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Opportunities and challenges for women PhD investigators in gastrointestinal research

Kathryn E. Hamilton^{1,3}, Marie-Pier Tétreault^{1,3}, and P. Kay Lund²

¹Division of Gastroenterology, Department of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania

²Departments of Cell Biology and Physiology, Pediatrics and Nutrition, and Center for Gastrointestinal Biology & Disease, University of North Carolina School of Medicine, Chapel Hill, North Carolina

Introduction

Clinical Gastroenterology has been a traditionally male-dominated field. Evidence of change stems from recent studies which demonstrate that increasing numbers of women are choosing careers in Clinical Gastroenterology ¹. According to the Association of American Medical Colleges and the American Board of Internal Medicine, 14% of gastroenterology residents/fellows were female in 1995–1996 ² and 31.9% were female in 2010 (<https://www.aamc.org/data/>). These numbers are encouraging, but there is still much to be done ³. The American Gastroenterological Association (AGA), a major professional society in our field, is actively promoting inclusion of women in all aspects of the society's work and elected its second female president, Dr. Gail Hecht, in 2010. In addition, the current President-Elect of the American Physiology Society (APS), Dr. Kim Barrett, is a woman PhD gastrointestinal (GI) researcher.

This commentary is a partnership between three women PhD investigators. Two are new investigators at different stages in transition from mentored research to an independent career, and the third an established investigator in GI Research who has advocated for women in science ⁴. We share a passion for uncovering basic biological and molecular principles that govern health and diseases of the GI system, and importantly a commitment to research that permits translation of discoveries to better prevent, detect, diagnose and treat GI diseases. Each of us has experienced working in both a basic biomedical research department and in a clinical department. The ultimate goal of this commentary is to highlight opportunities and barriers facing women PhD researchers in the GI field, and to suggest some useful solutions and directions, with emphasis on the perspective of new investigators.

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¹To whom correspondence should be addressed: 919-843-5428, empk@med.unc.edu.

³These authors contributed equally to this work.

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Ongoing challenges for women PhDs in academia and GI research

Despite great gains and encouraging trends, available evidence suggests that women are still under-represented in academia, especially those who advance beyond postdoctoral or mentored research levels to have their own labs and those at leadership levels ⁵. Although across all disciplines there has been marked improvement over the past 5–10 years, there is steady attrition of women as they rise through the ranks such that only 20% of all biomedical faculty hold the rank of full professor and even fewer women are Division Chiefs, Chairs or higher-level administrators (<https://www.aamc.org/members/gwims/statistics/>). This is a critical problem because it means there are few female role models in positions of leadership. Other tangible evidence of slow progress derives from statistics that more women than men were awarded K01s (57% versus 42%, respectively) in 2008, but the percentage of women-awardees for R01 awards was just 27% women versus 72% men ⁶. It is important to note that success rates for men and women who apply for these types of awards are the same. Current NIH data indicate that the percentage of women R01-equivalent grant awardees remained at 27% as of 2012. ⁷.

Subconscious biases and non-events

Although major progress has been made in overcoming gender discrimination in academic science, recent studies suggest that gender bias still persists ^{8, 9}. In 2012, Moss-Racusin *et al* reported that professors from both sexes were equally biased against women ¹⁰. Unintended and subconscious gender bias can result in barriers for women to be hired, promoted, credited for their achievements, nominated for leadership positions or viewed as leaders. An active and open dialogue about and recognition of subconscious gender bias is critical. Gender-blind review is one potential solution, but research publications are the currency of our field so this is rather difficult in science as a whole ¹¹. Consideration of implicit gender bias should be included in ethics training and charges to search committees, including awareness of and avoidance of common differences in reference letters or descriptors used for women and men ¹² (such as the ‘bright, hard-working’ woman versus the ‘smart and high-achieving man’). Increasing the number of female speakers, reviewers, editors and editorial board members will enhance the visibility of women PhD scientists and ensure their continued inclusion in all arenas of academia.

Experts on gender research have observed that implicit gender discrimination is not the only problem. Non-events or what is inadvertently not happening also contribute ¹³. “Non-events are about not being seen, heard, supported, encouraged, taken into account, validated, invited, included, welcomed, greeted, or simply asked along” ¹⁴. Many women discuss these issues among themselves, but they are rarely raised during formal career mentoring or counseling discussions. Accumulation of non-events over time can subtly discourage women and can have a deep impact on their confidence, development and career choices. Because non-events are subtle and cumulative, they are difficult to document or correct. A more frank, open, and active discussion about non-events and the ‘invisible woman’ and how to maximize collegiality and inclusion would be useful.

Work-Life Issues

Many of the challenges facing working women are not unique to PhD scientists in GI, or scientists in general; however, the concept that women are required to show exceptional productivity during their childbearing years in order to secure the next position (i.e. starting and succeeding in their own lab) is a uniquely female issue. Women are commonly advised to incorporate the timing of starting a family into their overall “plan”; however the best plans can be derailed by issues beyond individual control including meeting the right partner at the right time, fertility struggles, pregnancy difficulties, or having a disabled child. How

to anticipate and accommodate the unexpected is a difficult problem, but is worthy of more discussion. In 2012, the Women in Gastroenterology Committee hosted powerful presentations by women who addressed some of these issues. More of this type of event and some focus on PhDs would be extremely valuable. A new child undoubtedly impacts both mother and father, but for obvious biological reasons the heavier responsibility tends to fall on women. Beyond the physical limitations of pregnancy and breastfeeding, the day-to-day life of a mother-researcher is often more heavily affected by the needs of the child, and whether or not this is by choice depends on the individual ¹⁵.

The need for strategies to ensure that women can effectively pursue their work during and after pregnancy, and provide resources to assist working from home, flexible work schedule, and access to high quality and affordable childcare, could dramatically improve the lives of parents in research careers ⁴. Women scientists would benefit from more numerous, comfortable and accessible lactation rooms at their home institutions and at national meetings. This is a particular problem for women at pre-doctoral and post-doctoral levels who often do not have the privacy of an individual office. However, in many cases, these practical solutions are not yet adopted as standard practice at many institutions or are inadequate. Most often the burden falls on individual investigators to accommodate their mentees as they navigate new parenthood. As such, a solid mentor-mentee relationship plays perhaps the most critical role in the success of the mentee during these times ¹⁶. In this regard, there are few formal rewards or incentives for being a family-friendly mentor, and the increased challenges to research funding are not going to help this situation. Allowances for childcare can be included in NIH-funded career development award applications, permitted as fringe benefits or indirect costs only if there are established institutional policies ¹⁷. It is unclear how many institutions actually have such policies in place, and it seems that this resource may be under-utilized.

Universities and funding agencies have instituted various family-friendly policies that are intended to counteract adverse effects that family responsibilities may have on career satisfaction, retention and success. Extending the tenure clock and the NIH 'reentry to workplace' program (PA-12-150; <http://grants.nih.gov/grants/guide/pafiles/PA-12-150.html>) are excellent initiatives. However, in cutting-edge research, any hiatus can be detrimental to success and so it would be advantageous to consider additional strategies that allow scientists to stay and succeed in research while meeting family demands.

Opportunities to cultivate the women PhD constituency in GI Research

Critical role of basic GI researchers for translational research

Translation of basic science to the clinic is a major emphasis of biomedical and NIH-funded research with the aim to accelerate prevention and treatment of disease ^{18, 19}. This offers new opportunities for PhD scientists who possess unique skill sets in basic sciences and technology to contribute to the marriage between exciting bench research and clinical application, such as areas related to genomics, epigenetics, informatics, stem cells, and microbiome among other increasingly intersecting areas ²⁰. The translational emphasis encourages many investigators, men and women alike, to consider careers in clinical departments and divisions as well as the more traditional career track in basic science departments. Barrett and Montrose highlight ideas for PhDs to thrive in clinical divisions ²⁰, including interfacing frequently and effectively with clinical colleagues and learning the clinical language, even if this is at first uncomfortable. However, the potential double minority status of women PhDs in clinical GI-related divisions can increase the challenges and impact their comfort level in seeking out clinical collaborators. This is one area where mentoring and assistance in networking can be very helpful. Knowing when and how to say

‘no’ while still being a team player and contributing to one’s academic environment is also critical.

Each of us had opportunities to interact with clinicians early in our careers from undergraduate or graduate school onwards. Our experiences suggest that these early interactions are critical to optimizing a productive dialog that will foster interest of PhDs in translational research and promote comfort in a clinical setting. Having MD members of doctoral or subsequent mentoring committees is a major benefit to translational conversations and training and to ensuring that PhD scientists gain clear clinical perspective to their basic research. Projects with specific translational aims provide direct opportunities to collaborate and interact with physicians. An increasing number of training programs and NIH-sponsored Clinical and Translational Science Awards (CTSAs) provide opportunities for training in translational research. Mentors play critical roles by facilitating networking between their mentees and clinical collaborators, guest speakers, or at national and international meetings. PhD trainees benefit from visits to labs or participation in seminar series in clinical departments to learn new techniques, the clinical background to their research and the realities of clinical research or practice. On the mentee’s part, it is important to discuss and emphasize the desire for these opportunities.

National organizations, committees, and workshops for women

Numerous national organizations have been created to attempt to address the needs of women in science at all levels. For example, the Association for Women in Science (<http://www.awis.org/>) is the major multidisciplinary organization for women in Science Technology, Engineering and medicine (STEM) across all employment sectors. Also, the Scientista Foundation is a large network of college and graduate women innovating in STEM. Scientista works with student leaders to increase the number of women studying and pursuing careers in STEM. Another organization, the Science Club for Girls (scienceclubforgirls.org), pairs high school and middle school girls with female mentor-scientists through free science and engineering programs. Such organizations are outstanding seeds of change and help to facilitate much needed mentorship and inspiration among women in science. The ADVANCE programs sponsored by NSF have worked at innovative strategies to transform institutions engaged in STEM research to women-friendly work places (<http://www.nsf.gov/crssprgm/advance/index.jsp>). Such models and their strategies greatly benefit GI scientists, and the ADVANCE websites have much useful information that we encourage readers to explore.

Despite increases in the representation of basic science symposia and presentations Digestive Disease Week (DDW), there is a need for more attention to networking for young PhD scientists, increased representation on committees, and some attention to specific issues for women PhDs; even the Women in Gastroenterology committee of the AGA comprises largely clinical faculty, which may reflect the society demographics. Nevertheless, identifying common and unique goals and challenges for both women PhDs and MDs and working together to address them would be positive step forward. In addition to AGA, other societies implemented similar committees. The Women in Cell Biology committee of the ASCB serves as a resource for men and women at all stages of their career trajectories and produces monthly columns for the ASCB Newsletter that we recommend readers to look into (http://www.ascb.org/index.php?option=com_content&view=article&id=86&Itemid=12). The AACR-Women in Cancer Research offers membership to all AACR members, and is dedicated to achieving full participation of women in cancer research by recognizing their scientific achievements and fostering their career development and advancement in cancer research through all stages of their careers (<http://www.aacr.org/home/membership/-association-groups/women-in-cancer-research.aspx>).

Many institutions have taken the initiative to include strategies for recruitment, retention and advancement of women as indicated in a recent AAMC Benchmarking report (<https://www.aamc.org/members/gwims/statistics/>). In our own experience, the Perelman School of Medicine at the University of Pennsylvania developed a dean-funded program entitled FOCUS on Health and Leadership for Women (www.med.upenn.edu/focus/). As stated on its website, FOCUS collaborates with other medical schools, universities, national committees, and women in medicine programs to explore institutional change that fosters a more diverse faculty in the community of academic medicine. Furthermore, the chief of the GI division at the University of Pennsylvania, Dr. Anil Rustgi, who is a tremendous advocate for women and diversity, established a Women in Gastroenterology Committee in the GI division dedicated to the recruitment and retention of women in the field of Gastroenterology; and educating and encouraging research in women's health issues in Gastroenterology. Activities sponsored by this Committee include meetings between clinical and research faculty to discuss unique and common goals of women in the Department, as well as an annual dinner, which serves as both a networking and social event and features exceptional women in our field as a speaker and guest of honor at the dinner. These are all encouraging directions to develop new contacts and open the door for women to mentor, support and promote each other. Workshops on topics including negotiation, networking, time management and public speaking are increasingly available and we encourage women PhDs in GI to take full advantage of them. These types of events should evolve to discuss strategies to meet new challenges such as current reductions in research funding and be publicized and made accessible to all trainees. Such events should be incorporated into the workday so that they are accessible to parents who have a less flexible before- or after-work schedule.

Seeking out (and training to become) an excellent mentor

Access to excellent mentoring is essential to any individual training plan or the pursuit of a career in science, and is a key to retention and advancement of women in science. Confidence building is often essential for young women trainees. It is therefore advantageous for mentees/investigators in the early stages of their career to identify a senior mentor(s) (woman or man) who has the authority and willingness to recommend them for speaking opportunities, manuscript reviews, service on important committees, and to network with visiting scientists and clinicians. The mentor should also guide women to engage in career advancement activities that they enjoy and will bring some personal or tangible growth or reward, and to avoid over-committing. For women who plan to have children, or already have them, pro-family mentors can be identified by word-of-mouth and careful discussion with lab or department members or by directly asking the mentor prior to taking a position. In this regard, trainees should identify mentors who fit their career goals and trajectory, but can also guide and allow them to achieve an optimal work-home life balance.

Beyond senior mentor(s), it is advantageous to assemble diverse mentors at various career stages. Peer-mentors who are closer to the specific challenges that may be faced can be particularly valuable. In this regard the smaller size of PhD training programs compared with Medical School class size, and the distribution of PhDs across different labs poses unique challenges in developing a cohort of peer mentors and networks. Our experience suggests that T32 or K12 career development programs that include regular meetings between trainees across labs and years of training, and between PhD and MD investigators are enormously helpful in building cohorts. Peer or senior mentors from other departments or institutions can bring fresh and objective perspectives.

It is also important to facilitate the identification of new mentors and networks as new investigators aspire to the next level. Many of us have opportunities to network with Visiting

Professors, but these opportunities are usually short and rarely focused on specific issues for women scientists. It would be useful to consider asking visiting faculty if they are willing to have a networking/mentoring session devoted to women's issues or work-family balance. Specific 'Visiting Mentor' awards to allow women and men role models to spend more time than the typical 1–2 days and develop deeper connections with new investigators and trainees would also be valuable. This would have to be with the recognition that Visiting Professors are busy people, and that engagement in such activities should bring some recognition and reward.

Empowering ourselves

In addition to the barriers intrinsic to the academic system and society, there may be self-imposed barriers that we could try to empower ourselves to overcome. These include sub-optimal self-confidence, and dialing back on our aspirations based on a perception that compromises just have to be made. These obstacles are often underestimated and discussed only informally, but they merit more attention. When facing a career milestone or new opportunity, each of us has benefited from talking to a colleague about self-perceived deficits that don't actually exist, so taking advantage of the sisterhood is highly recommended. Making time to participate in workshops, training, and mentoring opportunities offered by the institution and professional organizations is advantageous. Getting involved in committees and networking opportunities is a great way to be heard and to help effect change. Stepping outside one's 'comfort zone' is critical for individual advancement, and the more this is done, usually the less uncomfortable it becomes. Finally, seek inspiration from the perspectives of high-profile women within and outside of science. Many of the principles for women to succeed transcend professions, including the need for women to support and promote each other, "sitting at the table" (not choosing the seats at the back or the side), welcoming challenges, taking some risks, and gaining the confidence to lead. These are all areas we should work on to optimize our environment and career satisfaction^{21, 22}.

Conclusion

One major goal here is to highlight that this is an exciting time for women PhDs in GI research and science as a whole, but also to promote change by raising awareness of and outlining strategies for the elimination of invisible, external and internal barriers to success of women PhDs in GI research (Table 1). Aside from equality issues, the representation of women at all career stages in GI research is critical to appropriate return on the investment made in the education of young women, who outnumber or equal men in many biomedical PhD programs. Their representation is essential to facilitate attention to sex-specific differences in GI biology, health, and disease, and to ensure that the perspective of those who make up 50% of the general population is heard in policy making and decisions about critically needed research and clinical directions. Our hope is that this commentary will facilitate discussions on how we can work to ensure that women PhDs achieve their goals in GI research in order to maximize the benefit of this talented pool of investigators.

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Table 1

Recommendations to overcome barriers experienced by women in academia

Barriers	Current Strategies	Opportunities For Improvement
Double-minority status of women PhDs in clinical departments	<ul style="list-style-type: none"> Seek early interactions with clinicians (through informal or formal mechanisms) Persist outside of 'comfort zone' 	<ul style="list-style-type: none"> Visit labs/attend seminar series in clinical departments to learn new techniques or the clinical background to your research and increase your network See Barrett and Montrose <i>Gastroenterology</i> 2012;143:278–81
Implicit biases	Discussed mostly in commentaries	<ul style="list-style-type: none"> Promote open dialogue about biases Include in ethics training and changes to search committees Host seminars about bias Appreciate and screen reference letters for implicit bias Increase invitations for women speakers, reviewers, editorial board members
Non-events (inadvertently excluding women from activities)	<ul style="list-style-type: none"> Discussed mostly in commentaries Addressed informally 	<ul style="list-style-type: none"> Raise awareness of this issue and promote open discussion in labs, departments, institutions Increase invitations for women speakers, reviewers, editorial board members
Work-life issues	<ul style="list-style-type: none"> Flexible work schedule Access to quality and affordable childcare, lactation rooms, technical and/or administrative support (available to some, not all) Extended tenure clock Re-entry programs 	<ul style="list-style-type: none"> Expand, improve and incorporate into institutional policy the resources listed in current strategies Consider additional strategies that focus on maintained productivity and career trajectory (for example, resources to assist working from home, or on-site childcare) Incentives for mentors to facilitate effective work-life balance for their mentees Encourage time for visiting scholars to specifically address these issues
Internal barriers	Discussed privately	<ul style="list-style-type: none"> Discuss openly Seek inspiration and role models Take advantage of available opportunities 'Sit at the table' and step outside of 'comfort zone'