

**Ernest Mario School of Pharmacy  
Research Working Group Report  
2018-2019**

**WORKING GROUP OVERVIEW**

1. Introduction

In fall 2018 Rutgers Biomedical and Health Sciences (RBHS) launched a formal review of the Ernest Mario School of Pharmacy. Over the next three months, the Research Working Group examined how the research productivity of the school has changed over the last five years at both the output level (principally publications) and input level (principally funding). We also consulted with faculty and students throughout the school to gain their input as to what aspects of our present system supported or hindered research productivity. We constructed a plan to optimize research endeavors going forward and consulted with faculty as to whether they felt this plan would be advantageous.

2. Charge

In September 2018 Rutgers Biomedical and Health Sciences (RBHS) launched a formal review of the Ernest Mario School of Pharmacy and created working groups to address key issues.

The charge states:

“The Working Group on Basic Sciences will provide the Schoolwide Review Committee with a report that documents and evaluates research at EMSOP and recommends policies, procedures, and the allocation of resources to further the research mission of the School.

The purpose of the review process is to:

- Provide the basic science faculty with opportunities for review and assessment of directions, goals, strengths, areas for improvement in research
- Assess present and future programmatic and operational needs to achieve/enhance excellence in research
- Identify the potential for internal and external collaborations that build on existing strengths
- Enhance research collaborations, bridging basic science with translational and clinical work
- Strengthen basic science research at EMSOP and broaden its excellence

The report of the Working Group on the Basic Sciences should include the following:

- List of programs, list of faculty (tenured, tenure track, and research)
- Review of the current state of research at EMSOP; including comparative metrics on faculty productivity, reputation, grant submissions, awards received, NIH ranking, etc.

- Review of trends in research at EMSOP, based on internal, peer, and aspirant data
- Review of the current state of graduate education (MS and PhD programs) under the direction of School of Pharmacy faculty. Review should include comparative metrics on graduate student funding, time to degree completion, post-graduate employment, etc.
- Review of the structure of research and graduate education at peer/aspirant schools and consideration of implications for research/graduate education enhancement of our programs
- Plans for the next five years for enhancement of basic research and graduate education, including consideration of large, multi-disciplinary projects involving faculty in other units, training grants, and potential for corporate support
- Recommendations regarding administration, structure and resource allocation to ensure that goals for graduate education and research are achievable.”

### 3. Membership

Andrew Gow, CS Yang, Edmond LaVoie, Suzie Chen, Pat Sinko, Grace Guo, Ken Reuhl, Ann Stock, Nancy Fiedler, Mike Toscani, Arash Hatefi, Luigi Brunetti, Tony Kong, Carol Goldin, Elissa Glinn

### 4. Meeting Dates (2018 – 2109)

Biweekly (October 17, 24; November 7, 14, 28; December 5, 19; January 8, 31)

### 5. Meetings with School Administrators, Faculty, Staff, Students

We conducted a number of meetings with members of the school. Dr Gow met directly with each of the department chairs and the graduate program directors to receive their input. Dr Yang conducted a meeting on December 11<sup>th</sup> with faculty from EMSOP. Dr Guo arranged a meeting with graduate students that was poorly attended. In addition, Dr Gow arranged meetings with undergraduate students involved in research throughout the school.

## DOCUMENTATION REVIEWED

1. Survey of department chairs
2. Funding records for the school along with AACP comparisons
3. Web of Science for publication output
4. Previous strategic plans

## BACKGROUND

The Ernest Mario School of Pharmacy at Rutgers has long been recognized for the quality of its research. Notable areas of strength in the basic sciences have traditionally included cancer chemoprevention, toxicology, drug discovery and delivery, among others. The School’s education and training programs have consistently attracted very high caliber students and fellows at the undergraduate, professional and postgraduate levels. Its renowned postdoctoral Pharmaceutical Industry Fellowship is highly successful and attracts talented PharmD graduates from around the U.S. EMSOP has historically occupied an enviable position as the acknowledged

“best” School of Pharmacy in the region, probably the best in the greater Northeast, and arguably one of the best (top 10%) in the country.

EMSOP’s 2015 Strategic Plan identified ways to strengthen research in basic, translational, clinical and population health sciences. These included concrete proposals and aspirational recommendations concerning faculty and administrative staffing, space, collaborations, and strategic investments (see Strategic Plan). The Research Working Group considered these recommendations in light of the School’s development over the intervening years and in light of the Responsibility Center Management budget model which emphasizes return on investment. For the Research Working Group, that constraint focused discussions about new resources on mechanisms that will bring in sufficient new funding to support and grow the mission of the School.

1. Organization of Research and Graduate Programs

The School has five academic departments: Pharmaceutics, Medicinal Chemistry, Chemical Biology, Pharmacology & Toxicology, and Pharmacy Practice and Administration. Each department operates as its own unit for research administration. Faculty at EMSOP run three PhD programs: the Joint Graduate Program in Toxicology (in which faculty from both Pharmacology & Toxicology and Chemical Biology participate); Pharmaceutical Sciences, and Medicinal Chemistry. The dual degree PharmD/PhD program provides a path for advanced PharmD students to join these PhD programs before they complete the PharmD. The School also offers a joint M.S. degree in Health Outcomes, Policy, and Economics with the School of Public Health; this program is housed in the Department of Pharmacy Practice and Administration.

2. Mission/Goals

The Ernest Mario School of Pharmacy is dedicated to excellence in pharmacy, healthcare and biomedical education; innovative and visionary research and scholarship in the pharmaceutical, biomedical, social, and clinical sciences; provision of safe and effective pharmaceutical care through exemplary clinical practice; innovative and effective interprofessional collaboration in education, research, and clinical practice; and outreach community services that address the needs of the citizens of New Jersey and society at large. In its 2015 Plan, the School noted, “Over the course of the next five years, the School will achieve greater distinction in each of these areas.”

The original charge for our group referred to the Working Group on Basic Science. In light of the School’s broad mission, we have renamed our committee as the Research Working Group. As such, it was our goal to describe the research environment within the school and how best to advance research as a whole across all five departments.

3. The School's infrastructure for research is distributed at a departmental level, there is no central schoolwide support.
4. Each department has grant administrative support, and large projects may have additional administrative support. There is informal support for grant writing, through the NRMN-CAN program supported by RBHS. RBHS also provides periodic training sessions for identifying grant funding opportunities and for the mechanics of the application process. Faculty and guest seminars, dissertation defenses, and conferences are publicized and open to all, but these efforts are not coordinated and communications across the school are not systematic.

While the school has laboratories in Levine Hall, including some that have been renovated recently, there is a pressing need for good quality research core facilities. Rutgers, with its robust research programs across the University, has much of this needed technology, available on a fee-for-service basis. But only one core facility is located in the Ernest Mario School of Pharmacy: Flow Cytometry/Cell Sorting Services & Confocal Microscopy Core Facility: <https://flowcyt.rutgers.edu/instrumentation/>.

The Office of Research and Economic Development operates core facilities, including molecular imaging, molecular design and synthesis, genome editing, and research pathology services for scientists across the University. Schools and units within RBHS also offer a wide range of facilities, including mass spectrometry, DNA synthesis and sequencing, histopathology, proteomics, analytical chemistry, metabolomics, as well as a precision medicine translational lab. Many of these labs are located near the School of Pharmacy: in the Rutgers Cancer Institute of New Jersey, EOSHSI, or RWJMS. Each runs on a fee-for-service basis. Unfortunately, opaque usage policies, low staffing, and set ups not designed for the needs of our faculty, result in frustration and limited use. Our faculty indicate that they frequently go outside of the Rutgers system to get lab work done, more quickly and for less money than within the University. A more transparent mechanism for using and sharing the cost of 'shared facilities' would help our faculty use these facilities more effectively.

Clinical faculty have appointments in a wide network of healthcare facilities and RBHS has resources and personnel working in the design, execution, and analysis of clinical studies. However, there is little information or support directly available for Pharmacy Practice faculty to participate in studies. Meanwhile, faculty in the other four departments are not well informed about the interests and expertise of their colleagues in Pharmacy Practice, nor about the resources available beyond the physical space of Levine Hall.

5. Lists of unit/program faculty, post-docs, resources, accomplishments, other data as appropriate.
  - a. Faculty Data  
We have considered the faculty numbers in total over the last five years. In other words, all faculty who have worked in one of these five years within the school are included in

the census. Table 1 shows the total number of faculty per department and the number of those faculty that are tenured or tenure track (\* represents 50% status for one line).

Table 1. Faculty by Tenure Status Over Last 5 Years		
	Total Faculty over 5 years	Tenured Faculty
Pharmacy Practice and Administration	83	6
Pharmacology & Toxicology	22	10
Chemical Biology	15	10
Pharmaceutics	12	7
Medicinal Chemistry	4*	4*

In order to understand seniority of faculty within each department, we analyzed the numbers of faculty at each rank irrespective of tenure status (Table 2). Notably within the basic science departments, 50% or less of the faculty are at the assistant professor level. Significantly, of all the assistant professors within the school (75) only two are either tenure or tenure track. These data demonstrate that our faculty distribution is somewhat top heavy.

Table 2. Faculty by Rank Over Last 5 Years			
Faculty Rank	Assistant	Associate	Full
Pharmacy Practice and Administration	56	20	6
Pharmacology & Toxicology	11	8	3
Chemical Biology	3	4	8
Pharmaceutics	4	2	5
Medicinal Chemistry	0	0	4

b. Graduate Students and Post-Doctoral Fellows

Within the School as a whole there have been 34 post-doctoral fellows over the last five years and some 184 graduate students. The effectiveness of the graduate programs can be demonstrated by the number of students graduating. In the last five years 88 students have graduated and currently there are 100 graduate students enrolled.

c. Outcome of Graduate Programs

Most of our graduate students are going on to careers in industry (75%), however, a significant proportion are continuing in academia (20%).

d. Graduate Student Enrollment

The highly competitive nature of our graduate programs is demonstrated by examining application data. Within the past 5 years we have received 1,547 applications to our three MS/PhD programs and have offered places to 118 students. Of those 118 students, 94 have gone on to accept a position. In addition, it is of note that 55% of our

graduate students are from the USA, which is important in terms of application for training grants.

e. Honors Students

In addition, the School trains a number of PharmD students in research practices through the use of an honors program. The program requires students to take didactic courses in research, complete research credits in an active research program, and write and present a thesis. On average there are 50 students at some stage of the program throughout the School. There is increasing demand for this program as students from the undergraduate honors college enter the School.

**FINDINGS**

1. Achievements (last 5 years)

In order to assess the achievements of the school within the research field we have considered three main areas of productivity; a) Funding, b) Patents, and c) Publication. Our focus has been to examine how the School’s productivity has changed over time and thus data are presented by year over the period of 2014 to 2018. We have used data collected directly from University records (for funding and patent information), the Web of Science (for publication and citation data), and from AACP for comparison data.

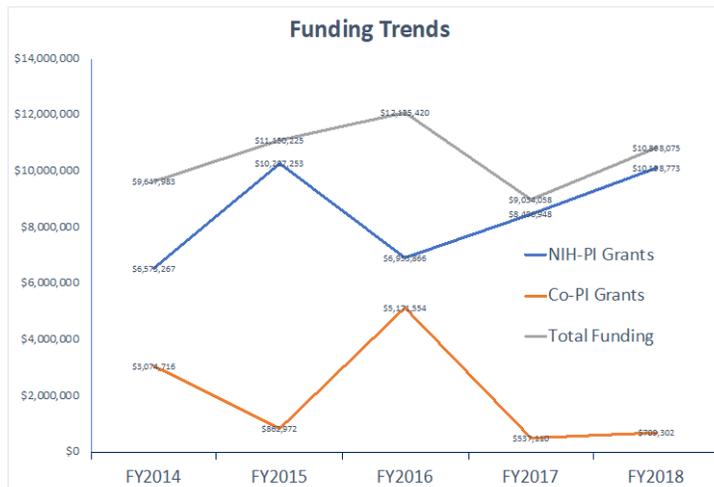


Figure 1: NIH funding over the last 5 years as per School records. Total NIH research (grey) has remained relatively constant, however, the reliance on individual PI (blue) funding has increased.

a. Funding

Using the school’s own records of funding we have analyzed the changes in NIH funding over the last five years (Figure 1). Total funding over this period has remained relatively constant with \$9,000,000 and \$12,000,000 coming in each year. Notably, however, there is an apparent shift over time with a decrease in the value of Collaborative Co-PI funding over the period, such that it is now less than 10% of total research income.

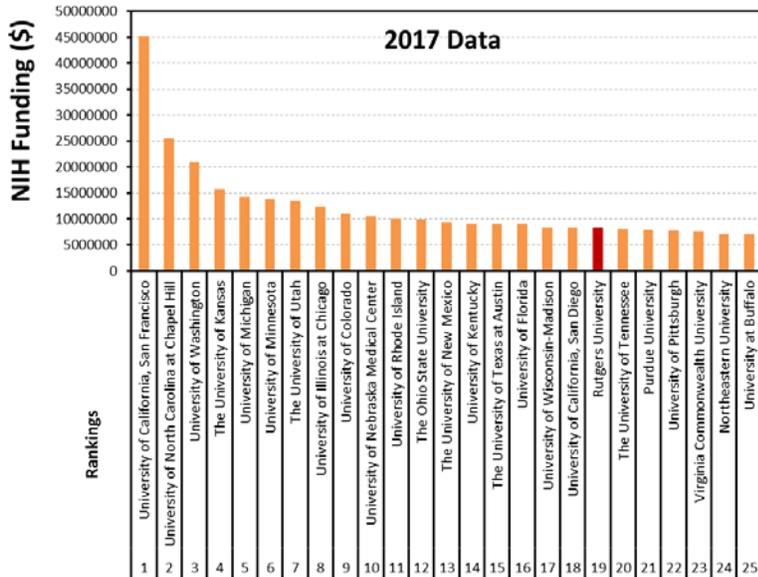


Figure 2. AACP data showing ranking of pharmacy schools in terms of NIH funding as of 2017. Rutgers is shown in red at position 19.

In order to determine where our school stands in comparison to other pharmacy schools in terms of ranking with respect to research funding, we examined AACP data. Figure 2 shows that the school ranks in 19<sup>th</sup> place in terms of NIH funding (as of fiscal year 2017), when compared to other schools of pharmacy. It seems relevant to point out that Rutgers has placed higher in previous years. Despite our NIH funding remaining relatively constant, our rank in funding is declining.

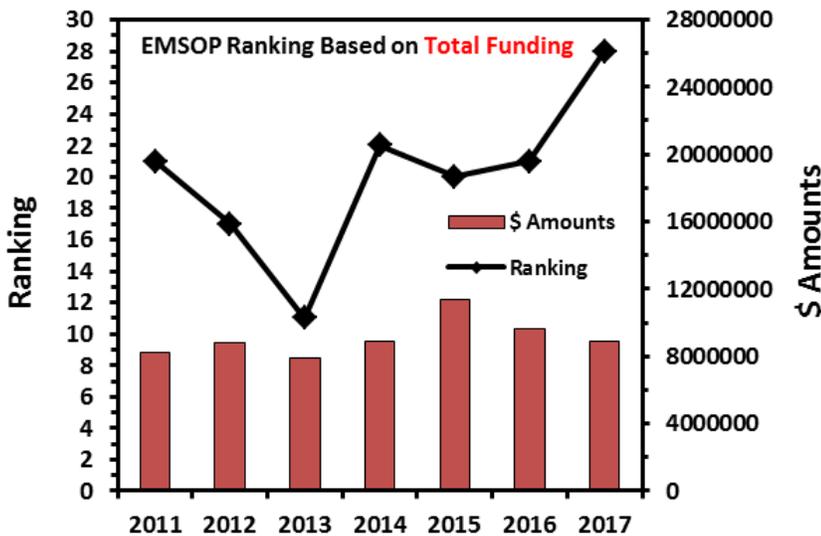


Figure 3. AACP data for total research funding to the Ernest Mario School of Pharmacy. The black line represents rank (left axis) relative to other schools of pharmacy. The maroon bars represent total research funding (right axis) in dollars.

The effect of this fall in funding ranking is further demonstrated when we consider AACP data for total funding since 2011 (Figure 3). Here one can see that we are maintaining our funding level, however, relatively speaking our position is declining as we now rank 28<sup>th</sup>, considerably lower than our earlier ranking as high as 11<sup>th</sup>. We also see that our ranking on total funding is lower than our NIH rank, suggesting that we are not seeking other sources of funding as effectively as other schools. In order to investigate this further we examined the sources of funding given for research publications by Web of Science. A tree map of these data (Figure 4) shows that the vast majority of our work lists NIH-related funding as its source. Notable by its

absence is significant funding from foundation-based sources other than the American Cancer Society. These data were difficult to collect and collate as many authors from EMSOP do not report their funding or their institutional affiliation accurately. This points to a need for some level of central oversight to assist in appropriate marketing of our productivity.



Figure 4. Tree map of funding sources for research grants received by EMSOP investigators.

b. Patent Chart

Another mechanism by which the school’s research productivity can be measured is the submission and authorization of patents. Figure 5 shows that faculty have been successful in both filing and receiving patents over the last five years.

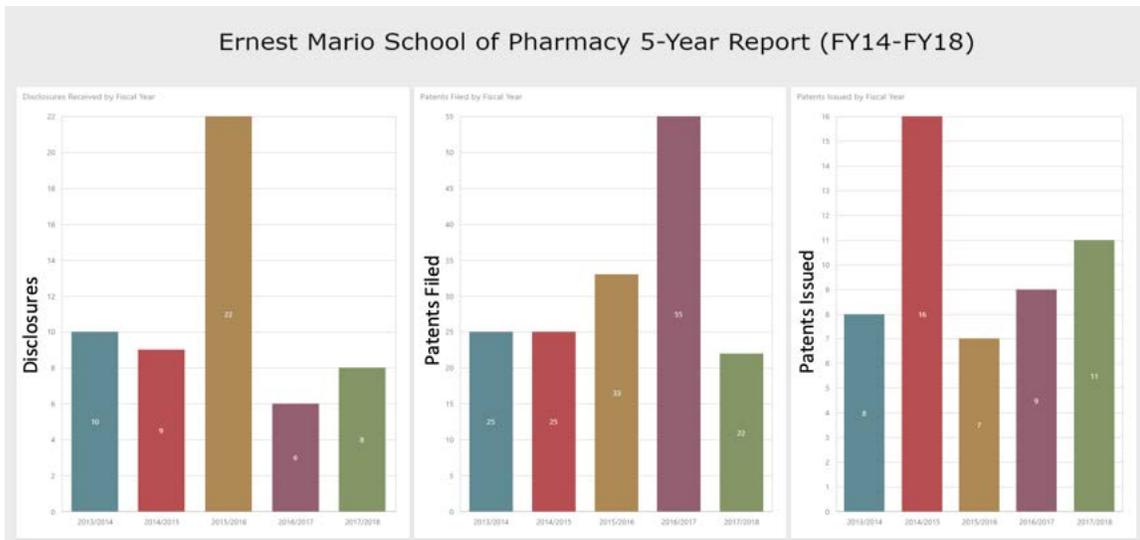


Figure 5. Patent disclosures received (left panel), filed (center panel), and issued (right panel) by fiscal year from 2014 to 2018.

c. Publication/Citation Chart

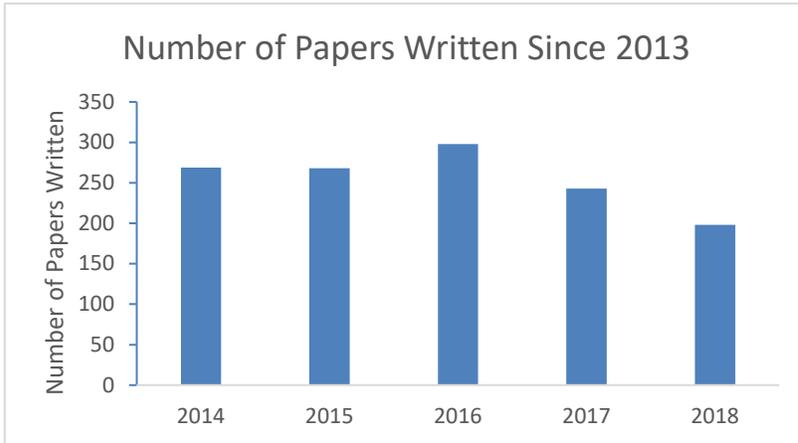


Figure 6. Number of publications per year from the School of Pharmacy as per Web of Science data.

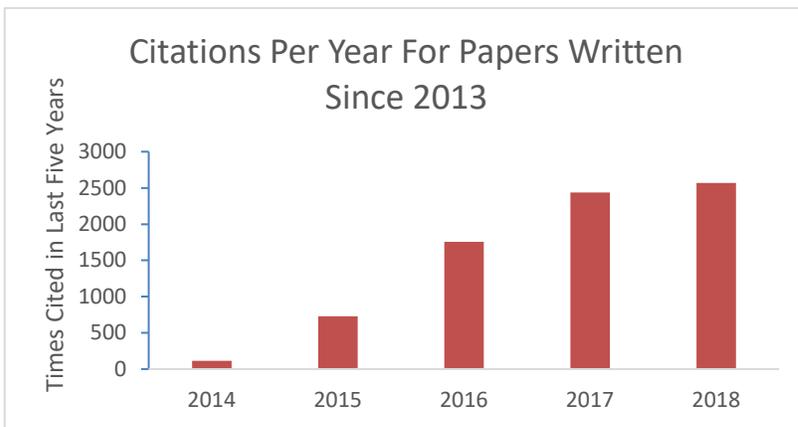


Figure 7. Citations per year for papers written since 2013. Data are collected from Web of Science for papers with one or more authors within the School of Pharmacy.

To examine productivity in terms of publication record we have analyzed data from the Web of Science. For each faculty member, we searched the database for their publications over the last five years and the number of times that these papers were cited in the literature. In order to improve the quality control of this data set, we sent each faculty member the output data we had collected and asked them to curate the list of publications (adding or removing publications as per their own knowledge of their productivity). The overall productivity of the faculty is very good and very consistent. Figure 6 shows that there are approximately 250 papers published per year by faculty members within the school. There are slightly fewer papers listed in 2018 (198), but this may be because papers published at the end of the year are

not yet included in the database. In order to gauge the impact of papers from the School we examined the citation rate as per Web of Science (Figure 7). We decided to consider only papers published in the last five years and how often they had been cited. Hence there are obviously only a small number of citations in 2014. There is a steady progression through the period to a maximum of 2570 citations per year, which is consistent with a high level of productivity that is relatively static. While the School has a large number of faculty, many are not actively publishing. Therefore, to get a more useful picture (focusing on those faculty who are publishing), we considered citations for all faculty, and then citations for the subset of those who had published 5 or more papers in the last five years. The latter group may be considered the research-active faculty. We considered two metrics in this analysis: 1) the sum of the times an individual faculty member has been cited in the last five years; and 2) the average number of

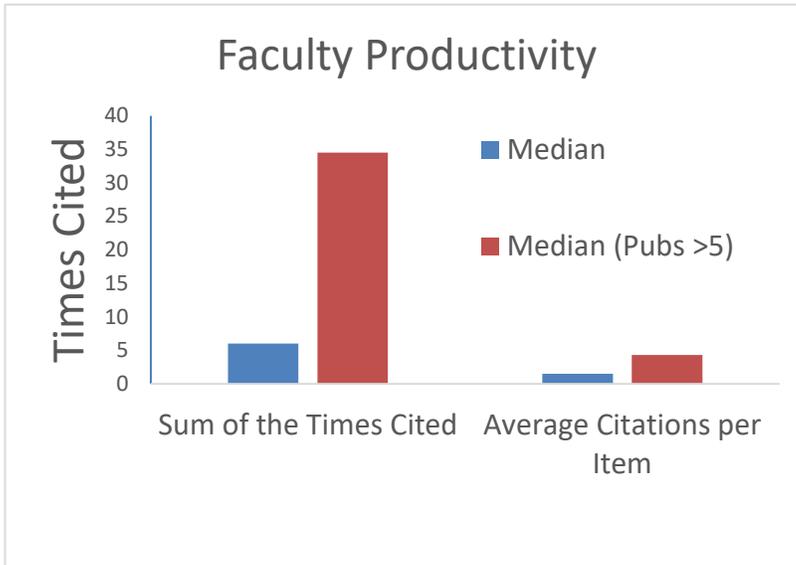


Figure 8. Faculty productivity as gauged by sum of times cited per member over the last five years or as average citations per paper. Two groups are considered: total faculty (blue) and faculty who have published 5 or more papers in the last five years (maroon).

citations per paper over that period (Figure 8). Considering our faculty as a whole, the median number of citations per member is 6, however, for faculty actively engaged in research, it is 34.5. The average number of citations per paper is 1.5 for all faculty and 4.3 for active research faculty.

Within the department of Pharmacy Practice and Administration the main responsibility of most of the faculty is clinical practice and preceptorship. Indeed,

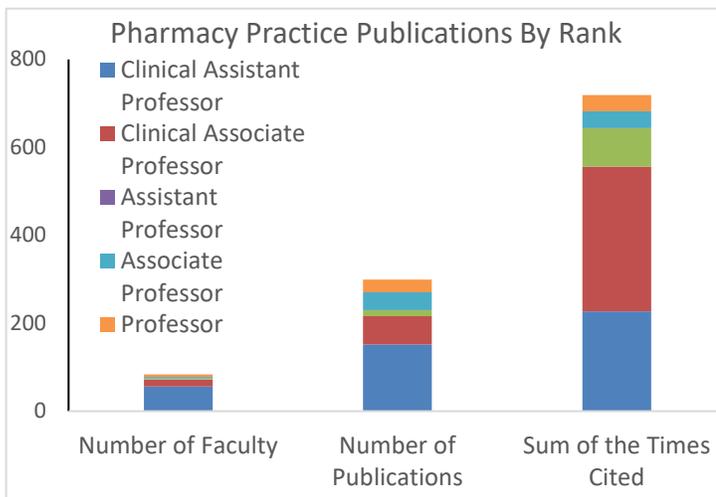


Figure 9. Publication output by members of the Pharmacy Practice and Administration Department. The total number of faculty, the number of publications written, and the sum of the times that those papers have been cited are given.

faculty on average spend 6 hours a day in direct clinical practice, supervise 14 APPE students and 5 residents per year, and write 3 internal publications a year. However, as Figure 9 shows, faculty from this department have published nearly 300 items and received almost 700 citations within the last five years. These data demonstrate the capacity of faculty within this department to produce scholarly research, but also how much more could be produced with increased practical assistance. This represents an opportunity for the School.

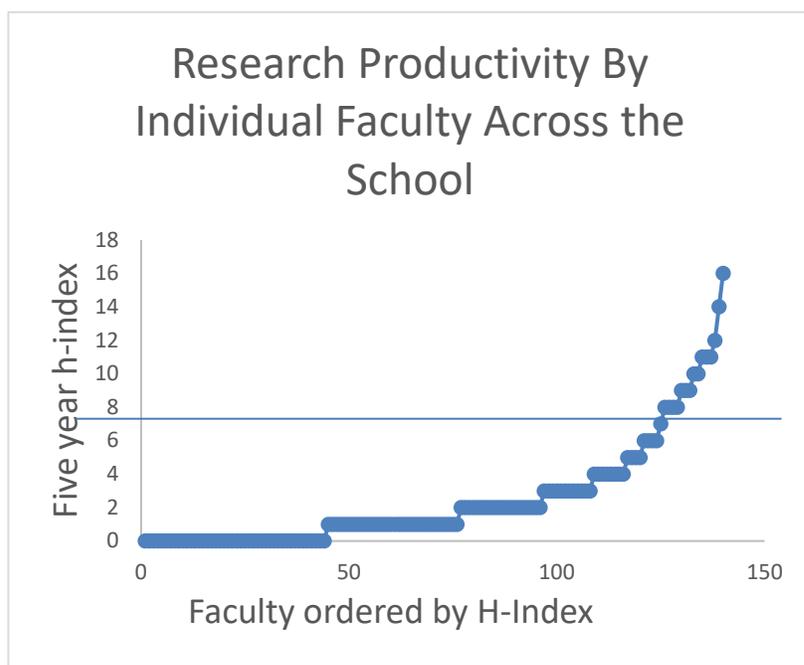


Figure 10. H-index for individual faculty considering only papers published in the last five years. Each point represents an individual faculty member and hence we have 42 faculty with an h-index of 0 and one with an h-index of 16.

These data indicate that our School is somewhat top heavy in its publication output, i.e. a large number of papers are being produced by a small number of faculty. To examine this more deeply, we considered the h-index of papers published in the last five years. The h-index considers the number of papers published by an individual and the relative rate at which these papers are cited. This index is often considered a valuable metric for individual faculty member output. If we consider the h-index for all our faculty we find that some of our faculty have a very high level (max 16), but only 18 faculty have

an h-index of higher than 6 (Figure 10).

- d. Faculty Recognition over the last five years in terms of research has been extensive. Some of the fellowships, awards, and recognitions that faculty have received for their research efforts are listed below.

**Fellowships:**

- Fellow – National Academy of Inventors
- Fellow (Elected), Controlled Release Society (CRS)
- Fellow (Elected), American Association of Pharmaceutical Scientists (AAPS)
- Fellow (Elected), American Association for Advancement of Science (AAAS)
- Rutgers University, The Board of Trustees Research Fellowship (2016)
- Elected to The Kosciuszko Foundation Collegium of Eminent Scientists as a Distinguished Fellow of the Collegium for Outstanding Achievements and Contributions to the Polish Scientific Community
- Board of Trustees Research Fellowship for Scholarly Excellence (2014)
- Presidential Fellowship for Teaching Excellence (2014)

**Awards:**

- New Jersey Health Foundation Excellence in Research Award (2015)

TA/GA Professional Development Award (2018)  
GALLO Award for Scientific Excellence, Cancer Institute of New Jersey (2016 & 2017)  
Research Excellence Award, New Jersey Pharmaceutical Association for Science and Technology (NJPhAST) (2017 & 2018)  
Thomson Reuters Highly Cited Researcher (2014)  
Rutgers Patent Award (2017)  
Dartmouth Technology Transfer Innovation Award (2017)  
Outstanding Young Investigator, Environmental Health Sciences Core Centers Annual Meeting, Emory University, Atlanta (2017)  
Impact Award, Society of Toxicology Cardiovascular Specialty Section (2016)  
Best Publication Award, Society of Toxicology Nanotoxicology Specialty Section (2016)  
Pathway to Independence Award (K99-R00), NIEHS (2015)  
Young Investigator Travel Award to attend NIH Conference Small Blood Vessels: Big Health Problems? The Microcirculation Society (2014)  
Liberty Science Center Mentorship Award, Jersey City NJ (2017)  
American Journal of Respiratory Cell & Molecular Biology, Most Outstanding Paper award (2016)  
Young Scientist Travel Award, AAPS Workshop on Drug Transporters in ADME: From the Bench to the Bedside (2013)  
Best Paper of the Year Award, Dermal Specialty Section, Society of Toxicology (2015)  
Society of Toxicology, Inhalation and Respiratory Specialty Section Paper of the Year Award (2019)  
Society of Toxicology, Mechanisms Specialty Section Career Investigator Award (2018)  
New Jersey Health Foundation Excellence in Research Award (2017)  
Society of Toxicology Education Award (2017)  
Society of Toxicology, Specialty Section Career Investigator Award (2015)  
Society of Toxicology, Women in Toxicology Mentoring Award (2014)  
Society of Toxicology Education Award (2016)  
Paper of the year, Dermal/Toxicology Specialty Session SOT (2015 & 2016)

**Recognition:**

High-End Foreign Expert in Pharmaceutical Science, China State Administration of Foreign Experts Affairs  
Pharmaceutics Advisory Committee, Pharmaceutical Research and Manufactures of America Foundation.  
Pharmacy School Advisory Board, Chapman KGI School of Biopharmacy  
Steering Committee, Co-Chair, National Institutes of Allergy and Infectious Disease, Long-Acting/Extended Release Antiretrovirals  
Steering Committee, Think Tank on Drug Delivery Systems, National Institutes of Health/Bill and Melinda Gates Foundation.  
Executive Committee, Long-Acting/Extended Release Antiretroviral Resource Program, National Institutes of Allergy and Infectious Diseases, NIH  
Distinguished Visiting Professor, Fuzhou University, College of Chemistry, China  
Testifying Witness, US - China Economic and Security Review Commission 2017 United States Congress hearing on China's Pursuit of Next Frontier Tech: Computing, Robotics and Biotechnology. "State of Nanotechnology R&D in China: Implications for Future US Competitiveness".

2017 Chair, Symposium “Transporters and Enzymes: Novel Insights Into the Regulation of Drug Disposition and Response”, International Society for the Study of Xenobiotics meeting, Rhode Island.

Honorary Assistant Professor in Pharmacy, University of Nottingham, UK  
 President, Controlled Release Society  
 Chair of the Gordon Research Conference  
 President of the Nitric Oxide Society

2. Strengths

- a. As a school, EMSOP ranks well in terms of research funding and has done so consistently over the past five years (Figures 1-3).
- b. Faculty productivity over the five-year period in terms of publications and patents has been very good (Figures 5-8), achieving a five-year citation rate of ~2,500.
- c. Faculty are well known for their accomplishments, as seen in awards and recognition from both national and international bodies.
- d. To gain a better understanding of the actual impact of our faculty outside of the School, we examined exterior collaborations both in terms of institution (Figure 11 upper) and country (Figure 11 lower). Only institutions with which there were at least 10 collaborative papers are shown. We found 25 such institutions meeting this criterion, ranging from other units of



Figure 11. Tree maps of Collaborating Institutions (upper panel) and Countries of Collaborators (lower panel). Data were taken from the addresses given on publications in which one or more EMSOP faculty were listed.

Rutgers to the University of Pennsylvania, Duke, and Shanghai Jiao Tong University. It is also significant that faculty publish with investigators throughout the world (Figure 11 lower panel). Faculty have published with collaborators throughout the Americas, Europe, Asia, and the Middle East. These data demonstrate that EMSOP faculty are both well respected and highly collaborative in nature. However, it is important to note that these collaborations are far more common outside of the school than within it. While nearly 40% of all publications involve a collaboration outside of EMSOP, only approximately 2% of all publications involve more than one department from the School.

- e. Another strength of the School has been the design and application of novel approaches to pharmacotherapy. This is evidenced by the number of patents filed and received and also by the number of pharmaceutical industry interactions that exist within the School.

### 3. Areas for Improvement

- a. Despite the high level of productivity of our faculty there are a relatively low number of publications that involve multiple departments from the School of Pharmacy (~2%). This suggests a lack of integration among the individual units. In the present research climate there is a need to develop collaborative groups. Both the NIH and other funding bodies are interested in having multidisciplinary studies that require a diversity of expertise. The School is well placed to produce such groups but lacks a mechanism to form such groups.
- b. The lack of interaction among departments is most pronounced between basic and clinical science (i.e., between our basic science departments and the department of Pharmacy Practice and Administration). There are considerable opportunities to build such relationships, as expertise on both sides can be brought together to dramatically increase research productivity and scholarly activity.
- c. The School does not have an effective mechanism for increasing interaction among researchers, particularly for bridging basic, translational, and clinical sciences.
- d. While funding has remained steady in the face of declining NIH support there has been a failure to secure large program-based funding and ultimately this is the only mechanism by which we can improve productivity and ranking.
- e. Our graduate programs are very successful both in terms of recruitment and student output. However, it would be advantageous to increase the proportion of domestic students to increase competitiveness for training grant programs.
- f. Despite there being considerable opportunity for clinical research within the School, there is no central organization to assist in the design and conduct of such work. Without such an organization it will always be difficult to support clinical research within the School.

### 4. Assessment of Goals and/or Strategic Directions

The overarching goal of the School in terms of research is to increase the impact of its scholarly activity and thereby increase funding and ranking.

- a. Strategic Direction: Execute a frameshift in our attitude to research within the School. As part of the pressure that currently exists on faculty in terms of maintaining productivity, we have become siloed. In other words, faculty are taking care of running their own programs and maintaining their current funding position. While in the short term this has helped the School maintain its funding level and publication record, this will inevitably lead to a long-term fall in the rankings and limit our impact. If we can institute a shift in the framework to encourage cross-disciplinary collaboration within the School we can ultimately improve our impact and ranking. Achievement of this frameshift will require a clear indication of support and intent from leadership.

- b. Strategic Direction: Increase multi-PI applications from the school (P, U and T awards). There exists only one significant programmatic award within the School of Pharmacy (a T32 training grant in Toxicology). Faculty should seek to develop funding for pharmacy-centered multi-PI programs, e.g., in drug development, drug delivery and drug metabolism. By finding the appropriate areas of interaction and providing some level of resource to support initial studies, the School should be able to increase large program based research funding. It is also important to consider outside funding mechanisms other than the NIH that could support this effort. In this regard, VA and DoD sources as well as industry interactions should be considered. These funds could significantly enhance the research foundation within the School. The areas of interaction should not be dictated by departmental emphasis but by cross-disciplinary interests possibly by focusing on disease areas.
  - c. Strategic Direction: Increase development of junior faculty within the School. As noted, the senior faculty wish to stay at EMSOP and maintain their productivity. However, significant developments in terms of both productivity and funding can result from the development of junior faculty. In the past five years three junior faculty have been supported and developed within the School. All three have gone on to be highly productive and to secure outside funding. These developments considerably enhance the School's academic mission. Hiring of new junior faculty and the development of present talent should be a major emphasis going forward.
5. Assessment of Current Operational and Capital Resource Needs
- a. Establishment of a Central Research Office. What is abundantly clear from our consideration of the present state of the research endeavor within EMSOP is that there is a lack of centralized leadership focused on enhancing research. Such leadership is necessary to achieve the objectives outlined above. However, this office needs to have a clear and significant commitment to it as well as specific objectives. Such an office could formulate plans to increase interaction and execute mechanisms to achieve the School's goals. Success will require faculty leadership as well as administrative support.
  - b. Coordination of a plan for Core Facilities. One mechanism by which the School can increase interactions and support collaboratives is by developing a coordinated plan for core facilities. Core facilities provide points of direct interaction and can support multiple research efforts. However, they require considerable support. As there are multiple facilities available outside of the School, it may be possible to increase core facility support by both establishment of new cores through shared instrumentation grants as well as coordinating faculty access to outside cores.
  - c. Establishment of a Forum for Interaction. Sometimes all one needs to do is have people talk to each other and new ideas can develop. The School needs to create mechanisms to increase these interaction opportunities. An example is the "Tea time" that is run within Chemical Biology, where investigators at all levels discuss their work and their challenges with other department members over tea. At the School level, such initiatives should be offered, including informal tea time, brown bag lunches, three-minute talks, and even "wine

and whine.” It would also be beneficial to have schoolwide mini-symposia, for example, focused on an individual disease area. These symposia could consist of short presentations from basic science and clinical faculty, and key external experts who could assist in focusing our efforts. Such sessions could be led by a facilitator and could ultimately lead to the development of proposals that could be given seed money to allow for development.

## RECOMMENDATIONS

1. Suggested New Opportunities and/or Directions that can be pursued with minimal new resources
  - a. Major opportunities exist in an increase in collaborative relationships within the School and development of a frameshift. Our suggested mechanism for executing this frameshift is to establish a central research office which would be coordinated by a research chair/dean appointed from the faculty of the School. The establishment of a research office with full time administrative support demonstrates a commitment to the effort. The research office would provide practical support in the coordination of interaction fora, coordination and administrative support for joint applications, and information on potential programmatic sources of funding. The research office could also provide a centralized place for students to look for research opportunities, an increasing need for their success.
  - b. A major opportunity is to increase leadership in research. The previous strategic working group had suggested hiring a very prominent scientist to join the School as dean of research. While this would be a potentially transformative move, it cannot happen without considerable funds. However, there is need for centralized leadership to improve our research position. We recommend the establishment of a research committee led by an individual from within the School. This individual would represent the School across the University in matters of research (importantly, at the moment there is no representative for EMSOP at University-wide committees that address research matters and initiatives). He/she, as well as leading the research committee, would also coordinate the activities of the research office. We propose that two faculty members from each department serve on the research committee. Members would serve at the behest of their individual department chairs and in this way all departments would be represented. The chair of the committee could be appointed by the Dean or elected from the faculty.
  - c. In order to fund these recommendations, we propose that a significant portion of the school’s total ICR funds be used to support the office and its programs. We also recommend that these funds be used to support collaborative studies and novel ideas that could provide seed data for bigger applications. This committee and its administrative office should enhance the School’s reputation and promote research funding. If it is funded via a percentage of ICR its own success would make it cost neutral.
  - d. Many of our alumni are actively interested in the research work of the school. The presence of a coordinated research effort can support alumni interaction, which could lead to either direct support of research efforts or general support of the School. It provides an ideal

mechanism to engage our alumni, especially those involved in industry research where new connections could be made, benefiting both the School and the alumni.

2. Suggested Longer-Term Opportunities and/or new Directions that require new operational and/or capital resources
  - a. In the long run, it would benefit the School to support the use of individual core facilities. This could be done either by establishing new cores through shared instrumentation grants, or by providing technical support and information to increase usage of cores throughout the University. Such efforts could be coordinated through the research office.
  - b. Bridging funds are critically important for covering temporary shortfalls. The research committee could carefully assess projects that show capacity for future support and provide bridging funds to assist in the maintenance of capacity within the School.
  - c. Seed money, especially for junior faculty and new collaborative translational research opportunities, can play an important role in generating new federal support. It is especially hard for junior faculty to gain their entry into the funded research world. Provision of small startup funds through the research office could accelerate the development of our junior faculty and increase Schoolwide output. The research committee could work to determine School priorities and then judiciously provide relatively small amounts of funding for promising initiatives.
  - d. Schoolwide hiring plans for faculty are critically important to ensure the School's research health over time. The research committee can work collaboratively to determine School priorities in hiring. We strongly recommend consideration of junior faculty, who may not yet have secured significant funding but show great potential for bringing research excitement, new ideas and energy to increase our research productivity. We also recommend joint recruitment of highly productive senior faculty. By hiring jointly with another RBHS unit, we can benefit from new, large research programs and from the strong, collaborative opportunities associated with the new position.