

## RESEARCH ARTICLES

# Evaluating the Pharmaceutical Industry's Need for Graduates with a Bachelor of Science Degree in Pharmaceutical Sciences

Kimberly Broedel-Zaugg, PhD<sup>1</sup>, David F. Kisor, PharmD<sup>1</sup>, and Donald L. Sullivan, PhD<sup>1</sup>

<sup>1</sup>Department of Pharmacy Practice, Ohio Northern University

**Objectives.** The pharmaceutical industry traditionally hires pharmacists with bachelor of science (BS) degrees for formulation development, manufacturing, etc. As the BS in pharmacy degree is phased out, it is important to know if manufacturers still need employees with the expertise that the BS degree provides.

**Methods.** Data were collected from a survey asking how pharmaceutical manufacturing scientists felt about employing persons with a BS in pharmacy, what persons with BS in pharmacy degrees currently do for their company, and what courses would be of value in a degree designed for industry employment. Demographic data were also collected.

**Results.** Survey packets were mailed to 1,000 AAPS members and 255 surveys were returned. Eighty-three percent of respondents agreed that pharmacy schools should offer BS degrees specific for industry employment. Courses in drug development and organic chemistry were the most desirable, while radiopharmaceuticals and immunology were the least favored. Respondents indicated that they would like to hire 826 persons with BS in pharmacy degrees within the next 5 years, creating a potential job market for individuals with a BS in the pharmaceutical sciences.

**Conclusions.** There is a need to provide the pharmaceutical industry with qualified persons trained at the BS level of pharmaceutical education. Educational programs of this type should be continued or developed.

**Keywords:** BS in pharmaceutical sciences, industry employment, pharmaceutical education

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## INTRODUCTION

As colleges of pharmacy complete the move to the clinically focused Doctor of Pharmacy (PharmD) degree as the sole professional entry-level degree, fewer individuals will have education at the Bachelor of Science (BS) level in the basic pharmaceutical sciences. The BS degree will no longer provide the education necessary to become a licensed pharmacist. Thus, a bachelor's degree in pharmaceutical sciences, focused on basic pharmaceutical sciences, provides the education necessary for possible employment with pharmaceutical companies or graduate school, but not for registration as a pharmacist. Pharmaceutical sciences are defined as pharmacology/toxicology, medicinal chem-

istry, and pharmaceuticals. As early as 1998, the shift to the clinically based curriculum was leading to a decrease in the number of individuals holding a Bachelor of Science degree in pharmacy in the pharmaceutical industry. That year, the American Association of Pharmaceutical Scientists (AAPS) Salary and Employment Status Survey indicated a greater than 27% decrease in the number of individuals in the industry holding a BS degree in pharmacy.<sup>1</sup>

Breimer<sup>2</sup> stated that pharmaceutical companies are major clients of pharmacy schools and that it is a challenge of this "labor market to know which types of competencies and skills graduates now need." In addition, as the industry changes, academia must change to meet new needs.<sup>2</sup> Mooney recommends a partnership between industry, academia, and government as he claims there is a shortfall between output from universities and demand by the pharmaceutical and health care industries for science and engineering graduates.<sup>3</sup> Further, pharmacy sales and marketing executives reported increasing diffi-

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**Corresponding Author:** Kimberly Broedel-Zaugg, PhD. Department of Pharmacy Practice, Ohio Northern University, 525 S. Main St, Ada, Ohio 45810. Tel: 419-772-2281. Fax: 419-777-1917. E-mail: k-broedel-zaugg@onu.edu

culty in recruitment from 1989 to 1994. Pharmaceutical companies are finding themselves without the talented individuals necessary to complete the tasks at hand.<sup>4,5</sup> The 6-year time commitment for PharmD programs (2 years in pre-pharmacy and 4 years in professional study) resulted in fewer individuals seeking graduate education.<sup>6,7</sup> Thus, it has become more difficult for pharmaceutical companies to hire qualified individuals as there are fewer persons with BS degrees as well as fewer pharmacy graduates continuing their education for graduate degrees.

Research applications in the sciences, along with clinical research, are the major components of drug discovery and development. These are the basic tenants of innovation in the pharmaceutical industry. Perhaps individuals trained at the BS level in pharmaceutical sciences could be employed in the pharmaceutical industry or be encouraged to continue their education for a career in pharmaceutical research. In 1991/92, the Argus Commission was requested by the American Association of Colleges of Pharmacy to consider the pharmaceutical industry/academic pharmacy interface. This Commission's recommendations included that data should be collected concerning the needs of the industry and career opportunities, and then distributed to members.<sup>8</sup> Thus, this survey of the pharmaceutical industry was undertaken to help evaluate the current function, need for and training desired of individuals at colleges of pharmacy in pharmaceutical sciences programs.

The purpose of this study was to evaluate pharmaceutical manufacturers' need for employees with a Bachelor of Science degree in pharmaceutical sciences that does not lead to licensure as a pharmacist. Three research questions were proposed: (1) To what degree do pharmaceutical scientists feel that persons with a BS in pharmaceutical sciences could contribute to the pharmaceutical industry? (2) How many of these persons are currently employed and what functions do they perform? and (3) what type of coursework should a BS curriculum include?

## **METHODS**

A self-administered mailed survey instrument consisting of 3 sections was designed using information gathered by a Midwestern College of Pharmacy Taskforce that explored the feasibility of the BS degree in pharmaceutical sciences that would not lead to licensure (Appendix 1). This taskforce gathered information on current hiring practices in industry<sup>1</sup> as well as curricula from colleges of pharmacy that offer a 4-year BS degree in pharmaceutical sciences. The

instrument was pre-tested on 10 pharmacy faculty members, one of whom was previously employed in industry, for face and content validity. In addition, AAPS and Ohio Northern University's institutional review board reviewed and approved the instrument.

The first section of the survey consisted of 10 items used to ascertain if the BS in pharmaceutical science degree would be valuable to industry. These 10 items were measured using a 5-point Likert scale on which "1" equaled "strongly disagree" and "5" equaled "strongly agree." The second section of the questionnaire included demographic information about respondents and requested information regarding the number of persons with BS degrees in pharmacy employed in their specific department, functions of those persons, and the intent to hire more persons with BS degrees in pharmacy. The third portion asked respondents to indicate the importance of including various courses in a BS curriculum for pharmaceutical sciences. This section was measured with a Likert scale similar to the one used in the first section.

A survey packet was mailed in August 2001 to 1,000 randomly selected members of the AAPS who were not currently employed in academia or government agencies. The packet consisted of a cover letter, a tea bag as an incentive, a postage-paid self-addressed return envelope, and the questionnaire. The cover letter explained the difference between a PharmD degree, the current BS degree that can lead to licensure, and the BS in pharmaceutical sciences that could lead to employment in industry but not to licensure. After 6 weeks, a second packet was mailed to non-respondents.

Data were analyzed using SPSS (Version 11.0) computer software.<sup>9</sup> Descriptive statistics were used to evaluate the Likert scales indicating the desirability of the BS degree and the importance of coursework as well as demographic data. Analysis of variance tests were used to identify differences between groups of respondents. Initially, respondents identified themselves as working in one of 11 different fields identified by the AAPS.<sup>1</sup> These 11 groups were collapsed into 4 groups in order to perform analysis of variance. Group 1 consisted of biopharmaceutics and pharmaceuticals/pharmacy, group 2 consisted of clinical pharmacology, clinical pharmacy, and pharmacokinetics, group 3 consisted of medicinal chemistry, and group 4 consisted of other areas (pharmacy administration, regulatory affairs, analytical chemistry, packaging technology, and several others). Differences between groups were identified by using the Bonferoni post hoc test. In addition, response bias was evaluated by comparing early re-

sponders to late responders in order to identify any differences. Alpha was set at 0.05.

**RESULTS**

Fifteen packets were returned as undeliverable and 5 persons requested to be removed from the mailing list because they did not feel they had the knowledge base to complete the questionnaire. A total of 255 usable surveys were returned for a response rate of 25.5%. This compares favorably to a response rate of 10% in a salary survey done by the AAPS.<sup>1</sup> Respondents can best be described as male (67.7%), not registered pharmacists (85.7%), holding a PhD (57.5%), and primarily involved in the field of pharmaceuticals (36.7%). See Table 1.

Responses to the statement that scientists in industry believed that employees with a BS in pharmaceutical sciences would be valuable employees are presented in Table 2. Respondents felt most strongly that pharmacy schools should offer the BS degree to better prepare students for employment in industry (4.01 ± 0.72). However, they did not think that licensure as a pharmacist was needed (1.80 ± 0.76). Several differences between groups of respondents were identified. Those identifying themselves as medicinal chemists did not feel as strongly as respondents in pharmaceuticals and in the “other” professions group that those with a BS in pharmacy and a PhD would have a better understanding of the drug development process than a PhD with a non-pharmacy undergraduate degree (*P*=0.002). Further, the medicinal chemists again differed from the pharmaceuticals group by not agreeing as strongly that people with a BS in pharmacy would have a medical knowledge base that would make them more valuable to the pharmaceutical industry (*P*=0.013). The last difference in opinion was between those in the clinical/kinetics group and those in the “other” group. The “other” group agreed more strongly with the statement “pharmacy schools should offer BS degrees in pharmacy that prepare students for employment in industry” (*P* = 0.021).

In the curricula portion of the questionnaire, scientists were asked which courses would be most important in their area (see Table 3). The most important courses were identified as organic chemistry (4.46 ± 0.59) and the drug development process (4.46 ± 0.68), while courses in radiopharmaceuticals (3.32 ± 0.82), immunology (3.48 ± 0.90), and physics (3.48 ± 0.89) were considered less important. Several differences occurred between the 4 groups of scientists (see Table 3). The clinical/pharmacokinetics group differed from all 3 other groups. They did not indi-

Table 1. Demographic Characteristics of Respondents (N=255)

Characteristic	n (%)
Gender	
Male	172 (68)
Female	81 (32)
Education	
BS	44 (17)
PharmD	5 (2)
MS	51 (20)
PhD	146 (58)
Other (BA, MA, MBA)	8 (3)
Field	
Biopharmaceutics (group 1)	22 (9)
Pharmaceutics/pharmacy (group 1)	92 (37)
Clinical pharmacology (group 2)	4 (2)
Clinical pharmacy (group 2)	1 (<1)
Pharmacokinetics (group 2)	34 (13)
Medicinal chemistry (group 3)	34 (13)
Pharmacy administration (group 4)	4 (2)
Other (regulatory affairs, packaging, analytical chemistry, others, group 4)	56 (22)
Hold a BS in Pharmacy	85 (34)
Registered Pharmacist	36 (14)

\*Not all respondents provided all information, percentages may not add to 100 due to rounding

cate as strong agreement with the need for a course about controlled release delivery systems (*P*<0.001). They also did not feel as strongly about a course in sterile products (*P*<0.001) or solid dosage forms (*P*=0.001) as did the pharmaceuticals or the other groups. The medicinal chemists did not feel as strongly about a course in physiology as did those in pharmaceuticals or clinical/pharmacokinetics (*P* = 0.001). In general, the clinical/pharmacokinetics group was the most likely to disagree with the other groups.

Respondents indicated that 2.4 ± 6.28 (range 0-70) persons with a BS degree in pharmacy currently work in their area. In addition, they identified the following top 5 functions that these employees perform: formulation development (73 responses), regulatory affairs (58), clinical trial monitoring/supplies (32), analytical method development (29), and manufacturing (20). One hundred fourteen (44.7%) currently had no one with a BS in pharmacy degree working in their area. Further, 80

Table 2. Respondents' Perceived Value of Employing Graduates with a Bachelor of Science Degree in Pharmacy in Industry

Item	Group 1, n=114 (SD)	Group 2, n=39 (SD)	Group 3, n=34 (SD)	Group 4, n=57 (SD)	Total n=244(SD)	P
Pharmacy schools should offer BS degrees specific to industry employment.	4.07 (0.72)	3.74 (0.79)*	3.97 (0.52)	4.17 (0.74)*	4.01 (0.70)	0.021
People with BS degrees in pharmacy would be valuable to my team.	4.10 (0.83)	3.67 (1.00)	3.82 (1.02)	4.07 (0.83)	3.98 (0.90)	-
Four year BS degrees in pharmacy should be offered as a foundation for graduate studies.	4.08 (0.81)	3.67 (1.00)	3.76 (0.82)	3.93 (0.90)	3.93 (0.88)	-
People with BS degrees in pharmacy would understand the drug development process better than persons with other BS degrees working for our company.	3.90 (1.02)	3.61 (0.94)	3.56 (1.08)	3.76 (0.99)	3.78 (1.01)	-
More people with BS degrees in pharmacy are needed in the industry.	3.85 (0.90)	3.59 (0.79)	3.77 (0.91)	3.80 (0.76)	3.77 (0.85)	-
People with PhD and BS degree in pharmacy would understand the drug development process better than PhDs who do not have a pharmacy degree.	3.82 (1.08)*	3.33 (1.20)	3.11(1.09)*	3.76 (0.97)*	3.63 (1.10)	0.002
People with a BS degree in pharmacy would have a medical knowledge base that makes them more valuable to industry than people with other BS degrees.	3.76 (0.93)	3.38 (0.91)*	3.23(0.99)*	3.54 (0.88)*	3.58 (0.94)	0.013*
Work experience as a pharmacist is valuable for employment in industry.	2.96 (1.04)	2.82 (1.07)	2.91 (1.06)	2.98 (1.09)	2.94 (1.05)	-
People with a PharmD degree are better prepared to work in industry than people with a BS degree in pharmacy.	2.66 (0.99)	3.03 (1.03)	2.82 (0.94)	2.83 (1.07)	2.78 (1.00)	-
Being a registered pharmacist is necessary to work in industry	1.78 (0.76)	1.77 (0.78)	1.85 (0.66)	1.84 (0.85)	1.81 (0.77)	-

\*Bonferoni post hoc test indicated that there was significant disagreement between these groups at alpha = 0.05.

(31%) scientists indicated they would not be hiring anyone with a BS in pharmacy degree within the next 12 months. Even so, the average need was  $1.67 \pm 1.55$  (range 0-75) new employees with a BS degree in pharmacy in the next 12 months. The total need from all respondents was 215. In addition, scientists were asked how many persons with BS in pharmacy de-

grees their area would need in the next 5 years. Total need was 611 with an average of  $3.90 \pm 5.55$  and a range of 0-50. Forty respondents indicated they would not be hiring anyone with a BS in pharmacy in the next 5 years. In addition, 63.1% of the respondents answered that they would support having a pharmacy student in their area as a learning rotation or internship experience.

Table 3. Respondents' Preferred Curricula for a Bachelor of Science Degree in Pharmaceutical Science

Course	Group 1 n=114 (SD)	Group 2 n=39 (SD)	Group 3 n=34 (SD)	Group 4 n=34 (SD)	Total n=244	P
Organic chemistry	4.46 (0.58)	4.29 (0.69)	4.50 (0.56)	4.50 (0.57)	4.46 (0.60)	-
Drug development	4.54 (0.63)	4.22 (0.82)	4.38 (0.65)	4.53 (0.63)	4.46 (0.67)	-
Basic physicochemical principles	4.53 (0.60)	4.24 (0.71)	4.26 (0.75)	4.43 (0.68)	4.42 (0.67)	-
Conventional drug delivery systems	4.46 (0.57)	4.05 (0.70)	4.18 (0.72)	4.33 (0.57)	4.33 (0.63)	-
Solid oral dosages	4.43 (0.64)*	3.92 (0.75)*	4.26 (0.71)	4.31(0.62)*	4.31 (0.68)	0.001
Biochemistry	4.224 (0.60)	4.45 (0.60)	4.29 (0.72)	4.31 (0.75)	4.30 (0.66)	-
Pharmacokinetics	4.35 (0.60)	4.45 (0.60)	4.18 (0.72)	4.15 (0.75)	4.30 (0.66)	-
Drug stability	4.37 (0.73)	4.03 (0.59)	4.24 (0.59)	4.24 (0.74)	4.27 (0.73)	-
Industry rotation	4.33 (0.77)	4.03 (0.85)	4.24 (0.70)	4.29 (0.70)	4.25 (0.78)	-
Biopharmaceutics	4.31 (0.65)*	4.24 (0.59)*	3.94 (0.69)*	4.28 (0.70)*	4.24 (0.67)	0.042
Controlled release	4.29 (0.67)*	3.76 (0.71)*	4.35 (0.49)	4.13 (0.74)*	4.18 (0.70)	<0.001
Research methods	4.15 (0.73)	4.32 (0.63)	4.14 (0.71)	4.05 (0.89)	4.15 (0.76)	-
Biostatistics	4.05 (0.74)	4.37 (0.63)*	4.03 (0.67)	3.95 (0.83)*	4.08 (0.75)	0.05
Regulatory affairs	4.00 (0.85)	3.97 (0.73)	3.97 (0.76)	4.33 (0.76)	4.06 (0.81)	-
Novel/targeted drug delivery systems	4.15 (0.71)*	3.76 (0.71)*	4.15 (0.56)	4.00 (0.92)	4.05 (0.75)	0.04
Quantitative chemistry	4.15 (0.71)*	3.76 (0.71)*	4.15 (0.56)	4.00 (0.92)	4.05 (0.75)	0.04
Physical chemistry	4.19 (0.76)*	3.66 (0.87)*	3.82 (0.87)	3.39 (1.06)*	3.93 (0.90)	0.001
Sterile products	3.98 (0.71)*	3.61 (0.72)*	3.89 (0.74)	3.89 (0.98)	3.92 (0.73)	<0.001
Biology	4.18 (0.75)	3.76 (0.61)	3.89 (0.74)	3.89 (0.98)	3.89 (0.80)	-
Physiology	3.91 (0.76)*	4.18 (0.56)*	3.47 (0.83)*	3.87 (0.88)	3.87 (0.80)	0.001
Calculus	3.91 (0.77)	3.87 (0.74)	3.56 (0.99)	3.65 (0.97)	3.81 (0.86)	-
Microbiology	3.81 (0.82)*	3.73 (0.74)	3.56 (0.70)*	4.16 (0.77)*	3.80 (0.81)	0.001
Inorganic chemistry	3.85 (0.90)	3.70 (0.88)	3.52 (0.81)	3.68 (1.02)	3.75 (0.92)	-
Physics	3.64 (0.81)	3.32 (0.85)	3.82 (0.82)	3.35 (1.03)	3.48 (0.88)	-
Immunology	3.34 (0.91)*	3.89 (0.62)*	3.36 (0.74)	3.59 (1.04)	3.48 (0.90)	0.009
Radiopharmacy	4.33 (0.83)	4.03 (0.73)	4.24 (0.69)	4.29 (0.94)	3.32 (0.82)	-

\*Bonferoni post hoc test indicated that there was significant disagreement between these groups at alpha = 0.05.

Several respondents returned job descriptions with the questionnaire. Titles of positions currently filled with persons having a BS in pharmacy degree included pharmacist, research associate, product regulation manager, and scientist. These jobs had various responsibilities that involved dispensing bulk chemicals, analyzing raw materials, technical laboratory functions, data analysis, record keeping, regulatory strategies for new drug applications, and formulation. Degrees preferred for these positions were BS in

pharmacy, chemistry, analytical chemistry, and biology.

## DISCUSSION

This survey identified a need for individuals with a bachelor of science degree in pharmaceutical sciences.

The number of individuals with a BS degree in pharmaceutical sciences needed over the next 5 years exceeded 600. This number is likely an underestimate as only 25% of surveys were returned for inclusion in the analysis. Also, based on past salary surveys conducted by AAPS,

over 1000 individuals with “basic science” bachelor degrees are typically hired annually in industry while the number of pharmacists hired annually is in the low hundreds.<sup>1</sup> Thus, the individual with a BS in pharmaceutical sciences would compete for jobs with individuals holding a basic science degree.

Clearly, the respondents had a positive view of the bachelor of science degree in pharmaceutical sciences as providing a valuable background for a career in the pharmaceutical industry. Expectedly, the need for licensure as a registered pharmacist was not viewed as a necessity. This relates to the basic/pharmacy science education needs by the industry as compared with clinical education. This is not to say that the clinical background of current pharmacists is not desirable in the industry. This issue was not addressed in this survey. “Clinically trained” pharmacists are key in clinical drug development.

The educational background of the respondents likely influenced their responses. For instance, medicinal chemists did not feel as strongly as pharmaceuticals professionals or those in the “other” group that individuals with a bachelor of science degree in pharmaceutical science plus a PhD would better understand the drug development process than a PhD with a non-pharmacy undergraduate degree. Being unfamiliar with the pharmacy curriculum at the bachelor of science level may have influenced their responses. However, based on differences expressed by these groups of respondents, it would be possible for colleges to offer specific tracks such as medicinal chemistry, toxicology, or bio-pharmaceutics. For example, a medicinal chemistry track might consist of general education requirements (English, speech, psychology, etc), inorganic chemistry, organic chemistry, biochemistry, physical chemistry, quantitative chemistry, physics, calculus, biostatistics, research methods, biology, physiology, drug delivery systems, dosage forms, pharmacokinetics, and an industry rotation.

As of the academic year 1999-2000, based on information supplied by the American Association of Colleges of Pharmacy, 15 institutions offered a 4-year program in the “Pharmaceutical Sciences.”<sup>10</sup> These programs will be necessary to supply industry with the needed individuals. As colleges and schools of pharmacy move to the clinically directed Doctor of Pharmacy degree as the sole professional entry-level degree, fewer individuals will have an education at the BS level in the pharmaceutical sciences.

## Limitations

An assumption was made that respondents would have sufficient knowledge of pharmacy education to understand the differences between the clinical PharmD degree, the current BS degree leading to licensure, and a BS in pharmacy or pharmaceutical sciences that does not lead to licensure. These differences were briefly discussed in the cover letter and a definition of BS degree in pharmacy as a 4-year degree was included in the directions for the survey (Appendix A). However, the survey was entitled “Evaluating the need for a bachelor of science degree in pharmacy,” which may have been misleading.

Further, respondents could have provided answers concerning the same department or company. Thus, the need for employees with a BS in pharmaceutical sciences may have been inflated if 2 respondents worked within the same department. Company names or departments were not included in the questionnaire.

## CONCLUSION

As enrollment at colleges of pharmacy continues to increase with respect to the PharmD degree, there is a need to provide the pharmaceutical industry with trained individuals who can bring employers a sound background in the pharmaceutical sciences at the bachelor of science level. This study supports the development or continuation of programs designed to provide pharmaceutical knowledge to persons desiring employment within the pharmaceutical manufacturing industry. Further study needs to be done in order to support a bachelor of pharmaceutical sciences degree specific for further graduate study.

## REFERENCES

1. Salary and employment status survey. *AAPS Newsmagazine*. 2000; 3:18-24.
2. Breimer DD. Future training needs in the pharmaceutical sciences: academia-industry. *Eur J Pharm Sci*. 2001;12, 347-52.
3. Mooney KG. Challenges faces by the pharmaceutical industry: training graduates for employment in pharmaceutical R&D. *Eur J Pharm Sci*. 2001;12:353-9
4. Hahn B. Employment outlook'95: one step forward, one look back. *Pharm Ex*. June 1995:56-66.
5. Gopal K. European report: immediate opening, apply within. *Pharm Ex*. July 1999: 28-30
6. Sheperd MD, Henderson ML, Ohvall RA. Career aspirations of graduate and postbaccalaureate PharmD students as factors affecting the supply of pharmacy faculty—a national study. *Am J Pharm Educ*. 1983;47:211-5.
7. Shepherd MD, Moore TS, Henderson ML, Ohvall RA. Examination of postgraduate education plans for academically superior undergraduate pharmacy students. *Am J Pharm Educ*. 1988;52:1-9.

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8. Biles JA, Campbell WH, Manasse HR, et al. The pharmaceutical industry/academic pharmacy interface: AACP's role in assuring outcomes. The 1992 Argus commission report. *Am J Pharm Educ.* 1992;56:4S-8S.

9. SPSS Base 11.0 User's Guide. Chicago, IL: SPSS; 2001.

10. American Association of Colleges of Pharmacy. *Profile of Pharmacy Students. Fall 2000.* Alexandria, VA: AACP, 2001:117.

Appendix 1. The Questionnaire, "Evaluating the Need for a Bachelor of Science Degree in Pharmacy. Only statements from the questionnaire are included. The Likert scales were defined, but not included as part of the appendix.

Listed below are a series of statements regarding how you might feel about the value of employing a person with a bachelor degree in pharmacy working in your department. The bachelor degree is defined here as a four year science degree that does not lead to licensure as a pharmacist. Please indicate your level of agreement or disagreement with each statement by using the scale listed below.

1=strongly disagree (SD)    3=neither agree nor disagree (N)    4=agree (A)  
2=disagree (D)    5=strongly agree (SA)

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1. People with bachelor of science (BS) degrees in pharmacy would be valuable members of my team.
2. More people with BS degree in pharmacy are needed in industry.
3. People with BS degrees in pharmacy would understand the drug development process better than persons with other BS degrees working for our company.
4. Four year BS degrees in pharmacy should be offered as a foundation for graduate pharmacy studies.
5. People with Ph.D.s and a BS degree in pharmacy would understand the drug development process better than Ph.D.s who do not have a pharmacy degree.
6. People with a BS degree in pharmacy would have a medical knowledge base that makes them more valuable to industry than people with other BS degrees.
7. People with a PharmD degree are better prepared to work in industry than people with a BS degree in pharmacy.
8. Being a registered pharmacist is necessary to work in industry.
9. Pharmacy schools should offer BS degrees in pharmacy that prepare students for employment in industry.
10. Work experience as a pharmacist is valuable for employment in industry.

Curriculum Preferences. Please complete this section as though you could develop the curriculum for BS pharmacy students that would be employed by pharmaceutical manufacturers. Listed below are courses that could be included in a four year BS pharmacy curriculum. Please indicate your level of agreement or disagreement as to whether the course should be included by using the scale listed below.

1=strongly disagree (SD)    3=neither agree    4=agree (A)  
2=disagree (D)    nor disagree (N)    5=strongly agree (SA)

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1. Inorganic chemistry
2. Organic chemistry
3. Biochemistry
4. Biology
5. Microbiology
6. Immunology
7. Physiology
8. Calculus
9. Biostatistics
10. Drug development process
11. Physics
12. Research methodology
13. Pharmacokinetics
14. Regulatory affairs (FDA, FTC, etc.)
15. Physical chemistry
16. Quantitative chemistry
17. Basic physicochemical principles in pharmacy
18. Conventional drug delivery systems
19. Solid oral dosage forms



- 20. Controlled-release drug delivery systems
- 21. Novel & targeted drug delivery systems
- 22. Biopharmaceutics
- 23. Drug stability & stability testing
- 24. Sterilization & sterile products
- 25. Radiopharmaceuticals
- 26. Industry internship/rotation

Please answer the following questions.

1. In what field or are of industry do you work?

- |   |  |
|---|--|
| <input type="checkbox"/> Biopharmaceutics         | <input type="checkbox"/> Pharmacognosy           |
| <input type="checkbox"/> Clinical Pharmacology    | <input type="checkbox"/> Pharmacokinetics        |
| <input type="checkbox"/> Clinical Pharmacy        | <input type="checkbox"/> Pharmacology            |
| <input type="checkbox"/> Microbiology             | <input type="checkbox"/> Pharmacy Administration |
| <input type="checkbox"/> Pharmaceutical/Med.Chem. | <input type="checkbox"/> Other, please explain   |
| <input type="checkbox"/> Pharmaceutics/Pharmacy   | _____  |

2. What is your highest level of education?

- |                                 |                                |
|---------------------------------|--------------------------------|
| <input type="checkbox"/> BS     | <input type="checkbox"/> MS    |
| <input type="checkbox"/> PharmD | <input type="checkbox"/> PhD   |
| <input type="checkbox"/> MD     | <input type="checkbox"/> other |

3. Do you have a BS degree in Pharmacy?  yes  no  
If so, are you a registered pharmacist?  yes  no

4. What is your gender?  male  female

5. How many people with BS degrees in pharmacy currently work in your area? \_\_\_

6. During the next twelve months, my area would like to hire \_\_\_ people with BS degrees in pharmacy.

7. In the next five years, my area would like to hire \_\_\_ people with BS degrees in pharmacy.

8. I would support a rotation site for a BS pharmacy student at my company.  
 yes  no

9. Please list up to five functions that people with BS pharmacy degrees currently perform in your area.

10. If available, please include a job description that you might use when hiring people with BS pharmacy degrees.