

Women in Science: Hints for Success



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For those who do not know us, let us first introduce ourselves. Both of us are basic scientists who have devoted our research careers to GI topics. We are beyond retirement age as defined by Social Security (and not giving more details), but still fully engaged in our careers. Both of us have raised families

and one of us has managed twins. We are not diverse racially or ethnically (more the pity) but are diverse in other ways. One of us was raised in an educated family in the United States; the other was raised in an uneducated farming family in Australia. One of us (M.K.E.) has spent her entire career in basic science departments and has worked on topics that have direct application to clinical gastroenterology; in contrast, S.J.H. has spent most of her career in clinical departments doing research that may ultimately have such applications, but is inherently more basic. We have both had continuous funding from the National Institutes of Health (NIH) for >40 years. Both of us have received various awards for our life work and one of us (M.K.E.) is a member of the National Academy of Sciences. Combined we have trained 39 graduate students, 20 MD fellows, 49 PhD fellows, 5 medical students, and 12 junior faculty. Most important, we both think a career in science is exciting and rewarding and remain passionate about our continued involvement.

In the remainder of this article, we have tried to distill our combined experiences into a list of hints for success and to illustrate 10 of these with vignettes from our careers. Additional hints are summarized in the [Appendix](#). We also encourage you to read a commentary with recommendations to overcome barriers experienced by women in academia.¹

Have a Career Plan, But Be Prepared to Deviate

There are numerous reasons why we feel that flexibility is part of the recipe for success. Be prepared to follow an

unexpected opportunity, such as a serendipitous observation in your research, a new source of funding, or a change in career direction. In addition, deviation from an initial career plan may be important to maintaining family stability, which in turn enhances the likelihood of success.

From Susan:

As a graduate student, my career goal was to become the first female chairman of a biochemistry department in Australia. For personal reasons I decided to stay in the US after my postdoc, so the Australia bit went out the window. But during my first 15 years as a faculty member, I still felt I would like to lead a basic science department. Then when the invitations to apply for such positions began to show up, I realized they would require relocation, which was not desirable at that juncture for either my husband or my 3 children. Around the same time, I was invited to join a clinical department – where I could never be chairman but I discovered the challenge and stimulation of mentoring physician-scientists, which remains a passion to this day.

From Mary:

As a junior faculty member studying tumor viruses, I initially struggled to obtain independent research funding to study mechanisms of adenovirus-induced cancer. A publication in *The Lancet* suggested that a newly discovered virus (subsequently named rotavirus) associated with gastroenteritis in children might cause Crohn's disease. I recognized that my molecular skills acquired in studying tumor viruses could test this idea if I could get access to Crohn's disease patient tissues and controls. My first grant from the Crohn's and Colitis Foundation allowed me to learn about translational research and, although we found no evidence for rotavirus being associated with Crohn's disease, my molecular studies on rotavirus changed my research area and career path. I discovered how fortunate I was to have clinical gastroenterology colleagues who would collaborate and I learned how important their

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clinical perspective was for stimulating new ideas about my basic science studies.

Read Broadly; Keep an Open Mind

Advances are made by scientists who have insight, are creative, and lead the charge. These individuals recognize the important, big picture questions that need to be answered and are willing to think outside the box. They read constantly, both about their current research, but also more widely. New technological breakthroughs developed in diverse areas of research, and frequently other than one's own, often bring a fresh approach to tackle a long-standing problem in your research area.

From Susan:

The first 15 years of my career were spent in biology departments where I carried a relatively heavy undergraduate teaching role. Rather than bemoan the extent to which teaching might have been detracting from my research, I took the attitude that teaching was forcing me to have broader knowledge than many of my competitors. Further, I believe that breadth of knowledge (which I have tried to maintain into the present by subscribing to both *Science* and *Nature*) was a key element in my funding success.

From Mary:

My research career changed several times as a result of my reading broadly and being willing to adapt newly developed technology from other fields. One example is my using the baculovirus expression system, shown to be effective in producing mammalian proteins, to produce rotavirus proteins to understand their function. I sought systems other than *E coli*, because I knew some of our proteins underwent posttranslational modifications that would not be made in bacterial expression systems. Our work was among the first to show the utility of this system to study viral proteins and to demonstrate that expressed proteins form functional oligomers including virus-like particles. A second example is my pursuing human intestinal organoid/enteroid systems to pursue new questions about human host-pathogen interactions.

Be Prepared to Take Risks; Venture Outside Your Comfort Zone

Personal discovery and development often happen outside your comfort zone. Opportunities will arise that you might not expect but can be eye opening experiences. Occasionally, it is good to expose yourself to new experiences outside your normal routine or comfort zone.

From Mary:

My career plan had always been to do research, but as I matured, others encouraged me to think of taking a

leadership position. Finally, with reservations, I looked at a few chair positions and even a directorship of a new vaccine center. Pushing myself to go to these interviews led me to rethink my career and reinforced my feeling that an ideal job for me would be to be a "director of research." Ultimately, I decided I would accept the challenge of trying to strengthen the GI research environment at Baylor and developed a NIH-funded Texas Medical Center Digestive Diseases Center that stimulates interactions between basic scientists, physician scientists, and clinicians. Taking this step was a risk because I really was a virologist, not a bona fide trained digestive disease investigator, and I questioned whether I knew enough to be an effective GI leader.

Think Strategically; Find a Niche

Early on, figure out positive ways in which you are different from your colleagues/competitors and develop these. Be prepared to invest time (and sometimes money) in training or enrichment opportunities that help you create a unique research niche.

From Susan:

After 12 years of studying the physiology of intestinal development, I realized that a mechanistic understanding of the regulatory influences on this clinically important topic would require a molecular approach. To equip myself for this new direction, I secured NIH funding for a full year sabbatical in a lab that was doing cutting edge molecular and cellular biology (on another organ system). Since then, my niche has been as a gut physiologist who has thorough training in molecular and cellular techniques. I feel this has given me a significant advantage over physiologists who don't have the extra training but merely dabble in molecular and cellular biology; also over those trained in the latter area but lacking in the physiological underpinning.

Be Tenacious, Persistent, and Resilient

Scientific careers, complex scientific problems, and great relationships are not typically accomplished overnight. This may seem difficult to appreciate in today's world driven by instant gratification and instant messaging. Success in science requires persistence.

From Mary:

There have been several times in my career where persistence was essential. An example in my mid-career was after we discovered that rotavirus produces a protein that functions as an enterotoxin, the first viral enterotoxin. This discovery was met with skepticism by some colleagues who challenged our results. To address the criticisms, we slowly

gathered evidence to answer the questions. By providing reagents, others confirmed our results. A second recent example is that despite my seniority and stature in the field, I had to write my rotavirus RO1 four times before it was refunded! Fortunately, I was able to obtain interim funding from the NIH and local resources so my program could survive. Being in a supportive environment is often critical to allow one to be persistent. This exemplifies that obtaining research support is difficult and one must learn to write superb grant applications that contain fresh and novel ideas to be competitive in today's environment.

Believe in Yourself and Your Science; Be Confident and Optimistic

Winston Churchill is quoted as saying, "A pessimist sees the difficulty in every opportunity; an optimist sees the opportunity in every difficulty." We feel that one of the wonderful things about science is that it is inherently optimistic. If we did not believe that we would be able to answer the research questions posed, why would we bother to try?

From Susan:

Over the years, the worst score I ever received on an NIH Grant was the 56th percentile (for a proposal to take my research in a totally new direction). Upon receiving the reviews, I felt that the overall rationale of the proposal had been misunderstood. So I vigorously defended my position in my revised application with the consequence that the revised score moved to the 5th percentile and resulted in designation as an NIH MERIT Award. Note that lest readers feel this is something that could have only happened in the past, in February of this year one of the young faculty of our department (who I have informally mentored) succeeded in moving his score from the 47th percentile to the 6th percentile.

Do Not Be Afraid of Collaborating, But Choose Your Collaborators Carefully

Team science is becoming the dominant paradigm in many research areas. There are benefits from this, including being able to address increasingly complex scientific problems, often by applying sophisticated conceptual and methodologic approaches that draw on multiple disciplines.

From Mary:

My career illustrates that it's possible (and enjoyable) to collaborate with individuals in many fields and such collaborations often result in new and exciting discoveries. I have had wonderful interactions and learned from gastroenterologists as well as have had other, long-lasting collaborations

with a structural biologist, infectious disease clinical investigator, and other virologists. Initially, it was intimidating to try and work with others when I didn't understand their language or the details of their methods. My successful collaborations have benefitted from each individual being an expert in his or her field; each individual was confident in their skills, passionate about their work, and no one has been egocentric. These qualities have led to a research environment based on trust, which I find is the key component for successful interactions. It becomes easy to recognize individuals who lack true interest in collaborating but approach you to enhance their own agenda. It is best to avoid such circumstances; these become instances where it is wise to politely say, "No, thank you."

Pick Your Battles and Do Not Be Intimidated

A burdensome feature of our gender is that we tend to always think others are brighter, more knowledgeable, more worthy, and so on. This leads to a tendency to stay quiet rather than speak up. Staying quiet may be the best approach in some circumstances, but not so in others. Thus, you have to analyze each situation carefully and pick when to go to battle and fight.

From Susan:

In 1971, when I arrived from Australia as a postdoctoral fellow at Stanford, I joined the lab of a very prominent and assertive physician scientist (NK). On my second day in the lab (when I was frightfully homesick) I saw NK verbally "demolish" another female post doc in the lab. My reaction (under my breath) was "He is *never* going to do that to me." As a result, the first time he challenged me I stood my ground and immediately earned his respect. We went on to have a very productive mentor/mentee relationship and NK was a valuable career advocate for me throughout his life.

From Mary:

After I was promoted to assistant professor from being a postdoctoral fellow at Baylor, I realized I hadn't received a raise. When I approached my departmental chairman, I was asked, "Why do you need a raise? Doesn't your husband have a job?" After explaining that my husband's salary was not relevant and I should be treated like any other new faculty member, I received a raise and subsequent full support from my chairman, a wonderful scientist.

Learn to Manage Your Time

Managing time is a learned skill that is critical for success.² Many women with families and a career learn they

must get organized if they are to balance the many responsibilities they face with the need to be productive.

From Mary:

I had some time management skills that got me through graduate school, but compared to others, I am not a naturally highly organized individual. This became an issue when my responsibilities increased as a junior faculty member with two young children. I realized I had to become more organized. I took a 1-day course on time management and learned many helpful tips. My skills greatly improved and I learned to easily set daily, weekly, and long-term goals. Over the years, I have learned to start and complete tasks early because you really can't predict what last minute crisis may interrupt you as you approach important deadlines. I see many young investigators who struggle until they learn this skill. Fortunately, there are many resources available today for trainees to acquire such skills.

Be Obliging and Collegial, But Learn When to Say “No”

Scientific research is virtually always conducted within a community—whether it be the small community of your own group, the larger communities of your division, your department, and your institution, or the national/international community of scholars in your field. All these function best when their members are “good citizens” and all require some level of “volunteer” service. So you need to be obliging and accept your share of service. But be vigilant about your time commitments. This issue can be particularly difficult for women and minorities, as illustrated in the following vignette.

From Susan:

During my early/mid-career I spent 10 years as the only female faculty member in a biology department of approximately 25 faculty. Repeatedly I would be asked to serve on various committees because “we need a female.” Initially I accepted all, because I felt it was important to have female representation (which it is). Then I realized that my total service load far exceeded that of my male colleagues and was likely to jeopardize my research productivity. Recognizing that this would have an adverse effect on the cause of women in science (“we hired a woman but she failed

to get her grants renewed”), I started to be selective in my service activities.

Looking Back and Projecting Ahead

As we worked together on this, we discovered that beyond the specific hints, we both have the overarching view that, regardless of gender, ethnicity, or background, a life in science is not an easy path. You have to love it! If you do, the “fire in the belly” will carry you through the difficult times and will inspire you to keep reaching for new ideas. Further, although your specific body of accumulated knowledge and wisdom is virtually impossible to pass on to trainees/mentees, your passion can be an igniting force for them. For both of us, upon reflection we realize that the greatest rewards of our careers are not any accolades we may have received, but rather the thrill of watching our trainees/mentees build their successful careers.

Appendix. Additional Hints for Success

Be resourceful and take advantage of your environment.

Learn to give great clear, exciting talks that are tailored to your audience.

Accept that bold ideas will always make someone uncomfortable.

Be loyal: to your seniors, your peers, and your trainees.

Build up a network of mentors and sponsors.

Learn to listen and execute based on productive criticism.

Do not be afraid to ask for help.

Never compromise quality for quantity in your scientific output.

Invest in training junior scientists, a win-win endeavor and rewarding.

Treasure your personal life and do not feel guilty about it.

References

1. [Hamilton KE, Tetreault M-P, Lund PK. Opportunities and challenges for women PhD investigators in gastrointestinal research. *Gastroenterology* 2013;145:266–271.](#)
2. [Andrade FH. Time management in the busy professional environment: take that first step. *Gastroenterology* 2013; 145:36–38.](#)

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Conflicts of interest

The authors disclose no conflicts.