s 2006 pharmaceutical industry profile, notes that “(t)he biopharmaceutical research industry is unlike many others. It invents products that people need to avoid illness, maintain their health and save their lives” (v). Although the title of the report classifies it as pharmaceutical, the internal text immediately binds pharma with biotechnology. Further, it positions the newly merged entity as unique, inventive, and therapeutic.

This self-definition/description has shifted significantly since the emergence of the pharmaceutical industry at the end of the nineteenth and start of the twentieth century. At that time, the industry defined itself in three major ways, as will be outlined below. The first was as advocates of standardization (that is, pursuers of quality, safety, and efficacy; believers in self-regulation; establishers of pharmaceutical societies and standardized pharmacopoeia; and opponents of government interference). The second was as chemists and the third was as rags-to-riches capitalists. With the arrival of the 1940s—and the commercialization of penicillin—the pharmaceutical industry gave one more definition to itself: producer of blockbuster products.

By most historical accounts, the modern pharmaceutical industry emerged concurrently with the introduction and acceptance of germ theory and rise of industrial manufacturing. In order to transition to a modern and professional status, nascent pharmaceutical companies had to overcome centuries of popular beliefs about the nature of disease and the treatment of illness. Amundsen and Ferngren describe the belief systems of ancient times whereby "(w)ell-being depended on living in a state of harmony with all aspects of the environment, which was animated by vague numinous or spiritual presences and able to be manipulated through a complex variety of magico-religious mechanisms" (485).

The concept of wellbeing as a "state of harmony with deified nature" was to continue through the Egyptian and Mesopotamian cultures at the beginning of the third millennium B.C., and did not appreciably change—with the exception of the ancient Hebrews—until the beginning of "desacralized" medicine in ancient Greece, around 500 B.C. At this time, "illnesses appear to have been categorized as either mysterious (and hence, of divine origin) or common (and, therefore, natural)" (Amundsen and Ferngren 487). Emerging at this time were medical craftsmen who "practiced empirical medicine but with little or no reliance on the magico-religious procedures of their ancient Near Eastern counterparts" thus paving the way for rational medicine (487).

However, the shift of belief systems neither easy nor clear cut. In Making Medicine Scientific, Terrie Romano writes of "the untidy nature of the era's shift from an intellectual system rooted in religion to one based on science, bridging worlds often thought antithetical, such as the metaphysical idealist and the materialist scientific" (3).

These two disparate philosophies were particularly evident during the Middle Ages with the emergency of alchemy, "a grandiose philosophical system which . . .

sought to bring the microcosm of man into relation with the macrocosm of the universe" (Read 14). As John Read describes it:

> (the) corpus of alchemy was of a dual nature. On the one hand, it was essentially practical and allied closely with the arts, crafts, and medicine; on the other, it was an indistinct aggregation of mysticism and cryptic expression. These two main aspects of alchemy persisted throughout the Middle Ages. (13)

The status of the alchemist, too, was also marked by schism. The profession had enough credibility that "(r)ogues assumed the title of alchemist solely to increase their professional status in the eyes of their patrons" (Read 74). At the same time, the preponderance of such false chemists created an atmosphere of deep suspicion in the public. Ben Jonson captured the jaundiced view the public took toward alchemists in his highly popular 1610 play, The Alchemist, in which the title character is portrayed as a "chemical cozener" (191) who represents "(c)heaters, bawds (and) conjurors" (190).

From the Middle Ages onward, the thrust to separate science from religion took greater force, beginning with the Protestant Reformation and continuing through seventeenth century Enlightenment and nineteenth-century Darwinism. It was during these transitional centuries that modern drug making, as an industry, began to emerge.

Geoffrey Tweedale of Manchester Metropolitan University traces the history of the modern pharmaceutical industry to the "activities of the apothecaries, who mixed and compounded drugs for the physicians and general populace in the fifteenth and sixteenth centuries" (33). He writes:

> This lineage can be traced through to the activities of those apothecaries who became chemists and druggists in the seventeenth and eighteenth centuries. Some

> of the latter, when they decided to concentrate on the dispensing and manufacturing of drugs (instead of following careers in medical practice), created anew profession of pharmacy . . . These chemists and druggists provided the springboard for later advances in drug manufacture and the businesses they operated became the forerunners of some of today's pharmaceutical giants. (33)

Following the scientistic is/is not paradigm, it was clear what the new drug makers were not. They were not magicians, mystics or hoaxers. Instead, they were members of a new group of professionals who would come to define their industry in several specific ways. The emerging pharmaceutical companies saw themselves as advocates for quality medicine through the standardization of manufacturing; chemists, rather than alchemists, and therefore modernists; and rags-to-riches capitalists. These descriptors served the industry well in its early years. However, in later decades, and particularly with the emergence of biotechnology, these descriptors would come to be challenged in dramatistic fashion.

Advocates of Standardization

From the mid-nineteenth century through the start of the early twentieth century, the new pharmaceutical professionals sought to distinguish themselves from their predecessors through the standardized methods they would employ to manufacture their products. Up until this time, drug manufacturing was highly decentralized, both in Europe and the United States. In fact, for the first 200 years of United States history, drug manufacturing was little more than a cottage industry, with medications "either compounded from a limited number of drugs or imported from the continent as finished products, intermediates, or patent medicines" (Worthen 55).

In what we would now consider to be a conflict of interest, doctors at that time often doubled as pharmacists, compounding and dispensing the prescriptions they themselves wrote. According to historian Gregory Higby, this was an arrangement that was of great benefit to the physician's personal financial success since "medicines were always dispensed for cash or for goods" ("A Brief Look" 2).

Of greater concern was the quality of drugs that were being manufactured. According to Higby:

> America had become the dumping ground for the poor quality drugs of Europe. While it had been common since colonial days for exporters to send shoddy goods overseas, the situation worsened in the 1840s. The drug market within Europe tightened up through regulation. Moreover, the emergence of alkaloidal chemistry made it possible to extract quinine or other alkaloids from medicinal plants and then send the partially (or fully) exhausted bark or root off to America. ("Introduction" x-xi)

A lack of government regulation meant that many of the drugs being produced had the potential to be toxic, addictive or both. Opium, for example, was a popular ingredient for a "vast range of medicines, patent medicines and quack 'remedies' in both Europe and American throughout the nineteenth century" (Booth 51).

In her history of Merck, Fran Hawthorne notes that "there were . . . hundreds of so-called patent medicines in the United States mysteriously claiming to cure everything from baldness to cancer to babies' teething pain" (20). She adds that

> even the legitimate pharmacists' drugs weren't necessarily safe. Because they were unregulated, they could be adulterated or diluted, or the wrong ingredients could be substituted—which was, in fact, what happened to American soldiers in the Mexican War of 1846 to 1848. Congress passed a Drug Importation Act the year the war ended that was supposed to ensure that drugs would be inspected for

> purity and quality at the port of entry to the United States, but it didn't do much good because it didn't set any standards and it didn't block the practice of appointing unqualified but politically connected customs officials. Between 1879 and 1906, a hundred more bills on food and drug purity would be introduced in Congress; all of them died. (20-21)

Early government regulation clearly did not benefit the nascent pharmaceutical industry. In fact, tension between the industry and government regulators would become a pattern for the next century and a half. Those in the newly emerging industry were much more comfortable regulating themselves. While Higby writes that "most pharmacists of the early 1800s did not view themselves as "professional men"—they were shopkeepers or specialized merchants" ("A Brief Look" 2), by the mid-1800s, this situation had changed. The medical profession increasingly focused their attention on the clinic and diagnosis, getting more comfortable with leaving compounding to pharmacists. Consequently, the number of pharmacy practitioners increased substantially. These new breeds of drug makers were ready to shed their image as snake-oil salesmen and develop a modern, professional image.

One way to accomplish this goal was to create professional organizations that would set standards not only for the medicines being compounded, but also for the behavior and ethics of all members.

The Pharmaceutical Society of Great Britain was started in 1841. Ten years later, in the United States, a convention of pharmacists assembled in New York City, laying the groundwork for the establishment of the American Pharmaceutical Association in 1852. Their objectives, according to Higby, were several-fold:

- Create a national association with a constitution and code of ethics;
- Support schools of pharmacy;
- Improve the selection and training of pharmacy apprentices;
- Investigate secret medicines and quackery;
- Urge enactment of laws for the inspection of imported drugs;
- Adopt a National Pharmacopeia as a guide in preparing medicines;
- Curb indiscriminate sale of poisons;
- Separate pharmacy from the practice of medicine;
- Encourage presentation of original papers on pharmacy and science ("Introduction" xi)

The establishment of the U.S. Pharmacopeia, a national guide that provides guidelines for the preparation and use of medicines, led to a major shift in pharmaceutical manufacturing away from the pharmacist with individual mortar and pestle, and toward large-scale manufacturers and ready-made drugs. As Higby writes, "It was nearly impossible for the pharmacist on the corner to make up coated pills and complex mixtures with the elegance of the large companies ("Introduction" 3). The same was true in England, with the first British Pharmacopoeia published in 1864.

In a 1980 speech celebrating the centennial of Burroughs Wellcome, company president Fred A. Coe, Jr. noted that the corporate mission—"to discover, develop, produce and market high quality pharmaceutical products to treat disease and reduce suffering"—had not changed over the past 100 years (Coe 7). In pursuit of this goal, founder Henry Wellcome purchased the most modern and efficient machinery to support the company's manufacturing efforts. The capital investment was successful because "the young company quickly developed a lead in the manufacturing field, excelling in the technology of compressing medicine into tablets" (Coe 9). In fact, Henry Wellcome was responsible for coining the word tabloid as a term for compressed medicines. As a point of linguistic curiosity, tabloid would later be co-opted by the tabloid newspapers that "compressed and condensed news onto small pages" (Coe 9).

Trademarking was one way of ensuring a company's reputation for quality products. It was a step Burroughs Wellcome took to protect its tabloids from would-be counterfeiters. In a 1908 version of its Excerpta Therapeutica, a company-published index of diseases and treatment, the company notes that

> The trade marks 'Tabloid' and 'Soloid', invented by B.W. & Co, are B.W. & Co. hall marks. They mark the work of Burroughs Wellcome & Co. They mean "Issued by Burroughs Wellcome & Co." They stand for 24 carat products. (Burroughs Wellcome 9)

In the therapeutic notes section of the Excerpta, the company makes it clear that good manufacturing practice and high-quality products go hand in hand:

> 'Tabloid' brand products, the excellence and the advantage of which are now so universally recognized, contain only the finest drugs, so that therapeutic activity is secured; they are accurate in dosage, are readily carried, and keep well in any climate. They are made under the supervision of specially trained and qualified chemists and pharmacists of many years' experience. (Burroughs Wellcome 156)
>
> [. . .]
>
> The admitted superiority of 'Tabloid' Brand products is maintained only by unremitting care and attention to minute details. They have been often imitated, but in no case has their combined perfection of ingredients, manufacture, dosage, and therapeutic activity been approached.
>
> In these imitations and counterfeit preparations, there lies an obvious danger to the physician's reputation and to the patient's health. The word 'Tabloid' is a brand which designates products issued by Burroughs Wellcome & Co., and to ensure the supply of genuine preparations, this brand should always be specified when ordering. Medical men are requested to report any cases of substitution. (Burroughs Wellcome 157)

Like Burroughs Wellcome, then-chemical company Merck was also concerned about piracy. In 1890, "Merck labels were being illegally placed on other companies' chemicals" (Hawthorne 21), thus threatening the company's good name and prompting the founder's grandson to travel to the United States from Germany to oversee the business. This move ultimately spurred the transition of Merck from a German-based supplier of fine chemicals to a multinational producer of pharmaceutical products.

Chemists, Not Alchemists

Merck is just one of several large pharmaceutical companies whose roots can be traced to chemical manufacturing. As Hawthorne explains, "Pharmacists, in the United States as well as Germany, made their own medicinal compounds with ingredients bought from fine-chemical companies, many of them German" (20). It was simply logical that these suppliers of pharmaceutical chemicals would ultimately try their hand at making the drugs themselves.

Pfizer, the largest pharmaceutical company in the world today, started as a fine-chemicals business in New York in 1849. Pfizer originally produced tartaric acid and cream of tartar, which were useful as a laxative and diuretic, respectively. During the Civil War, Pfizer says it expanded its production of drugs, producing "iodine, morphine, chloroform, camphor, and mercurials, which in addition to medicinal applications, were used in the emerging field of photography" ("Exploring Our History, 1862") In 1880, Pfizer began manufacturing citric acid, which "had a variety of applications, including papermaking, dissolving iron oxides, and as a flavoring for foods and in soft drinks" ("Exploring Our History, 1849-1899").

The French pharmaceutical company Aventis originated in 1858 as a supplier of chemical for the leather and textile dye industries. After "140 years of complicated history with companies being bought and sold off, nationalization and privatization, and several Nobel Prizes being awarded to chemists connected to the company," Aventis was officially created in 1999 "as the result of the merger of two chemical companies, Rhone-Poulenc and Hoechst AG" (Turner 45).

In its history of the pharmaceutical industry, the American Chemical Society emphasizes the chemical background of pharmaceutical companies such as Bayer, which in 1913 was "Germany's third largest chemical company." The ACS writes that "Bayer's reputation as a major pharmaceutical company is primarily a result of its exhaustive program of chemical analysis" and that "by 1900, Bayer chemists routinely tested all new chemicals for medicinal effects" ("Bayer"). Bayer's big breakthrough as a commercially viable pharmaceutical company came in 1899, when it marketed acetylsalicylic acid under the trade name Aspirin.

The connection of the growing pharmaceutical industry to the chemical industry was significant for two reasons. First, the new medicines that were rationally designed through chemical science could be made distinct from ancient herbal remedies and mystical cures. Second, chemistry established a modern approach to drug making through the application of scientific methods of design and analysis. In his history of drug discovery, Walter Sneader writes that the rapid development of synthetic organic chemistry in the mid-1800s meant that drug makers no longer needed "to rely on nature to provide new drugs" (4) since a "limitless range of new drugs" could now be synthesized (5).

Rags-to-Riches Capitalists

The rags-to-riches tale is a significant and defining narrative for many of the early pharmaceutical companies, and sets the foundation for a deep-seated and continuing commitment to capitalism in this industry.

Bristol-Myers Squibb (BMS), the eighth largest pharmaceutical company worldwide, was created in 1989 with the merger of Bristol-Myers with Squibb. The BMS web site provides a history of the Bristol-Myers side from its founding in 1887 by William McLaren Bristol and John Ripley Myers, with startup funds of only $5,000. The story on the web site not only describes the rags-to-riches narrative, but also merges in the advocate of quality and standardization sub-narrative, as follows:

> The partners worked hard to expand the business, but at first it was an uphill struggle. From the start, however, they had two rules: insist on high quality and maintain the firm's good financial standing at all costs. ("BMS Brief History")

The web site describes how sales blossomed after the turn of the century with two important products: a laxative mineral salt and Ipana toothpaste. The demand for these two products, according to the company, "transformed Bristol-Myers from a regional into a national company and then an international one," with gross profits of over $1 million by 1924 ("BMS Brief History"). The rags-to-riches story continued, with the company going public in 1929 with a listing on the New York Stock Exchange.

The history of the Squibb side also reflects the advocate of quality sub-narrative, stating that the prototype of the Squibb logo “represented product uniformity, purity, efficacy and reliability based on research.”

Pfizer, too, tells a similar story on its web site. In the section entitled, “1849: Arriving in America,” the company writes:

> With $2,500 borrowed from Charles Pfizer's father, cousins Charles Pfizer and Charles Erhart, young entrepreneurs from Germany, purchased a modest brick building on Bartlett and Tompkins streets in the Williamsburg section of Brooklyn. Their goal was to make chemicals not then produced in the United States.
>
> Their first product, santonin, was used to treat intestinal worms, a common affliction in mid-19th century America, but its taste was so bitter, few people would swallow it. Combining their skills, Pfizer, a chemist, and Erhart, a confectioner, blended santonin with almond-toffee flavoring and shaped it into a candy cone. An immediate success, the “new” santonin was soon in great demand—and Charles Pfizer& Company was launched.
>
> Within a decade, raw materials from around the world were pouring into the young company and more than a dozen chemicals were pouring out. As their business prospered, the cousins bought 72 acres surrounding their building, and, in 1857, established an office on Beekman Street, in the heart of what was then Manhattan's drug and chemical district. (“Pfizer: Exploring Our History 1849-1899”)

The pharmaceutical self-definition of rags-to-riches capitalists was also interwoven with messages of hard work and optimism. In a 1966 speech to the Newcomen Society, E. Claiborne Robins tells the story of the A. H. Robins pharmaceutical company. His grandfather, an “old gentleman (who) worked long hours and a seven-day week” founded a “small apothecary and manufacturing chemist’s shop” in 1878 in Richmond, Virginia (9). A photo of this shop, included in the Newcomen reprint of the speech, shows a store front with the words Robin's Chemicals inscribed in the window (10b).

The old gentleman's son, Claiborne Robins, followed in his father's footsteps and eventually became a registered pharmacist. Upon his graduation, he was tasked to develop the manufacturing side of the business, which eventually was established as the A. H. Robins Company. When Claiborne died young (two years after E. Claiborne was born), Mrs. Martha Robins, E. Claiborne's mother, took over the business. A photo caption from the Newcomen reprint states:

> Mrs. Martha Robins, who guided the destinies of the A.H. Robins Company from 1912 to 1936, was one of the pioneer business-women of Richmond. Her determination to keep the Company alive until E. Claiborne could graduate from college and pharmacy school was a motivating force in her life, and she gave up everything to accomplish it. Mrs. Robins took over the business upon the death of her husband. (10a)

E. Claiborne Robins notes that he was "well aware of what my mother sacrificed to give me an education," and how she "moved into a man's world" by "(m)ixing liquids, counting tablets, filling and capping bottles, pasting on labels, (and) keeping the books"(10).

The loan of $2,000 from a local bank was a turning point for the company, along with the goodwill of suppliers who "carried us in those days on 'a wing and a prayer'" (12). Robins' message then turns to one of patriotism, when he states that

> this could only happen in America—the story of progress under the free-enterprise system which is indeed the story of A.H. Robins Company. Under what other auspices could a young man parlay an invested capital of less than three thousand dollars—borrowed money, at that—into a firm doing business in fifty

> states and about fifty-five foreign countries, with gross sales of more than sixty-five million in 1965? (13)

Robins notes that in the United States, “under the free-enterprise system, we have set the pace for the world in new drug discoveries, while in Communist countries under a non-incentive system, not a single worthwhile drug has been produced” (15). He expounds on what he considers “threats” to the free-enterprise system, including “the cancer of central government control” (15). He states that “(c)ontrol is good only when it is helpful to the end product; excessive government control can only be a form of strangulation” (16). This is significant because it is a theme that prevails in the pharmaceutical industry even today.

Public Response to the Early Pharmaceutical Industry

Thus by the end of the nineteenth and start of the twentieth century, the pharmaceutical industry defined itself in three major ways: as advocates of standardization; as chemists and as rags-to-riches capitalists. They had distanced themselves from herbalist healers, mystics, and snake oil salesmen. They had demonstrated cohesiveness and homogeneity in their industry. They were thoroughly modern in outlook, evidenced visually by the new steel and glass buildings they constructed. The new laboratories housed well-educated scientists, who worked by standard rules and scientific methodology, and a well-trained technical staff that manufactured products using validated systems. The chemists were kings; Man was in control; and quality, safety, and efficacy were the new watchwords.

However, public receptivity to the industry as a whole did not flourish. Writing in 1959, historian Tom Mahoney said that “Until the 1930’s, accomplishments of the American drug industry were few” and that “[a]s late as 1939 no ethical drug manufacturer in America had a sales volume as large as a department store like Macy’s in New York or Hudson’s in Detroit” (4).

Industry prestige, in fact, was very slow in arriving, and respect for drug companies individually was no better. Mahoney notes that in 1927, the American Society for Pharmacology and Experimental Therapeutics ruled that “(e)ntrance into the permanent employ of a drug firm shall constitute forfeiture of membership” (4).

An example in literature of the early skepticism toward the pharmaceutical industry can be found in Arrowsmith, Sinclair Lewis’ novel of 1925 in which Martin Arrowsmith, a young and idealistic physician, makes a career decision to become a highly paid member of the “McGurk” pharmaceutical research institute, located in a thirty-story high glass and limestone building in New York city (289). At first, he is intrigued by the opportunity to focus on important research, but ultimately Arrowsmith is horrified by implications of working for a profit-generating organization. He rebels against twittering cocktail parties, the idea of publishing first and plugging up the holes later, and public relations in general. When Dr. Rippleton Holabird, a business-oriented director at McGurk, gushes about the honors that lie ahead for Arrowsmith (“Acclaim by scientific societies, any professorship you might happen to want, prizes, the biggest men begging to consult you, a ripping place in society!”) (338), Arrowsmith is appalled:

> He perceived the horror of the shrieking bawdy thing called Success, with its demand that he give up quiet work and parade forth to be pawed by every blind devotee and mud-spattered by every blind enemy.
>
> He fled to Gottlieb as to the wise and tender father, and begged to be saved from Success and Holabirds and A. DeWitt Tubbses and their hordes of address-making scientists, degree-hunting authors, pulpit orators, popular surgeons, valeted journalists, sentimental merchant princes, literary politicians, titled sportsmen, statesmenlike generals, interviewed senators, sententious bishops. (339)

The novel clearly set forth the ambivalence of the American public toward pharmaceutical research.

In terms of the rhetorical helix, it was all well and good that the pharmaceutical industry defined itself in terms that it considered positive. Clearly, the industry's cherished self-definitions (advocates for standard manufacturing, chemists, rags-to-riches capitalists) had largely been framed in terms of how the industry wished to view and position itself, and not necessarily in terms of appeal to those outside the industry.

Significantly, it was not until the pharmaceutical industry constructed the "second rung" of its rhetorical helix that public opinion would begin to shift in its favor. This second rung would consist of description—a construction of meaning that would be not merely understood by others, but embraced by them. Unlike concrete definitions, description bathes the subject in an aura of intangibility, where feelings and impressions predominate over facts and figures.

The descriptive side of pharma's rhetorical helix did not truly flourish until the industry began making products that contributed substantially to the betterment of mankind. The teeter-tottering of public opinion would tip distinctly in favor of the pharmaceutical industry in the 1940s with the advent of a “miracle drug” known as penicillin. This was a product that would not only define the pharmaceutical industry as a producer of life-saving drugs, but would, for decades to come, color most descriptions of the industry in bright rosy hues. The development of penicillin allowed the pharmaceutical industry to weave rich and vivid descriptions of itself that spoke to the industry’s compassion, humanity and genuine concern for others, and would pave the way for public ingratiation.

CHAPTER IV

AFTER DEFINITION, DESCRIPTION: USING BURKE'S DRAMATISTIC LENS TO VIEW THE PHARMACEUTICAL INDUSTRY

As described in the previous chapter, at the turn of the twentieth century, emerging pharmaceutical companies defined themselves as advocates of standardization, chemists, and rags-to-riches capitalists. Since the rhetorics of definition and description operate as a helix to engender ingratiation, it was not sufficient for drug companies to define *what* they were, via definition; they also needed to determine *how* they were, via description. It is description, rather than definition, that establishes an aura around a person or thing described. In the rhetorical helix, definition and description are integrally linked, with the latter an essential step toward ingratiation. A positive aura is built on the self-styled rhetoric of reputation.

Thus, emerging pharmaceutical companies needed to become their own audience (ROM 563), in Burkean terms, in order to identify the sympathetic qualities, representative anecdotes, and heroic metaphors that would represent them and thereby refute any disparaging commentary on their industry. This then set the stage for the process of identification, whereby members of the general public would come to believe that their interests (e.g., good health, recovery from illness) were "consubstantial" (ROM 545) with that of the pharmaceutical industry.

Whereas *what* pharmaceutical companies were had been defined in is or is not scientistic fashion, *how* they were became described in shalt or shalt not dramatistic fashion. Burke calls this, satirically, “directing the intention” as it applies to how an individual chooses to conduct his affairs (LSA 45). Yet, by setting out an ethical *in*tention, which largely is directed to oneself, one also directs the *at*tention of others to the establishment of those ethics (as well as, it should be noted, their subsequent achievement or failure).

Burke also notes that many of the observations that we make about any given reality are largely related to “the spinning out of possibilities implicit in our particular choice of terms” (LSA 46). For example, he says, the injunction crede, ut intelligas (“believe that you may understand”) is “at once pious and methodological” and serves “to define the relation between faith and reason” (LSA 47).

It is revealing that the word credo (“belief”) was chosen by the pharmaceutical company Johnson & Johnson (J&J) to represent its internal code of ethics. J&J’s credo was written in 1943 by company founder Robert Wood Johnson. In it Johnson outlined a hierarchy of responsibilities: first to those who use the products; next to employees who work in plants and offices; third to management; fourth to communities; and last to stockholders. It is an excellent example of “shalt” style rhetoric in which an ethical environment of what *should be* is privileged.

The company provides a copy of the 1948 version on its website, as follows:

> Our Credo
>
> We believe that our first responsibility is to the doctors, nurses, hospitals, mothers, and all others who use our products. Our products must always be of the highest quality. We must constantly strive to reduce the cost of these products. Our orders must be promptly and accurately filled. Our dealers must make a fair profit.

> Our second responsibility is to those who work with us—the men and women in our plants and offices. They must have a sense of security in their jobs. Wages must be fair and adequate, management just, hours reasonable, and working conditions clean and orderly. Employees should have an organized system for suggestions and complaints. Supervisors and department heads must be qualified and fair minded. There must be opportunity for advancement—for those qualified and each person must be considered an individual standing on his own dignity and merit.
>
> Our third responsibility is to our management. Our executives must be persons of talent, education, experience and ability. They must be persons of common sense and full understanding.
>
> Our fourth responsibility is to the communities in which we live. We must be a good citizen—support good works and charity, and bear our fair share of taxes. We must maintain in good order the property we are privileged to use. We must participate in promotion of civic improvement, health, education and good government, and acquaint the community with our activities.
>
> Our fifth and last responsibility is to our stockholders. Business must make a sound profit. Reserves must be created, research must be carried on, adventurous programs developed, and mistakes paid for. Adverse times must be provided for, adequate taxes paid, new machines purchased, new plants built, new products launched, and new sales plans developed. We must experiment with new ideas. When these things have been done the stockholder should receive a fair return. We are determined with the help of god's grace, to fulfill these obligations to the best of our ability. ("Credo")

In this case, the company positions its credo alongside its name to establish the reality that J&J has not merely composed a morally based belief system, but that J&J itself is to be believed. J&J determines how it shall or shall not be, codifies these decisions through its credo, and steers the company to this guidance. The public then absorbs this rhetoric through news articles, broadcasts of the day and so forth.

The terms of the credo reflect J&J's culture, and the company updates the credo as needed to adjust with the times. The most recent version of the credo incorporates new shalt rhetoric that places emphasis on care for the environment and maintaining balance between work and family.

Over the years, and especially during the company's Tylenol crisis of 1982 when several people died after ingesting the product, the term J&J's Credo has served as a terministic screen to reinforce the description of J&J as a highly ethical company that makes decisions consistent with a morally upright belief system.

J&J's credo balances statements that are directed toward an internal audience with those that are focused externally (e.g., on patients and the community), which makes the credo a particularly effective example of descriptive rhetoric. While Burke writes that "(i)n traditional Rhetoric, the relation to an external audience is stressed" (ROM 562), he also says:

> a modern "post-Christian" rhetoric must also concern itself with the thought that, under the heading of appeal to audiences, would also be included any ideas or images privately addressed to the individual self for moralistic or incantatory purposes. For you become your own audience, in some respects a very lax one, in some respects very exacting, when you become involved in psychologically stylistic subterfuges for presenting your own case to yourself in sympathetic terms. . . . The individual person, striving to form himself in accordance with the communicative norms that match the cooperative ways of his society, is by the same token concerned with the rhetoric of identification. To act upon himself persuasively, he must variously resort to images and ideas that are formative. (ROM 562-563)

Thus for J&J, and indeed for all pharmaceutical companies, it is difficult to present an effective and sympathetic case to the outside world unless the argument is first presented and accepted by those inside the company.

Company mission statements represent opportunities for pharmaceutical companies to "test drive" messages with employees prior to sharing them with an external audience. The values that a corporation chooses for itself—the shalt and shalt not directives—are captured in a number of publications that are shared with others. In 2004, for example, Bayer published a newly revamped mission statement in a pamphlet called Science for a Better Life. In it, Chairman of the Board Werner Wenning explains that the new mission statement

> (d)efines our future perspectives, our goals and our values, and guides our strategy at a time of sweeping change. It outlines to our stockholders, our customers, the public and especially our employees how we think and behave as a company. In seeking to arouse everyone's enthusiasm to contribute to Bayer's success, we aim to impart one thing above all else: the fascination that is Bayer. (Bayer AG Communications 2)

The pamphlet merges language that is scientistic and definitive with language that is dramatistic and descriptive, such as, "Bayer is an inventor company infused with a pioneering spirit" (6). Bayer underscores its text with messages of innovation, new technology, and idealism, as follows:

> This mission statement underscores our willingness as an inventor company to help shape the future and our determination to come up with innovations that benefit humankind. Of special importance in this respect are:
> - new products emerging from our active substance research,
> - the consumer health business,
> - the growth markets of Asia,
> - new areas such as biotechnology and nanotechnology. (3)

Companies reinvent themselves as well through their values statements which, like mission statements, define what a company is through descriptions of how it behaves. On its website, Pfizer lists its company values of "integrity, respect for people, customer focus, community, innovation, teamwork, performance, leadership and quality." To this are added definitive statements such as "We recognize that people are the cornerstone of Pfizer's success" and "Since 1849, the Pfizer name has been synonymous with the trust and reliability inherent in the word Quality" ("About Pfizer").

Occasionally, the role of internal audience can be assumed by an individual leader. For example, Roy Vagelos, the former chief executive officer and chairman of Merck, tells his own story in The Moral Corporation, conflating the moral and philosophical lessons of his life with that of his pharmaceutical company employer. He has a dialogue with himself upon joining Merck, identifying the sympathetic qualities of past companies, and adding his own personal flavor. He describes himself and what he stands for, and, by extension, does the same with Merck.

Vagelos writes that when he joined Merck, he "knew very little about the pharmaceutical business and virtually nothing about the American business system" but he was convinced that

> if the company improved the quality of its research and [its] strategy for drug discovery, it would have a much better chance of someday developing new therapies that would really make a difference. That was the hook for me – believing I could have a positive impact on the company's ability to reach that laudable goal. (Vagelos and Galambos 25)

In this manner, Vagelos is presenting Merck's case to himself, merging scientistic definition with dramatistic description. In essence he is saying, 'Yes, we define ourselves as capitalists; but we shall be capitalists with a strong work ethic and a commitment to doing good.'

Vagelos also references his own personal rags-to- riches story of capitalism. He tells of his Greek-born mother and father, writing:

> My life has in many ways been the classic American drama: Poor immigrants come to the United States and work very hard; their children receive an excellent education and lead a better life. Like most such myths, the story has some truth to it, as it certainly does in my case. (Vagelos and Galambos 4)

Vagelos' reference to myth invokes the idea of play, and of the give and take that exists in language. If we describe ourselves as ethical and heroic, and others describe us as such, eventually description has the potential to meld with definition. Language creates the reality. For example, during his lifetime, Albert Einstein delivered highly intellectual lectures and published works of brilliance; today, the name Albert Einstein is synonymous with genius.

At the turn of the twentieth century, being a chemist meant being modern, scientific, and rational. It was how pharmaceutical companies defined themselves, and it provided a foundation for the descriptive language they shared with the public. But by the turn of the twenty-first century, being a chemist was perceived as equivalent to tampering with nature. In 1962 the environmental writer Rachel Carson confronted the chemical industry with her landmark publication, Silent Spring, and the description of chemicals shifted from helpful to hurtful.

As was evident throughout the Newkirk "a rat . . . is a boy" example, the idea of definition and the idea of what ought and ought not to be wrap around each other incessantly. This is particularly evident in literature. In the novel, The Last Prophet, for example, two characters are describing the nature and essence of pharmaceuticals and the pharmaceutical industry, in conjunction with "chemtrails"—a relatively new term to describe suspicious chemicals allegedly released in the vapor trails of over flying aircraft. Their conversation is as follows:

> "OK, well, you know how most all of TV is owned by just a few companies?"
> "Yeah."
> "Well those companies make their money mostly through selling commercials right?"
> "OK."
> "Have you noticed most of the commercials are for pharmaceuticals now-a-days?"
> "Oh, well yes, I guess that's true."
> "OK well, there you go."
> John confused, "what are you talking about?"
> Tim tries a different angle, "Alright, what are chemtrails made of?"
> "Ah, chemicals, Barium…"
> "Right chemicals, and what are pharmaceuticals made of?"
> John gives him a patronizing, "chemicals?"
> "Exactly, see, there ya go."
> John rolls his eyes.
> "You've got your poison, and you've got your antidote and they're both made out of chemicals."
> "Oh!", John didn't expect that. It reminded him of something he recently heard.
> John recaps, "so the pharmaceutical companies are putting chemtrails in the air which cause disease, so they sell drugs which help the disease and they control the TV stations because of all the money they spend on commercials which sell their drugs." (Carter 91)

Through his characters, Carter defines pharmaceuticals as chemicals and as both the antidote and the poison itself. Carter says his book is "a work of fiction and in no way is meant to characterize real persons or events," but he then adds, "However, the message is real" (i). In so writing, Carter is very much in the vein of Rachel Carson by using a dramatistic and literary approach to deliver a scientistic message.

Thus in both works of literature and reference materials, we find opposing scientistic-style definitions (or viewpoints) spiraling in a rhetorical helix toward each other, encountering the other, and being made unstable by some change to the dramatistic pentad (e.g., the people involved, the time frame, the surrounding circumstances). The definitions then spiral out again, changed—significantly, modestly or barely perceptibly—as a result of the encounter.

At the turn of the twentieth century, pharmaceutical companies defined themselves through the precise and standardized ways they manufactured their products. But by the turn of the twenty-first century, the industry was under fire for cutting corners and being sloppy in their drug development process. MedAdNews, one of the premier publications of the pharmaceutical industry, recently carried an editorial entitled, "Word to the Wise" that warns the industry that words are critical to public perception. The author writes that complicated pharmaceutical industry jargon, which usually is peppered throughout company press releases and other public documents, is an impediment to true understanding. She writes that, as a consequence,

> Pharmaceutical industry image continues to be a problem. There is a lot of talk about how the general public thinks the industry is out to empty its pockets, that companies are hiding critical information about side effects, that DTC [direct to consumer advertising] hypes drugs at the expense of patient health. (Truelove 3)

Obviously the "right" words and the "right" descriptions lead to public ingratiation, whereas the wrong words lead to alienation. Less obvious is how to determine what will strike a responsive chord in the public.

The Myth of Pharmaceutical Traits

In a lecture on semantics and discourse, Philipp Koehn writes that it is possible to detect stereotypes through the use of Google. By typing in a nationality, along with the phrase <u>are known to be</u> and a wild card asterisk, it is possible to gain a perspective of how that nationality is perceived. He provides the following examples:

> • Enter: Scots are known to be * => frugal, friendly, generous, thrifty, . . .
> • Enter: Englishmen are known to be * => prudish, great sports-lovers, people with manners, courteous, cold, . . .
> • Enter: Germans are known to be * =>pathetic, hard-nosed, arrogant, very punctual, fanatical, hard-working, . . .

To write that a Scotsman is thrifty is to go beyond the realm of definition into, as Burke would put it, "the rhetoric of oratory and advertising, mythologies, theologies and philosophies after the classic model" (LSA 45). For example, <u>The Thrifty Scotsman</u> is the company name and symbol for a used furniture store in Littleton, Colorado. The thrifty Scot is fodder for scores of jokes about penny pinchers. While descriptions such as thrifty do not define Scottish citizens per se, many descriptions emerge from some basis in reality. As the Scottish Council Foundation, a non-profit research organization, writes:

> Rightly or wrongly, the Scots are regarded as a nation that understands money. The concept of the "thrifty Scot" may be little more than a caricature, but Scotland is home to much of Britain's domestic and international financial services industry. (Vizard 7)

The thrifty Scot is seen as an endearing mythology—if it were not, such a characterization would never even be mentioned in an official investment brochure. As Koehn points out, the Scots have other stereotypical traits, too. These are largely positive in the public eye.

In his biography of Alexander Fleming, a key figure in pharmaceutical history, Gwyn MacFarlane writes that Fleming "acquired the true Scottish characteristics and, like most expatriate Scots, he retained them tenaciously throughout his life" (3).

The ascribing of praiseworthy Scottish traits to Fleming—not just by MacFarlane, but by many others—gave Fleming a heroic status that would be consistent with his use as an early pharmaceutical industry icon. The description, too, of Fleming's mythological discovery of penicillin lent credence to the positioning of the pharmaceutical industry as purveyors of miracle drugs. Similarly, in 1908 the immunologist Dr. Paul Ehrlich described what he saw as "magic bullets"—chemical compounds that would seek out and kill disease-causing microorganisms while having no harmful effects on the patient himself.

Writing in 1945, Dr. Boris Sokoloff characterized Ehrlich's approach as "the proud conviction of German science" whereby "man's intellect overcomes every natural obstacle on the road to success" (123). He contrasted this with penicillin, which followed "the road of research designated by those natural forces that dominate and control the human organism" (123). Thus, penicillin was linked with nature, not chemicals. Even more powerful, from a rhetorical perspective, were the descriptions of miracle drugs and magic bullets, which would endure in the public consciousness for much of the twentieth century.

The author of a 1945 history of penicillin entitled Yellow Magic: The Story of Penicillin says that he was convinced that many people would take issue with the title of his book. He writes:

> Medical men bridle at the word magic when it is used in connection with their science. They are similarly provoked by the word miracle. Miracles, they contend, happen only in biblical literature, not in modern hospitals. And they say that there is no magic involved when some new drug snatches back a life that was within moments of extinction.
>
> Despite the modern medical man's dislike and distrust of the word magic, I still believe that its use is justified. But the reader can decide this for himself. (Ratcliff 3)

From a definitional standpoint, the pharmaceutical industry had worked hard to separate itself from the idea of miracles and magic. Yet, from a descriptive and dramatistic standpoint, these concepts were somehow comforting and understandable to the public at large.

One reason for studying the role of description, particularly in the Fleming story, is to gain insight into the part it plays in the rhetorical helix. Although definition is suasive to a degree, its scientistic structure allows limited maneuverability of language. Ingratiation, on the other hand, presupposes that an emotional connection has been made and that the interests and motives of one party are deemed to be the same as another party. Description is the process in the middle. Description can allow us to feel closer to a subject, and move us toward ingratiation, or distant from a subject, prompting perhaps another attempt at description or definition.

By examining the descriptive rhetoric surrounding the pharmaceutical industry, it is possible to probe how rhetoric serves to act. That is, by using Burke's dramatistic pentad, we can re-view the myths of Fleming and penicillin and expand the multiple narratives that are possible.

The first task is to explore what the general population has embraced about the penicillin narrative and then to draw comparisons with other narratives originating from the pharmaceutical industry itself. Ultimately, the goal is to find the descriptive terminology that is so ingrained, so long-lived, that it seems nearly definitional.

Pharmaceuticals: Hero or Villain?

In today's world, one doesn't need to look far to find a description of big pharma—that is, the world's major pharmaceutical companies—as an irresponsible industry that "jack(s) up the price of drugs," "refuses to do any research with natural methods or prevention" and "fudge(s) the data used in scientific papers" (Kinsinger C3). Although pharmaceutical insiders would likely beg to differ, the fact remains that many elements of these characterizations have now become entrenched in the public's perception.

Yet historically, in the mid-twentieth century, the pharmaceutical industry had achieved eminent status, with penicillin serving as its quintessential success story. Collectively, the industry began to establish its heroic metaphors and representative anecdotes, and the star of this language "act" was clearly penicillin. From an internal communications perspective, not only did penicillin reinforce pharma's connection with chemistry, it also validated the industry's ability to successfully manufacture a complicated product and sell it to millions.

External rhetorical texture came from images of trailblazing and heroism. Penicillin was powerful and effective, and served as an example of pharmaceutical prowess. As a blockbuster product (that is, a drug with a substantial number of sales), penicillin was a forerunner for other blockbuster drugs, such as Prevacid and Prozac, which also achieved major commercial success. However, as opposed to blockbusters such as Viagra, which could be considered merely life-enhancing, penicillin was life-saving, particularly during the Second World War. And although aspirin was and is a highly successful pharmaceutical whose origins can be traced to nature (in its case, the willow bark), aspirin did not perform the same heroic feats as penicillin. Furthermore, since aspirin was a product of German research, it became tainted as a result of World War I. In fact, the trademark Aspirin was seized shortly after the war by the Allies.

As a potent symbol of the pharmaceutical industry, however, penicillin was aptly suited for U. S. and British public relations and would provide powerful ammunition for many, many years against any detractors of the industry.

Penicillin also had a fascinating narrative associated with its discovery—a narrative that continued to be told decades after the fact. For example, in 1999, when Time magazine published its list of the "most important scientists and thinkers" of the twentieth century as part of its "Most Important People of the Century" series, it included the discovery of penicillin. The Time magazine article by Dr. David Ho relates the story of how, in 1928, spores from a *Penicillium notatum* mold had accidentally drifted into Dr. Alexander Fleming's laboratory and settled onto a culture dish that had been smeared with *Staphylococcus* bacteria. In what Ho describes as a "Eureka" moment, Fleming noticed that the bacteria did not grow in the areas contaminated by the mold and thus, the mold must have somehow inhibited bacterial growth. Ho, who describes Fleming's discovery as "the stuff of which scientific myths are made," writes the following:

> It was a discovery that would change the course of history. The active ingredient in that mold, which Fleming named penicillin, turned out to be an infection-fighting agent of enormous potency. When it was finally recognized for what it was—the most efficacious life-saving drug in the world—penicillin would alter forever the treatment of bacterial infections. By the middle of the century, Fleming's discovery had spawned a huge pharmaceutical industry, churning out synthetic penicillins that would conquer some of mankind's most ancient scourges, including syphilis, gangrene and tuberculosis. (117)

This story of Fleming's discovery, with little variation, has been told and retold countless times. As a familiar and popular tale, the Fleming story serves as a tool to understand people's thinking about pharmaceuticals. It is Fleming's discovery that serves, in Burkean terms, as the "representative anecdote" (GOM 60) that succinctly sums up a more complex story.

It's also a basis—a line in the sand—from which we can observe departures. Through the Fleming story, we can assess which parts of the narrative resonate with the public and which parts are glossed over.

The prototypical narrative casts Fleming as the "young Scottish research scientist" (Ho) who is both brilliant and charmingly messy. As the folklore goes, Fleming disliked the chore of washing the laboratory dishes, and so allowed them to pile up instead of washing them after an experiment. Fleming worked in what the Fleming Museum calls a "small, musty, dusty laboratory" at St. Mary's Hospital in London—a place where mold spores apparently could flourish.

It is interesting to note that Ho describes Fleming as a "young Scottish research scientist," although Fleming was 47 years old at the time of the incident. As will be discussed later, the use of youth, or newness, in pharmaceutical (and later, biotech) descriptions is a recurring and strategic rhetorical move to engender ingratiation.

Fleming's status as "the first" is of major importance to the myth. His premier status in being the first to discover penicillin allows him to be lionized as a "Trailblazer" (Hantula), "Pioneer" (Kaye), and "Groundbreaker" (Parker), while his intelligence and scientific acumen positions him in anthologies entitled "Giants of Science" (Birch) and "Great Minds of Science" (Tocci). In the literature, penicillin is variously described as a "wonder drug," a "miracle drug," and a "magic bullet." In his hyperbolic version above, Ho says that penicillin—"the most efficacious life-saving drug in the world"—would "change the course of history." Just as Neil Armstrong was the first on the moon and Columbus was "first" to discover America, it is Fleming who is the first to discover penicillin.

What Ho also does is gloss over what happens between the time the mold was discovered on the culture dish and the spawning of a huge pharmaceutical enterprise, by using the passive phrase, "when it was finally recognized for what it was." There is no mention of the fact that there were others involved in making penicillin into a medicine or the great number of steps that had to transpire in order to transform the mold into a useful medicine. Thus, Ho distills a complicated process into a simple one.

Ho's approach is similar to that found in other popular narratives such as children's books, anthologies, popular magazines, websites, and sermons—anywhere a complicated story is made simple. If, as Burke suggests, language is a selection of reality, then the popular narrative is its ultimate end product. It is a story stripped down to its most basic layer.

An important part of the popular narrative concerns Fleming's altruism. RampantScotland, a web site devoted to "everything about Scotland" describes Fleming's motivation for bacterial research as stemming from seeing the "failure of current antiseptics to treat infected wounds" during his own stint during World War I. The site contends, "Fleming did not patent penicillin, hoping that this would help to develop the product as a cheap and effective drug" ("Famous Scots").

Not only was Fleming altruistic, he was also modest and self-effacing, according to several biographers. Tocci describes how the cash award from the Nobel Prize "would be most of the money that Fleming ever made from his work with penicillin" (102). And when penicillin drug manufacturers once offered Fleming a check for $100,000 (worth $1 million in 21st century terms), Tocci writes, "Fleming protested, saying that he could not possibly keep the money for himself. So he asked that the money be used for research by his department at St. Mary's Hospital" 103). Fleming biographer Andre Maurois, writing in 1959, talked about the scientist's positive qualities that many attribute to the Scots, such as "a capacity for hard and sustained work, a combative spirit which refuses to admit defeat, a steadfastness and loyalty which creates respect and affection, and a true humility which protects against pretentiousness and pride" (9).

Goldsworthy and McFarlane offer another perspective of the story of penicillin, calling it a myth that "meets the specifications of the archetypal 'quest story,' as described by the Russian anthropologist Vladimir Propp." They write:

> The basic quest story seems to be a template in every human culture. It involves heroes who undergo trials or answer riddles, usually with the help of magical or divine intervention (in this case, mould spores drifting through windows). It has been argued that the quest story's structure (along with other story structures) is "hardwired" into the human brain, and that such structures evolved, like poetry and music, in human brains as mnemonic aids to help preliterate people store and remember vast quantities of words. (176)

Barthes, on the other hand, would argue that myth is simply "a type of social *usage*," and "system of communication" (109). Fleming's story, in other words, was (and is) useful for society, and this usefulness not only propelled his tale "from a closed, silent existence to an oral state" (109) but kept it there for years. Although Barthes asserts that there are no eternal myths, there are certainly very ancient ones (110). In popular fairy tales, the brave young knight slays the dragon and is rewarded with princehood. In the Alexander Fleming version, the kind Scottish researcher saves countless lives and is rewarded with a knighthood (in 1944) and the Nobel Prize (in 1945). And upon his death in 1955, Fleming "was given the kind of funeral reserved for national heroes, his ashes interred near those of Nelson and Wellington in the crypt of St Paul's Cathedral" (Gilchrist 31).

In summary, what seems to be deeply ingrained in the psyche of the public is the story of Fleming as a brilliant, ethical man, and inadvertent hero. As a website at the Massachusetts Institute of Technology puts it, “No scientific story illustrates the power of luck coupled with ingenuity quite like the tale of the discovery of penicillin” (“Inventor”).

In accepting and promulgating the “standard” version of the story, we (that is, the collective we) reject other potential narratives—of which there are many. What is involved—what is the human motivation—when we say Alexander Fleming discovered penicillin by chance? How is this to be accounted for? Clearly, there are aspects of the standard version that are sympathetic to the pharmaceutical industry. Saving lives with a unique medical compound (penicillin) is one. Having industry associates with virtuous personal characteristics (Fleming) is another. At the same time, there are aspects of the story that appear less harmonious with industry objectives. If, for example, we embrace the concept of accidental discovery, what does that say about modern research methods that stress a systematic and deliberate scientific approach? Also, what happens when the star of this heroic scenario (penicillin) begins to lose its potency through misuse or in the face of antibiotic resistant bacteria? The latter example in particular shows how definitions and descriptions (e.g., “this is heroic”/“this is not”) can easily become destabilized.

Through dramatism, it is possible to reveal the many variations of the penicillin story, with the overarching objective of understanding popular reaction to the pharmaceutical industry at large. Below, six variations of the penicillin story are presented, using Burke's pentad of terms. In each variation, the change of one term, scene (that is, a different historical time period) drives a completely new potential narrative. Through these variations, it is possible to observe the push and pull of descriptive rhetoric and gain an understanding of how all of us have come to think and talk about the pharmaceutical industry.

Pentad 1: The Early Twentieth Century

If the simple, popular narrative of the discovery of penicillin is put into Burke's pentad format, we have the following:

Act:	The discovery of penicillin
Scene:	The early 20th century
Agent:	Alexander Fleming as hero
Agency:	Fortuitous drifting of mold spores on the right spot at the right time
Purpose:	Seeking to solve the mystery of the body's fight with infection

In this pentad, the event takes place in the generic 20th century, a catch-all timeframe that synthesizes the year 1928 into a 100-year period. It is a timeframe that is chronicled in magazines and anthologies under headings such as "the most important discoveries of the twentieth century." Alexander Fleming's discovery of antibiotics was included as one of "ten magnificent achievements" in the field of medicine (Friedman and Friedland 228). In 2007, when the British Medical Journal invited its readership of physicians to list the greatest medical breakthrough since 1840, the discovery of antibiotics came in at number two, with roughly fifteen percent of the vote. (Good sanitation was first, at roughly sixteen percent.) (Ferriman 111). Robert Bud, principal curator of the National Museum of Science and Industry in London, described penicillin as the “iconic antibiotic” whose “introduction into clinical practice was widely celebrated” (“Antibiotics”).

In embracing this scenario, we are saying that we like the concept of the agent as one doctor, acting alone, who has a noble purpose and admirable Scottish traits. We also respond positively to an act that is the first of its kind and represents a trailblazing discovery. This scenario also privileges fortune, destiny and God—all concepts that are somehow greater than man.

In this scenario, the agency is also strongly related to nature and biology, since it is air that carries the natural mold substance to the Petri dish. An underlying theme could be that Nature provides the answers to man’s critical problems.

As mentioned earlier, this is the scenario that can be found in popular literature, such as anthologies and children’s books, and in popular journalism.

Pentad 2: 1928

The first years of the 20th century were fraught with suffering and death. World War I (1914-1918) leveled heavy casualties in Western Europe. While many were the direct result of artillery fire or chemical weapons, such as mustard gas, many other soldiers died from trench foot, a fungal infection that often led to gangrene and amputation.

The two years following World War I were even worse, when the Spanish Flu pandemic killed between 20 and 40 million people – roughly one-fifth of the world’s population. An estimated 675,000 Americans of influenza during the pandemic, ten times as many as in the world war, and of the U.S. soldiers who died in Europe, eighty percent, or 43,000, fell to the influenza virus and pneumonia and not to the enemy (Crosby 206).

By the time 1928 rolled around—the year that Fleming observed the penicillin mold—both the war and the pandemic had been over for a decade. With no pressing urgency to develop an anti-infective, penicillin lay dormant in Fleming's lab. Thus, instead of characterizing Fleming as a brilliant hero, the alternative pentad could label him as incompetent and lacking the skills to develop penicillin into a viable medicine; lazy and unindustrious; or lacking vision that the horrors of the previous decade could happen again. Given such a scenario, the new pentad could look like this:

Act:	Noticing a curious bacterium on a Petri dish, and then doing nothing with it.
Scene:	1928, ten years after WWI and the Spanish Flu pandemic
Agent:	Alexander Fleming as incompetent /unindustrious/short-sighted
Agency:	Penicillin as a mere curiosity
Purpose:	To record a mere curiosity while pursuing the "real" objective of looking for cure for syphilis.

One example of this pentad was found in 2006 on the British Broadcasting Company website. In its pages on historical figures, the BBC characterized Fleming as incapable and an egotist:

> After his initial discovery, Fleming did little more than keep a supply of the mould and return to his routine work. It was the scientists Howard Florey and Ernst Chain who developed penicillin further. Florey and Chain were chiefly responsible for the research which led to its success as a drug, although Fleming took most of the credit for the discovery and its subsequent development. ("Historic Figures")

In fact, this version didn't even give credit to Fleming for identifying the substance, but gave the credit to "one of Fleming's colleagues who identified the mould as penicillin."

It is to be noted that as of March 1, 2007, this characterization of Fleming was no longer posted on the BBC website, but replaced with a new version. The new version still credited Florey and Chain with "develop(ing) penicillin further," but deleted any inference that Fleming either sat on his hands in developing penicillin, or hogged the credit once it was made available as a drug.

Obviously, at least at some point in 2006, someone at the BBC website had made the decision to allow Fleming to be stripped of his "heroic" status. This action could have been taken to elevate the notion of a team rather than individual effort; to disparage a Scotsman; to bring forward the achievements of "scientists" rather than country doctors; to elevate the status of Florey and Chain, or any other host of theoretical reasons. Whatever the rationale, the 2006 version did not stand for long. In the 2007 version, Fleming's heroic status appears to have been restored, and several points were added to ameliorate his personal characterization.

The above is just one example of this particular pentad in action. However, the fact that the Fleming anti-hero story appeared, disappeared, and was replaced by the traditional Fleming-as-hero story speaks to the impetus to preserve the "traditional" story.

The BBC has always championed British heroes and it seems probable that nationalistic motivation is also somehow in play in this scenario. This is a theme that will be discussed further, per the scenario below.

Pentad 3: The War Years (1939-1945)

World War II was the deadliest conflict in history. Battlefield casualties came either immediately, as the result of bombs or bullets, or slowly and painfully, from infection and gangrene. The U. S. and British governments were under tremendous pressure to address the issue of infection and tremendous resources were directed to "save our boys." Penicillin needed to be manufactured on a large scale, and it needed to be done quickly.

This is the basic story of penicillin and World War II. Beyond this, the story expands in a number of ways. In the new pentad featuring WWII as the scene, the lone Scottish doctor and his Petri dish are no longer in the forefront of the story. Instead, Fleming is relegated to an historical and somewhat sentimental position, replaced by major pharmaceutical companies, governments, and others as the dominant drivers of the story.

Act:	The development and commercialization of penicillin
Scene:	The years of World War II
Agent:	Pharmaceutical companies; governments
Agency:	Fermentation and chemical synthesis as new "weapons" to fight infection
Purpose:	To "save our boys" from infection and gangrene; to win the war

In what can be considered a neo version of the Revolutionary War, U. S. and British governments fought for control of the story of penicillin and for the credit of its discovery. In his account of the American pharmaceutical industry, Tom Mahoney quotes Dr. Henry Welch, director of the Food and Drug Administration's antibiotic division. Welch says, "The American chemical and pharmaceutical industries have never been given ample credit for the tremendous efforts they put forth in the development of penicillin" and "It is the ingenuity, drive, and 'know-how' of the American chemical and pharmaceutical industries that have made possible this tremendous advance" (Mahoney 12).

Historical researchers John Mailer and Barbara Mason describe the tug of war between the agents as follows:

> Authors have written any number of books and articles on [the story of penicillin], and while most begin with Sir Alexander Fleming's discovery in 1928 and end with Sir Howard Florey's introduction of penicillin into clinical medicine in 1941 or John C. Sheehan's inorganic synthesis in 1957, broad differences of opinion exist between and among the principal scientists, governments, laboratories, and drug industries in Britain and the United States as to the details of this story. Over and above the microbiological and chemical achievements in penicillin's discovery are to be found aspects of competition between two nations and their scientists; political and wartime intrigue; competition for academic and financial reward; the formidable challenge of producing penicillin in quantities to support the military in World War II; the complexities of cooperation among governmental, industrial, and academic entities; and human, legal, and national differences over patent rights and royalties in postwar years. (39)

As writers for the periodical Illinois History Teacher, Miller and Mason concern themselves with the role Illinois played in the development of penicillin. They describe how German bombing raids imperiled Britain's manufacturing capabilities, thus necessitating production in the United States and specifically at the government-sponsored Northern Regional Research Laboratory in Peoria, Illinois, "the middle of the greatest corn-growing farmland in the world" (Miller and Mason 42). Of Illinois, the authors write:

> The corn-milling industry of 1941 was already well experienced with the fermentation process required to produce penicillin. But since the original penicillin molds from England produced uneven results in the manufacturing process, American scientists needed a more reliable source. They found the mold they needed, which was "discovered on ripe cantaloupes by Mary Hunt from Peoria." (42)

Later in the article, Miller and Mason set up a polarity between the government scientists at Peoria and the pharmaceutical industry, with the former advocating "scientific disclosure of information" and the latter insisting on "the protection of proprietary rights" (42). This gives the government an open and generous role, and the pharmaceutical industry (defined principally as Merck, Pfizer, Squibb and Abbott) a more avaricious stance.

Miller and Mason privilege the activity of the state of Illinois, and also elevate the status of American crops in producing a more potent medicine. Mary Hunt, a lab worker, is given special mention, demonstrating that ordinary folks can play as much of a role in medical history as Nobel laureates. Although they assign the role of hero to the United States government, the authors cannot completely discount the contributions made by the pharmaceutical companies. They write:

> Thanks to the work of scientists and their staff, together with the Illinois farms and numerous drug companies, the drug saved the lives of hundreds of thousands of war victims during World War II and has continued to shorten illness and save lives every day since. (43)

Pharmaceutical companies, of course, also vie for control of the WWII penicillin story. Ads contemporary to the time depict pharmaceutical companies as the "masters" of the complex problem of penicillin manufacturing. A typical example is the ad shown in

Figure 1, from Schenley Laboratories, which is no longer in operation as an antibiotic manufacturer.

Figure 1. ***Schenley Laboratories Advertisement for Penicillin, 1944.***

The ad, published in Life magazine on August 14, 1944, reads as follows:

> When the thunderous battles of this war have subsided to pages of silent print in a history book, the greatest news event of World War II may well be the discovery and development—not of some vicious secret weapon that destroys—but of a weapon that saves lives. That weapon, of course, is penicillin.
>
> Every day, penicillin is performing some unbelievable act of healing on some far battlefront. Thousands of men will return home who otherwise would not have had a chance. Better still, more and more of this precious drug is now available for civilian use . . . to save the lives of patients of every age.
>
> A year ago, production of penicillin was difficult, costly. Today, due to specially-devised methods of mass-production, in use by Schenley Laboratories, Inc. and the 20 other firms designated by the government to make penicillin, it is available in ever-increasing quantity, at progressively lower cost.
>
> Listen to "THE DOCTOR FIGHTS" starring RAYMOND MASSEY, Tuesday evenings, C.B.S. See your paper for times and stations.
> SCHENLEY LABORATORIES, INC.
> Producers of PENICILLIN-Schenley

The ad's sidebar was entitled, "From Ordinary Mold—the greatest healing agent of this war!" It reads:

> On the gaudy, green-and-yellow mold above, called *Penicillium notatum* in the laboratory, grows the miraculous substance first discovered by Professor Alexander Fleming in 1928. Named penicillin by its discoverer, it is the most potent weapon ever developed against many of the deadliest infections known to man. Because research on molds was already a part of Schenley enterprise, Schenley Laboratories were well able to master the problem of large-scale-production of penicillin, when the great need for it arose.

The ad's language references Alexander Fleming (a name that in 1944 still carried weight and authority) and describes penicillin as a "miraculous" substance. At the same time, the company also identifies a problem more contemporary to 1944—that is, large-scale production—and describes how Schenley was able to "master" that problem, thus elevating itself and its peer companies to heroic status.

Even today, the "race" to produce penicillin still figures in pharmaceutical company lore. In its 2005 citizenship report, Pfizer notes how in 1944 the company used deep-tank fermentation to successfully mass-produce penicillin and become "the world's largest producer of the 'miracle drug'" (33). The company distinguishes itself historically from its peers by stating that it is the only company to use fermentation technology of all those producing penicillin, and that "(m)ost of the penicillin used by Allied forces on D-Day is made by Pfizer" (33).

The notion of accepting a challenge figures prominently in the WWII penicillin story. Abbott Laboratories noted that in 1941, Britain sought help in initiating large-scale production and "Abbott accept[ed] the challenge." In doing so, Abbott became "one of the five pioneers in the United States" ("Abbott History").

Pfizer also says in 1941 it "respond[ed] to an appeal by the U. S. Government to expedite the manufacture of penicillin" and "emerged victorious" in the race for production ("Pfizer: Exploring Our History 1900-1950").

Bristol-Myers Squibb also touts the fact that "(s)ix decades ago, discoveries by Bristol-Myers Squibb helped make the mass production of penicillin possible. Today, we are still the largest manufacturer of penicillin in the world, and the maker of some of the world's most prescribed antibiotics" ("Bristol Myers Squibb: Working Together").

For its part, Merck tells the story of how, in 1942, the head of its research labs, Dr. Randolph Major, was able to secure a few grams of the precious penicillin commodity in order to save the life of a "young wife and mother." The feature story, describes how the company was concerned about ensuring the supply of penicillin for the war effort, but also in saving the life of Anne Miller, a nurse, wife and mother in New Haven, Connecticut. The website states that Mrs. Miller's temperature chart, which "looked more like the great market crash of 1929" is preserved in the Smithsonian Institution, thus validating the heroic status of the drug, the era, and the company ("Milestones in Merck History").

And in his discussion of Merck as a "moral corporation," Roy Vagelos makes a point of mentioning Merck's "long record of superb accomplishments," including "important contributions to the development of penicillin and streptomycin, the first effective treatment for tuberculosis" (Vagelos and Galambos 23).

Clearly, playing a part in the successful outcome of WWII is a recurring motif in the literature of several major pharmaceutical companies. Furthermore, competition for WWII glory, even in the early twenty-first century, remains active. A fall 2003 publication by Bristol-Myers Squibb quotes Murray Kaplan, a former employee of the company, as saying that "Bristol Laboratories was probably the first to crystallize penicillin in the U.S., but the company, being small and secretive at the time, did not get the credit it should have" ("Penicillin and the Age of Miracles" 2).

The article describes how scientists at Bristol conducted experiments with fermentation and chemical synthesis to improve penicillin. At the same time, the article makes a point of saying that Kaplan's "stroke of luck" in 1944 "brought another tremendous breakthrough." The article states:

> The bottle-grown penicillin harvested at the Taylor Street laboratory yielded a yellow-gold extract that scientists had not yet learned to refine into pure crystalline form, which would make true mass production possible. Murray Kaplan, the 21st employee hired by Bristol Laboratories, was among those working day and night on this problem. Then one day, someone accidentally knocked a test tube of penicillin out of Mr. Kaplan's hand.
>
> "My first reaction was, there goes six months of work all over my desk. I got a cloth, wiped up the desk and put the cloth aside. I looked at the cloth a little while later, and I saw that penicillin crystals were clinging to it. I knew then that we had our form." (2)

The Kaplan story is interesting because the "accidental" nature of his discovery harkens back to the Fleming story and reinforces the appeal of fortune over the scientific process. Even when the scene of the pentad is changed to World War II and 1940s-era chemistry, writers cannot help but summon, once again, the allusion to a power that is greater than man. This largely Christian meta-narrative positions man as imperfect but capable, through careful observation of nature, of discovering the secrets of God's plan, as described in the book of Genesis. Since nature is the agent in these "accident" narratives, one possible implication consistent with a Christian lens is divine intervention (God as agent in the form of Nature) rather than accidents, since accidents per this theology do not happen in a world that unfolds according to God's plan.

Pentad 4: 1945

In December 1945, when the Nobel Foundation was awarding its annual prizes, the last battle of World War II was over by six months. Although, as per the pentad above, pharmaceutical companies like Merck, Abbott, Pfizer, and Bristol-Myers Squibb had competed (and still do compete) for public acknowledgment of their contributions to the development of penicillin, it was ultimately three individuals who were recognized by the Foundation: Alexander Fleming, Ernst Chain, and Howard Florey.

Chain was a university-trained chemist and a refugee from Nazi Germany. In 1933 he fled to England and obtained a position in chemical pathology at Oxford University. Florey was Australian, also a chemist, and also a professor at Oxford. Chain and Florey collaborated in 1938 to begin work on penicillin.

At the Nobel presentations, it was noted that it was unusual that only four years had elapsed between a scientific discovery (i.e., isolating the active substance in penicillin) and Nobel Prize recognition. In terms of motivation, one could argue that the Nobel Committee truly sought to bestow honor on the deserving individuals or, less charitably, that theirs was a strategic initiative to be a part of the publicly well-known and well-regarded story of penicillin. It can also be argued that Nobel Prize ceremonies are simply dressed-up political statements, in the same vein as other award ceremonies.

Since World War II had yielded the atomic bomb, the ramifications of man's genius was somewhat suspect. Awarding a Nobel Prize for the contribution of penicillin to mankind was a convenient way to make reparations for human-initiated harm. In presenting the awards at the Nobel ceremony, Professor G. Liljestrand, a member of the Staff of Professors of the Royal Caroline Institute, said:

> In a time when annihilation and destruction through the inventions of man have been greater than ever before in history, the introduction of penicillin is a brilliant demonstration that human genius is just as well able to save life and combat disease. (Nobel Foundation)

Thus the pentad for this scenario would play as follows:

Act:	Awarding the Nobel Prize in Medicine to Sir Alexander Fleming, Ernst Boris Chain and Sir Howard Walter Florey
Scene:	December 10, 1945, six months after the last battle of WWII
Agents:	The Nobel Foundation
Agency:	Presentation of Award at the Nobel banquet in Stockholm, Sweden
Purpose:	Per the will of Alfred Nobel, the Nobel Prize is given to the "person who shall have made the most important discovery within the domain of physiology or medicine"; to be a part of the historic story of penicillin; to make amends for WWII evils

In their acceptance speeches, all three recipients were vying to tell a different part of the story. Chain discussed being part of a persecuted race and how he was grateful to Providence that he could work on a project to alleviate suffering. Florey's message was that scientists "must be free to pursue scientific enquiries without political interference," and Fleming was motivated to tell his story of how the discovery was an accident. Thus two of the three recipients stressed that which is greater than man.

Also important was the notion that the three Nobel recipients were acting for the good of man, rather than for their own private gain. At the awards ceremony, Professor A. H. T. Theorell, Director of the Department of Biochemistry at the Nobel Institute of Medicine, related one of Grimm's fairy-tales in which a student received a wonderful plaster (bandage) from a "mighty spirit." One side of the bandage had the power to heal, while the other side could turn iron into silver, thus making the student-turned-physician both celebrated and wealthy. At the Nobel banquet, Theorell said, "You have dug up a wonderful plaster, too, that has healed countless sores . . . but there is a difference between you and the student—you have not used that side of the plaster which made silver" (Nobel Foundation "Banquet Speech").

Although Florey and Chain also received the Nobel Prize in 1945, it is safe to say that their names are less well known, by far, than that of Fleming. Whereas, for example, the New York Public Library has nine titles on Alexander Fleming, it has only two on Howard Florey and merely one on Ernst Chain. The ratios are similar in periodicals as well.

Macfarlane said that it was with “a lingering sense of injustice” that he wrote a book about Howard Florey, and that the sense of injustice was compounded when the Florey book was rejected by various publishers (x). Macfarlane writes:

> [N]one of the commercial publishers whom I approached showed any interest either in the subject or the author except one, who suggested kindly that I should write a biography of Fleming instead. ‘At least,” he said, ‘everyone has heard of *him*.’ (x)

If Florey’s story is not well known, then Ernst Chain’s story is even less so. Ronald Clark writes that Chain “has remained the relatively unknown scientist in the enterprise, even though he became a leading figure in the development of antibiotics” (1). Clark states that Chain, a German-born Jew, was an irritating and prickly man who supported “causes that were not always popular” (149).

For his part, Macfarlane says that although Fleming’s ascension to world hero is “unjustified by the facts of scientific history” (ix), it is not necessarily Fleming’s doing. He is quick to point out that the “honest, likeable and truly honest” Fleming (x) was not likely the source of the Fleming-as-hero version of events, but was rather a factor of a “somewhat mysterious exercise in public relations” (ix) in which newspaper accounts of the day attributed Florey and Chain’s work to Fleming. It may be, of course, that the

Fleming version is simply easier to tell than the Florey/Chain version. David Wilson writes that the standard myth leaves out a number of important ideas, one of which is that the word penicillin should actually be penicillins. He writes:

> Go back to the very first word of the standard myth—penicillin. It is used in the singular, as it will be throughout this book. Yet this is incorrect, the word should be in the plural—penicillins. There are many different types of penicillin in nature and literally thousands more penicillins have been produced by scientists in their laboratories. (5)

Such complexity, however, is hard to capture in the popular press.

From the 1945 scenario, we can assume that in the public psyche the following notions are privileged: individuals, rather than corporations or individuals working on behalf of corporations; “that which is greater than man”; and selflessness in the pursuit of the common good.

Pentad 5: 2007

As we skip to the present day, we find that the traditional penicillin story (i.e., that penicillin is a miracle drug and Alexander Fleming is a hero) is still rampant. Evidence for this can be found in the modern media, recently published books and many websites.

The popular penicillin narrative shows up regularly in retrospective news stories, as it did in the “Best of Leaders & Success” section of Investor’s Business Daily (Alexander A03). The headline for this story captures all of the essential elements to the myth: “His Messy Desk Sparked the Discovery of Penicillin; An Eye for Observation: Researcher Alexander Fleming’s Keen Concentration Helped Deliver a Knockout Punch to Bacteria." Even the concept of "knockout punch" positions Fleming as a victorious protector of mankind.

Alexander recounts the story of Fleming's messy work area and reminds readers of Fleming's Scottish heritage. She also privileges Fleming's personal attributes of creativity and astuteness, with a keen sense of observation for the natural world:

> As a young boy, Fleming trained his senses so he could detect the smallest changes in the world around him. Wandering around his family's 800-acre sheep farm in Scotland as a child, Fleming memorized every crag and stream. He made it a point to notice the slightest shifts in the color of the leaves and the grass beneath his feet. Looking at his experiments, Fleming's eyes were tuned to focus on the tiniest areas. In his spare time, Fleming used different colors of bacteria to create brilliant "paintings" in petri dishes. This might've seemed like sheer play, but in doing so Fleming trained himself to see the exact hues of different bacterial strains and thus opened his creative mind. (A03)

Alexander also chronicles Fleming's persistence:

> Convinced his discovery would change the course of medicine, he presented his findings in London at the February 1929 Medical Research Club meeting. His colleagues weren't impressed. They ignored his findings, claiming that penicillin was useless because there was no way to preserve and mass produce it. Fleming didn't back down. He published his research in the <u>British Journal of Experimental Pathology</u> and passed papers and proof of the medicine to his peers. He gave out samples of his mold to anyone who showed an interest. (A03)

Alexander also privileges Fleming's role in the commercial development of penicillin, making no mention of the role of government or major pharmaceutical companies.

A major part of the narrative is the idea that Fleming is somehow merely a tool or conduit of God. Fleming has been widely quoted as saying, "I can only suppose that God wanted penicillin, so He created Alexander Fleming" (Anderson 64). Those who choose to replay this quote are reinforcing the notion of Providence, and that Fleming was merely there to observe what God had provided. Typical of this is a sermon presented to St. Simon's Anglican Church in North Vancouver in which the minister conflates Fleming and Jesus:

> Countless millions have been saved physically through Fleming's sacrificial work on penicillin. Countless millions have been saved spiritually through Jesus' sacrificial work on the cross. When is the last time that we thanked God for such amazing acts of generosity? (Hird)

The classic discovery of penicillin story provides evidence that the public views the following positively:

- The concept of a modest individual as single discoverer
- Medicine that comes from nature
- A heroic product, a wonder drug
- Medicine that is effective and serves a noble purpose
- Altruism
- Reward for a good deed (but not just any reward – recognition, rather than profit)
- The idea of God (or fortune or destiny) helping to unveil the drug

If the above is true, then what the public does not respond to is the following:

- Institutional discovery (either large corporations or the government)
- Chemistry-based medicine
- Medicine that serves no noble purpose
- Profit as a driving motivation

Pentad 6: The Generic 21st Century

Penicillin is now 80 years old, and the old reliable story is now threatened—not by government, or big business, or chemists, but by the fact that penicillin itself may no longer be the wonder drug it once was.

Act:	The resistance of bacteria to antibiotics such as penicillin
Scene:	Early 21st century, more than 70 years after penicillin was first made commercially available
Agents:	Health-care professionals; individuals
Agency:	Misuse of antibiotics; ignorance
Purpose:	Major threat to public health

Many media outlets have raised the alarm that antibiotics may no longer be effective. The South China Morning Post said that the "spectre of a plague of superbugs that do not respond to treatment . . . is not the futuristic scenario it may seem to generations who grew up in a world made safer by the wonder drug penicillin" ("Change of Attitude" 14). The paper listed the factors it believed contribute to the resistance problem, which included the issuance of prescriptions for healthy patients, overly short courses of treatment, illegal sales, and general misuse, including self-medication. According to the paper, the World Health Organization said that unless these practices are changed, "the rise of drug-resistant diseases threatens to turn the clock back to the dark days before penicillin" (14).

On their website, the Centers for Disease Control called antibiotic resistance "one of the world's most pressing public health problems." It wrote that resistance "can cause significant danger and suffering for people who have common infections that once were easily treatable with antibiotics" ("Get Smart"). The site warns that when antibiotics no longer work, the consequences can be life-threatening.

The fault for this, the CDC goes on to say, rests with regular folks who pressure their doctors to prescribe penicillin "just in case"—not realizing that antibiotics are only effective against bacterial infections and not viruses. The CDC also points the finger at those who neglect to finish their prescribed course of medicine. By killing off some, not all of the bacteria, these careless individuals make the bacteria that are left in the body even stronger, turning them into "superbugs."

The finger-pointing is not just directed toward the uneducated man. The government points to the use of antibiotics in chicken feed, a common pharmaceutical practice for years (e.g., Bayer Corporation). Others place the blame with the government, saying it needs to step up education and control of the industry.

No matter who is at fault, if penicillin is rendered ineffective, the pharmaceutical industry will have lost its major star. The industry's magic drug will have been taken away and the reputation of Fleming, which has been so carefully carved and preserved for the past half century, may be irreparably damaged. It is an ironic situation because Fleming himself foresaw potential problems with resistance.

Sorting Out the Narratives

The six alternatives outlined above expand on the standard myth of Fleming and the discovery of penicillin as the representative narrative for the pharmaceutical industry. The alternative narratives demonstrate the stories that could have flourished, but did not.

Clearly, much of the Fleming story and the description surrounding it has served to ingratiate the pharmaceutical industry with the public at large.

The many stories of penicillin have been useful to pharmaceutical companies in the past and Fleming's name and story are still invoked by them today. Photos of Fleming and his hand-written notes can be found, for example, on the Pfizer website, and the company routinely makes reference to Fleming and penicillin in its annual reports. On the Pfizer website, the company includes a summary of Fleming's achievements and a visual of an old ad showing WWII service personnel with the caption, "These are alive today . . . because of penicillin."

Similarly, GlaxoSmithKline, in a section on worldwide business development, lists the discovery of penicillin on a page called "Forward Thinking." The company writes:

> Forward Thinking enables GlaxoSmithKline to successfully pioneer and deliver new and innovative medicines for a world that is waiting. Forward Thinking is also the reason that GlaxoSmithKline recognizes the value in seeking collaborations with like-minded companies, whose own similar promise to the world can only strengthen with the right collaborator. (GlaxoSmithKline "Forward Thinking")

Like most pharmaceutical companies, Glaxo has adjusted its definitional and descriptive rhetoric over the past several decades to better engender public ingratiation. While, in the early part of the twentieth century, the pharmaceutical industry in general took pride in its values of standardization, chemistry, and capitalism, the public responded to concepts of biology and altruism and the messy story of Fleming's discovery of penicillin. The industry and the public reached a stasis of sensibility in the mid-twentieth century when they saw eye to eye on the pharmaceutical industry as representing quality, capitalism with heart, and responsiveness to the public need.

However, this balance shifted toward the end of the twentieth century when the public no longer viewed the pharmaceutical industry as caring, competent, or careful, and began to seek more appealing alternatives—including natural-based products and/or biotechnology.

The emergence of biotechnology as a science did not, in itself, disrupt pharma's self-concept since the industry simply considered biotechnology as another tool. From the mid-twentieth century onward, pharmaceutical companies continued to describe their essential characteristics as doing good for humanity by creating the products that make people well. Such a self-description can be found in company speeches, advertisements, historical documents, and autobiographies. In its 2002 annual report, for example, Pfizer incorporates all of the messages that resonated successfully with the public throughout the twentieth century. On a page entitled, "Helping people live longer, happier, healthier lives," Pfizer describes itself as "an original American company." The company reminds the public that it "was there in World War II with a breakthrough in penicillin production that save thousands of soldiers' lives." The company also points to its caring and responsiveness by making the claim that it has always put people first. The company writes:

> One-hundred fifty-four years ago, in a small brick building on Bartlett Street in Brooklyn, New York, an original American company called Pfizer opened its doors . . .

> We're still there today, and since 1849 our mission has stayed the same: to help more people live longer, happier, healthier lives.

The report concludes with the registered tagline: "Pfizer. Life is our life's work" (73).

Pfizer, as well as most big pharma manufacturers in the U.S. in the late-twentieth century, continued to build and reinforce an aura of themselves as patriotic humanitarians through the terministic screens of <u>life</u> and <u>happiness</u>. Freedom, too, is part of the essential message, with freedom from disease and illness conflated with the freedom of operation for the pharmaceutical industry. One example can be found in a keynote address that Hank A. McKinnell, Jr., Chairman of Pfizer, gave to the World Health Care Congress in Washington. McKinnell spoke about his "vision for a new American healthcare system . . . that is distinctly grounded in the virtues and qualities that make America—America." Success of this vision, he said, "would lead to a healthcare system that makes the most from America's best virtues—individual freedom, personal responsibility, and community caring."

Yet while large pharmaceutical manufacturers were sounding the trumpets for a new system of healthcare, the public became increasing skeptical about big pharma's ability to deliver the innovation necessary for such a new system, particularly in comparison with the newly forming biotechnology industry.

As discussed earlier, the general public is not attached the concept of corporations, the government, or the specifics of science. For the regular man, it is human health that is all-important, with innovation the conduit for achieving it. The emergence of the biotechnology industry and its intrinsic capabilities for innovation are causing the pharmaceutical industry to recast itself once again. It is possible to argue that biotechnology, by being new, has made the pharmaceutical industry seem old by comparison. By being fresh and innovative, biotechnology has made pharma seem staid. By bringing a fresh imperative to change society, biotechnology has made pharma seem complacent. And by being—for the most part—not yet profitable, biotechnology has made pharma seem avaricious in its corporate earnings.

With public ingratiation clearly at stake, the pharmaceutical industry began to modify its self-expression. In doing so, it stepped up the activities associated with the first sense of the rhetorical helix—that is, recursively modifying its self definition and description to generate a positive aura and engender public appeal. At the same time, pharma commenced activities associated with the second sense of the rhetorical helix whereby it began to engage in interactive competition with the biotechnology industry.

Thus, faced with public skepticism, big pharma began to shift its "technological paradigm . . . from a chemical to a biological basis" (Gambardella 162) and infused its self-description with messages of new and vital capabilities for innovation. All this was done in reaction to and in competition with the new and self-defined industry called biotechnology.

CHAPTER V

THE DOUBLE HELIX AS BIOTECHNOLOGY'S REPRESENTATIVE ANECDOTE

If the development of penicillin is the representative anecdote for the 20th century pharmaceutical industry, then the discovery of the double-helical structure of DNA in 1953 must surely be the same for the biotechnology industry. By illuminating how genes are organized within the body and how they serve to build and maintain a living organism, the double helix provided a new and critical understanding of molecular biology which Genentech calls "the basic science underlying biotechnology." Genentech, founded in 1976, is generally acknowledged as the world's first biotechnology company.

Without the double helix, the thinking goes, there would be no biotechnology. As Robert Tjian, professor of molecular and cell biology at UC Berkeley and co-founder of the biotechnology company Tularik expresses it, "There would be no biotechnology sector without the structure of the double helix, but at the same time, the full implications of the double helix would not have been realized without the biotech industry" (Sanders). Biotechnology and the DNA double helix, in other words, are symbiotic; one cannot exist without the other.

As this chapter will discuss, the double helix is one of science's most powerful metaphors, possessing the capability to evoke both fiery passion and cool logic. As Lakoff and Turner write, "metaphor is a matter of thought—all kinds of thought: thought about emotion, about society, about human character, about language, and about the nature of life and death" (xi). Lakoff and Turner provide a number of parameters to distinguish metaphorical thought. These include conventionalization, whereby a metaphor is "automatic, effortless, and generally established as a mode of thought" and basicness, whereby it is linked to cultural thought (55-60). Although the image of the double helix is relatively new, it has already become so ingrained in our way of thinking about science that it has gained footing with many other metaphors of life. The double helix, metaphorically speaking, is a key to the mysteries of life; it is a map of humankind; it is a blueprint of our selves. As Lakoff writes, "Metaphor is principally a way of conceiving one thing in terms of another, and its primary function is understanding" (Lakoff and Johnson 36). Whether we see a two-dimensional drawing or a three-dimensional sculpture, we understand that the double helix represents new and innovative science.

From the start, the emerging biotechnology industry grasped control of the image of the double helix and as a result accrued the associated benefit of its positive aura. The pharmaceutical industry, by comparison, could invoke the powerful imagery of the double helix only through its association with biotechnology. It was not enough for big pharma merely to capture the term double helix in its self-definition or description. The pharmaceutical industry had to rhetorically wind its way in and out of the biotech industry, competing head-to-head with biotech in order to gain proximity to the term.

Prior to the discovery of DNA's double helical structure in 1953, the term "double helix" was virtually non-existent. A search of The New York Times archive revealed no usage until 1953—the year that Watson and Crick made headlines with their discovery of the structure of DNA. The first references after that were primarily definitional, explaining how the double helix related to the organization of deoxyribonucleic acid and its subunits of adenine, thymine, cytosine, and guanine. For the public, DNA was a highly abstract concept, until definition became description through the image of DNA's double helix as a gently twisting ladder.

When Aristotle devised his "Great Chain of Being" metaphor, he allowed people to visualize man's place in the universe through a chain (or ladder) in which all life is positioned hierarchically from lowest to highest. Lakoff and Turner write that "(t)he reason that the GREAT CHAIN METAPHOR is so powerful in scope is that it applies to our overall knowledge of everything in the Great Chain, from human beings down to inanimate physical objects" (172). They write that when we say, "Achilles is a lion" it means that we are asked to "understand the steadfastness of Achilles' courage in terms of the rigidity of animal instinct" (195).

Although Aristotle's metaphor allowed people to visualize man's place in the universe, it also locked people into fixity of thought:

> (I)f every link is occupied, and none are occupied twice, no species can ever move from one position to another, since to do so would leave one level empty and put two species on another. Thus, in Aristotle's perfect universe, species couldn't ever change. This idea …was the prevailing perspective at the beginning of the 19th century. One of the great cultural changes over that century was the movement away from this restriction in thinking toward a more dynamic view of the natural world. Without this adjustment in thought, it is probable that Darwin (and Wallace) would either never have conceived of evolutionary thought, or would have made no impression when they published their ideas. (Fancher)

In 1953, the new “ladder of life” was the double helix of DNA. The image of ladder held to what Lakoff and Turner would call a basic conceptual metaphor (54) that provides a concrete visualization of the nature of life. However, Aristotle’s ladder and the DNA ladder vary to one significant extent: whereas the former represents rigidity and quintessentiality, the latter represents potential and transformation. The DNA ladder, which in a metaphorical sense, can ascend to great heights, is also capable of being unstable and shifting, with rails and rungs splitting apart from one another and reconnecting with others. In Aristotle’s ladder, man was forever separate from the animals. In the DNA ladder, the essence of man shifts in and out, by virtue of genetic engineering, recombinant DNA technology, genetic modification, and gene splicing. Scientists in Taiwan reported that they added genetic material from jellyfish into pigs in order to make them fluorescent and hence easier to study under ultraviolet light (Coonan). At other labs, scientists continue to work on the design of transgenic pigs that can serve as organ donors for humans.

When Lakoff and Turner ask, “Can anything be anything?” (199), they could well have been speaking about the metaphorical malleability of the double helix to act in ways that stimulate the collective imagination. The “new” DNA ladder plays with the metaphor, allowing us to question the essence of ladder in rhetoric, much as M. C. Escher did with staircases in art.

As with the history of penicillin, the tale of the DNA double helix encompassed a tangle of human emotions as various factions struggled for control of the story. The DNA narrative, like penicillin, has both a popular version as well as lesser-known accounts that wrestle for a place in the public consciousness. And, as with penicillin, the rhetoric surrounding DNA reveals much about our culture, our values and our deep-seated need for the power of transformation.

From the start, the DNA double helix came to represent science, knowledge and even life itself. As a powerful symbol of innovation, DNA easily replaced penicillin in the public's collective imagination. Whereas penicillin was perceived as simply one single drug, albeit a potent and life-saving one, DNA was a tabula rasa, a blank slate on which mankind would ascribe its most fervent hopes for the future.

The most simplified version of the DNA double helix story features James D. Watson and Frances Crick as the duo that, in popular terms, cracked the code of DNA and discovered the secret of life. The importance of DNA to biotechnology and the prominence given to Watson and Crick is expressed concisely in the following sentence, taken from The Biotech Investor's Bible:

> The biotechnology industry's watershed moment occurred at Cambridge University in 1953 when James Watson and Francis Crick first discerned the double-helix structure of DNA (deoxyribonucleic acid). (Wolff 4)

Similarly, as business writer Richard W. Oliver expresses it, "Watson and Crick's discovery created an entirely new field: biotechnology" (114).

Watson and Crick, as the two discoverers of the double helix, is the version of the story that everyone knows. As one observer put it, "The names of Watson & Crick are one of those things that just seems to stick in everyone's head no matter how little they paid attention in school (kind of like the term onomatopoeia)" (West). The amalgamated

Watson-and-Crick name has appeared often in anthologies, in lists of important people and in children's books. Time magazine, for example, places Watson and Crick on its list of the 100 most important people of the century, with the merged pair occupying one spot (Wright). The World Almanac for Kids 2004, which says on its cover that is "trusted by parents" and "loved by kids" compresses the story by saying that in 1953, "Francis Crick and James Watson figured out the structure of DNA, opening up a new era in biology" (Seabrooke 312). The 2007 science fiction film, The Last Mimsy, features a class of elementary school children being taught by their science teacher about Watson, Crick and DNA. Children's author Donna Farland, an elementary science specialist for the Boston public schools, uses Watson and Crick to illustrate the concept of collaboration in her book, It Takes Two: The Story of the Watson & Crick Team. Her book is meant to illustrate that two people working together on a project is better than working alone.

The reality of course, is that the success that Watson and Crick enjoyed by being first to publish (in the journal Nature in 1953) was predicated on the hard work of many others including, notably, Rosalind Franklin. Her famous "photograph 51" clearly showed the structure of DNA and, depending on one's perspective, either formed the basis for Watson and Crick's hypothesis or confirmed it. Public relations for the late Franklin (who died from cancer in 1958 at age 37) have escalated in recent years, with feminist science studies often leading the charge.

Maurice Wilkins, Franklin's supervisor, also contributed substantially to unveiling the molecular structure of DNA and, like Watson and Crick, received a Nobel Prize for his efforts in this field. However, unlike Watson and Crick, his name did not resonate with the public and upon his death in 2004, he was called “the forgotten man of DNA” (Radford). Several recent books have attempted to resurrect Wilkins’ name, including a memoir by Wilkins in which he refers to himself as “The Third Man of the Double Helix.” In the publisher’s notes for Wilkins’ 2005 book, Oxford University Press acknowledges Wilkins’ forgotten status by asking, “Quick, who won the Nobel Prize for discovering the double helical structure of DNA” and answering, “Most people would say Watson and Crick.” The publisher goes a step further by calling Wilkins the “Rodney Dangerfield” of biology, presumably for the lack of respect the scientist received for his part in the discovery.

Yet another player in the double helix drama was Linus Pauling, a quantum chemist at Caltech. A pacifist and outspoken critic of nuclear proliferation, Pauling was nearing a solution to the puzzle of DNA structure when the U. S. government rescinded his passport, thus denying him access to critical scientific information. Burkean dramatism would question the link between Pauling’s political leanings and his ultimate place in science history.

Since few people have the time or interest to sit and read expanded versions of the events in question, the basic and most simple version is usually the one that predominates. In this case, the tale of Watson and Crick—just as with the story of Alexander Fleming—is appealing in its ability to reduce a complex series of events to one “eureka” moment. This is a particularly useful device for journalists, who seek to reference past events as a quick bridge to the main thrust of their articles. For example, shown in Table 3 are the opening paragraphs of several typical articles published in mainstream newspapers.

Table 3

Mainstream Media References to Crick and Watson

Opening Paragraphs	Citation
Throughout the history of science, lasting fame and glory have generally been reserved for the men and women with the big ideas: Galileo, Sir Issac (sic) Newton, Charles Darwin, Marie Curie, Albert Einstein, Francis Crick and James Watson, to name a few. Robert Koch arguably belongs on this list.	LaFee, Scott. "“Cultural Revolution; Why the Petri became Science's Favorite Dish." The San Diego Union-Tribune 25 Jan. 2007: E-1.
The Human Genome Project may go down as public health's silver bullet. It took more than a decade and $300 million for scientists to create a person's chemical code, the sequence of DNA that forms a complete genetic blueprint. Today, a half-century after James Watson and Francis Crick discovered the twisted-ladder structure of DNA, science is on the verge of dramatic advances in medicine. Armed with a growing knowledge of human genes, researchers hope to one day alter and even conquer some hereditary diseases.	Loft, Kurt. "The Stuff of Life." Tampa Tribune 21 June 2004: 6.
Science, of course, is a young man's game. Newton, Einstein and many other greats were in their late teens or early 20s when they made their huge discoveries. So, from a purely scientific point of view, Nobel Prize laureate and University of Chicago grad Dr. James Watson was entirely correct when he advised 13-year-old U. of C. medical student Sho Yano to "concentrate on making a big discovery and not getting a girlfriend." Ahem. With all due respect to Watson, one of the major scientists of the 20th century, the discoverer, along with Francis Crick, of the DNA double helix, we aren't so sure that his advice is sound, either for this particular young prodigy or for students in general.	"Lighten up, Doc." Editorial. Chicago Sun-Times. 21 Jan. 2004: 63.

ANYONE who still doubts the towering influence of MTV's "Real World" on American culture (it is to television what Watson and Crick's work on DNA was to molecular biology) has only to compare two similar shows this Sunday to concede the point. "Anatomy of a Scene," on the Sundance Channel, is a documentary about making the movie "The Secret Lives of Dentists."	Stanley, Alessandra. "Where Has Escapism Gone?" The New York Times. 18 Jul. 2003: E-1.
Fifty years ago this week, two brash young scientists in an obscure lab at the University of Cambridge in England unraveled the structure of DNA, the elegant living thread that is the genetic basis of inheritance and evolution. The discovery of the double helix by James Watson, 25, and Francis Crick, 36, on Feb. 28, 1953, unveiled what Crick called "the secret of life." DNA is the molecule that makes and maintains all life. It enables life to re-create itself. It contains the blueprints and the toolbox for understanding how humans work. Even now, researchers are exploiting these tools to turn medicine from an uncertain science in which they treat the symptoms of disease to one in which they attempt to find out and fix precisely what is wrong.	Sternberg, Steve. "Double Helix Unlocked Key to Life. USA Today. 24 Feb. 2003: 1D.
Western culture is filled with examples of heroic male friendships. Lewis and Clark opened up the American West. James Watson and Francis Crick unveiled the DNA double helix, the secret of life. Crime-fighting duos from the Lone Ranger and Tonto to Batman and Robin have kept bad guys at bay. And what have women's friendships fostered? Cut to Carrie and her "Sex and the City" pals sipping cosmos and dishing about their boyfriends, Dolly Parton and the Steel Magnolias bawling at the local beauty salon and Rebecca Wells's Ya-Ya Sisterhood with their motto: "Smoke, drink, never think."	Kuchment, Anna. "The More Social Sex." Newsweek. 10 May 2004: 88.

The simple story of Watson and Crick has, without question, embedded itself in the public consciousness. But is what appeals in the Watson and Crick story the same as appeals in the Fleming story? By examining the standard myth and opening it up to dramatistic variations, we can better understand why the Watson-and-Crick story resonates with the public, how the story relates to the biotechnology and pharmaceutical industries at large, and how the language used to describe any given scenario is always in negotiation, always affected by culture, and always performing.

In Chapter IV, the alternative narratives for the discovery of penicillin were distinguished by a change of historic scene, from the early 20th century to the early 21st century. For the DNA double helix story, the object of scrutiny is purpose, followed closely by agency. Purpose offers a perspective of why the agent may have performed the act, while agency describes how the agent achieved his or her aims. By querying purpose, we can ascribe a host of motivations to the one act of discovery and reveal the ambiguity in various interpretations of the event. Doing this sets the stage for the wider question of public perception of the biotechnology and pharmaceutical industries.

To address Burke's theoretical question, "What is involved when we say what people are doing and why they are doing it," it is useful to distinguish between what agents themselves say their motivations are, what others attribute as the motivations of the agents, and what practitioners of the dramatistic pentad might conjecture. For Watson and Crick's single act of ascertaining the molecular structure of DNA, it is possible to devise an entire spectrum of motivation, with each theoretical "purpose" expressing specific cultural values.

Most anthologies, in summarizing Watson and Crick's efforts, ascribe simple motivations to the pair on the order of scientific curiosity (Olby; Stich, Carruthers and Siegal), competition (Runco), or the quest for the Nobel Prize (Starko). Undoubtedly, much of this comes from The Double Helix, James Watson's own account of the discovery. In the book, Watson speaks of DNA as “a mystery, up for grabs” (13). He discusses his hope to beat the eminent scientist Linus Pauling “at his own game” (37) and speaks of himself as “one of the winners” of the race for the double helix (13).

Watson recounts the day when Crick entered the Eagle pub at Cambridge and announced that he and Watson “had found the secret of life” (126). But nowhere in the book is any reference made to exactly how that secret could benefit mankind, if at all. In fact, altruism does not seem to be Watson’s strong point. He has been described as “the Caligula of biology” for his bluntness (Segerstrale 292). Watson himself acknowledges that he tolerates no fools, saying that “a goodly number of scientists are not only narrow-minded and dull, but also just stupid” (18-19). His partner, Crick, fares little better by Watson’s account, as he says, “I have never seen Francis Crick in a modest mood” (15). These accounts clearly contrast with the older story of penicillin and the so-called modest character of Alexander Fleming.

One cognitive researcher proposes that emotions—curiosity, happiness, hope, sadness, and anger—are the underlying factors that drive scientists:

> Fear can also be a motivating emotion. Watson and Crick were very worried that the eminent chemist Linus Pauling would discover the structure of DNA before they did, and they also feared that the London researchers, Rosalind Franklin and Maurice Wilkins, would beat them. Watson wrote that when he heard that Pauling had proposed a structure, “my stomach sank in apprehension at learning that all was lost.” (Thagard 240)

Many philosophers have delved into the complex topic of motivation, with some saying full recognition of one’s purpose may not be overtly apparent even to the agent himself. Smith, for example, discusses the ambiguity inherent in the pursuit of the Nobel

Prize, with Alfred Nobel's altruistic dictate on the one hand (awarding of the prize "to those who, during the preceding year, shall have conferred the greatest benefit on mankind") and "instant fame and fortune" on the other (96-97).

Pollack speaks of the heady realization that comes to a scientist when his or her name is permanently associated with an aspect of nature, as in "the Freudian slip and the Watson-Crick model of DNA" (80). He writes:

> Players in a game that can confer even this sort of immortality—however rarely—cannot be playing only for conscious stakes. In the medical sciences, the belief in winning immortality of this sort can become problematic . . . It is not that science and medicine wish to avoid finding cures. It is that they are too strongly motivated by an irrational, unconscious need to cure death to be fully motivated by the lesser task of preventing and curing disease . . . (80)

Rhetorician Leah Ceccarelli also speaks to the life-affirming traits of molecular biology. She asks about Watson and Crick, "What was it that motivated them (and others responsible for the birth of molecular biology) to break away from more traditional approaches in physics and in biology" to focus on "the physical nature of living matter"? (62). She provides several answers to her own question; one reason is because the field offers "big problems to solve"; another is what she calls a "psychological motivation" of guilt (62). She writes that the motivation for physicists "may have been the deep guilt that many felt about their participation in the Manhattan project; perhaps some sought a new career in the biological sciences because they had a desire to be part of something that was life-affirming rather than destructive" (62).

Corner, who is concerned with capturing the proper voice of a given agent in documentary format, speaks to the motivation of science itself. He writes that

> although there were the usual egoistic motivations in the race for the structure of the double helix, awe of the elusive structure itself was a motivation, as is evident, if not explicit, in Watson's account of the discovery. But to colleagues of Watson and Crick, their pursuit of the structure seemed at times zealous or obsessive. (87)

Since the motivations listed above are varied and somewhat conflicting, we can reconcile them in a useful way by stating that all of the attempts to determine purpose underscore the rhetorical malleability of biotechnology. In other words, people see in biotechnology what they want to see. If one chooses to see biotechnology as noble, then it is possible to ascribe this characteristic to the motivations of Watson and Crick. Conversely, in choosing to see biotech as dangerous, one could characterize their actions as too rushed and too blinded by competition. To a large extent, narrative selection (that is, language use) is indicative of the underlying beliefs and values of a people and society.

Of all the possible motivational factors, three themes stand apart: Watson and Crick as pioneers, Watson and Crick as advancers of human knowledge, and Watson and Crick as self-aggrandizers. These are the major narrative themes that provide a basic foundation for biotechnology rhetoric and from which to begin an exploration of biotechnology descriptive language.

Pentad 1: Watson and Crick as Pioneers

Act:	Discovery of the double helical structure of DNA
Scene:	1953, Cambridge, England
Agent:	James D. Watson and Francis Crick
Agency:	Publication in the April 25, 1953 edition of the journal <u>Nature</u>
Purpose:	To be the first; to win the "race" against other scientific competitors

As discussed in earlier chapters, being first in any endeavor conveys special status. In the public mind, Alexander Fleming achieved this special status for his discovery of penicillin and as such became immortalized in public anthologies. The fact that Fleming's discovery was characterized as "accidental" (and thus, in the minds of many, fate- or God-driven) did nothing to diminish Fleming's premier status. By contrast, the scientific quest to describe the molecular structure of DNA has seldom been characterized as an accident, but rather as a well-calculated race as in the title of the 1994 film, Race for the Double Helix. A plot synopsis of the film says, "Watson and Crick race to find the structure of DNA before Linus Pauling, Maurice Wilkins, or Rosalind Franklin can find the key to unlocking the secret."

Watson himself, in his memoir The Double Helix, refers both to the concept of a horse race ("But now the race was over and, as one of the winners, I knew the tale was not simple and certainly not as the newspapers reported") (13) and a game to be won ("Within a few days after my arrival, we knew what to do: imitate Linus Pauling and beat him at his own game") (37). Glasner and Rothman write extensively about scientists and the concept of winning the race:

> It is not really surprising that scientists find themselves in situations that lead to races. After all in any field at any given moment there are only a limited number of key or important problems or research tasks, often fewer than the available talented people and groups seeking to solve them. The ability to function as a scientist depends on access to resources, both financial and intellectual. These are easier to obtain if one is highly regarded by one's peers and research awards agencies. Being first to make a major discovery provides priority over potential rivals both for prestige and intellectual property rights. Winning the race provides prestige, which in the scientific community is an important component of social power. However, it is not always clear who has won the race . . . (46)

The race-to-success metaphor is well-embedded throughout various accounts of the Watson and Crick story (e.g., Ede, Marx) as well as other science-based events of recent history. In the early 1960s, for example, Americans were enthralled by the space race, which was the rivalry between the U. S. and the Soviet Union to put a human being into orbit. When the Soviet Union won this victory in 1961, the U.S. reframed the competition to be the first on the moon, reflecting a strong nationalist sentiment to achieve an American victory.

During WWII, nationalism was clearly a motivating factor among pharmaceutical companies who were intent on keeping penicillin out of the hands of the Germans, which they did successfully. Nationalist sentiment may or may not have been at work for the Americans Watson and Pauling, and the British Crick, Wilkins, and Franklin. From a U. S. standpoint, it can be argued that the American love of competition extends throughout its culture, from sports to consumer products (e.g., Avis versus Hertz; IBM versus Macintosh). The race for the molecular structure of DNA was no exception. When the New York Times reported in a 1953 headline that an "American and Briton Report Solving Molecular Pattern of Vital Nucleic Acid," the newspaper proclaimed that their work "should make biochemical history" (17). Interestingly, the article also credited Dr. Linus Pauling, whom they identify as an American, as having "done most of the pioneer work on the problem" (17).

From the moment of the announcement, characterization of Watson and Crick's achievement as a race helped set the tone for biotechnology as purposeful, driven and goal-oriented. The race to the double helix would subsequently generate the race for the human genome and, later, the race to commercialize biotechnology.

Like the race for the double helix, the race for the human genome generated huge feelings of rivalry among the parties involved, which were the government-funded Human Genome Project, first headed by James Watson and later by Francis Collins, and its rival, Celera, a private company led by Craig Venter. Since the human genome story is much newer than the double helix story, its narrative in many ways is still being constructed. In fact, as of as few years ago, the human genome project was so new, that computer spellcheckers were correcting the term to read, "The Human Gnome Project" (Shreeve 14).

The purpose of the human genome project is to create a map of all genetic material in human beings. Although the human genome project was considered the grandest quest, similar projects were undertaken to create maps of genetic material for other living entities such as the mouse, fruit fly, and yeast. Mapping is accomplished through DNA sequencing, which is the process of determining the exact order of the three billion chemical bases that comprise human DNA. The metaphor of map is appropriate since it speaks to pioneers trying to find their way in an entirely new terrain. To the one who gets to the finish line first come the fruits of victory. It is not accidental that Venter called his corporation Celera, which is Latin for "speed."

The two groups, public and private, differed substantially on their approach to the genome. The strategy of the Human Genome Project was to map first and sequence later, which placed the emphasis on making sure that all elements of the genome were correct and in place from the start. As the journal Nature explains it, "The public project's sequencing strategy involved producing a map of the human genome, and then pinning sequence to it. This helps to avoid errors in the sequence, especially in repetitive regions" (Olson 816).

The Celera group, on the other hand, felt that speed was of the essence, since they were profit-driven and thus responsible to their investors. They took a shotgun sequencing approach, which underscored the belief that if it's close enough, it's good enough. In essence, the shotgun method involved assembling the genome without using a map ("What a Long, Strange Trip").

From the early 1990s, the two groups vied with one another to be the first to publish. In the same week in February 2001, Celera published its draft sequence of the human genome in Science, while the Human Genome Project published its sequence in Nature. Many have characterized the rivalry in simplistic terms, with HGP on one side and Celera on the other. In this characterization, HGP was in support of the public at large, with their intentions placed squarely on the goal of making the information from the genome available to all. Celera, on the other hand, was clearly profit driven, with the intention of grabbing the rights and protecting its patents. Shreeve escalates the concept of competition between Collins and Venter by calling their rivalry "the genome war." At the same time, he writes that a simplistic, black-and-white view is not necessarily appropriate because every characterization is dependent on individual perception. While some saw Venter as egotistical, others perceived him as cautious and graceful. Shreeve writes eloquently of the ambiguity of the man and the science:

> While those recollections contradict each other, they may also both be accurate, not just because two people often see the same individual differently, but because some individuals can project two images simultaneously. They are self-contained contradictions, like holograms whose views toggle back and forth depending on the angle of the light striking them. . . .
>
> I am doing this for humankind, Venter seemed to say. Turn the hologram, and I am in it for myself. I am Albert Schweitzer. I am Bill Gates. Flip the hologram faster—I am Bill Albert Schweitzer Gates. I am a scientist. I am an entrepreneur. I am a scientist/entrepreneur. I am the slash between the two. How can you not love me? Go ahead, hate me. You think I care? (Shreeve 51)

In play during the human genome race was the cult of personality. The popular press characterized Collins as a noble and selfless individual who was capturing the knowledge of the Creator. His "side" stood for the belief that information from the human genome project belonged to the people; it was good for humankind. Venter, on the other hand, was considered by many to be arrogant, ego-driven, and determined to be first in order to make a name for himself and to make money.

Ultimately, Celera's goal of becoming the "the world's definitive source of genomic information" failed when HGP "showed the will and ability to stay just a few months off the company's pace" (Shreeve 368). In 2002, Craig Venter stepped down as Celera's president and the company then began a series of changes to its corporate structure and mission. Celera describes this transition on its website, using language that positions its genomic database business in the past and puts the understanding of disease in the future. On its website, the company writes:

> While the Celera database business ultimately became profitable, it was clear by 2000 that this was not a sustaining business model, as the public effort caught up and provided free access to genome sequences.

> Celera moved on—both scientifically and commercially. Scientifically, we recognized that understanding complex conditions like Alzheimer's and cardiovascular disease required a greater understanding of human genetic variability . . . ("Celera")

This language straddles the gap between altruism and commercialism. Throughout the genome war, Venter was portrayed as a profiteer who sacrificed quality science for a so-called quick and dirty approach to getting answers and who sought patents on what rightly should belong to mankind—i.e., human genes. Celera was accused of grabbing for genes in much the same manner as the California '49ers rushed for gold. Now, with the above language, Celera shifts the focus toward acknowledging the needs of patients who would most profit from genetic-based therapeutics. This is a softening strategy, and one that has been employed for many years by pharmaceutical companies in their advertising and other public rhetoric.

Science is allowed to mix with business, in other words, only if the common good is place in the forefront. This is something that the Human Genome Project seems to recognize. On its website, HGP touts the human genome accomplishment as "one of the great feats of exploration in history—an inward voyage of discovery rather than an outward exploration of the planet or the cosmos . . ." ("All About"). At the same time, the group also takes care to emphasize the good to mankind through genomics. HGP writes,

> We are entering a new age of discovery that will transform human health. Our eventual knowledge about the workings of the genome has the potential to fundamentally change our most basic perceptions of our biological world. It is difficult to predict what will be learned and how future knowledge will be applied, but there can be little doubt that understanding the genome will revolutionize our concept of health and improve the human condition in remarkable ways. ("All About")

For the public, ingratiation with a scientific effort is highly dependent on the promise (and not necessarily the actuality) of a tangible outcome of the race. As long as the promise is there, the reality seemingly can wait. When news of Watson and Crick's achievement was conveyed to the public, reporters and others spoke of the "secret" of life, a future-oriented metaphor that spoke to a virtual treasure box of information of potential use to mankind. Similarly, the human genome project was a "blueprint" of the human being. Follow the steps of the blueprint accurately, the assumption went, and perfect humanity could be possible. An alternative metaphor for the human genome project has been "cracking the code of life," whereby the genome is a secret that the human genome project unlocks. The perception is that once the secret has been unlocked, it will be possible to understand human diseases and disorders and fix the defects. The possibility also dangles that scientists can bioengineer life to make sure there are no defects in the first place. The reality is, of course, far more mundane with real advances in medical therapies lagging well behind the hype.

The metaphor of a race to the finish line is also well tied into the concept of youth. The stereotypical perception has always seemed to acknowledge that the young are far more fleet-footed than the old. Youth is associated with swiftness of body and mind, and imbued with verve and vitality. The term young is frequently linked with the term scientist when the author wishes to make a point about new and innovative developments in science. In fact, the term "young scientist" is far more predominant in common speech than its opposite. A Google search in early 2007 of the term "young scientist" revealed 58,800 hits, whereas "old scientist" had merely 3,450 hits.

"Experienced scientist" had 2,380 hits and "mature scientist" had only 449 hits. Such deep-seated bias toward science and youth also appear in literature, as in this example from Frameshift:

> And so Pierre found himself back in an introductory genetics course. By coincidence, the same pencil-neck Anglais teaching assistant who had originally pointed out the heritability of eye color was teaching this one. Pierre had never been one for paying attention in class; his old notebooks contained mostly doodled hockey-team crests. But today he really was trying to listen . . .at least with one ear.
>
> "It was the biggest puzzle in science during the early 1950s," said the TA. "What form did the DNA molecule take? It was a race against time, with many luminaries, including Linus Pauling, working on the problem. They all knew that whoever discovered the answer would be remembered forever . . ."
>
> Or perhaps with both ears . . .
>
> "A young biologist—no older than any of you—named James Watson got involved with Francis Crick, and the two of them started looking for the answer. Building on the work of Maurice Wilkins and X-ray crystallography studies done by Rosalind Franklin…
>
> Pierre sat rapt.
> . . .
>
> "It was an amazing breakthrough—and what was even more amazing was that James Watson was just twenty-five years old when he and Crick proved that the DNA molecule took the form of a double helix . . ."
>
> Morning, after a night spent more awake than asleep, Pierre sat on the edge of his bed.
>
> He had turned nineteen in April. (Sawyer 42)

In another example, youth and ambition are presented as naturally occurring hand-in-hand:

> Watson had learned of Linus Pauling's and Robert Corey's work on the structure of crystalline amino acids and small peptide proteins. Pauling was one of the most famous organic chemists in the world. Watson feared that Pauling would soon model DNA structure, robbing the young and ambitious scientist of fame and scientific immortality. Watson saw himself in a scientific race with Pauling to be the first to discover the structure of DNA. Pauling did not know that Watson existed. (But this is the general model of human competition, the young racing to exceed their elders; and scientists are only human.) (Betz 29-30)

Pentad 2: Watson and Crick as Advancers of Human Knowledge

Unlike the previous narrative alternative in which the pursuit of science is interpreted as a race or a game to be won (with commercial profit, world recognition and competitive satisfaction as possible rewards), this second version sees knowledge as an end in itself.

Act:	The discovery of the double helical structure of DNA
Scene:	1953, Cambridge, England
Agent:	James D. Watson and Francis Crick
Agency:	Research; work in the laboratory
Purpose:	To contribute to the body of world knowledge; to satisfy intellectual curiosity; to share findings with others

Rathman writes that Watson and Crick's discovery in 1953 was the "ignition spark" that led to "advances in gene manipulation, monoclonal antibodies, gene sequencing and gene synthesis" and billions of dollars in investment (47). According to Nature magazine, while the human genome project "does not hold a candle to Watson and Crick's 1953 paper," the human genome does launch the era of post-genomic science (Baltimore 814). It is clear that what one scientist does can pave the way for others to follow.

Evelyn Fox Keller, rhetorician and professor of the history and philosophy of science, has written that Watson and Crick, like many other molecular scientists, were greatly influenced by the book What Is Life? by Erwin Schrödinger. The book, first published in 1944, begins with Descartes' famous quotation, cogito ergo sum, which argues that when one thinks, one exists. This quotation has special meaning for many scientists, who simply are not satisfied unless they are challenged with a puzzle that stretches their brainpower to the limit.

For his part, Schrödinger set out by asking what he called a large, important and much-discussed question: "How can the events in space and time which take place within the spatial boundary of a living organism be accounted for by physics and chemistry?" (3). Schrödinger reveals his optimism and his faith that mankind can attain an answer to this incredibly difficult question when he writes, "The obvious inability of present-day physics and chemistry to account for such events is no reason at all for doubting that they can be accounted for by those sciences" (4).

This, then, was the intellectual gauntlet that was thrown down and was picked up with enthusiasm by Watson and Crick. In The Double Helix, Watson writes that Schrödinger's book "very elegantly propounded the belief that genes were the key components of living cells and that, to understand what life is, we must know how genes act" (18). Watson also says that this belief is what prompted Crick to change his career path to biology.

In his presentation speech at the 1962 Nobel Prize ceremony, Professor A. Engström of the Royal Caroline Institute clearly privileged the value of knowledge when he addressed the winners by saying:

> Dr. Francis Crick, Dr. James Watson, and Dr. Maurice Wilkins. Your discovery of the molecular structure of the deoxyribonucleic acid, the substance carrying the heredity, is of utmost importance for our understanding of one of the most vital biological processes. Practically all the scientific disciplines in the life sciences have felt the great impact of your discovery.

Biotechnology resonates with the intellectual thrill of seeking and possibly obtaining answers to some of the greatest mysteries of nature and human existence. Such language can be readily found in recruitment ads, which frequently emphasize the need for curious minds to solve scientific problems. The biotechnology company Invitrogen, for example, says that its staff is comprised of scientists who “dream big thoughts, have a thirst for change, understand how to work with people around the world, and have an insatiable curiosity to see what’s next” (“Invitrogen”).

The Biotechnology Institute, a non-profit organization whose mission is to “engage, excite, and educate the public, particularly young people, about the promise and challenges of biotechnology” offers interviews with a number of biotechnology scientists on its website. Most of those interviewed cited personal curiosity and a desire for intellectual freedom. A profile of Bruce T. Lahn, a professor of human genetics at the University of Chicago, reveals that his favorite book as a child in China was Ten Thousand Questions, and that his natural curiosity continues to surface in his research on the human genome, with new questions such as "why is the Y chromosome so small?" and "why is Y a magnet for male fertility genes?" ("Biotech Career Profiles").

Seeing the "big picture" is frequently cited as a source of inspiration for biotech scientists. A 2002 article in Career World magazine quotes a pathologist from Houston, Texas, as saying:

> Science is about the relationship between humans and nature. It's not about hawking some product [or] attending boring sales meetings. . . . It's about uncovering real truths of the universe—how matter and energy interact to produce what we call life with all its complexity. (Wallis 6)

The same article also lists a host of other altruistic reasons for selecting a career in biotech:

> . . . biotechnology will be the branch of science that discovers ways to improve the diagnosis and treatment of hereditary diseases. It will provide us with safer drugs and more environmentally friendly herbicides and pesticides. Biotechnology will help us find cures for spinal cord injuries, come up with innovative new ways to solve crimes, help clean up the environment, and give us safer, more efficient industrial products. That's why the amount of money invested in the biotech industry increased a whopping 156 percent in one year, from 1999 to 2000. (6-7)

Pentad 3: Watson and Crick as Self-Aggrandizers

The alternative narrative above emphasizes the notion of sharing findings with others. However, for modern-day scientists, such collegiality usually comes only after publication and patent filing. These are well-accepted practices that protect intellectual property and corporate investment. Much has been written of Watson and Crick's race to be published as well as the race, years later, between HGP and Celera in codifying the human genome in public journals. This third alternative narrative explores the gap between the good-natured competition of Pentad 1 with a more cutthroat competition in which self-interest is the driving force. This alternative narrative also explores the hubris of Watson and Crick in elevating Man (with a capital "M") to controller of his destiny and man (with a small "m") as usurper of the proper recognition that by rights should have also gone to a female colleague.

The pair published their results in the prestigious British scientific journal Nature, and then soon became scientific superstars.

Act:	The discovery of the double helical structure of DNA
Scene:	1953, Cambridge, England
Agent:	James D. Watson and Francis Crick
Agency:	Autobiographies, speeches
Purpose:	To advance personal interests

In The Astonishing Hypothesis, Francis Crick puts forth the proposition that "'You,' your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules" (3). He argues that just as the work of Galileo and Newton expanded Man's knowledge of physics, and Darwin and Wallace illuminated evolution, the understanding of the molecular nature of genes expands our view of living creatures. Crick is a humanist, stating that a majority of neuroscientists see the soul as nothing but "myth" (6). Further, he insists that nature is knowable by man, in stating, "The history of science is littered with statements that something was inherently impossible to understand ("we shall never know of what the stars are made"). In many cases time has shown these predictions to be incorrect" (6).

Crick also makes his position very clear in his autobiography, What Mad Pursuit: A Personal View of Scientific Discovery, when he writes of his early skepticism and view of himself as an "agnostic with a strong inclination toward atheism" (10). He writes that "it is detailed scientific knowledge which makes certain religious beliefs untenable" (11).

Crick's bold position set off, predictably, a host of counter-arguments, largely from Christian philosophers and other theologians. Mark L. Y. Chan, for example, critiques "the reductionist idea that the human person is coextensive with and reducible to his or her genetic constitution" (191). He accuses Crick and others of promulgating "a naturalistic world-view that sometimes manifests itself in a doctrinaire intolerance of all who do not subscribe to a thoroughgoing materialistic view of the person" (192). Haught contrasts Crick's idea of reductionism, which "implies that the only real 'stuff' lies at the bottom, at the level of mere matter, fully accessible to scientific conquest" with religion, which believes that "(t)he more elusive and mysterious things are, the more important and real they are" (74). Almy goes so far as to call Crick ridiculing of theology and "contemptuous of any possibility of explaining the mind outside of materialistic science" (119-120). He writes, "For Crick, those who look for anything more are ignorant and sentimental" (120).

Surprisingly, James Watson also describes Crick's superior attitude in his memoir The Double Helix. He writes,

> Though he was generally polite and considerate of colleagues who did not realize the real meaning of their latest experiments, he would never hide this fact from them. Almost immediately he would suggest a rash of new experiments that should confirm his interpretation. Moreover, he would not refrain from subsequently telling all who would listen how his clever new idea might set science ahead.
>
> As a result there existed an unspoken yet real fear of Crick, especially among his contemporaries who had yet to establish their reputations. The quick manner in which he seized their facts and tried to reduce them to coherent patterns frequently made his friends' stomachs sink with the apprehension that, all too often in the near future, he would succeed, and expose to the world the fuzziness of minds hidden from direct view by the considerate, well-spoken manners of the Cambridge colleges. (16-17)

Watson infuses his own egotism when he writes that Crick did not worry about those who were skeptical of DNA since "(m)any were cantankerous fools who unfailingly backed the wrong horses" (8).

Watson elevates his and Crick's status, in part, by disparaging other scientists. He calls most botanists and zoologists "a muddled lot" who often "wasted their efforts on useless polemics about the origin of life or how we know that a scientific fact is really correct" (53). Although he calls Linus Pauling "one of the world's leading scientists" (79), he also critiques Pauling's scientific articles as "full of rhetorical tricks" (31). Worse is Watson's treatment of Rosalind Franklin, whom he characterizes as a "real problem" who "could not keep her emotions under control" (21). Watson writes extensively of Franklin's appearance:

> By choice she did not emphasize her feminine qualities. Though her features were strong, she was not unattractive and might have been quite stunning had she taken even a mild interest in clothes. This she did not. There was never lipstick to contrast with her straight black hair, while at the age of thirty-one her dresses showed all the imagination of English blue-stocking adolescents. So it was quite

> easy to imagine her the product of an unsatisfied mother who unduly stressed the desirability of professional careers that could save bright girls from marriages to dull men . . . Clearly Rosy had to go or be put in her place. (20)

Watson even writes that he "wondered how she would look if she took off her glasses and did something novel with her hair" (51). Finding no warmth in Franklin, Watson later writes, "The thought could not be avoided that the best home for a feminist was in another person's lab" (21).

Whatever Watson thought about Franklin's looks or personality was only part of the issue. Of greater concern to many was the possibility that Crick and Watson had cheated Franklin out of the recognition that was properly due her. As the UCLA physics department expresses it, Franklin's colleague Maurice Wilkins, "without obtaining her permission, made available to Watson and Crick her then unpublished X-ray diffraction pattern of the B form of DNA, which was crucial evidence for the helical structure" ("Franklin").

Some felt that Crick and Watson, who did not credit Franklin in their published paper on the structure of DNA, cheated Franklin of the Nobel Prize. Others argue that since the prize was awarded in 1962, it was Franklin's death in 1958, at the premature age of 37, which cheated her since Nobel Prizes are awarded only to living recipients. One of the earliest writers to champion the cause of Franklin was Ann Sayre, who set out to correct what she felt were falsities in Watson's book. The American Society for Microbiology, which houses Sayre's collection of Rosalyn Franklin materials, says that "Sayre felt that the portrait of her friend Franklin (who had died in 1958) that emerged from Watson's book was not only unflattering, but wrong" (Zilinskas).

Sayre says that starting with the nickname of Rosy, which was never used by any friend of Franklin's, Watson created a mythological "female grotesque we have all been taught either to fear or to despise" (19). Whereas Watson writes that "Rosy . . . claimed that she had been given DNA for her own problem and would not think of herself as Maurice's assistant" (20), Sayre says that such a characterization makes Franklin seem "uppish" and "mutinous" (20). Franklin was, in fact, "quite justified in her reluctance" to be so labeled, says Sayre, because Franklin did not work for Maurice Wilkins at all (20). "We have been misled" (20) she writes. She adds that Watson's book teaches us that "science is done by ambitious and competitive people" (17).

When asked about the possible injustice done to Franklin, the scientist Linus Pauling defends Crick and, to a lesser degree, Watson, in the following interview remarks:

> There are probably some scientists who are opportunists, who are eager to make their mark in the world and consider that more important than learning about nature. Crick isn't that sort of man at all. He has great interest in scientific problems and works away at them essentially independent of whether the solutions will benefit him. Crick is a good scientist. In The Double Helix you can see Watson is very much interested in fame and fortune. I think he's interested in science, too. (Brian 11)

In his theories of creativity, Mark A. Runco postulates that Watson and Crick were not motivated as much "from the desire to beat out other individuals so much as . . . the kind of achievement motivation that is tied to success" (356). He writes:

> In other words, someone may be motivated to achieve and accomplish something, and the only way they can accomplish it is to beat out others who are trying to do the same thing. In Watson's case, the prize was the Nobel award. (356-357)

And yet, other sources—as in this quotation by Watson himself—indicate that fame in itself is a driving motivator for Watson:

> I was 17, almost 3 years into college, and after a summer in the North Woods, I came back to the University of Chicago and spotted the tiny book What is Life by the theoretical physicist Erwin Schrödinger. In that little gem, Schrödinger said the essence of life was the gene. Up until then, I was interested in birds. But then I thought, well, if the gene is the essence of life, I want to know more about it. And that was fateful because, otherwise, I would have spent my life studying birds and no one would have heard of me. ("Succeeding" 1812)

Sorting out the Narratives

The differences between the representative narratives for the pharmaceutical and biotech industries are numerous. As a representative anecdote for the early pharmaceutical industry, the popular story of Alexander Fleming as discover of penicillin is uncomplicated and, over the past 85 years, has settled down into a standard myth that is rarely challenged. Biotech's representative narrative, by contrast, is newer and still being constructed. Although Francis Crick died in 2004, James Watson is still alive and generating new commentary through his own writing and through interviews. It is to be noted, however, that the pharmaceutical story is far from finished, as it, like biotechnology, continues to be influenced by culture and contemporary events. One prime example is the negative publicity surrounding Vioxx (rofecoxib), an anti-inflammatory drug that was withdrawn in 2004 by Merck & Co. following concerns about the drug's association with an increased risk of heart attack and stroke. Events such as these elevate public skepticism of the safety of pharmaceutical drugs in general.

Whereas the public rhetoric surrounding Fleming portrays him as a modest man with good personal qualities, that surrounding Crick and Watson is more mixed. In anthologies, newspapers and other public narratives, Watson and Crick are largely described as intellectually curious and desirous of winning a scientific race. However, in many accounts Watson, in particular, is seen as egotistical and hungry for fame, qualities that are also frequently attributed to Craig Venter, a figure who looms large in later biotech history. Interpretations of character are often fraught with ambiguity, and particularly vulnerable to reinterpretation following a passage of time. In the rhetorical matrix of the pharmaceutical and biotechnology industries it could be possible to re-characterize the Fleming popular character (as opposed to the actual man) as staid and old-fashioned, rather than modest and unassuming. Watson and Crick, by contrast, could be interpreted as having the positive characteristics of boldness, initiative, and vitality. One only needs to peruse a few chapters of Watson's account of The Double Helix to obtain an idea of the young, brash man who positioned himself front and center of a whole new chapter in science history. This, perhaps, underscores the rhetorical message of biotechnology as new, young, brash, big, bold, and given to hyperbole. It is a science that defies the general public to look away. As Matt Ridley writes, the double helix and the genome (which he calls the "towering bookends" of Watson's biotech career) could easily have been discovered by any number of others. He writes:

> . . . any one of them could have snatched the prize if they had shared Watson's urgency and vision. But that is what makes Watson's achievement all the more remarkable. It was precisely because the prize was ripe, and so many brilliant minds were after it, that his grasping it equal-first was an act of genius. He may have shaved only months, perhaps a year, off the timetable of history, but he won

> the race, something Shakespeare and Beethoven never had to do . . . What a much duller—and safer—history DNA would have had without Watson stirring things up. From the first friction with Rosalind Franklin to the battle against regulation in the 1970s to the confrontations with Craig Venter in the 1990s, it was Watson's ability to live dangerously that made history. (xv)

Biotechnology rhetoric that seeks ingratiation with the public does not emphasize the very human motivations of jealousy and mean-spiritedness, of course. Instead, the attributes that are positioned foremost include a spirit of entrepreneurialism, risk-taking, brilliance, youth, flexibility, and ingenuity. These traits are attractive to venture capitalists, who are the financial lifeblood of emerging, nonpublic biotechnology companies, and who often consider themselves mavericks of sorts.

In the Fleming anecdote, the popular notion is that nature was revealed through a fortunate (and perhaps divinely initiated) accident. The Watson and Crick story, by contrast, is all human, with the two often portrayed as hard workers who pursue a personal quest to discover life's secrets. Religion and science have seldom been happy bedfellows, and the thought that Man could suddenly be in possession of —or worse, manipulate—elements of nature is a theme that frequently emerges to frighten the public and thus destabilize the acceptance of biotech. Whereas Fleming's penicillin was given by God, the thought goes; DNA and genetics are the case of man playing God. The polemic to this would argue that those who champion biotechnology embrace a healthy sense of self and a scientific rationality that assumes achievable answers to cosmic questions. Fleming aside, the pharmaceutical world, too, has long been the subject of many of the same ethical and theological concerns now facing biotech, although to a far lesser extent since pharmaceuticals are perceived more as the manipulation of chemicals than the manipulation of the very biology that constitutes life.

For their respective efforts, Fleming, Crick, and Watson were all awarded the Nobel Prize—the "Holy Grail" for scientists and source of legitimacy for public perception of brilliance. In the Fleming story, the public took little note of those who came later—for example, Chain and Florey—whose efforts helped turn a bacterium into medicine that would be made available to all. Despite efforts by groups such as the American Chemical Society, an elevation of their status in the public's mind simply did not take hold. Similarly, Maurice Wilkins' name and involvement in characterizing the double helix are largely unknown. However, efforts to redeem the status of his colleague, Rosalind Franklin, continue to gain traction in the early twenty-first century. Franklin is becoming a new representative anecdote for women in science, and her name is increasingly present in historical anthologies. In a roundabout way, the successful inclusion of Franklin in the annals of science argues for a characterization of biotechnology as democratic and accessible to all brilliant minds. Successors like Barbara McClintock, honored with a Nobel Prize for her work in genetics (and subject of a first-class U. S. postage stamp issued in 2005), and Linda Buck, who won the Nobel Prize in 2004 for her work on gene coding for olfactory receptors, also reinforce the notion that biotechnology is open to all. The Franklin-as-hero is a modification (some would say improvement) of the standard Crick and Watson story, which continues to elevate the status of a specific individual (as opposed to corporations), but introduces a sense of fairness into the mix.

In the penicillin story, the drug itself is the star. Knowing that the general population places a high value on safe and effective therapeutics, the pharmaceutical industry infuses its public rhetoric with the ingratiating message of helping people through prescription medicine. Biotech, on the other hand, largely relies on messages of promise and potential since many of its products have not yet transitioned from theory to actuality.

If one rejects the premise that the above alternative narratives are mutually exclusive, then a combined list of characteristics could be posited for the biotechnology industry, as represented by Watson and Crick:

- The concept of a team of two as prime discoverers
- Later acceptance of a female scientist as critical to the discovery (thus, opportunity and fairness)
- Boldness
- Human initiative; pioneering spirit
- Youth; newness
- Quickness; ability to think and act fast
- Ability to live dangerously; courage
- Drama; hyperbole
- Sense of self, scientific rationality (or, alternatively, "man playing God")
- Love of new ideas, knowledge
- Science based on human cells, genetic code
- Potential of biotech science
- Promise of useful products

Of the collective list, the most powerful and transformative biotechnology industry attributes are captured in the words promise and potential. As future-focused words, they abet a malleable and personalized vision of how science could, should and ought to be. Youth and newness, too, are linked to the concept of transformation since the future offers options that are wide open to those who are young (or enterprises that are young). Genentech, the company that is universally acknowledged as the first biotechnology company, has a culture that feels "more like a college campus than a pillar of the FORTUNE 500" and cultivates an attitude of "flout(ing) conventional wisdom and tak(ing) a damn-the-torpedoes approach to naysayers" (Morris, Burke, and Neering 80).

The concept of pioneering and its associated characteristics of boldness and courage speak to the future and transformation as well. The very nature of discovery is linked to imagination: one can only guess as to what appears on the other side of the door. Until the door is opened, any manner of destiny can be imagined. The opening of the metaphorical door to the double helix was an action that generated more doors, each becoming bigger and wider and holding behind them concepts that were increasingly grand (or, depending on perspective, frightening): a map of the human genome, personalized medicine, the re-engineering of human beings, immortality.

Promise and Potential as Powerful and Transformative Biotech Rhetoric

The science historian Robert Bud has commented on the "promiscuity" of the word biotechnology ("Biotechnology in the 20th C." 419). By this, he means that the term has been used in many ways by many people, thus exemplifying the ambiguity of the word and the concept. He calls biotechnology a "boundary object" between engineering and biology that "can be associated with many passage points and translations" (419). He writes, "Typically, border objects tend to have shifting meanings, depending on which neighbour is dominant" ("Uses of Life" 3). He writes:

> 'Bio' suggests natural; it connotes all those living things whose lives, it often seems, would be better but for the human species. By contrast 'technology' evokes human control over nature. The combination of the two has often seemed deeply disturbing, even monstrous, as amalgams of people and machines have been described. ("Uses of Life" 2-3)

It can be argued that biotechnology is also a boundary object between the pharmaceutical industry and life science. If one accepts an ultimate vision of either defeating death completely or at least postponing it indefinitely, then penicillin and other antibiotics fulfilled this powerful vision for many decades. Life expectancy in 1900, for example, was 49 for white women and 47 for white men. By 2000, these numbers jumped to 80 and 75, respectively (Stevenson). While some of the reasons for increased life expectancy can be attributed to improvements such as better sanitation and nutrition, immunizations and antibiotics were also acknowledged to have played an important role.

However, by the end of the twentieth century, the infallibility of penicillin and other antibiotics was clearly jeopardized by the emergence of antibiotic-resistant microbes. With no new miracle drugs on the horizon, the pharmaceutical industry did not seem to be in a position to lead the way to a new era of continuous life. However, from a rhetorical standpoint, if biotech is a boundary object, then pharmaceuticals had several passage points to it. Big pharma could ingest biotech literally, through mergers and takeovers, or it could simply appropriate the language of biotech—that is, the language of risk-taking and innovation. Both of these scenarios are commonplace, and are what Kenneth Burke would term a state of merger that acts to "bridge the gulf" between two voices in a dialogue (GOM 402).

In its 2005 industry profile, for example, the pharmaceutical organization PhRMA writes that "(t)he convergence of traditional pharmaceutical chemistry and biotechnology has led the pharmaceutical and biotechnology industries, once thought of as being distinct and independent, to become more similar than dissimilar" (5).

A 2002 advertisement by the giant pharmaceutical company Aventis illustrates the merger of the traditional pharmaceutical rhetoric with a new message of innovation. The ad, subtitled "Our Challenge is Life," reads,

> Whether young or old, people wish to live a long and healthy life. Aventis, a world-leading research-oriented pharmaceutical company, makes a decisive contribution to the protection of health with innovative pharmaceuticals, preventive vaccines and therapeutic proteins. We are using our comprehensive experience and competence, as well as new technologies like biotechnology, to research and develop new and improved pharmaceuticals. After all, it is our aim not only to be able to treat illnesses more effectively but to prevent them. So that all of us can enjoy a long and healthy life. (43)

The ad, which depicts a three-generational family (grandfather, mother, father and two children) skillfully blends the old and the new in both its visual and textual rhetoric. It can be argued that the family represents the pharmaceutical and biotechnology industries, with the former bringing wisdom and experience to the narrative, while the latter brings the improvements of youth.

The absorption of biotechnology by big pharma is not always perceived as a strength for the latter, but often as a desperate means to stay afloat. As an example, when the biotechnology industry reached its 25th anniversary, the San Francisco Chronicle ran an article that described how biotech was "hotter than ever, viewed by many as the answer to the problems of old-line drug companies saddled with portfolios of dated products" (Tansey). The author also wrote of Pfizer's loss of $20 billion in market value "when it had to scrap development of an experimental cholesterol drug that it had hoped would replace its blockbuster Lipitor, soon to lose its patent." The author writes:

> Pfizer's disappointment epitomized the predicament of big pharmaceutical companies, whose flagging in-house research efforts are forcing them to buy or partner with biotech companies to maintain growth rates.
>
> "If you look at big pharma, they're in deep yogurt," said Steven Burrill, chief executive of the life sciences merchant bank Burrill & Co. in San Francisco. (Tansey)

In positioning itself head to head with big pharma, biotechnology often takes an equal and opposite tack. Michael S. Rosen, president of Rosen Bioscience Management, is a frequent contributor to Midwestbusiness.com, an online technology newsletter. Rosen's articles frequently position one industry against another, with titles such as "Biotechnology Flourishes in 2005, while Big Pharma Flounders" and "Eat Your Heart out, Big Pharma: Top 10 Biotech Companies Explode." Biotechnology rhetoric often tampers fears about the industry through the appropriation of pharmaceutical language—that is, expression of nobility of purpose through the advancement of human health and declaration of goodwill for humankind. In so doing, biotechnology could position itself as the "white knight" and position the pharmaceutical industry as the metaphorical dragon to be slain. A cover article in Forbes magazine illustrates this scenario. The magazine says that "killer germs" (also referred to as "scary superbugs") kill 100,000 people a year:

> Frighteningly lethal and insidiously efficient, these bacteria replicate and mutate prodigiously, turning out variants that elude most of the chemical weapons—

> antibiotics—that medicine has invented over the past century. (Langreth and Herper 62)

What's worse, the article continues, is that "Big Pharma, rather than riding to the rescue, has largely abandoned antibiotic research, a low-ticket business, for more lucrative pursuits" (64). Thus in one short sentence, Forbes has undermined the characteristics of the pharmaceutical industry as altruistic and noble and has crushed the Fleming myth of penicillin as wonder drug. The help that is on the way, the magazine says, is "not from the drug giants but from a coterie of obscure biotech boutiques" (64). The magazine continues the imagery of biotech *versus* pharmaceuticals when it talks about how one scientist was a "defector" from big pharma, leaving it for an antibiotic startup (74). It is an example of Burke's state of division between two voices in a dialogue (GOM 402).

Biotechnology rhetoric frequently can be distinguished from pharmaceuticals through bolder use of language and through closer alignment with life sciences. Whereas pharmaceuticals could only hope to "cure" mankind of diseases and disorders, the argument goes, biotech could seek permanent immunity against these ills through re-engineering of the body. An article in The Scientist, which calls itself a "magazine of the life sciences," asks the question: "What if humans were designed to last?" The authors write:

> Evolution has given humans a beautifully orchestrated set of genetic programs to carry most of us through to sexual maturity, but we have also been given a brain large enough to ponder our demise. Yet, if the molecular, cellular, and genetic machinery used to conceive, develop and operate a human were designed rather

> than the result of evolution, humans would be different and life would look different. This is our challenge. (Olshansky, Butler, and Carnes 28)

Thus, even evolution—which has long been the ultimate symbol of transformation—comes up short against biotechnology. Whereas evolution is passive, biotechnology is active and deliberate. Biotechnology products have the theoretical capability to be customized to individual people, in contrast to a "one-size fits all" drug such as penicillin. Tay-Sachs disease, for example, is a fatal genetic disorder caused by a specific enzyme deficit. It is impossible to introduce the needed enzyme directly into the brain, where it is needed, due to its protective barrier. The brain can, however, be penetrated by a bacterium that carries a "good" gene, which then reproduces in the body and replenishes the proper enzyme. As of this writing, genetic engineering for Tay-Sachs remains hypothetical and, like many biotech-related initiatives, subject to intense scientific and ethical debate.

Bio, as an equivalent term for biotechnology, has now become a code word for all that is new and innovative. The term has gained so much perceived value that companies that are not even related to biologically based science are using the phrase. EdenPure, a company based in Canton, Ohio that manufactures and sells portable heaters, recently mailed an information packet to consumers along with a letter marked "Biotech Research." EdenPure's heaters have nothing to do with biotechnology, but since biotech connotes that which is new and innovative, EdenPure can impart these benefits onto its products simply by appropriating biotech language.

As a terministic screen, the word bio directs the attention to size (small and startup), market space (that which is not pharmaceutical) and attitude (fresh and youthful). That biotech is also edgy and "sexy" can be seen in a recent advertisement from Harrison and Star, a creative services company. The ad, which is entitled, "Making Science Sexy," shows a female torso whose low-cut blouse is loosely tied with ribbons that are configured to look like the double-helix (Harrison and Star 65).

Some development organizations have used visual rhetoric to connect local culture with biotechnology messages. Invest Australia, a national agency to promote investment in Australia, recast the double helix as an aboriginal artwork, rendering the two strands in yellow, red and orange dots (Invest Australia 4). Another Australian biotechnology organization merged the double helix with an abstract rendering of the country's beloved Sydney opera house ("AusBiotech").

Thus, since 1953, the double helix has grown to be one of the most powerful metaphors in the world of science, becoming an effortless substitution for the concept of life itself. As visual rhetoric, it presents a far more unique and forceful image than a penicillin tablet. If we position pharma in competition with bio, it is bio that surely has the advantage of primary association with the rhetorical helix. As a rhetorical tool proprietary to the biotechnology industry, the double helix gives bio a distinct edge over big pharma because it has become, to use Lakoff and Turner's words, "a matter of thought, not merely language" (107).

Along with the entity itself—that is, the double helix as visual and rhetorical icon—the story behind the discovery has also become infused with meaning whereby the drama of Crick and Watson is one with the drama of biotechnology. And while this drama can largely be interpreted as positive for bio, it is also quite clear that the pharmaceutical industry is not ready to capitulate on the ultimate prize of public ingratiation. Rhetorical tensions between bio and pharma—i.e., the rhetorical helix—continue to be in play to pull the two industries together and to pull them apart. As will be discussed in the next chapter, the strategies for union (or division) are deliberate and active products of the composing process.

CHAPTER VI

WOOING THE PUBLIC IN NORTH CAROLINA: BIOTECHNOLOGY AS A TRANSFORMING AND LIFE-BASED ENDEAVOR

In The Making of Meaning, Ann E. Berthoff tells teachers of writing that "the character of the composing process [is] one in which everything happens at once— forming/thinking/writing" (6). She writes:

> After reading several accounts of the discovery of the structure of the DNA molecule, I constructed for my own amusement a model of the composing process as a double helix, trying to let the relationships articulated in that form help me discover those of composing. I had heard Francis Crick remark that you know a model is working for you when you get more out of it than you had put in – and I was delighted to see this happen. Although the process begins at the bottom and works its way upward, in each of the units, the four acts of mind, whether perceptual, conceptual, or rhetorical, can be read from top down as well as from bottom up. (7)

Berthoff's model is particularly apt for describing the activities of those who are charged with "making meaning" for the biotechnology industry or biotechnology activities. Meaning encompasses not only the facts and figures of definition and the feelings and impressions of description, but personal meaning as well. In crass terms, personal meaning (i.e., that which is meaningful to an individual) is the "what's in it for me" question, with the answer often a product of wish fulfillment. A better economy, more jobs, elevated community status, and effective therapies can all be elements that are meaningful on a personal level.

In her double helix of composition, Berthoff lists several sets of what she calls "acts of mind," including the following: seeing in context, establishing a perspective, looking, and responding (8). It is context and perspective that establish relative positions for pharma and bio. As Berthoff describes it, context and perspective are dynamic and changeable. While the general context for pharma and bio could be considered the health care industry or perhaps life sciences, the context could also be industries that use animals for research. Thus bio and pharma could be thrust into the same positive, negative or neutral bucket. Bio and pharma can also be positioned in opposition to one another, with one wearing the proverbial white hat and the other the black. If bio is new, it is because its oppositional element, pharma, is old. If pharma makes enormous profits, it is a useful construction to say that bio has yet to make a profit. As circumstances change (that is, as the general context changes), perspective changes with it. For example, in 2006, the biotechnology industry turned 30; whether 30 is old or young depends upon one's point of view—and one's motivation for describing it thusly.

North Carolina presents an excellent case study of the biotech rhetorical helix as composition in action. It also serves to demonstrate both senses of the rhetorical helix: composition of definition and description, in juxtaposition to one another; and composition of a public climate that will favor one industry over another. In the past few decades, state-sponsored agencies and others have introduced biotechnology to the public at large. They have articulated its merits and classified it vis a vis other industries in the state. They have substantiated their position through the use of positive examples. They have employed metaphors to facilitate meaning. And, most strategically, they have placed

North Carolina biotech within a context of critical economics and have established a perspective of achievable competition. All of this has been accomplished within a Berthoff-style framework that recognizes "how you construe is how you construct" (Berthoff 10). In North Carolina, biotechnology has been constructed as both life-giving and life-changing.

The North Carolina Biotechnology Center, located in Research Triangle Park, was founded by the state in 1984 to drive biotechnology development and to foster appreciation for the sector. In a 2004 publication subtitled "Moving Biotechnology from the Mind to the Marketplace," the NC Biotech Center says that its mission is to "provide long-term economic and societal benefits to North Carolina through support of biotechnology research, business and education statewide." The pamphlet says the Center's 50-member staff pursues six goals:

- Strengthen North Carolina's academic and industrial research capabilities
- Foster North Carolina's biotechnology industrial development
- Enhance the teaching and workforce-training capabilities of North Carolina's educational institutions
- Work with business, government and academia to move biotechnology from research to commercialization in North Carolina
- Inform North Carolinians about the science, applications, benefits and issues of biotechnology
- Establish North Carolina as a preeminent international location for the biotechnology industry.

All of the goals listed above have a counterpart rhetorical mission that is manifested in all communication from the center including documents, interviews, publications, newsletters, meetings, seminars, lobbying efforts, and more. It is a grand plan for wooing the public, for persuading state citizens and others that positioning biotechnology in North Carolina is consubstantial with their interests.

The messages directed at those considering relocation to North Carolina emphasize themes such as the state's excellent infrastructure, trained workforce, incentive package, and attractive living environment. For the internal audience (North Carolinian citizens), the most powerful and transformational message lies in biotechnology's capability to change North Carolina from a state built on traditional industries—agriculture, textiles, and tobacco—to one with all of the new, young, and innovative qualities of biotech. The underlying message is that it is not only the state that is acquiring these characteristics, but its citizens as well.

One theme employed by the North Carolina Biotechnology Center hearkens back to the concept of "winning the race." In a pamphlet entitled "Biotechnology Works in North Carolina," the Center references "North Carolina Firsts," which include the first public university (the University of North Carolina) and the first successful powered airplane flight (by the Wright Brothers). The reference to the Wright Brothers in particular is a strategic move because, as with Crick and Watson, it puts a human face to a technological achievement and emphasizes the fact that this notable achievement took place in North Carolinians' own backyard. The North Carolina Biotechnology Center also, strategically, includes itself in the list of firsts, saying that it was the "world's first government-sponsored initiative in biotechnology." Just as the Wright Brothers showed initiative in aviation, the NC Biotech Center and, by extension, the citizens of North Carolina are driven to be first in biotechnology.

Biotechnology is not only a field of science, it is—in rhetorical terms—a community as well. To make the concept of biotechnology feel local and friendly, BioSpace, a provider of web-based information, established a successful marketing campaign that organizes clusters of biotech organizations into what BioSpace calls "hotbed communities." The BioSpace maps visually depict, within a particular geographic region, those companies that define themselves as biotechnology related.

The underlying message of the hotbed map is that unlike the pharmaceutical industry with its century of history and major barriers to entry, biotech is accessible. Becoming a major pharmaceutical company requires substantial resources for research and development, large-scale manufacturing and marketing. A biotechnology organization, on the other hand, can be as intimate as two people with an idea. For cities or states that wish to infuse life into their stagnant communities, biotech provides a feasible option. The names on each BioSpace map underscore the folksiness of the biotech communities. Notable examples include "Biotech Beach" (Southern California), "BioGarden" (New Jersey), "Genetown" (Massachusetts) and "BioForest" (Northwest United States and Canada).

The BioSpace website says that the hotbed maps have "highlighted thriving clusters of life science industry, helping to attract investment, talent and additional resources to specific geographic areas." The site also says that the original hotbed map—"Biotech Bay" (the San Francisco Bay Area)—is on permanent display in the Smithsonian Institution's National Museum of American History.

In essence, the BioSpace maps compress all three stages of the rhetorical helix. They define, in scientistic style, what biotechnology is in any given area; they describe the biotechnology community in a folksy way; and they ingratiate the local community by establishing shared aims (e.g., successful economic development).

Like the other BioSpace communities, North Carolina has defined itself on a hotbed map, as shown in Figure 2. Again, keeping the connection with first flight, the map features several forms of air transportation: a Wright-style biplane, jet, hot air balloon and zeppelin.

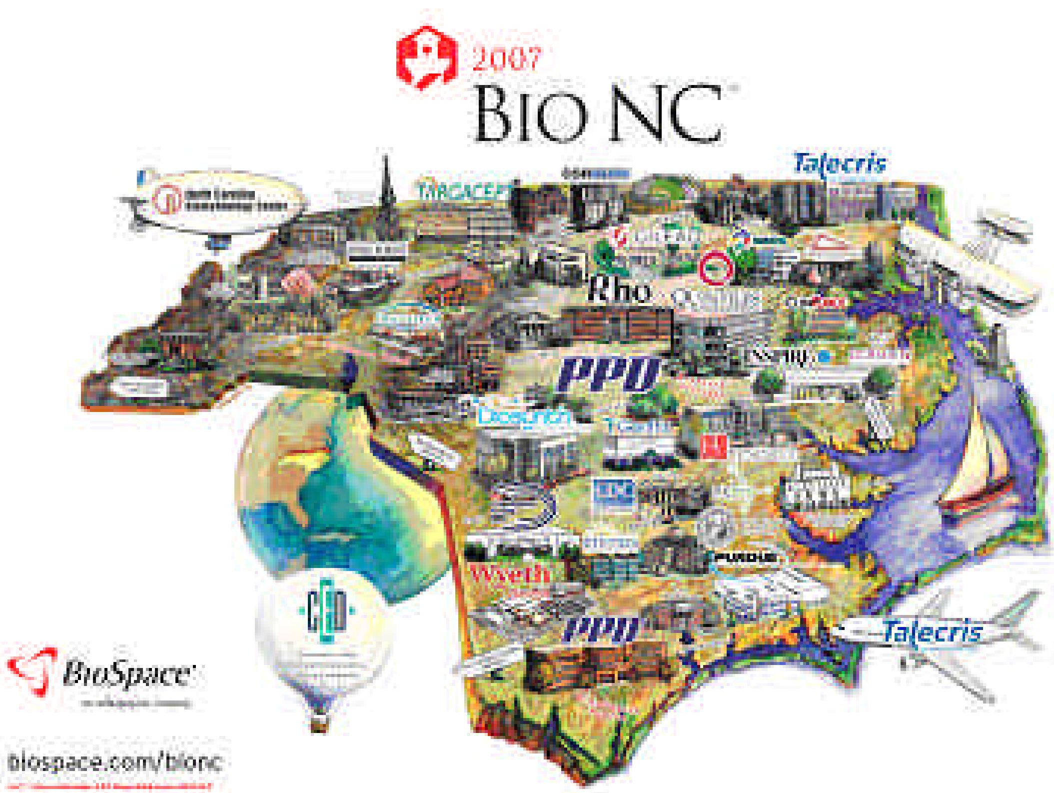

Figure 2. ***BioSpace North Carolina Hotbed Map. Manasquan, NJ: BioSpace, 2007. Reproduced by permission.***

North Carolina biotechnology companies themselves also employ the language of competition and speed. In a double-page ad in Fortune magazine, Quintiles Transnational Corporation, a contract research company that provides services to biotech, shows a large photo of a North Carolina city with a biplane flying overhead. The caption reads, “Great innovations have always had a way of taking off in North Carolina.” The text reads,

> Today it’s biotechnology. North Carolina is home to more than 170 fast-moving biotech companies, dozens of academic research facilities and Quintiles Transnational—the company that helped speed 9 of the top 10 best-selling biotech products to market.

W. Steven Burke, Senior Vice President for Corporate Affairs at the North Carolina Biotechnology Center, says the center is “communicationally intensive,” which is necessary in “a world peppered with biotechnology expectations triggered by nations, states, governors, and agencies” (personal interview). The NC Biotech Center publishes the newsletter BT Catalyst on a bimonthly basis, and sends it free to any member of the public who requests to be on the mailing list. It is also published in an electronic format. The Center also publishes Fast News, a weekly e-mail digest that reports on biotechnology developments across the state and is linked to other articles about biotechnology from the general media and biotech sources.

Burke, who described himself as one of the Center’s first employees, said the driving question for the organization has been “how to bring biotech to the life of a place.” Burke says that the words he would use to describe biotechnology are “responsible,” “transforming,” and “life-based.” “Life is everything,” Burke asserts. “If you have a technology that can manifestly understand, shape, and presume to shape life, you have the most significant endeavor ever in hand."

Burke says that he prefers the term endeavor over the term industry because it implies more than simply being a tool of capitalism. Although a biotechnology industry provides a source of jobs and represents the business of manufacturing, the biotechnology concept is larger than that. An endeavor, on the other hand, encompasses a business message, but also suggests that which has "profound societal and civic importance," he says.

Burke says that while biotechnology has proven key to changing the nature of pharmaceuticals, it also affects every other aspect of life, from plant and animal agriculture to forestry to biofuels. However, the aspect of biotechnology related to drugs receives the most emphasis because it is achievable and profitable.

Biotechnology is a complicated story to tell, Burke says, and given the emotional connotations of language, it is not easy to counter the voices of skeptics. As an example, he says that those who speak on behalf of biotechnology have not come up with a tool of language half as effective as Frankenfood (a pejorative term for genetically modified foodstuffs).

"People like easy, incisive connotations," Burke says. "When people accuse biotech of 'playing God,' these words together have an easy shorthand resonance, but no logic. What we're doing is 'playing man'—tinkering, evolving, making mistakes."

But the concept of playing man cannot be easily explained, Burke says. With such a complicated story as biotech, unless people are interested, they don't stay engaged for long, says Burke. And those who are skeptical won't listen in the first place.

However, this is not to suggest that there are many skeptics when it comes to biotechnology. In fact, biotech is generally well regarded in the United States, Burke says. "Biotechnology is affected by our ambient culture more than we know," he says. "Americans have traditionally been a society very tolerant of—and for growth, dependent on—new technology," starting with the telegraphs, new construction, ships, and railroads of the last century.

Burke says that a good deal of effort is made to define biotechnology because giving "utterance to definition is comforting and revealing." Only the things that can't be defined are the things to be afraid of, Burke says. He notes that when he first came to work for the NC Biotech Center 20 years ago, he came across 47 different definitions for biotechnology. Each definition, in its own way, struggled to capture the concept of "life-changing technology," Burke says.

Those who are in a biotechnology audience in North Carolina are usually "engaged and attentive," Burke says. Language directed to the public about the biotechnology community is usually not highly scientific and is usually kept at a general college level. Burke says he likes the term biotechnology community since it implies working together for positive outcomes, saving lives and creating a civil society. "This is human activity," he says. "The key is human spirit."

The messages from the North Carolina Biotechnology Center are, in a sense, an extension of earlier efforts by the state to develop a major technology center in Research Triangle Park (which encompasses Durham, Raleigh, and Chapel Hill). The park, known as RTP, was developed in the 1960s to transform an economy dependent on textiles and farming into the modern age. In a 1999 video about the endeavor (North Carolina's Research Triangle Park: An Investment in the Future), former North Carolina governor Jim Hunt says, "Forty years ago we were a poor state. North Carolina was one of the poorest states of our area and we just didn't see how it was gonna change." Hunt continues by saying that textiles and farming were "not sufficient to keep our young people at home and provide the economic base we needed."

Narration from a Department of Commerce film, made in 1954 and embedded into the RTP video says, "Every year, some of our best educated young people leave to find a living elsewhere. Of all our state's resources, these young people are most valuable and we're still losing them by the thousands."

Youth and vitality, it was determined, could be recaptured through the recruitment of high technology initiatives such as telecommunications, environmental sciences, chemical companies, pharmaceutical companies and biotechnology. "RTP has transformed North Carolina's economic landscape," the narration says.

Tales of personal transformation are told in the video as well, such as the story of Judy Watkins, who had been a textile operator until 1987 when her company closed its doors and she was out of a job. Watkins later got a job in biotechnology as a media preparer. She is quoted as saying, "It's a different world here than at the textile mills."

Also, significantly, the video touches on the transformation of tobacco, which had traditionally been the state's most important cash crop. In the video, Dorcas Green, a science teacher at a Kinston (NC) high school, says:

> In this area, historically, tobacco has been the number one crop. If we use biotechnology in making new products out of tobacco, I know that we are going to improve the economy here. Our students already see that we can generate cosmetics from tobacco and a cure for cancer. Of course with their minds they can come up with all the things that we haven't even thought of. ("North Carolina's Research Triangle Park")

In a few short sentences, Green touches on all of the messages that resonate most clearly with public sentiment and lay the foundation for embracing biotechnology in the state. These messages are as follows:

- An old economy of tobacco and textiles can be transformed into a new economy of biotechnology and health care
- Tobacco, an old product criticized for its deleterious health effects, can be transformed into new, health-enhancing products

Green's statement contains elements of hyperbole ("cure for cancer"; "they can come up with *all the things* that we haven't even thought of") that resonated earlier in the Watson and Crick representative anecdote for biotechnology. Similarly, she also privileges newness, quest for knowledge, and youth, with its inherent characteristics of quickness, agility, and innovation.

In a recent supplement of The Scientist magazine, focused solely on North Carolina, an article described all of the "villages" in the state that grew into "technology giants with the right combination of rural roots and corporate investment" (Macek 66).

Towns that had been previously best known for Christmas tree farms, furniture manufacturing, poultry farming, and tobacco crops are now being resurrected as seats of biotechnology that produce immunotherapy products, biofuels, and other biotech products.

For North Carolinians, the tobacco story touches on deep-seated emotions. According to the North Carolina Department of Agriculture and Consumer Services, tobacco's historical importance cannot be underestimated. Feelings about the crop still run high, especially since well over one-third of all tobacco-related employment in the United States is in North Carolina. A passage on the department's website reads,

> Tobacco has always been an important part of North Carolina's economy and a vital crop to our producers. Many people raised in this state can find a heritage relating to some area of the tobacco industry. The golden leaf is a bedrock to North Carolina. ("NCDA&CS Marketing Division")

The site notes that the tobacco industry "has been in a transition period" since October 2004, when a tobacco quota buyout was put into law by the federal government, thus ending federal farm price support.

A strong indication of the winds of change for tobacco came in spring 2007, when both chambers of the North Carolina General Assembly proposed bills that called for a smoking ban in all public places and worksites, for reasons of health. Elon University, a North Carolina-based school, conducted a poll to determine support for these bills and found that sixty-five percent of respondents in favor of the law, with thirty-one percent opposed. Hunter Bacot, director of the poll, said that "It appears that the historical ties to tobacco in this state are now essentially severed, as anti-smoking sentiments prevail among North Carolinians" ("Elon University Poll").

Even tobacco manufacturers acknowledge the reality of change. In a press release dated March 21, 2007, Reynolds American Inc. and its largest subsidiary, R. J. Reynolds Tobacco Company, said that the company supports "reasonable public smoking restrictions with common-sense exemptions for places such as private homes and adult-only facilities like bars" ("Reynolds American"). On April 3, 2007, a North Carolina House committee took a step closer to a total tobacco ban when it passed a bill to establish no-smoking zones around most buildings in the University of North Carolina system.

Clearly, the North Carolina public has acknowledged that tobacco does not represent the future of North Carolina. At the same time, the scenario of "rehabilitated" tobacco is appealing and lends itself to messages of new, human-driven science that takes nature and improves upon it. In an interview with UNC-TV, a public television station, Dr. Charles E. Hamner, who led the North Carolina Biotechnology Center from its inception in 1984 until his retirement in 2002, spoke to the possibility of inserting genes into tobacco plants, thus causing them to produce specific proteins which could then be used for pharmaceuticals, blood replacements, enzymes for industrial use, and "a number of potential valuable food products, all from tobacco." Hamner said that rather than seeing tobacco as a health risk through its use in smoking, it is possible to see it as a "value-added plant" ("Interview").

One of the most compelling tales of transition can be found in Targacept, Inc., a biopharmaceutical company located in Winston-Salem, North Carolina—one of several communities throughout the South that was built on the strength of the tobacco industry. Targacept originally started out as a research program at R. J. Reynolds Tobacco Company (RJR) which, according to its website, is the second-largest tobacco company in the United States, manufacturing one of every three cigarettes sold in America. As a financial powerhouse, RJR not only gave rise to its headquarters skyscraper located in the heart of the city, but it also contributed liberally to numerous educational, economic development and human-service programs through its private foundation. As industry critics describe it, "Cigarette makers are America's 20th-century Medicis, sponsoring symphonies, art exhibits, dance, and theater troupes" (Mollenkamp, Levy, Menn, and Rothfeder 15). The same authors write:

> Winston-Salem, North Carolina, population 144,000, is one of the largest cities tobacco built. Thousands work at RJR, which has dominated the town for a century. On warm summer days the musk of drying tobacco hangs in the air. There's even a nearby community called Tobaccoville, named in the 1870s after the town's lone landmark: a chewing-tobacco factory. (Mollenkamp et al. 16)

In the mid-1980s, R. J. Reynolds Tobacco embarked upon a mission to understand everything about nicotine, the active ingredient in tobacco, including its pharmacology, chemistry, and toxicology. Thus, RJR established the Nicotine Research and Analogue Development Program (NRADP) at a cost of tens of millions of dollars.

The company was looking for possible new products, including a "reduced risk cigarette," but what it found was a series of nicotinic compounds that "appeared to have potential therapeutic applications for a wide variety of ailments, including Alzheimer's and Parkinson's diseases, ulcerative colitis, and Tourette's syndrome" (Lord, Mandel, and Weger 117).

As Targacept's website explains:

> During our incubation within RJRT [R.J. Reynolds Tobacco], RJRT's researchers published hundreds of scientific papers and abstracts. Many of the publications focused on neuronal nicotinic receptors (NNRs), a unique class of molecular targets in the body that maintain and adjust central nervous system (CNS) activity.
>
> The findings from RJRT's researchers, as well as numerous investigations into the biological effects of nicotine reported in the scientific literature, suggested a role for NNRs in the treatment of human disease and led to the creation of Targacept. ("Targacept")

Targacept, which became a wholly owned subsidiary of RJRT from 1997 to 2000, was ultimately spun out as an independent company in 2000. A "best practice" study in Harvard Business Review described the events leading up to the spinout:

> (B)y the mid-1990s, pressure on the tobacco industry was intensifying, and RJR's parent company, RJR Nabisco Holdings, was in the midst of a corporate breakup. RJR Tobacco was forced to retrench and focus on defending its core business; its top managers could no longer afford to lavish time and resources on one of the company's more-promising, if surprising, areas of new product development. As one of the NRADP researchers puts it: "RJR's core product is an agricultural product that comes rolled in paper; it's manufactured very simply. An R&D-intensive pharmaceutical business was hardly a strategic fit." Internal interest in NRADP evaporated, its funding dried up, and despite its promising discoveries, its future within RJR looked bleak. (Lord et al. 117)

The debate within RJRT was whether to axe the research program, support it minimally, or sell it off completely. RJRT felt that the unit had the capability to transition from a wholly owned subsidiary to an independent company, and thus took the decision to spin out Targacept in 2000.

This transition to independent company status was an act of wooing in itself, particularly on the part of J. Donald deBethizy, then-head of RJR's product research and development group. DeBethizy, who shouldered the mantle of champion of the new company, had to convince RJR that the spin-off could generate substantial value for the parent corporation and that RJR should continue to provide the necessary resources to Targacept until the new company could stand on its own, financially and otherwise. He also had to embark on a strategy to pursue and attract outside partners and investors. In this effort, deBethizy presented the typical business arguments: Targacept had a substantial patent portfolio; advanced research capabilities, including a proprietary discovery platform; and an experienced staff—all of which translated into tremendous commercial viability and potential return on investment.

These are the traditional arguments that Burke would call an act of persuasion "for the purpose of causing the audience to identify itself with the speaker's interests" (ROM 570). As an example, a potential investor would be attracted to Targacept because of a shared interest in achieving good financial return. At the same time, deBethizy also engaged in another Burkean strategy: drawing on "identification of interests to establish rapport between himself and his audience" (ROM 570). In other words, deBethizy had to convince potential investors and partners that not only were Targacept's interests the same as their interests, but that Targacept's attitude and style matched theirs, too. To a great extent, this meant distancing Targacept from the "good old boy" profile of the harmful big tobacco industry and embracing the notion of Targacept as a new organization devoted to therapeutic advancements for the well-being of humankind.

DeBethizy recalls a visit to one high-powered investment firm to present a five-minute overview of Targacept. At the meeting, one of the general partners acted impatient from the start, interrupting deBethizy and instructing him to skip parts of the presentation. “In his mind, I was a stereotypical tobacco hack,” recalled deBethizy (personal interview). DeBethizy explained that not only did most people see the field in general as ethically questionable; they did not view data from the tobacco industry as scientifically credible.

For deBethizy, a primary challenge was learning how to ingratiate himself and company with the audience at hand. He understood that his company’s affiliation with the big tobacco industry posed a major credibility problem and intuitively understood that the way to overcome the problem was to emphasize the company’s transition from old to new. He was able to accomplish that rhetorical mission, in part, through the powerful use of metaphor.

DeBethizy did not skip any parts of his presentation. Instead, he relied on an image of transformation that overtly acknowledged the negative while offering the promise of something positive. It was the image of a phoenix, of a beautiful and healthy golden bird that spread its wings to take off to new skies. This metaphor struck a responsive chord with investors as well as the media, who were quick to notice the irony in the imagery of “rising from the ashes.” The Financial Times wrote about the “surprising virtues” of nicotine (Cookson 13), while The Wall Street Journal reported that

"Some top nicotine researchers applaud Reynolds' efforts with Targacept, saying it represents an opportunity for the nation's No. 2 cigarette marketer to put its nicotine savvy to socially responsible uses" (Hwang F3).

The phoenix was a useful metaphor to represent the idea of good emerging from bad; of youth from age; of rebirth from death. It is what Lakoff would describe as "a device of the poetic imagination and the rhetorical flourish" (Lakoff and Johnson 3). The idea of the phoenix rising is an orientational metaphor, a deep-seated notion that good (including health and life) is associated with up and bad (including sickness and death) is associated with down. Just as Lazarus rose from the dead, the phoenix rises from its own dead ashes to spring forth young and powerful.

DeBethizy said he also relied on his down-to-earth personality to woo and connect with his audiences. While deBethizy described himself as proud and confident, he said he also made a consistent effort to be honest and genuine in his interactions with the general public. He recalled one time seeing a highly placed executive from Pfizer speak in an arrogant manner and thinking to himself, "You sound just like a tobacco executive." DeBethizy noted that the pharmaceutical industry, like the tobacco industry, does little to address issues of pricing and profits. Big tobacco, he said, had historically always been on the defensive, emerging in the public eye only if there was a threat to the business. "Realists saw no value in going out and getting beaten up," deBethizy said. He said that big industries like tobacco, oil, and pharmaceuticals all place themselves well above the common man. "That's what happens when you get power," deBethizy noted.

Thus, in a compressed time frame of five years, deBethizy and his Targacept colleagues engaged in the rhetorical process of self-definition, description and ingratiation. This was a rhetorical helix of activity that the pharmaceutical and biotechnology industries had also engaged in, albeit over the course of decades.

To a great extent, deBethizy's task was to "make meaning"—that is, to construct an account of Targacept through written materials, speeches, one-on-one meetings, and even through the physical appearance of Targacept's shiny new headquarters building. Just as Berthoff speaks of the process of written composition as a "continuum . . . by which we make sense of the world" (69), deBethizy and his colleagues had to make sense of Targacept by finding and forming meaning for their new company. DeBethizy's efforts tracked with what Berthoff calls "interpretive paraphrase," or "the means by which meanings are hypothesized, identified, developed, modified, discarded, or stabilized" (72).

Although the science platform for Targacept was based on medicinal chemistry and small molecule development, both of which are traditionally associated with the pharmaceutical industry, the leadership at Targacept chose to identify the company as biotech. "We were an emerging growth company, so we called ourselves bio," recalled deBethizy. "It was a way to differentiate ourselves from the larger pharmaceutical companies. As a small growth company, it put us into a class with others like us." In this, deBethizy and his peers employed Burke's concept of reduction, whereby the activities in which Targacept is employed are reduced from the grand heading of science to the very specific grouping of biotechnology. It is an intentional selection that emphasizes certain properties that the company has in common with others. As Burke writes, “any generalization is necessarily a reduction in that it selects a group of things and gives them a property which makes it possible to consider them as a *single entity*” (GOM 96).

In addition to size, the designation bio also allowed Targacept to distinguish itself by high potential growth rate, along with high potential risk. Whereas pharma, in deBethizy’s words, are “old drugs being defended from generics,” bio represented “innovation” and “promise.”

Another metaphor deBethizy offered up is the idea of the biotech industry as a child and pharma as “cranky, self-centered adults.” He stated that “people love children” and that the “child-like metaphor works for us” because it allows the company’s representatives to be wide-eyed, enthusiastic and emotional. The idea of family underscores a basic conceptual metaphor which Lakoff and Turner define as “part of the common conceptual apparatus shared by members of a culture” (51). In fact, Lakoff writes extensively of the metaphorical concept of parents and children in Moral Politics, in which the “strict father” family is associated with metaphors of moral strength, order, and authority (99), and the “nurturant parent” family is associated with metaphors of empathy, self-development, and happiness (136-137).

The imagery of parent, child and family is used widely throughout the business community to conceptualize everything from mergers, which are often described as marriages, to spinouts, which are frequently portrayed as births. If we consider biotechnology as an offspring of pharmaceuticals, we have what Burke calls “the paradox of substance” whereby “(t)he offspring is “substantially one” with the parent: its history thus being a development from merger (during the Edenic conditions of the foetus in the womb) to division (at the first “biological revolution,” experienced by the offspring at the time of parturition” (GOM 405).

In other words, biotechnology (as the child) is one with pharmaceuticals (as the parent) and, at the same time, separate from it. As Burke puts it:

> the bursting of the bonds that has been made necessary by the growth of the foetus to the point where the benign circle of protection, the “enclosed garden,” had threatened to become a malign circle of confinement; and its status as offspring of this parent rather than that keeps it consubstantial with the familial source from which it was derived. (GOM 405-6)

For Targacept, the “ambiguity of starting points” (GOM 406) is doubled since its historical status makes it substantially one with big tobacco, and its rhetorical positioning as a biotech company makes it substantially one with pharmaceuticals. Association with strong “parental” business units can be advantageous. Targacept found that the press releases it issued that incorporated references to R. J. Reynolds or to large pharmaceutical companies were picked up much more readily by news organizations than those that did not. On the other hand, it can be argued that positioning oneself as a “child” business unit can be equally, if not more, advantageous for Targacept or any other biotech company because it assumes all of the characteristics of youth, including promise and potential.

After six years as an independent company, Targacept successfully completed an initial public offering in 2006, now becoming what deBethizy describes as “an older adolescent.” The move to metaphorical adulthood does not necessarily sever rhetorical relationships with the parent, not does it necessarily create an autonomous identity. This is particularly true given Targacept's new ventures into strategic partnerships with pharmaceutical companies. Such relationships can be considered as "ambiguities of substance" that Burke describes as follows:

> In being identified with B, A is "substantially one" with a person other than himself. Yet at the same time he remains unique, an individual locus of motives. Thus he is both joined and separate, as once a distinct substance and consubstantial with another. (ROM 545)

In keeping with the metaphor of biotechnology as a child-into-adolescent, those who analyze the industry are given to saying that biotechnology has "come of age." The transition of the industry as a whole can be tracked rhetorically by the report titles and introductory language used by Ernst & Young, a financial services firm that has tracked biotech progress since 1986. Per the messages extracted below, it is clear that industry analysts place biotech in an ambiguous position—distinct from pharmaceuticals insofar as its science is concerned, but similar to the pharma industry in terms of pressure for the need to provide products and deliver a return on investment. Table 4 shows some of the descriptions applied to biotech as it has evolved over two decades, with metaphors of movement, family, and self-composition clearly in play.

The success of the communications efforts made by the North Carolina Biotechnology Center and others exemplify the last bulleted item in Table 4—that is, that biotech is now moving into the public mainstream. The biotechnology industry's public relations initiatives have taken root, with articles in the public press largely in favor of the new industry. People are for biotechnology and the characteristics that seem to be associated with it, although some admit that they really don't understand the science behind it. As one reporter expresses it:

> Once it was easy to understand what we made in our factories in North Carolina. Furniture. Socks. Blue jeans. But now we're becoming known for making biological products such as drugs, diagnostics, vaccines, vitamins, amino acids and enzymes. If we're lucky, we soon will be known as a world leader in the field. Perhaps by then North Carolinians will know a little bit more about this strange new industry. (Rafferty 49-50)

Table 4

Cross-section of Introductory Language from Ernst & Young Biotech Reports, 1986-2001

Title	Messages (bolding mine)
Biotech 86: At the Crossroad	- A survey of an industry **in evolution,** including interviews with **industry pioneers** and the new generation of managers - The crossroad is **a place for questioning**, but also a place that calls for confidence
(No report issued for 1987)	
Biotech 88: Into the Marketplace	- Biotech products are not yet reaching the market routinely, but the **experience curve pitched upward** in 1987. - Biotech will be the answer to AIDS - Biotechnology will have **enormous positive impact** on agriculture
Biotech 89: Commercialization	- The title of this year's survey…speaks to what the industry has centrally cared about and achieved: staying on course in the **journey** that leads from the laboratory to the marketplace
Biotech 90: Into the Next Decade	- The first wave of technology with which the industry made its start **is now fully developed**, and new waves of technology are coming in behind faster than before. - It is certain that **biotechnology is fundamental**. - This industry is necessary and permanent.
Biotech 91: A Changing Environment	- …just as **biotechnology is transforming** its environment, so, too, is the environment transforming biotechnology - Hoffman-La Roche's acquisition of a majority stake in Genentech took many by surprise, but in retrospect, it has an inescapable logic. Genentech faced an integral dilemma of **a technology company coming of age** – the conflict between funding new product development versus Wall Street's demand for quarterly earnings' growth.

Biotech 92: Promise to Reality	- The year contains its own drama – almost two billion dollars in new capital raised within the first six months of calendar 1991. - This is also a story of products and alliances, and of **an industry growing up**. - In retrospect, it is the story of the **promise of an industry** being fulfilled
Biotech 93: Accelerating Commercialization	- **From its birth**, the industry's progress has been governed by a unique confluence of factors. Massive breakthroughs in science and technology. Enormous capital needs with a long horizon to payback. Financial markets that turn alternatively hot and cold. The heavy hand of regulation…. - **No other major industry has had to grow up with so many hurdles** to surmount in order to bring value-added products to its customers and earn commensurate profits
Bitoech 94: Long-Term Value, Short-Term Hurdles	- BIO now has more than 520 members in 47 states. - Our member companies are not only the current leaders in all facets of the industry…**they are the foundation of the industry's future**, the startup companies and the innovators who will turn today's dreams into tomorrow's successful products.
Biotech 95: Reform, Restructure, Renewal	- Biotech companies are aligning with big pharma companies and with each other – in the U.S. and overseas – in a **complicated web of interdependence**.
Biotech 96: Pursuing Sustainability	- …the truth is, that many of this year's events mark the **industry's passage into greater maturity**. - The biotechnology investment climate has moved from passion to panic. The passion began with Genentech's public offering, because every potential investor could identify with biotech's mission of addressing serious diseases such as Alzheimer's, cancer, and ALS. - However, the capital markets were **operating under the fallacious assumption that, because biotechnology dealt with molecules that were natural, biotech's products would be safer** than traditional pharmaceuticals and would get through the FDA regulatory process faster.
Biotech 97: Alignment	- Twenty years ago, the industry known as biotechnology **sprouted roots** in our academic and medical institutions. - However, these are new times for our industry, and **the challenge now is adapting** to the new healthcare environment. Our industry cannot sit back and be content with resting on our success. The healthcare industry is a tough one, the dollars

	are limited, and the solutions are great.
New Directions 98	- The **issue of genethics**, which came to the forefront this year, could significantly impact the direction of research, depending on which route public and political opinion takes. - The public and political response to Dolly, the cloned sheep, provided a wake up call, indicating how important genethics will be as the profile of the biotech industry increases in years to come.
Biotech 99: Bridging the Gap	- A significant gap has emerged as investors, especially in the public equity markets, are increasingly unwilling to recognize and reward value being created during the development process of a biotechnology product.
(2000) Convergence: The Biotechnology Industry Report	- In our last report, Bridging the Gap, we lamented that the market has not recognized the value being created in the biotechnology industry. That all changed as the year turned, with genomics stocks leading the way to often dizzying heights. - **Biotechnology advances are working to turn into reality what sounded so futuristic in the last century.** They are creating a world which, in a sense, is more "living" than ever…
Biotech 2001: Focus on Fundamentals	**Biotech's high profile moves it more into public mainstream**

In other words, people like what biotechnology seems to stand for, although they may not precisely know what biotechnology *is*. Such a paradox is the rhetorical helix at play, with definition and description winding around each other en route to the destination of ingratiation.

Targacept, meanwhile, has now firmly entrenched itself in the biotechnology community in the Piedmont Triad of North Carolina, an area becoming known as the "research triangle" of the western part of the state. The local chamber of commerce and other economic development agencies have frequently offered up Targacept as a representative anecdote for the Triad's transition from an old economy to new.

Several stories have featured Regina Whitaker, a medicinal chemist at Targacept, who had once been employed as a textile worker in the agrarian community of

Yadkinville, as an example of how students and other young people are being retrained for biotech. As one reporter describes it, "Regina Whitaker represents a voice of hope for the state's displaced workers" (Craver A12). The government, too, has jumped on the old-to-new economy transformation by offering Whitaker up as an example of a biotechnology industry success story ("Biotechnology Industry Success Stories").

Whitaker acts as what Lakoff, in Don't Think of an Elephant, calls a "person metaphor," where, in this case, transformation from old technology to new is conceptualized in terms of a single person (69). In explaining the negative sense of a person metaphor, Lakoff discusses the use of Saddam Hussein as a representative of the war in Iraq. Here, in the positive sense, Whitaker can be thought of as a representative of biotechnology and the notion of a community becoming economically healthy and fully able to compete.

The transformation of Whitaker, and others like her, underscores what Burke calls the "realm of the idealistic" whereby "a sense of consubstantiality is symbolically established between beings of unequal status" (ROM 570). From the perspectives of pay, opportunity and job challenge, the mundane world of farming or textile manufacturing is not equal to the sophisticated world of biotechnology and medicinal science. But from an idealistic perspective, a textile- or tobacco-based community could aspire to a rise in status through local biotech training programs and the infusion of new high-tech businesses into the area. As a result, virtually everyone located near biotech companies like Targacept has a symbolic opportunity to share in the new-economy vision. Those in low-paying factory jobs, for example, can now dream of being retrained as skilled professionals in biotech.

Ironically, tobacco profits are being used to transition workers out of the tobacco industry and into biotechnology. The Golden LEAF Foundation, a nonprofit organization that distributes funds from a 1999 master settlement agreement with cigarette manufacturers, is facilitating this change. In describing its activities, the foundation said that in 2003 it initiated a $60 million biotechnology initiative that "immediately focused national attention on North Carolina." In this, the foundation added, "the Golden LEAF biotech initiative already is providing to be transformational" ("In the Spotlight").

The golden leaf, it should be noted, is a nickname that had been bestowed on the tobacco leaf for its once-golden opportunity to bring its growers and manufacturers great prosperity. In a potent metaphor of birth, death, and rebirth, the dead leaves of tobacco have reblossomed into a new golden leaf of life. The capitalist gold of tobacco has transformed into the prosperous gold of biotech therapeutics.

As biotechnology companies such as Targacept engage in self-definition and description, and as they are defined and described by others, they fulfill the first sense of the rhetorical matrix. The second sense of the matrix—biotechnology companies and the industry at large interacting in competition with the pharmaceutical industry—is far more complex. Not only can biotechnology (as the "child") never fully disassociate itself from the parent, in many instances, mergers and other affiliations act to push the strands of the matrix back together. As described in Ernst and Young's 1995 annual report, biotech companies are now aligning with big pharma "in a complicated web of interdependence."

In other words, the new interwoven structure of biotechnology and pharmaceuticals brings a new twist to the rhetorical matrix whereby the two entities fuse to form a new rhetorical entity: the biopharmaceutical industry.

CHAPTER VII

CONCLUSION

At the heart of the rhetorical helix is an examination of language that presents itself as solid and unchanging, language that presents itself as fluid and malleable, and the relationship between the two. It is an important helix, this definition/description swirl, because it traverses between the liberating, yet perhaps threatening, concepts of possibility and change, and the confining, yet perhaps comforting, concepts of standardization and stasis, and makes us question our reaction to each.

The rhetorical helix is also a way to understand how industries and businesses compose themselves, and how they create meaning as a means to attain ingratiation. The helix is a metaphor for understanding that development is not linear and that multiple forces are always at play. The rhetorical helix highlights the way in which the pharmaceutical and biotechnology industries, as the primary example, move through rhetorically constructed illusions of independence and interdependence. As a construct of movement and transition, the rhetorical helix is inherently unstable and ambiguous – a postmodern image for a postmodern world.

A physical example of the ambiguity that a double helix presents can be found in the courtyard of the Piedmont Triad Research Park (PTRP) in Winston-Salem, North Carolina. There stands a sculpture of three gleaming, stainless steel strands of DNA that appear to intertwine as they reach upward (see Figure 3).

Figure 3. ***Triple Helix Sculpture at Piedmont Triad Research Park***

A report from the National Center for Biotechnology Workforce describes the imagery thusly:

> Spiraling into the sky, the curves of a triple-helix sculpture stand near an entranceway to the Piedmont Triad Research Park. With the remarkable biotechnological breakthroughs being made in the field—from advances in Alzheimer's disease to capabilities for growing new body organs—this shining sculpture also marks a gateway to the future. ("Addressing the Need" 1)

In the human body, DNA has a distinctive spiral shape that some have compared to a gently twisting ladder, with each "ladder" having two rails connected by multiple rungs, and each rung having two basic chemicals that are called base pairs. In order for DNA to duplicate itself, the chemicals in the rungs "unzip" from one another.

But in the PTRP sculpture, the rungs do not unzip. Instead, as the ladder climbs toward the sky, the rungs get shorter and the rails come closer to one another until, ultimately, the rails converge to a point. It is an artistic liberty, one without foundation in biological reality. It is also, perhaps, an artistic liberty that speaks to a desire for closure.

While some individuals, particularly entrepreneurs, are highly tolerant of ambiguity (Gladstone and Gladstone), others simply cannot cope with the conflicting and multi-layered messages that bombard our modern world. In his study of media literacy, W. James Potter states that the stronger our "emotional intelligence," the more we can appreciate different perspectives. He writes:

> If we have a low tolerance for ambiguity, we will likely choose to ignore those messages that do not meet our expectations; we feel too confused or frustrated to work out the discrepancies.
>
> In contrast, if we are willing to follow situations into unfamiliar territory that go beyond our preconceptions, then we have a high tolerance for ambiguity. Initial confusion does not stop us. Instead, this confusion motivates us to search harder for clarity. We do not feel an emotional barrier that prevents us from examining messages more closely. (53)

The "unfamiliar territory" that Potter speaks of is just what Burkean dramatism forces us to encounter. However, what dramatism has illuminated in the pharmaceutical and biotechnology helix is an affinity for that which seems eternal and true. Through the mythologies of Fleming and Watson and Crick, we demonstrate our willingness to return to that which is familiar, and that which we value.

When we accept the myth of Fleming as a young Scottish scientist who, by good fortune (or destiny, or Providence) accidentally discovered penicillin through mold spores drifting into an open window, we are essentially agreeing to assign significance to the values of fortune, destiny, and God. When we accept the myth of Crick and Watson as smart, bold, innovative, and brash, and validate these traits in anthologies and children's books, we as a society are saying we value these qualities as well.

If the story of Fleming has come to be associated with the pharmaceutical industry, and the story of Crick and Watson has come to be associated with the biotechnology industry, it is because we as a society have allowed for it to be so. As Barthes writes, "the meaning of the myth has its own value, it belongs to a history" and that meaning "postulates a kind of knowledge, a past, a memory, a comparative order of facts, ideas, decisions" (117).

In this regard, the myth is a sort of crystallization. It is an attempt to rid ourselves of ambiguity through collective agreement that God and nature are responsible for penicillin, not corporations and chemicals. As a society, we comfortably lock in our version of the events, and it all works very well until we are forced to rethink our position.

As the industry's first blockbuster product, penicillin transformed the big pharmaceutical players into extraordinarily wealthy entities. But in a world that expects its saviors and heroes to work for free, the concept of excessive profit did not reconcile well. Horror stories like thalidomide, which caused grievous birth defects, and Vioxx, which was linked to cardiac arrests, increased public skepticism of pharmaceutical products, and the myth of the pharmaceutical industry as life-giving saviors began to be rewritten. The pharmaceutical industry lost public goodwill. In movies and novels, pharmaceutical executives were frequently cast as evildoers, unscrupulously testing dangerous drugs on an unwary public. By then, it was very easy for the public to place the "black hat" on pharmaceuticals. The pharmaceutical industry as the bad guy became the new myth, the newly accepted collective agreement.

The rhetorical matrix is the means by which an industry such as pharma can fight pigeonholing. In an unambiguous world, one could place the black hat squarely on pharma and the white hat on bio. However, in the ambiguous world of the rhetorical double helix, pharma and bio both wear grey, with the potential always there to "spiral upward" (using the metaphor that up is good) or spiral downward.

In the rhetorical helix, definition is in constant interaction with description. Definition seeks to lock in the truth through a scientistic approach that affirms whether "it *is*, or it *is not*." Definition, on the other hand, has more dramatistic play, posing the option of whether something *should* or *should not* be, and providing for alternative scenarios. Whether we accept or reject these scenarios speaks to our values as a society.

Over the course of their histories, the pharmaceutical and biotechnology industries have strategically defined and described themselves—within their own industries, in relation to the other, and in relation to the public.

These ongoing rhetorical exercises are the essence of what Kenneth Burke would describe as dialectic or "the employment of the possibilities of linguistic transformation" (GOM 402). The debates represent a continuum: always pushing and pulling, and always in connection to each other. When Burke speaks to merger and division he notes the danger of treating one aspect of a thing as indicative of the essence of that thing and notes that "there are always ways whereby, in searching for the "essence" of a thing, we can consciously or unconsciously choose to seek either the "specific" essence or the "generic" essence" (GOM 409). This is precisely the dilemma for the pharmaceutical and biotechnology industries as they go forward, and can be a subject of interest for rhetoricians who wish to observe how this drama plays out in the decades to come. Do bio and pharma belong together, should their self-definitions and descriptions be merged, or should distinctions continue to be drawn between the two? Or is there an entirely different alternative that makes these polarities moot?

Considered in isolation, pharmaceutical and biotechnology industry rhetoric essentially communicates each industry's ability to transform us in some way—to provide jobs for our communities; to bring therapeutics to our medicine cabinets; to make us, by association, innovative and heroic.

Penicillin's discovery (or invention, depending on one's point of view) was integrally linked with the world of pharmaceuticals. It was a product that represented transformation at its most figurative—and literal. Taken by mouth, one small penicillin tablet had the power to transform a human being from the near-dead to the recalled-to-life. Penicillin was a product that was desperately needed by humankind, transforming its manufacturers into saviors and heroes.

Biotechnology, meanwhile, also communicated its capability to transform, particularly in sleepy communities whose industries were become less viable. In the early history of North Carolina, those in the Piedmont Triad made their living from the earth. In High Point, they turned trees into beds, tables, and chairs, making that city the "furniture capital of the world." In Greensboro, they spun denim and rayon into useful fabrics, making that city an important textile hub. And in Winston-Salem, they picked tobacco leaves and turned them into cigarettes, with a portion of the profits directed toward city growth. All were examples of transformation, both in terms of the products that took shape from raw materials, and the life those products then gave to their communities.

Those in biotechnology have attempted to imbue their industry with a mythological power of transformation that can affix itself to anything it touches. Gwyn Riddick, director of the Piedmont Triad office of the North Carolina Biotechnology Center likens biotech to a nucleus that is at the core of life. He says:

> Every cell has a nucleus, and that nucleus is at the core. It's driving the rest of the cell. The core circle is biotechnology, which is the driver—the lowest common denominator . . . The next circle is life sciences, which revolves around biology and biochemistry and includes more stuff than biotechnology. The bigger circle is bioscience, which includes fields like environmental science and marine science . . . And then there's health care where hospitals and many other institutions fall, comprising an even bigger circle which includes all things that affect the health of humans. (Rogoski B15)

What this imagery does is turn the genesis of biotechnology and pharmaceuticals upside down. Instead of biotechnology being a subset of pharmaceuticals, or the child of pharmaceuticals, it is the seed from which all else springs. It is a hierarchical relationship, but one that makes it impossible for pharmaceuticals and biotechnology to be adversaries since they are all part and parcel of the biggest circle of life itself.

In a double helix, although the two strands appear to twist and weave first closer and then apart from one another, in reality they maintain a consistent distance, separated by base pairs. By contrast, as the distinctions between the pharmaceutical and biotechnology industries grow murkier, their strands move so closely to one another as to be nearly indistinguishable. While biotech grows bigger and more pharma-like, pharma, by adopting biotech language and absorbing bio technology, becomes more bio-like. In fact, the term biopharmaceutical is now emerging to capture the generic essence of that which is bio and that which is pharma.

In its 2005 annual report, the industry group PhRMA noted that the pharmaceutical industry has brought under its wing a number of biotechnology advances. The organization writes, "The convergence of traditional pharmaceutical chemistry and biotechnology has led the pharmaceutical and biotechnology industries, once thought of as being distinct and independent, to become more similar than dissimilar" (5). In appropriating bio references, the pharmaceutical organization seeks to increase its acceptability quotient with the public at large.

Dr. Frank Baldino, Jr., Chairman and CEO of Cephalon (which calls itself a "biopharmaceutical" company), makes light of the distinction between biotechnology and pharmaceuticals, saying that he has been in the biotechnology industry for close to 20 years and still doesn't know what biotechnology means. Tongue firmly in cheek, he writes:

> So what then is biotechnology? Maybe it is a process. Maybe it is how we do business. We say a lot of odd things to describe our business, after all we are forever telling everyone that we focus on innovative products for unmet medical

> needs that address large under-served markets using of course (and my personal favorite) validated targets.
>
> I guess that by definition then the pharmaceutical industry uses only invalidated targets for medical needs that have already been fully satisfied and, perhaps, they use no innovation at all. ("Cephalon")

As the biotechnology matures, observers are beginning to question the essence of this industry. A recent Forbes article describes how Amgen "started life in California as a biotech boutique obsessed with the new science of genetic engineering" and how, 25 years later, "it is a teenage hippie trapped inside the musclebound body of a $10 billion-a-year behemoth" (Langreth, "Biotech Behemoth" 130).

Similarly, an article in The Wall Street Journal says that Amgen, "the world's largest biotech company by sales" is now facing "big-company woes" (Chase A1). As biotech products find their way through the FDA approval process to market, biotech companies are now facing the same safety and efficacy scrutiny of their products that their pharmaceutical counterparts have dealt with for years.

In terms of Burkean dialectic, the concept of merger would imply that both biotech and pharma have their flaws and their successes. Examples of the positive-to-negative continuum for big pharma range from:

- "Pharma provides much-needed medical products" to "Pharma pushes drugs"
- "Pharma's drugs are safe" to "Pharma's drugs are pushed out of research too quickly; they aren't safe"
- "Pharma's drugs are fairly priced" to "Pharma is simply out to make money"

A similar continuum can also be constructed for bio, ranging from:

- “Biotechnology is biology; it’s natural” to “Biotechnology is not natural; it’s fooling around with nature”
- “Biotechnology is ethical; it offers new approaches to healthcare” to “Biotechnology is unethical; it manufactures Frankenfoods; it promotes eugenics”

The concept of division, on the other hand, would mean that certain aspects of pharma are flawed while aspects of bio are heroic (or the converse).

Judging from the popular press, a middle ground is emerging whereby bio and pharma are both acknowledged as having flaws that are lessened when the two industries combine. One industry writer says that “Biopharmaceutical companies have emerged as an ideal hybrid combining both the technology platforms of traditional biotech companies and the drug development expertise and capabilities of mainstream pharma companies” (Viswanathan 20).

If dramatism is, as Burkean David Blakesley expresses it, “the systematic method for articulating these strategic spots, those eddies of meaning where it is possible for rhetoric to prove opposites” (22), what then does it mean when two entities weave so closely together that opposition no longer applies? If biotechnology has been synthesized (or is synthesizing) into pharmaceuticals and vice versa, then the dialectic (or rhetorical matrix) between the two has come to rest. If this is the case, then we can rid ourselves of ambiguity once and for all by fusing the helix into a single, unambiguous biopharmaceutical (or perhaps “life science”) strand.

And yet, try as hard as we may to solidify our ideas, the rails of the helix separate and we once again move from a scientistic is/is not basis of comfort to a dramatistic impetus for inquiry and potential instability. In the world of the DNA double helix, although the "unzipping" of DNA's base pairs is biologically programmed for consistency (thymine can only be paired with adenine; guanine can only be paired with cytosine), mistakes can and do happen, causing mutations. In the world of the bio and pharma rhetorical helix, separation of the rails (and, for that matter, integration of the rails) can also be cause for instability.

Attempts to merge biotech and pharma strands into one have been met with great resistance in some camps. In fact, some industry observers are attempting to deconstruct bio and pharma into smaller components, with the pharmaceutical industry positioned not merely as one giant big pharma entity, but several different entities, such as "little pharma," "generic pharma," and "specialty pharma." The same phenomenon is also occurring in the biotechnology arena.

Ronald A. Rader, president of the Biotechnology Institute, notes that the term biopharmaceutical—as in the intersection of the terms biotechnology and pharmaceuticals—and other related terms "are so misused and abused that they are losing their meaning" ("Part 1" 60). He writes that because the term biopharmaceutical "is used inconsistently, other pharmaceutical sectors—including the R&D services and mainstream drugs (Big Pharma) industries—are co-opting it for their own uses" ("Part 1" 61).

Rader notes that "(i)n the biotechnology business view, anything that appears high-tech and involves pharmaceuticals (or life sciences), particularly if it is about small companies, is described as biopharmaceutical (and/or bio-technology)" ("Part 2" 43). He continues by saying that "hundreds of small drug discovery and related service companies that have no involvement in or use of biotechnologies are called biopharmaceutical" ("Part 2" 43).

Rader suggests that biopharmaceutical and biotechnology are "buzzwords that attract audience attention and evoke warmer, more positive images than alternatives such as drugs" ("Part 2" 44) He complains that "both companies and journalists often seem to care more about attracting attention and exploiting biotech's positive image than about precise use of particular terms" ("Part 1" 60).

Rader is right, of course, from a scientific perspective. Arbitrary use of the bio modifier does confuse issues such as industry reporting and financial analysis. But from a rhetorical perspective, Rader's observations merely serve to underscore how powerful and attractive the notion of bio is in American society. The media, the pharmaceutical and biotech industries, and individuals all seem to be jumping on the bio bandwagon.

When billionaire David H. Murdock, senior chairman, CEO and owner of Dole Food Company was looking to transform the old textile town of Kannapolis, North Carolina into a new biotechnology research campus, he described the new place as a "biopolis," noting that "(t)he dictionary might say there isn't such a word, but it's a new term that will be used extensively about our town. I want to make this entire town into a think tank" (McCurry 2).

But in the unstable helix of bio-pharma rhetoric, the terms bio or even biopharma may not necessarily be a safe haven. Just as there are scores of people who point fingers at the evils of pharmaceuticals, so too are there others, like Adam Wolfson, writing for the New Atlantis, who are highly concerned about biotech. Wolfson writes,

> First, the continued development of biotechnology in certain directions will require the violation of truly basic moral strictures. Second, biotechnology will initiate a revolution in how we think about family, parenthood, the relation between the generations, work and achievement, and many other areas of human life. And third, biotechnology could bring about a fundamental rupture in human history, leading us into a "posthuman"age. (55)

Wolfson characterizes certain aspects of biotechnology—eugenics, cloning, embryonic research—as moral and biblical issues. As rhetoric, such shalt or shalt not edicts act dramatistically by pushing and pulling at our emotions. If the public sees cloning, for example, as contrary to its interests then—in Burkean terms—the interests of the public will not be consubstantial with that of the biotechnology industry (or at least that sector of the biotechnology industry).

Similarly, if the public sees the need for new and better therapeutics as critical to its interests, then both the pharma and bio industries will find ways to highlight their responses to the public's perceived need. Public ingratiation with pharma, bio, or biopharma is always a construction and always in play. Public ingratiation is dynamic; one needs only look at the history of pharmaceuticals to see how reaction to an industry can advance from negative to positive to negative.

Meir Statman discusses the process of "creative destruction" in the pharmaceutical industry whereby "entrepreneurs constantly look for opportunities to compete by improving their products and production processes and by introducing new products" (1). The result, he says, is "competition through creative destruction (replacement) of existing products and forms of organization" (1).

Ultimately, both pharma and bio may need to engage in creative destruction as the idea of therapeutics is now interacting in an entirely new rhetorical helix with the concept of prevention as the opposite rail.

Historically, pharmaceutical companies promoted the notion that in order to be healthy, we simply needed to ingest a pill and all would be well. Even as the pharmaceutical companies appropriated language from biotechnology, the message was still the same: new, entrepreneurial drugs can help address mankind's medical needs.

The appeal of biotechnology was to take the body's own naturally produced proteins and harness them for medicinal purposes (as Genentech did with the body's anti-clotting protein). Bio, therefore, was equivalent to natural, innovative, and even personalized. Bio also linked itself with newness and potential for the future. As the official voice for the biotechnology industry, BIO develops the content of its web site in a way that is most favorable to its interests. On BIO's web site, biotechnology as a word and a concept takes the front row seat, with more mentions than the common word the. The future-focused words potential and opportunity are more prevalent on the site than present-focused words such as profit and responsibility. And yet, although the biotechnology industry emerged as a new way to develop drugs, those drugs are also largely based on curing disease.

"The pharmaceutical and biotechnology industries project themselves as solving the world's problems," stated Vincent Henrich, Director of the Center for Biotechnology, Genomics and Health Research at the University of North Carolina at Greensboro (personal interview). "This is an error of enthusiasm."

Henrich stated that instead of antidotes, the real health care paradigm shift will be an increased focus on pre-symptomatic diagnosis, early detection, and monitoring techniques. Although therapeutics may extend people's lives, they do not prevent the trauma of the disease itself, he said. "Curing cancer is a noble goal and has captured a lot of young imaginations," Henrich said. "But there are two questions: (a) Is it cost-effective, and (b) Isn't it better for the patient if he didn't get cancer in the first place?"

If Henrich is right, then the rhetorical helix of the biotechnology and pharmaceutical industries may be shifting completely, as their combined categorization as therapeutics may be newly positioned, through definition and description, in opposition to pre-therapeutic approaches. As one Forbes writer expresses it,

> The pharmaceutical industry, despite a golden age of biology that has unraveled mysteries of the genetic code and yielded miracle drugs that save thousands of lives, may be on the brink of a backlash. Millions of us are popping prescription pills for innocuous ills, when simple lifestyle changes of diet and exercise—harped on by physicians for decades—are more effective and a lot cheaper. (Langreth, "Just Say No" 103).

Perhaps these two new rails—biopharmaceuticals and pre-therapeutic approaches—will attempt to reconcile with each other, through a new post-pharmaceutical, post-biotech world of health. Whatever this new world of health may be, and however it may be defined or described, it will certainly be part of a new, always-ambiguous, always-interacting rhetorical helix.

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APPENDIX A

APOLOGY FOR A TASTELESS COMPARISON

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Apology for a tasteless comparison
By Ingrid Newkirk May 5, 2005

When the investigative footage of the violations at the AgriProcessors glatt kosher slaughterhouse was released last December, an observant Jewish staff member here at PETA (People for the Ethical Treatment of Animals) suggested that we consider referencing the classic Yiddish song "Dona, Dona" to convey the horror of the calves who are transported to slaughter, and perhaps use its haunting music to accompany the video images.

When I consulted with other Jewish staff and PETA advisors, some thought that this was an offensive and inappropriate use of the song, which alludes to the journey to concentration camps.

This renewed the heated debates that were provoked during the "Holocaust on Your Plate" Campaign, taking me back to the mental wrangling that we have experienced here over the profound conflicts that comparisons to the Holocaust generate, and the diversity of complex positions on these issues within the Jewish community. Even among Jews who are aligned with animal rights, the melancholic song incited a spectrum of passionate and visceral reactions.

We decided not to use the song in connection with the AgriProcessors case, and I have decided to apologize for the pain caused by the "Holocaust on Your Plate" Campaign.

When "Holocaust on Your Plate" was originally launched, we knew that it would be emotionally charged and intellectually provocative. Even if we had used more conventional tactics, people don't like to have it pointed out to them that they[1]re causing unnecessary pain and suffering by eating meat. We did aim to be provocative. We did not, however, aim simply to provoke.

Hard as it may be to understand for those who were deeply upset by this campaign, I was bowled over by the negative reception by many in the Jewish community. It was both unintended and unexpected. The PETA staff who proposed that we do it were Jewish, and the patronage for the entire endeavor was Jewish. We were careful to use Jewish authors and scholars and quotes from Holocaust victims and survivors. And since Judaism has some of the strongest teachings regarding compassion for animals among the monotheistic faiths, I truly believed, as did the Jewish staff members who proposed the exhibit, that a large segment of the Jewish community would support it.

We had also seen the positive response to Holocaust scholar Charles Patterson's book, ‘Eternal Treblinka: Our Treatment of Animals and the Holocaust,’ and felt that our exhibit was very much in keeping both with the spirit and goals of his book, as well as the history that he documents, which finds more and more Jews opting for vegetarian diets as a part of their response to the Holocaust applied to humans and other animals.

The Orthodox Jewish Press wrote, “Charles Patterson’s book gives us pause for thought, and if killing and consuming our animal protein is a societal cause of homicide and genocide then we must stop to give some consideration. After all, foods of animal origin are especially prone for causing most of our major illnesses, such as cancer and heart disease.”

A member of the editorial staff at the daily Israeli paper, Ha’aretz wrote, “this is a thorough and thought-provoking book. If the linkage of animal rights and the Holocaust seems startling at first, it begins to make perfect sense as one reads on. Some might see this as trivialization of the Holocaust; it isn’t. Instead, the chilling parallels Patterson exposes seem to offer even more reason to despair of the human race.”

Another daily paper from Israel, Maariv opined, “the moral challenge posed by 'Eternal Treblinka' turns it into a must for anyone who seeks to delve into the universal lesson of the Holocaust... .”

The Jerusalem Post stated, "Even if you are not persuaded to give up meat meals for moral reasons, at least you will never be able to say of the suffering behind them: “I didn't know... .”

Similar responses have been published in Jewish papers all over the world.

The “Holocaust on Your Plate” Campaign was designed to sensitize people to different forms of systematic degradation and exploitation, and the logic and methods employed in factory farms and slaughterhouses are analogous to those used in concentration camps. We understand both systems to be based on a moral equation indicating that “might makes right” and premised on a concept of other cultures or other species as deficient and thus disposable. Each has its own unique mechanisms and purposes, but both result in immeasurable, unnecessary suffering for those who are innocent and unable to defend themselves.

As with the song “Dona, Dona,” we had hoped to draw attention to the common, terrifying experience of the condemned en route to their horrible and unnecessary slaughter. We recognize that the analogy made in “Dona Dona” resonates as more than a rhetorical or literary comparison, especially to those for whom the experience is still too personal to universalize. The differences cannot be translated or reduced to a metaphor, particularly for the victims and survivors who still bear physical and emotional scars of persecution and for the Jewish community still so horribly vulnerable to continued acts of anti-Semitism.

We sincerely wished to bridge these different forms of systematic abuse. By showing how humans were treated "like animals" it was never our goal to humiliate the victims further.

We believe that we humans can and should use our distinctive capacities to reduce suffering in the world. Even the vegan diet that we endorse out of concern for animal suffering promotes human health, protects the environment, and liberates us from violent practices, as Dr. Richard Schwartz makes so clear in his book Judaism and Vegetarianism. These are all goals directed at alleviating human suffering as well as that of other beings.

Our mission is a profoundly human one at its heart, yet we know that we have caused pain. This was never our intention, and we are deeply sorry. We hope that you can understand that although we embarked on the "Holocaust on Your Plate" project with misconceptions about what its impact would be, we always try to act with integrity, with the goal of improving the lives of those who suffer. We hope those we upset will find it in their hearts to work toward the goal of a kinder world for all, regardless of species.

APPENDIX B

NEW SECTORS IN NAICS

“New Sectors in NAICS.” 3 June 1998. U.S. Census Bureau. 7 May 2007. <http://www.census.gov/epcd/www/naicsect.htm>.

New Sectors in NAICS

NAICS groups the economy into 20 broad sectors, up from the 10 divisions of the SIC system.

11	Agriculture, Forestry, Fishing and Hunting
21	Mining
22	Utilities
23	Construction
31-33	Manufacturing
42	Wholesale Trade
44-45	Retail Trade
48-49	Transportation and Warehousing
51	Information
52	Finance and Insurance
53	Real Estate and Rental and Leasing
54	Professional, Scientific, and Technical Services
55	Management of Companies and Enterprises
56	Administrative and Support and Waste Management and Remediation Services
61	Educational Services
62	Health Care and Social Assistance
71	Art, Entertainment, and Recreation
72	Accommodation and Food Services
81	Other Services (except Public Administration)
92	Public Administration

APPENDIX C

1997 U. S. NAICS CODES AND TITLES

"1997 U.S. NAICS Codes and Titles." July 1998. U.S. Census Bureau. 7 May 2007. <http://www.census.gov/epcd/naics/naicscod.txt>.

1997 U.S. NAICS Codes and Titles

325: Chemical Manufacturing
- 3254: Pharmaceutical and Medicine Manufacturing
  - 32541: Pharmaceutical and Medicine Manufacturing
    - 325411: Medicinal and Botanical Manufacturing
    - 325412: Pharmaceutical Preparation Manufacturing
    - 325413: In-Vitro Diagnostic Substance Manufacturing
    - 325414: Biological Product (except Diagnostic) Manufacturing

541: Professional, Scientific, and Technical Services
- 5417: Scientific Research and Development Services
  - 54171: Research and Development in the Physical, Engineering, and Life Sciences
  - 54172: Research and Development in the Social Sciences and Humanities