The Professions in Theory and History: the Case of Pharmacy

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Economics has no theory of professions as distinct economic institutions. Economists have, however, written extensively about individual professions, like medicine and law, and about professions generally. Almost without exception, economic studies of professions take the existence of professions as given and focus instead on certain behaviors commonly associated with professions, like licensing or bans on advertising. In taking this approach, economists are making the implicit assumption that professions are ordinary, though perhaps objectionable, neoclassical firms whose performance we can assess appropriately using the same standards we apply to firms. Even the most rigorous expositions of economic theory as applied to professions view professional conduct as a simple question of market structure: "The policy maker's problem ... reduces to whether professionals should ... be allowed to retain monopolistic powers" (Shaked and Sutton, 1981, p. 217).

The decision to treat professions as firms has created some intriguing problems for the economist's research agenda. To begin with, while professions are defined as firms, professionals are most often modeled as some kind of non-homogeneous self-employed labor. That is, practitioners are assumed to maximize some sort of personal utility function rather than profit. Of course, no one is entirely happy with this artifice, especially since the comparative-static results are often quite sensitive to these arbitrary specifications of utility functions. The problem, of course, is that there is no theory that can help us judge among these alternative formulations. The dissatisfaction increases as we attempt to apply these models in order to explain the organizational behaviors of professions. For instance, how do we explain the existence and general acceptance of self-regulating professional associations, whose constraints on professional behavior would be unacceptable to any standard neoclassical firm and which current economic theory can comprehend only as a cartel?

In large part the problem is that most of the economic studies purporting to study producers are in fact asking questions about demand. For instance, when economists ask if production is made more or less efficient by the presence of licensing, they are really asking whether the consumer is better or worse off under licensing. In fact, the analysis often has nothing to do with the way in which production takes place. The premise of this paper is that professions are not firms, but instead are unique economic institutions that have evolved and continue to survive because they represent comparatively efficient solutions to certain kinds of *production* problems. In this paper, I identify some specific kinds of problems that professions solve particularly well. One of the interesting implications of this analysis is that licensing — a central issue for much of the economics debate about professions — is neither a necessary nor a sufficient condition for the existence of professions.

A theory of professions.

I begin with the following definition of a profession (Savage 1993).

➨ **A profession is a network of strategic alliances across ownership boundaries among practitioners who share a core competence.**

The remainder of this section expands upon this definition

Competences.

In broad terms, dynamic capabilities and competences can explain how firm-specific assets can be developed and then adapted as responses to changes in the external and internal competitive environment. The theory of economic capabilities is still in a relatively early stage of development. In fact, the terminology is far from standardized (Teece et al, 1992). The literature owes a great deal to the work of Penrose (1959) and Nelson and

Winter (1982). Both of these books focus on the ways that firms adapt in order to survive, on what firms know, and on how they know it.

Neoclassical production theory relies on factors of production as the basic units of analysis. The capabilities framework distinguishes such homogeneous inputs from firm-specific assets because the former lack an organization-specific component. Examples of homogeneous inputs include unskilled labor and information available in the public domain; firm-specific assets include special production facilities and processes and methods of managing innovation and change. These assets can neither be easily imitated nor transferred between organizations because they embody organizational knowledge that, by its nature, is tacit. Or, the assets may be technically transferable, but only at a transaction cost that is sufficiently high to offset entirely their value to other organizations.

Taken as a group, these firm-specific assets constitute a competence. The value of these competences is that they are not product specific, and may be a source of rent in a variety of applications. *Core competences* are those that are crucial to an organization's survival. Good management successfully identifies, nurtures and develops core competences, and constantly samples the market to identify goods and services to produce with them. Some of the literature identifies as *distinctive competences* the set of activities that a firm can coordinate better than other firms. Finally, *capabilities* are the activities that can be undertaken with a set of competences.

This terminology, used increasingly in business strategy literature, appears likely to become the standard for discussing the capabilities and competences of the firm. A recent description characterizes a competence as “the collective learning of an organization” (Prahalad and Hamel, 1990). However, in terms of its ability to convey the importance of acquiring and managing knowledge, I prefer the Nelson-and-Winter approach to understanding how firms exploit specific assets. In their explanation, knowledge is

contained in routines. The ability to replicate production tasks is a simple example of a routine — although not necessarily a simple routine; the ability to establish new competences is another. The knowledge contained in routines is not only that of individual employees and managers but also the larger and largely inseparable knowledge of the organization. Each firm has an underlying strategy that must be consistent with its structure. For example, "a firm whose strategy calls for being a technological leader that does not have a sizeable R&D operation, or whose R&D director has little input into firm decision making, clearly has a structure out of tune with its strategy" (Nelson 1991, p. 67). The success of the organization depends on having "practiced organizational routines" (p. 68) that underlie the existence of core competences and capabilities of the firm. No matter how brilliant the plan, without complementary capabilities, the job will not get done.

Networks.

While core competences play an important role in defining professions as knowledge-reliant production organizations, the concept is insufficient to differentiate professions from firms. Professional reliance on the existence of *networks* serves this purpose. Networks generally involve the exchange of capital, products, and/or knowledge. This need not imply equity investment. For our purposes, we want to think of a community of practitioners operating separately for many purposes, but dependent on the network for the maintenance and development of core competences that earn them rents. This interdependency identifies professional networks as exchange organizations that rely on interaction with and feedback from a network of individual practitioners within the institution.

Note the way in which this differentiates professions from firms. First, firms in the same industry usually will not expend resources in constructing formal alliances with each other because they are not dependent upon them. In contrast, the knowledge, routines

and capabilities that give economic meaning to professional competences reside in organizations and institutions, and not in individuals. For example, this is one reason why successful companies don't go under when one person leaves. Yet in professions, the actual delivery of the product is done by individuals who are members of the network. By definition, the network is a feedback mechanism made up of mortal practitioners and a longer-lived institution. (A useful analogy can be made to the importance of Mozart as an individual. Other musicians can play his music, but they can't write new pieces. The knowledge of his music and methods is (imperfectly) stored in written materials and collective memory.) So the first and foremost reason for the interdependence, and therefore the success, of the network form of institution, is the development and maintenance of routines. This applies to professions because no single professional knows all of the routines nor can manage all of the competences that make up the required capabilities.

Professions are particularly well adapted to dealing with uncertainty because of the system of practitioner-level autonomy. This form of organization allows decision-making processes to be unstructured and varied; yet open communication between professionals allows successful outcomes — innovations, for example — to be adapted and diffused rapidly without destabilizing related markets. Practitioner-level autonomy succeeds because the contents of certain routines have been developed through the network process — they are the result of past and ongoing, explicit and tacit, negotiations.

Notice that it is not the nature of the product, but the nature of production, that is crucial to the choice of organizational form. Professional production contains many standardized routines, to be sure. However, production itself is far from routinized, especially in the sense that very few of the decisions professionals make can be completely prespecified. This is in sharp contrast to most kinds of production. For example, an employee of a burger joint, given an order, has only one decision to make: how fast,

within a small subset of choices, do I hustle? The decision about what a hamburger is, and how it is to be prepared, has already been made: Two all-beef patties, special sauce, lettuce, cheese, pickles, onions on a sesame seed bun. Professionals on the other hand are expected to translate requests for products into production by combining standardized routines and their own experience (a kind of capability) into decisions. This explains why so much innovation — often in the form of improvements to routines — originates at the practitioner level, which is unlikely to have a formal research and development structure.

More often than not, a practitioner's performance has a direct, if not necessarily immediate, effect on the ability of other practitioners to use their own capabilities. For example, standard terminology and techniques are important in both law and medicine because independent practitioners need to be able to reconstruct both the process and the outcome of another practitioner's production decisions. That is, practitioners often play complementary roles, even while competing among themselves.

There is a lot of economic research on the importance of reputation in professions, especially in models that identify reputation as a restraint on undesirable behavior. Reputation, which in a network setting becomes a Marshallian external economy, has value to individual members of the network. Over time, professionals develop reputations that reflect on the way in which other members do their jobs. This "stock" reputation effect is exacerbated by the "flow" effect of the entry of new members and the exit of others. Reputations have all the advantages of brand loyalty, and most of the problems of public goods. We often overlook the importance of reputation for production, where reputation signals the ownership of assets that are valuable as inputs into production by other professionals, and for which market transfer mechanisms are unlikely to work.

Ownership Boundaries.

To most consumers, the boundaries between professions probably seem as real as the Berlin Wall of the Cold War era: clearly illuminated, carefully guarded, and if not always convenient, at least unambiguous in intent. Consumers know that (legally, at least) they can purchase certain categories of goods and services only from specified professionals. Suppliers know what their final products and services are supposed to look like and, to some extent, how they are to produce them. Although the customary divisions of labor — for example, those between doctors and nurses, doctors and pharmacists, and, in Great Britain, barristers and solicitors — are sometimes awkward and expensive, they are at least reasonably consistent across professions and not altogether counter-intuitive.

On the other hand, professionals, like Cold War politicians, most certainly do not take these boundaries as set in concrete. Professions and paraprofessions constantly jostle for position, seeking to extend their jurisdictions. Professionals also test the boundaries in less formal ways, by building competences and, over time, introducing new products and services that reward their efforts.

Unfortunately, by focusing on the demand side of the market, economists also tend to take the divisions as givens. It follows that, to the extent that they consider the origins and continued existence of the borders at all, these economists assume them to be the result of licensing all by itself. For example, by interpreting the arrangements between professionals and clients solely as a principal-agent problem, we assume that the clients' problems are solved by finding a contract that aligns the interests of professionals with those of clients. In fact, both demand *and supply* must be considered. The evidence surely shows that, where even applicable, the professional has a problem getting the incentives of the client in line with her own so that any production at all will be accomplished.

One of the strengths of the production-based approach is its ability to offer an economic explanation for the observed recent escalation in the number and intensity of border skirmishes (Felsenthal 1992). First, however, I need to explain the role of ownership in professions and to contrast it with the ownership problem of the firm.

By boundaries I mean the location of production, and especially of potential overlap between practitioners and the profession, professions and other professions, and professions and other economic organizations. What can the nature and location of boundaries tell us about relationships among practitioners in the same profession? Where does a profession end and the market begin?

Recall that the existence of a network allowed a community of practitioners to operate independently for some purposes but not for others. That is, professional networks preserve autonomy and authority for professions, while sharing some and building many distinctive competences available across ownership boundaries. This concept clearly differentiates professions from occupations, where each person owns his or her own labor and need seek only an employment relationship in order to use that labor to earn income.

By *autonomy* I mean that no one except another professional is able to challenge the day-to-day decisions of a professional. The essential routines that constitute the production of professionals are chosen and adapted by the individual practitioner. Along with autonomy, the institutions of professions must also inculcate self restraint if the authority of the professions is to be legitimate. The origins of the capabilities that operationalize autonomy are complex. As with many craft jobs, mechanisms exist through which basic knowledge of routines is conveyed gradually as the apprenticed member passes specified selection points. Each selection point emphasizes a different competence. As a full-fledged member of a network, however, a professional is free to choose the

situations in which particular routines will be used; that is, qualified professionals choose their own jurisdictions. They are also free, indeed expected, to use accumulated experience to apply routines in new ways, to stop using other routines, and to invent new routines.

By *authority* I mean to emphasize that professionals possess command capabilities not available to non-professional economic actors in a market economy. Examples of this include the attorney's command over the legal system's resources, and a physician's command over the health care system. The source of authority is expert knowledge — that is, the professional not only knows a lot in terms of difficult, abstract principles, but knows routines that allow the application of these principles. Professionals have the ability to solve routine problems easily, and nonroutine problems routinely. By authority I do *not* mean the ability to force clients into actions: patients cannot be forced to undergo procedures or even comply with advice; students can be sanctioned by bad grades, but this is surely not compliance; and lawyers, too, can only hope that their advice will be heeded.

Competences and Boundaries in the History of Pharmacy.

This section confronts the theory of professions adumbraded above with the history of pharmacy as a profession separate from medicine and chemistry. The separation involved both different professional tasks or skills and different professional goals. The central problem here is to identify the appropriate location of production. I solve this problem by identifying a unique, constant, and identifiable core task that has successfully differentiated pharmacy from all other related professions: *the certification of the strength and purity of medicinal drugs.* All of the other tasks that have been identified with pharmacy at one time or another, or in one place or another, have been peripheral to this core; as such, they have been episodically jettisoned by pharmacists or raided by other professions. Pharmacists have had to respond to changes in science and technology as well as to

developments in the economic organization of trade and production in order to be able to continue to fulfill their core responsibility. Their predominant response has been attempts to institutionalize their expertise, which has resulted in less flexible boundaries between the professions. In spite of this rigidity, controversies (which I call border skirmishes) continue to occur, as the realities of change overwhelm the existing institutions. For example, changes in technology, coupled with an increasing understanding of disease, have altered the location of both drug research and production. In the twentieth century, therapeutic drugs have become sufficiently complex that both pharmacists and physicians have yielded to pharmaceutical chemists in both of these areas.

Boundary disputes in the provision of medicinal substances can be traced back as far as recorded history (Savage 1993). But it is appropriate here to consider the development of the profession in the United States. A watershed event for identifying the core task of pharmacy occurs in the 1840s, when a pharmacist, Ewen McIntyre, "discovered that a portion of supposed calcium carbonate, imported from England, was in fact calcium sulfate" (Kremers and Urdang, 1976, p. 198). Further investigation proved that many of the drugs coming into the country were "substituted, adulterated, or deficient in strength" (*American Journal of Pharmacy* **23**: 290, 1851). The traditional institutions that had existed in Europe to deal with these problems did not exist here. This led to the creation of institutions uniquely suited to economic and legal conditions in the United States. First, the federal government enacted a law that set standards for and required inspection of imported drugs. The law proved to be useless, since the inspectors lacked the knowledge, the training, and the tradition of professional ethics of pharmacists. They were technically unable to test substances for ingredients and strength. And, by Pharmacopeia standards, the legal definitions were so imprecise as to be unenforceable.

This chaotic situation provided the impetus for the creation of a national professional association of pharmacists. At the urging of local pharmacy and medical

associations and colleges, a letter was sent to call a convention "for the purpose of considering the propriety and practicability of fixing a set of standard strengths and qualities of drugs and chemicals for the government of the United States Drug Inspectors." This afforded pharmacists an opportunity to organize for more broad purposes, and resulted in the drafting of a constitution in 1856. The articles of this constitution address various aspects of pharmacy practice, including business relations with pharmacists, education, and entry. However, the first section of Article 1 defines the aim of the organization as "to improve and regulate the drug market, by preventing the importation of inferior, adulterated or deteriorated drugs, and by detecting and exposing home adulteration."

In the early republic, of course, the task of assuring quality and purity was bundled with other tasks, including compounding and research and development. In the process of preparing drugs for patients and physicians, individual pharmacists continually added to the accumulated knowledge of interactions between chemical substances, and they speculated on the way in which these drugs worked in the body. They developed dozens of ways to administer drugs, and in the process learned how to purify, make extracts, distill, and infuse. All of these are part of the compounding function. It is easy to see the economic advantage that would accrue to a local pharmacist who could come up with a new drug or a new method for making a drug. In fact, in the seventeenth and eighteenth centuries, most of the new remedies and preparation methods that appeared in formularies were the creations of community pharmacies.

It is a small step from this type of applied research to small-scale manufacture. In most countries, guilds had long-established traditions of compounding quantities of drugs for their communities. In the United States, the Colleges of Pharmacy in Massachusetts, New York and Philadelphia carried on this tradition. However, the bulk of this type of work was done at the shop level. Soon, however, technology began to exert its influence

on the ability of community pharmacists to create new treatments. Early in the nineteenth century, research breakthroughs in chemistry led to methods of synthesizing the active ingredients of medicinal plants. This marked the beginning of the end of shop-based research. In fact, the growing influence of the industrial revolution on markets and manufacturing methods, coupled with these advances in science and technology, effectively shifted drug and chemical manufacturing out of small laboratories altogether and into large, specialized firms. It is critical to this story, however, that this move was itself an unintended result of pharmacy's obsession with standards. It was not, at least at the time of the shift, an inevitable result of industrial expansion. For instance, Eli Lilly licensed other manufacturers for its products, but only under the condition that they agree to Lilly's testing and quality standards.

Retail pharmacy in the United States has never resembled the economic or institutional forms of community pharmacy in Europe. In those countries, the historical effect of guilds in granting monopolies over the sale of specific services, drugs, and other goods resulted in the boundaries of the professions being more clearly defined and legally protected. In Colonial America, by contrast, consumers were happy to get familiar drugs from whatever source they could. Generally, this meant waiting for shipments from European cities. While there was some interest on the part of newly resident physicians in identifying indigenous plants and producing medicines here, there simply wasn't the time or financial support for it. The result of these beginnings is that medicines were sold and compounded by physicians who had dispensaries in their offices; by professional pharmacists, to the extent that they emigrated here in the early years of expansion (pharmacy schools were formed much later than medical schools); by general stores, which engaged in barter for all kinds of goods; and by wholesalers and importers, who capitalized on the demands of various ethnic groups for familiar kinds of drugs.

The contrast with European pharmacies is clearly quite sharp. While individual pharmacists exhibited the same recognition of the task of certifying the quality of drugs as their counterparts in the old country, they could not depend on having a prescription-compounding practice sufficient to support the research and testing that would have to be done. In addition, they were competing directly with physicians, who were at least as educated and were firmly attached to including compounding and dispensing among their tasks. The interest in physicians in this aspect of their practice was no doubt threefold. Dispensing produced additional income for the practice; even if they were willing to write a prescription, there were only a few professional pharmacies capable of filling it correctly; and, finally, in the virtual absence of legislative standards of any kind, the safest drugs were those secured and prepared by the physician himself. As a result, physician dispensing became a traditional task of practicing medicine, and as late as the 1940s, the majority of doctor's offices included facilities for preparing drugs.

The retail drug industry was characterized by consumer access to a variety of types of sellers. Prescriptions were not required by law or custom, and consumers were free to purchase whichever drugs they felt would benefit them most. Advertisements for medicines were aimed exclusively at the consumer, not at physicians and pharmacists. As a result, retail pharmacies in this country never earned the largest part of their income from their prescription practice. In 1931, fewer than one percent of all business calling themselves pharmacies received as much as half of their revenues from their prescription departments. However, during the early part of the century, the technical changes that were making it difficult for local pharmacists to compound drugs in their shops also had an effect on production by physicians. Also, significant institutional changes, primarily in law, led to a drastic increase in the number and type of prescriptions that physicians were writing. Over the next few decades, pharmacy prescription practice grew rapidly, and by 1962 25 percent of all pharmacies earned half or more of their income from prescriptions.

Note that these statistics are further evidence that the sale of drugs was not the main concern of pharmacists; their economic success in this field is a recent development.

The increasing share of prescriptions as a source of a revenue to pharmacists was a by-product of the institutional responses of professional pharmacy to changes in technology and other economic changes. In the 1930s, 75 percent of all prescriptions still required compounding skills. That is, the physician's written prescription was a formula composed of a variety of substances which the dispenser needed to combine using technically sophisticated methods. By 1950, the number of prescriptions fitting this description fell to 25 percent; by 1962, to four percent; and by 1973, to less than one percent. Physicians were writing more prescriptions than ever before, with the express intention that they be filled by pharmacists, but the medicines they specified were increasingly the finished products of large manufacturing companies. In fact, a growing number of physicians had adopted the practice of prescribing drugs by reference to trade-name-specific nomenclature rather than to the ingredients at all. A 1973 survey reported that almost 90 percent of all drugs were prescribed this way. As a result, only 12 percent of prescribed drugs were included in the U. S. Pharmacopeia (U.S.P.).

These trends raise two important issues. First, what accounts for the drastic increase in prescription writing? Second, what was the effect of the decrease in shop-based compounding on the location of the performance of the core quality task of certifying quality, strength and efficacy?

In wrestling with the problem of whether and how to include patent drugs, the 1905 Pharmacopeia was in actuality attempting to adapt this institution to the realities of the U.S. drug industry. Seventy-five million dollars a year were spent on patent medicines, which, overwhelmingly, were either worthless or dangerous. The U.S.P. was designed to help pharmacists certify quality by setting standards and specifying tests.

However, patent medicines were by nature secret formulas. Increasingly, pharmacies lacked the technical facilities needed to reveal the contents of snake-oil medicine bottles. In addition, the formulas of individual remedies were changed at the whim of the manufacturer, which prevented even a slow accumulation of information about the many medications on the market. A private study by muckraker Samuel Hopkin Adams showed that many contained alcohol, opium, or cocaine as their active ingredients. They were habit-forming, and long-term use caused lung disease and other illnesses.

Since the standards approach proved to be inadequate, pharmacy associations supported the adoption of specific laws. In particular, they wanted all drugs to be clearly labeled with the names and amounts of all of the ingredients. However, by this time the Proprietary Association, the patent-medicine trade association, was very strong. The advertising fees its members paid were virtually the sole support of the print media, and sale of the drugs accounted for a large part of the revenues of general stores. As a result, the 1906 Pure Food and Drug Act allowed for penalties against producers of misbranded drugs. A misbranded drug was one whose label contained false or misleading statements about its contents. Pharmacists also wanted explicit labeling about the strength of the active ingredients. Instead, the bill recognized the U.S.P. as the official standard, but allowed manufacturers to use drugs of greater strength in their products. As a result, the bill did almost nothing to protect the ability of pharmacists to certify the purity, safety, and efficacy of drugs sold in their shops. Even worse, the federal law effectively superseded the control that some states had granted to state pharmacy boards in order to regulate drug production and sales.

The next critical juncture was the Massengill Elixer Sulfanilimide disaster in 1937. Although the story is actually quite complicated, we can summarize it briefly. The crisis occurred when the company created a liquid form of the drug sulfanomide, which had been used successfully and safely for several years in capsule and tablet form. This

chemical was the first drug created by sophisticated research using synthesis of molecules. Many companies marketed versions of the drug. In order to improve its early market performance, therefore, salesmen for the company requested a version that more closely resembled the popular patent medicines. Many companies had tried unsuccessfully to create a liquid form, but couldn't find a solvent. Massengill finally stumbled upon a terrifically successful one, diethylene glycol. Almost as soon as the drug hit the market, reports of painful and torturous deaths were reported to the American Medical Association. This should come as no surprise to us, since the solvent is well known to us as antifreeze. A successful recall, in which pharmacy records played an important part, was instituted; but about 100 people died, and many of them were children. The 1906 law did not prohibit the sale of dangerous or untested substances; it only addressed the problem of mislabeling. Ironically, however, it was misbranding that allowed the recall to occur and sanctions to be applied. The U.S.P. defined an elixir as containing alcohol, which this mixture did not. If the label had read tincture, no penalties could have been enforced.

This background brings us to the answer to the question of why prescription drug dispensing rose so quickly in its importance to pharmacy incomes. In 1938, a revised law was enacted. The Food, Drug and Cosmetic Law required manufacturers to provide labels for their drugs that included the identity of ingredients, directions for use, specific dosages, and warnings about potential problems. The law reestablished the liability of the producer if the specified dosage caused injury. Finally, it required tests proving that claims on the label were true. Once again, pharmacists encouraged this legislation as a new institution that could aid them in certifying the purity, safety and efficacy of the drug to the general public. Once again, too, the drug producers reacted by proposing amendments that weakened the bill. This time, the exception was that the labeling requirements would not apply to drugs that were to be repackaged (presumably by

pharmacists), or to those for which prescription was provided by a physician, dentist, or veterinarian. The justification for this was that physicians would provide detailed information directly to the patient.

The unintended and unforeseen result was that drugs were effectively but arbitrarily divided into over-the-counter and prescription-only drugs. The option depended on the willingness of the manufacturer to assume responsibility for labeling. Pharmacists criticized the amendment for its effect on the public. The sponsors responded that the "bill is not intended to restrict in any way the availability of drugs for self-medication. On the contrary, it is intended to make self-medication safer and more effective" (H.R. 2139, 1938, p.8). In fact, of course, choices were curtailed. Ironically, moreover, the provisions inserted at the behest of the drug companies had the unintended effect of creating a guaranteed income for pharmacies.

Peter Temin (1979) has attempted to explain the adoption of this law. He views it as the first manifestation of an official belief that consumers were unable to understand or use drugs without official supervision, regardless of how carefully they were labeled. He argues that there is no reason for this attitude, since there had been no changes in the technology of how drugs were produced, and no change in the number of new and complex drugs. He concludes by admitting that he can't explain how or why this belief emerged. In fact, as the above quotation demonstrates, his basic premise is incorrect. So, too, is his assumption about the nature of technological change in drug production. First, although pill machines still looked the same, the medicines were very different. Even before 1938, which is Temin's watershed for the creation of new drugs, many important scientific advances had occurred. Organic chemistry allowed pharmacists to create drugs that interacted with biological material; synthesis of molecules led to aspirin production in 1880 and barbiturates in 1903. Sulfa drugs resulted from applications of tests on streptococci bacteria in the early 1930s. These techniques are clearly advances in the

technology of producing drugs, and resulted in an increase in the number of new drugs introduced.

Whatever the intentions of the law, the result was a change in the ability of both physicians and pharmacists to accomplish their jobs. Physicians became the consumers' agents in the use of drugs. Pharmacists still pursued their goal of certifying the purity, efficacy, and safety of drugs, but in a new way. Compounding became increasingly rare; but repackaging became more common. Pharmacists assumed responsibility for maintaining a large inventory of unadulterated and properly stored drugs, a task that had been theirs for centuries. In addition, their core responsibility took on additional dimensions. They could best accomplish the task of quality certifiction by standing between physicians and patients. For example, they checked prescriptions for errors, monitored drugs for interactions, and supervised ongoing drug use through careful record keeping and contact with customers through refilling.

In the last few decades, pharmacy began to lose important parts of its professional status. The changing technology of drug research, development, and production, as well as changes in prescription drug laws and distribution sites, reduced both their tacit knowledge base and their authority. Still, according to surveys, the public continued to rank pharmacy as the most respected profession. Building on this reputation base and their remaining specialized capabilities, pharmacists devised a new strategy that has succeeded in re-invigorating their network. Most colleges now award a doctorate, called the Pharm.D., as the terminal pharmacy degree. This allows pharmacists to interface with Ph.D. chemists and biologists as well as physicians. As a result, and as the theory predicts, these networks welcome pharmacy into their midst because pharmacists now possess knowledge that these other networks want to internalize in a form that they can use.

This is an excellent example of how capabilities help explain professionalization and deprofessionalization. Pharmacists have been reluctant to give up tasks like compounding and research even when technological imperatives make it clear that, with their current strategy, they would have to do so. As Nelson (1991) points out, routines have to be practiced, for two reasons. First, sometimes the information acquired in performing routines is more valuable than the direct payoff of the routine reflects. For example, routines often generate innovations that benefit other capabilities. Second, if you give up routines, you may lose parts of other capabilities. Once given up, routines may become impossible to recover. Individual practitioners quickly lose the requisite skills, and the network may lose access to necessary complementary assets. If, as in drug development, technology radically alters the location of production, network members find themselves out of the feedback loop.

One of the reasons that pharmacy didn't go under is that it is harder for network institutions to disappear from the economy than it is for firms, who can just dissolve. A network exists as long as there are any shared routines with the ability to generate rents. Pharmacy hung around until pharmacists in the academy developed a new strategy and convinced pharmacists in other subspecialties to change their strategies. The Pharm.D. places pharmacists squarely in the academic network, which has long been an excellent base from which to build a knowledge base with marketable capabilities.

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