Which Pharmacy Degree to Profess

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A HISTORICAL AND PHILOSOPHICAL NOTE

The issue of which degree to award students who complete the course of study in pharmacy has been with us since the turn of the century, perhaps longer. Some colleges granted a student the Doctor of Pharmacy (Pharm.D.) upon completion of a two-year curriculum, usually after he or she passed a special examination, wrote a thesis, or both. Other colleges followed this practice but required the completion of a three-year curriculum, while others required the completion of an optional four-year curriculum. This practice was not highly regarded because of the meagerness of the curriculum, and the practice was discontinued after the four-year Bachelor of Pharmacy or Bachelor of Science in Pharmacy degrees were mandated during the 1930s. As a result of this stigma, some pharmacy educators have been reluctant to advocate the Doctor of Pharmacy degree unless it was based on a course of study comparable to other learned doctoral curricula (1).

But what is the nature and status of traditional degrees: the Bachelor of Arts or Science, the Master of Arts or Science, and the Doctor of Philosophy? The term bachelor originally meant a young knight who served under another's banner, that is, an understudy. During the development of the university as an institution in the early thirteenth century, the practice (especially at the University of Paris) of an academic apprenticeship (known as bachelordom) was

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the means by which a scholar would become a licentiate as a master or teacher. The apprentice was known as a bachelor, and when he obtained his master's license, a biretta (a cap, now mortarboard) was placed upon the new master's head. Thus, the bachelor's degree was derived from the practice of qualifying to become a scholar under a master's tutelage. Similarly, the Master of Arts (Science, Music, or other) degree was derived from the second and last stage of this practice, that is, becoming a master teacher (2-4).

Note the similarity in terminology and practices used in the academic institutions and the guild system for artisans and tradesmen. Indeed, the purpose of the practice was the same: to protect the middle class from rapacious landlords and other powerful personages.

The Doctor of Philosophy (and other doctorates) had a somewhat similar history, but with a slightly different emphasis. The term doctor originally meant teacher or a learned person. It was, and still is, associated with the highest degree or level of learning in a particular field of study. With the reestablishment of the Roman and Greek classics during the Renaissance, emphasis on philosophy–that is, a renewed interest in the nature of the world and man–permeated the university culture. Thus, the Doctor of Philosophy became the preeminent degree. The Ph.D. represented not only the highest degree, but an achievement beyond the mastery of expert skills and knowledge (2-4).

How were other doctorates affected by these developments? The first European university, if not the very first formal university, began as a medical school in Salerno, Italy, during the tenth century. It was designated as the only authorized school of medicine in the Kingdom of Naples by Frederick II in 1231. The second university, at Bologna, Italy, specialized in the study of law. Over time, the Renaissance influenced these and all institutions of higher learning, especially in the study of law, medicine, and theology, the three learned professions. The degrees granted in these three fields varied by country, but eventually a doctorate was granted in almost every jurisdiction. Later, the curricula built upon a four-year liberal arts bachelor's curriculum. Thus, the three learned professions established the precedent and standard for professional doctorates. The Ph.D. became known as an academic degree (2-4).

Other professions generally have followed this precedent with only a few exceptions, viz., chiropractic, optometry, podiatry, and pharmacy. These professions adopted six-year curricula not built upon a four-year liberal arts curriculum. Pharmacy, however, has not yet established the Doctor of Pharmacy as the only acceptable professional degree, and it has not officially established the 2 + 4-year curriculum as the basis for the future Doctor of Pharmacy degree.

THE ISSUE

The issue is not whether a doctorate should be given for completing professional curricula other than the learned professions curricula, but whether the pharmacy curriculum should be extended beyond five years and, if so, how much longer and what degree is most appropriate. The master's degree has been awarded for completing many professional curricula, including accountancy, agriculture, business, education, engineering, fine arts, forestry, music, nursing, and several allied health specialties. Therefore, the options are not simply the five-year B.S. in Pharmacy or the six-year Pharm.D.; other options are available.

THE PERSPECTIVE FROM SUPPLY AND DEMAND DATA

Selecting the Time Series

Several sets of data were reviewed that might provide some insight into the forces that determine the supply of and demand for pharmacists. The number of live births per year for the period 1940-1967 was selected as the underlying basis for the supply side because, allowing for a 23-year lag between birth and graduation, those born in these years would have graduated in the period 1962-1990. The data were tabulated for California and the U.S. in Table 1.[1] The number of degrees granted for the years 1962-1990 was tabulated for California and the U.S. in Table 2.[2] The birth years of 1942-1967 corresponding to the graduation years of

TABLE 1. LIVE BIRTHS 1940-1967 (1,000s)

YEAR	CALIFORNIA	USA	YEAR	CALIFORNIA	USA
1940	112.2	2,559	1954	306.2	4,078
1941	126.1	2,703	1955	312.3	4,104
1942	153.6	2,989	1956	333.1	4,218
1943	172.5	3,104	1957	350.0	4,308
1944	177.2	2,939	1958	349.0	4,255
1945	183.1	2,858	1959	358.4	4,245
1946	217.9	3,411	1960	372.2	4,258
1947	245.5	3,817	1961	380.9	4,268
1948	240.8	3,637	1962	378.1	4,167
1949	244.1	3,649	1963	380.4	4,098
1950	243.8	3,622	1964	374.4	4,027
1951	259.5	3,823	1965	355.0	3,760
1952	280.4	3,913	1966	337.7	3,606
1953	296.6	3,965	1967	336.7	3,521

1965-1990 were selected for analysis. The years 1965-1990 were selected because of the reduced number of degrees in 1964 in the transition to the five-year curriculum. The number of live births represents approximately the pool of students from which pharmacy students could be recruited, and the number of degrees granted represents approximately the supply of pharmacists who regularly enter practice.

On the demand side, the number of prescriptions dispensed per year in the U.S. is shown in Table 3.[3] There are, of course, other indicators of the demand for pharmacists, such as the number of pharmacists employed in hospitals, education, industry, and government, but there is no readily available source of reliable statistics on an annual basis for these types of employment. The number of prescriptions dispensed annually serves as a fair proxy for the overall demand because most pharmacists in education, industry, and government are involved directly or indirectly in providing drugs to consumers. The ratio of hospital pharmacists to community phar-

TABLE 2. DEGREES 1962-1990

	CALIFORNIA			USA		
YEAR	BS	PHARMD	TOTAL	BS	PHARMD	TOTAL
1962	31	154	185	3,574	154	3,728
1963	41	174	215	4,014	174	4,188
1964	63	166	229	2,029	166	2,195
1965	65	183	248	3,177	183	3,360
1966	51	189	240	3,470	189	3,659
1967	59	173	232	3,571	173	3,744
1968	62	222	284	3,766	222	3,988
1969	57	182	239	4,079	209	4,281
1970	75	202	277	4,517	241	4,758
1971	71	223	294	4,524	223	4,747
1972	59	218	277	4,570	288	4,858
1973[A]	115	249	364	4,933	368	5,301
1974	62	294	356	5,663	433	6,096
1975	47	311	358	6,399	449	6,848
1976	47	352	399	7,105	485	7,590
1977	64	357	421	7,649	551	8,200
1978	47	349	396	7,430	552	7,982
1979	37	319	356	7,095	651	7,746
1980	56	367	423	6,985	627	7,612
1981	54	371	425	6,869	664	7,533
1982	29	335	364	6,448	618	7,066
1983	27	352	379	5,919	726	6,645
1984	17	377	394	5,546	748	6,294
1985	6	355	361	5,144	812	5,956
1986	13	346	359	5,190	820	6,010
1987	6	350	356	5,164	902	6,066
1988	9	306	315	5,374	972	6,347
1989	4	332	336	5,721	1,058	6,779
1990	NA	NA	NA	6,010	1,248	7,258

[A]First year that post-BS PharmD degrees were reported.

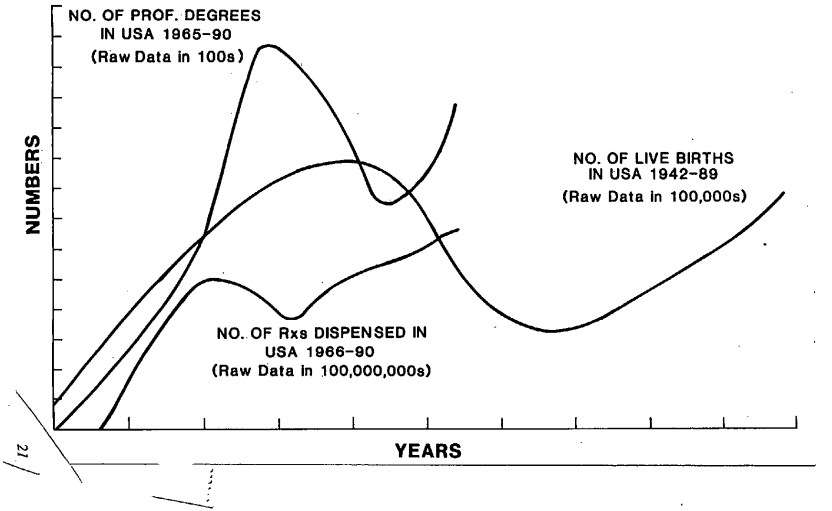
TABLE 3. PRESCRIPTIONS DISPENSED IN USA 1966-1990 (IN 1,000,000s)

YEAR	NO. OF RXs	YEAR	NO. OF RXs
1966	1,055	1979	1,366
1967	1,062	1980	1,394
1968	1,145	1981	1,447
1969	1,197	1982	1,495
1970	1,280	1983	1,513
1971	1,352	1984	1,534
1972	1,435	1985	1,548
1973	1,519	1986	1,558
1974	1,505	1987	1,580
1975	1,490	1988	1,631
1976	1,461	1989	1,641
1977	1,413	1990	1,656
1978	1,397		

macists has been fairly constant over the past several years, with a gradual increase in the percentage of hospital pharmacists.

The three statistical series are depicted in Figure 1. Note the 23-year lag in the number of graduates vis-à-vis live births. The assumption was that, given the time lag, there would be a high correlation between the two series. The correlation coefficient for the raw data was 0.572. There are two explanations for the low level of correlation. First, the year-to-year variability was rather high for both series. The second reason was the early peak for degrees in 1977 compared to 1980 based on the 1957 peak for live births data plus the 23-year lag. There is an explanation for this discrepancy. The government programs to increase the numbers in nearly all of the health professions curricula in the 1970s plus the post-B.S. Pharm.D. degrees beginning in 1973 boosted the numbers graduating from pharmacy colleges to an artificially high level.

FIGURE 1


NO. OF PROF. DEGREES
IN USA 1965-90
(Raw Data in 100s)
NO. OF LIVE BIRTHS
IN USA 1942-89
(Raw Data in 100,000s)
NO. OF Rxs DISPENSED IN
USA 1966-90
(Raw Data in 100,000,000s)
NUMBERS
YEARS

Computing Trends and Correlations

To adjust for these variabilities, the data were regressed to a trend line with the equation $Y(ln) = a + bX$, where Y = number of degrees and X = year. The same treatment was given to live births. The correlation coefficient between the two trend lines was 0.999 using the simple regression equation $Y = a + bX$. Then demand data were regressed to a trend line using the natural log of Y equation. When the trend line for demand was correlated with the trend line for supply, the number of annual degrees, the correlation coefficient was 0.999. Thus, there was a close correspondence between supply and demand over the long-term trend of 25 years.

Projecting into the Future

What would the effect be of letting the natural development of the forces of supply and demand determine the number and mix of degrees that would be awarded in the future? First, the number of live births corresponding to college-age cohorts was projected at 5-year intervals for the period 1995-2015, as shown in Table 4 [$Y(ln) = a + bX$]. This method of projection was used because analysis of the natural trend in the number of degrees awarded was compromised as discussed above. Thus, the trend in live births for the period 1957-1967 was used to estimate the expected number of degrees for 5-year intervals for the period 1995-2015, as shown in Table 4.

Based on the long-term trend (1975-1990) and the log model, the projected number of prescriptions that will be dispensed annually at five-year intervals is also provided in Table 4. Using the above projected prescriptions and the correlation of prescriptions and degrees (1980-1990) for estimating the demand for manpower, the required number of newly awarded degrees annually for the same five-year intervals is tabulated in Table 4.

Reviewing Table 4, we find that the projected number of newly awarded degrees for the year 2000 and the years thereafter exceeds the estimated requirements. The estimated cumulative pool of pharmacists will have the capacity to counsel patients and provide expertise in pursuits other than practice.

TABLE 4. PROJECTIONS OF TIME SERIES

DATE	LIVE BIRTHS[A]	PROF DEGREES[B]	NO OF RXs[C]	DEGREES REQUIRED[D]	% OF PHARMD[E]
1995	4,411	7,816	1,791	8,265	26.3
2000	4,774	8,963	1,901	8,893	38.6
2005	5,167	10,206	2,011	9,521	56.5
2010	5,593	11,553	2,121	10,148	82.9
2015	6,054	13,011	2,231	10,776	100.0

A Live births in 1,000s corresponding to college age cohorts for the respective dates were projected based on historic data.

B Professional degrees based on projected live births of college age cohorts and the correlation of degrees (1965-90) and live births (1942-67).

C Number of prescriptions in 1,000,000s based on projections from 1975-90 data.

D Number of required degrees based on the number of projected prescriptions in the table and the correlations of degrees and prescriptions 1980-90.

E Projected % of PharmD degrees of total degrees based on 1980-90 data *(y(ln) = a + bx)*; actually 100% is reached July 2013.

If a shorter period (1980-1990) is used to project the number of prescriptions, the number of prescriptions per year is estimated to be 1.804 billion in 1995, 1.949 billion in 2000, 2.107 billion in 2005, 2.278 billion in 2010, and 2.462 billion in 2015. The estimated number of required pharmacists per year for the same years would be 8,340, 9,167, 10,068, 11,044, and 12,094. The estimated number of new graduates per year would fall short of estimated requirements by about 200 to 500 annually until 2003. Then the

estimated number of graduates would equal requirements for about two years before beginning to run a surplus.

Caveats

Projections into the future based on regression analysis are founded on the assumption that trends and relationships remain the same for the project period as for the base period.[4] There is no assurance that this will happen. On the other hand, such projections are better than a simple guess. The rationale for using a shorter, more recent period for the projections is the potential for trends to alter rates, or even direction, of change.

The increasing number of pharmacists–especially those with a Pharm.D., M.S., or Ph.D.–employed in hospitals, industry, and government appears to be established, although the rate of increase is not great. The rate of increase of the Pharm.D. (see below) will adequately meet the demand for that degree in those organizations. The outlook for the supply of M.S. and Ph.D. holders is not as good.[5]

Composition of the Work Force

A related issue is the composition of the classes of graduating pharmacists following 1990. Again, the *Y(ln)* trend was used to address this issue. Only 5.2% of the degrees awarded in 1970 were Pharm.D.s. By 1980, the percentage had increased to 8.2%–only a 3% change. By 1990, the percentage had increased to 17.2%.[2] Clearly, only fairly current data should be used for projecting the proportion of Pharm.D.s into future years.

As shown in Table 4, the projected percentages of Pharm.D.s were 26.3% for 1995, 38.6% for 2000, 56.5% for 2005, 82.9% for 2010, and 96.6% for 2012. Given the dynamics of projecting increasingly rapid change over time, it seems reasonable to predict the attainment of 100% Pharm.D. graduates around 2010 or earlier. The increasing enrollment in the Pharm.D. option and the switch to an all-Pharm.D. curriculum by several colleges can be expected to transpire during the period 1992-2000. There are now 13 all-Pharm.D. or predominantly Pharm.D. programs. It does not appear

to be necessary to force early change to the Pharm.D.-only curriculum to achieve this end fairly soon after the year 2000.

To further characterize the dynamics and effects of the Pharm.D. versus B.S. degrees, comparative data for California and the U.S. were compiled in Tables 2 and 3. The approach used was to compare data from California, where the predominant degree since the early 1950s has been the Pharm.D., with similar data from the U.S., where the predominant degree has been the B.S.

First, the trend for live births for California was calculated, and then the trends for California and the U.S. were correlated. The correlation coefficients were 0.913 and 0.905, respectively, using the $Y(ln)$ form of the regression equation. Second, the trend for number of professional degrees was calculated for California, followed by the correlation with U.S. data. The correlation coefficients were 0.779 and 0.938, respectively, using the same methods as above. Third, the correlation between live births and number of professional degrees, using a 24-year lag, was calculated for California. The correlation coefficients were 0.774 and 0.997, respectively, using raw data and Y' values.

These correlation coefficients indicate that the two sets of data are comparable and that the compositions of the degrees have negligible effects on the relationships among the variables. However, California is not a self-contained system, and pharmacists from other states and California students attending pharmacy schools outside California were licensed to practice in California.

Females currently constitute 61.6% of total enrollment in all professional curricula. This percentage will most likely increase, but at a decreasing rate. Short-term trends in enrollment figures indicate that this may be the case.[6] The trend of increasing female enrollment probably will not affect the supply and demand projections to any great extent, even though females tend to have a shorter productive professional life. Also, it appears that there may be a slight surplus of pharmacists between 2005 and 2010.

THE FUNCTIONS OF PHARMACY PRACTICE

What are the basic functions and responsibilities of pharmacists? How do these considerations relate to the primary issue under consid-

eration? For the purpose of this discussion, the operative principle is what pharmacists should do, not what many pharmacists find themselves doing, viz., dispensing as many prescriptions per hour as possible. This discussion will not be an exhaustive treatment of the subject; rather, it will be an outline of the essential factors to be considered.

The basic functions of pharmacists are detailed in Tables 5 and 6. They include:

- Dispensing medications, including prospective DUR and all that is explicit and implicit in the law and code of ethics
- Counseling patients on the appropriate use of their medication. This requires face-to-face encounters on an ongoing basis; eliciting a history of medications, allergies, illnesses, and related information; and maintaining this database. The specifics are based primarily on the new requirements in the Medicaid program.
- Assisting patients in their selection and use of nonprescription medication, prescription accessories, home health supplies, and appliances
- Managing the personnel, inventory, finances, and operations under the pharmacist's responsibilities
- Showing concern and consideration for patients and providing psychological support for them in coping with and managing their illnesses.

The new Medicaid requirement [Omnibus Budget Reconciliation Act of 1990 (OBRA)] mandates that pharmacists perform prospective drug review and offer to counsel personally–at the point of dispensing–all patients receiving Medicaid benefits, or their care givers, beginning 1 January 1993 (6). This legislation will set the minimum standards for all patients in the near future. The consultation with the patient or his or her care giver must be in person whenever practicable. The pharmacist must offer to discuss these matters with the patient, but he or she is not obligated if the patient refuses the counseling.

In addition to the basic functions and responsibilities, there are other special functions and responsibilities in various practice settings, such as hospitals (and there are various types of hospitals),

TABLE 5. CATEGORIES AND CRITERIA FOR DUR UNDER MEDICAID

Duplicative Therapy: Duplicate Rx, same drug Two drugs, same therapeutic class
Overutilization: Refill too frequently Excessive quantity Exceeds dosage regimen Excessive duration of therapy
Underutilization: Refill lag Inadequate quantity Below appropriate dosage Duration of therapy insufficient
Inappropriate Therapy: Not drug of choice Because of age Because of sex Because of ethnogeny Because of pregnancy Because of physiological deficit Because of allergy Patient noncompliant
Adverse Drug Effects: Drug-drug interaction Drug-food interaction Drug-disease contraindication Severe adverse reaction Mild side effects
Uneconomical/Inefficient: Any one of the above categories Failure to use generic version of drug
Involvement of the Patient: Responsibility for medication use Responsibility for personal health care Responsibility for economic aspects of care Active concern for social and spiritual well-being

long-term care facilities, nuclear pharmacies, industrial positions (and these vary greatly), organizations, and government agencies. Each of these requires some degree of different education and/or training. The means and methods of obtaining the additional expertise for these practices/positions must also be considered when schools develop curricula and degree programs. In view of an all-Pharm.D. curriculum, there is a need for certain students to have the

TABLE 6. OUTLINE OF THE ELEMENTS FOR COUNSELING AND PATIENT PROFILES UNDER MEDICAID

COUNSELING:
* Name and description of the medication
* Route, dosage form, dosage, route of administration and duration of therapy.
* Common severe side or adverse effects, interactions and therapeutic contraindications that may be encountered, including their avoidance, and the action required if they occur.
* Techniques for self-monitoring drug therapy.
• Proper storage.
• Prescription refill information.
* Action to be taken in the event of a missed dose.
PATIENT PROFILE DATA:
* Name, address, telephone number, age/or birth date and gender.
• Individual history, where significant, including disease state(s), known allergies and drug reactions, and a comprehensive list of medications and relevant devices.
• Pharmacist comments relevant to the individual drug therapy.

option of taking the B.S. in Pharmacy (or Pharmaceutical Sciences) to pursue the M.S. or Ph.D. for various specializations and positions, e.g., nuclear pharmacy.

CURRICULAR AND DEGREE IMPLICATIONS

Strategy

The first consideration is the appropriate strategy to guide the body pharmaceutic. Do we want to mandate that an all-Pharm.D. curriculum begin in the near future, that it begin at some arbitrary future date, or that the forces of supply and demand–along with individual faculty preference and decision–dictate the timetable to implement an all-Pharm.D. curriculum? A modification of the third alternative would be to establish a criterion based on natural devel-

opments at which point the all-Pharm.D. curriculum would be mandated. For example, the point at which 60% of the faculties or 60% of total enrollment represents Pharm.D. curricula could be a workable criterion and a reasonable time to set the future date for the all-Pharm.D. curriculum.

There is a rationale for the third alternative, or its modified form. First, it allows time for Pharm.D. graduates to be absorbed into the social and economic system with much less dislocation and misuse of professional talent. A review of the experience of Pharm.D. graduates in California reveals that many of these have practiced, and still practice, beside B.S. pharmacists with little or no professional differentiation. Such a situation is clearly a misuse of talent and economic resources. This strategy will allow time for enterprising Pharm.D. pharmacists, both in the organized health care setting and in the freestanding ambulatory pharmacy setting, to develop pharmacy practices that require a level of expertise not generally possessed by B.S. pharmacists. If this cannot be demonstrated in both types of practice settings as a significant increase in the skill level of practice activities, then there is little, if any, rationale for Pharm.D. pharmacists to serve the general public. The new Medicaid requirements provide the impetus for these developments, which will evolve over time. The timetable can be adjusted based on these developments.

The second reason for this strategy is that it allows pharmacy schools with few resources, or few potential resources, more time to plan for the necessary resources to implement a successful Pharm.D. curriculum. This strategy places much less stress on the pharmacy academic system.

The third reason for advocating this strategy is that it runs less risk of perpetuating and exacerbating a chronic social-professional disease: underutilized and overtrained professionals. The academic education of a professional person is only part of the process. The student must be socialized and trained to perform in a particular manner. Pharmacy certainly has not been very successful in this latter component of the training and practice process. There are many examples of 2 pharmacists (including Pharm.D.s in many cases), 2 assistants/technicians, and a computer "dispensing" 600 or more prescriptions in a 12-hour day with very little, if any, coun-

seling of patients. This type of practice is little better than mail-order prescription centers. The only difference is that the pharmacist is available to answer a question if the patient can get his or her attention. Without a drastic change in this sort of practice, the concept of an all-Pharm.D. curriculum makes no sense at all. Such a change can come only when educators and practitioners reach a consensus.

Curriculum

The current 2 + 4 Pharm.D. curriculum in many, if not all, instances has been a continuation of the overcrowded 5-year B.S. curriculum. It is not well designed to produce a professional person in the full sense of a professional person. Among the deficiencies are few, if any, courses in the humanities; too few courses in the social sciences; no courses, in most instances, in foreign languages; inadequate coverage of the history, ethics, and administrative aspects of pharmacy within the professional component of the curriculum; and a disproportionate coverage of the biological, therapeutic, and clinical course sequence within the four-year professional component. This does not mean that there is too much taught in the biological, therapeutic, and clinical course sequence, but that too much is crowded into the four years vis-à-vis other disciplines.

The 2 + 4-year Pharm.D. curriculum is simply inadequate to educate and train a professional person in the pharmaceutical sciences. Such an objective would require a 2 + 5- or 3 + 4-year curriculum with the B.S. in Pharmaceutical Sciences awarded at the end of 4 years and the Doctor of Pharmacy (Pharm.D.) awarded at the end of 7 years. Students could opt to pursue graduate study at the end of four years or to pursue the Pharm.D. degree.

There is a solid rationale for this strategy. The foremost reason is the inadequacy of the 2 + 4 Pharm.D. curriculum. Second, pharmacists would be on an academic par with medicine, dentistry, law, theology, or divinity doctorates; they would not be perceived as having a lesser doctorate. Third, pharmacists could be better socialized into a professional role. Fourth, the academic, economic, and emotional investment in a full-fledged doctorate would provide the student with the motivation as well as the tools to practice as a professional therapeutic expert in the health care field. He or she

would have the expertise and professional authority not to prescribe but to validate, monitor, and control drug therapy. Dispensing (with prospective DUR/E in the complete sense of DUR/E) with patient counseling would readily become the norm. This is not happening with many 2 + 4 Pharm.D. graduates now. To begin to achieve this status, academic pharmacy should convert to the 2 + 5 or 3 + 4 Pharm.D. curriculum now.

Degree

Few, if any, would disagree that the 2 + 5 or 3 + 4 curriculum, properly developed, warrants the Doctor of Pharmacy degree. Others, like the author, probably question the authenticity of a 2 + 4 Pharm.D. degree. The only other six-year doctorates include chiropractic, chiropody or podiatry, and optometry. The record of the current 2 + 4 Pharm.D. degree indicates that it has not transformed pharmacy to any great extent. Although many Pharm.D. graduates have performed admirably, some reaching eminent status, they have been in the minority. It would be too much to expect for the outcome to have been otherwise.

The doctorate is not the only degree that may be used for a course of study that is less than a full-status professional doctorate. The profession should have considered the professional Master of Pharmacy degree with the implementation of the 5-year curriculum in 1965. The 2 + 4 years (180 credit hours) are comparable to several professional master's degrees, the MBA (4 + 2 years) being one example. This would be in keeping with the tradition of granting a master's degree upon mastering a field of study. The appellation of doctorate was originally bestowed only on people who had achieved the highest level of learning in a field, the term doctor having been borrowed from the title of a learned high officer in the church.

CONCLUSION

This article was not written to belittle the current Pharm.D. degree or those who have earned it. Any person who has studied at a higher plane in any field is to be applauded. The current Pharm.D. degree is an honest endeavor to achieve a higher status for pharma-

cy and for the holders of the degree. It simply has not achieved all that was generally envisioned for pharmacy. I believe that this article is an honest appraisal of the status of pharmacy education, including the current 2 + 4 Pharm.D. degree. It is not that the 2 + 4 Pharm.D. is not good, but it is not quite good enough to achieve a high-level professional status for pharmacy.

NOTES

1. Data for live births were compiled from volumes of *Vital Statistics of the United States*, 1940 to 1990.

2. The numbers and types of degrees granted for the various years were compiled from issues of the *American Journal of Pharmaceutical Education*.

3. The number of prescriptions dispensed annually was compiled from the April issue of *Pharmacy Times* for 1967-1991.

4. The three primary time series are autoregressive, i.e., they have serially correlated variance. This affects the confidence intervals but not the estimation of the values of the parameters including Y' estimates. To test the accuracy of the forecasting, we performed an ex post facto forecast of the number of degrees from 1981-1990 based on estimated live births [$Y(ln) = a + bX$] in 1942-1957 and the nonstochastic equation $Y_t = a + bX_t$, where X_t is the Y' values for live births and Y_t is the estimated number of degrees. The ex post facto forecast overestimated the number of degrees by 520 per year. However, this, in part, reflected the actual change in the raw data for 1985-1990, which was 260 degrees per year. Using similar methodology, the ex post facto forecast of the number of degrees required based on the number of prescriptions dispensed per year was more accurate: an overestimation of 284 degrees per year. The overall methodology was selected because it used the best data available and a straightforward rationale. Ostrom makes the statement that because we usually have no information with which to make an estimation of the random error variable associated with forecasting, the general practice is to ignore the error term and generate the forecast deterministically (5).

5. An analysis of the supply of and demand for pharmacists with the M.S. and Ph.D. degrees is beyond the scope of this article. Such an analysis may be the focus of another project.

6. Enrollment figures were found in various issues of the *American Journal of Pharmaceutical Education*.

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