Research in Academic Colon and Rectal Surgery: Keys to Success

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ABSTRACT

In the current medical climate, there is increased pressure on colon and rectal surgeons to generate clinical revenue and decreased availability of time and resources to do research. For faculty who want to pursue research as part of an academic career, this article reviews some of the issues involved. The first half of the article discusses key issues in choosing the right job, such as institutional/departmental support and resources. The second half of the article discusses what is needed to make a research program successful, including funding mechanisms, mentors, collaborators, and the different requirements for basic science versus clinic research.

KEYWORDS: Academic surgery, research, colon and rectal surgery, grants

Objectives: Upon completion of this article, the reader should be familiar with the keys to success in academic colon and rectal surgery.

There is not extensive literature available on the subject of performing surgical research in an academic setting and even less on research in the field of colon and rectal surgery. Therefore, this article is a combination of a review of the available literature and resources and the author's experiences and advice. Several websites where more information is available are included in this review.

This review is sorted into two sections. Section 1 is about looking for your academic colon and rectal surgery job from a research perspective, and section 2 discusses getting started on your research and make it successful when you have your job. There is overlap between the two sections as many topics are pertinent for both.

The first thing you need to do before you begin your job search or at least before you settle on a job is decide what role you want research to play in your career. Consider the following questions:

1. How much time do I want to spend doing research (i.e., how much time do I want to spend being an operating colon and rectal surgeon)?
2. What type of research do I want to do? Research can be divided into three types: pure basic science research, pure clinical research, and a combination of both or translational research. Being able to place yourself into one of those three categories will also help you to assess whether the job you are looking at has the resources that you need to be successful in your research.
3. What subject, disease process, or molecule do you want to research? If there is a specific disease process that you want to study or you would like to continue research you have done previously, it is easier if you choose a job where there are similar interests. For example, if your interest is in inflammatory bowel disease (IBD) research, a job at a major cancer center might not be appropriate. If you do not have a

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specific predetermined interest, the field is more open.

PART 1: WHAT TO LOOK FOR IN AN ACADEMIC JOB

Choosing the Right Job

One of the important determinants of how successful you will be in an academic surgery career is choosing the right job. You need the appropriate support and resources to perform successful research. Without it, your research interests can become buried under the pressures for clinical productivity. The following are important issues to consider.

Environment

Consider the following questions:

1. Is the environment of the institution conducive to you having a successful research program? That is, will the institution pay your salary while you do research or does research have to be on your own time?
2. Are there others in the department who do research or will you be the only one?
3. Are there others in the institution who do research or will you be the only one?

These questions are interrelated and are a big determinant of how successful you can be doing research at a particular institution. You must consider how much research the department you are joining (be it a colon and rectal or a surgery) does and how much research is done in the institution overall. It is easiest to start a research program in an institution and department that has an obvious research interest and appropriate support. If the department you are considering joining has no track record in research but wants to develop a research program, you need to realize that this will take a great deal more work on your part. Although starting a *de novo* research program can be done, it is not recommended for someone without significant prior research experience.

Support Systems

COLLABORATORS

It is hard to do basic science or clinical research in a vacuum. From the basic science standpoint, collaborations with basic science faculty (if there are any at the institution) are invaluable. They can often bring a different perspective to the project and may have

knowledge of complex techniques that you did not have any idea existed. An opportunity to work with a funded investigator in your field will help you to become more familiar with the field and to carve out your own niche.¹ From the clinical research standpoint, many clinical trials require participation from several different specialties. For example, the recent American College of Surgeons Oncology Group (ACOSOG) study looking at chemoradiation in addition to local excision for small T2 rectal cancers requires the participation not only of the colon and rectal surgeon but also of the medical oncologist and radiation oncologist. Not only will collaborators help you with your research, but you will probably be able to become involved in their projects, thereby expanding your research productivity.

CORE FACILITIES

Large equipment that is too expensive for individual investigators is often purchased by the institution and maintained in a core facility. It is then available to all faculty, usually at an hourly rate. Other services that can be provided by an institutional core facility are creation of probes, primers, and possibly microarrays. As an example, the core facility at the Penn State Milton S. Hershey Medical Center provides the following: protein/peptide sequencing, peptide synthesis, oligonucleotide synthesis, mass spectrometry, transgenic mouse facility, molecular genetics core facility, confocal microscopy, deconvolution microscopy, electron microscopy, fluorescence microscopy, histology service, flow cytometry core facility, microarray analysis, custom microarrays and protein arrays, quantitative real-time polymerase chain reaction (PCR) systems, laser capture microdissection, mass spectrometers, 1D and 2D gels, quantitative proteomics, magnetic resonance imaging/magnetic resonance spectroscopy (MRI/MRS) facility, and a bioluminescent imaging facility. Although some of these services such as peptide synthesis could be purchased from an offsite company, others such as flow cytometry have to be on site. If your research requires or is likely to require this type of equipment, you must assess its availability prior to undertaking any projects.

GRANTS OFFICE

Grants offices can be very helpful in running a research program. They often keep a list of available grants and send out notices from funding sources. They can also be very helpful in the preparation of grant applications from simply just mailing them to the right place, to making sure the final application conforms to the instructions, to editing the grant application. In addition, any internal grants from the institution are usually administrated through the grants office. The grants office may also provide resources and seminars for grant application writing.

COMPENSATION PLAN/PROMOTION

Although there are still a few institutions that pay faculty a straight salary regardless of productivity, many institutions have some sort of incentive or bonus plan. You will need to inquire how the plan works (or if you are eligible; some institutions do not offer incentives to junior faculty). If bonuses are strictly for clinical productivity, this may be a barrier to research as you may suffer financially for doing research instead of taking care of patients.² You need to find out if there is a "research equivalent incentive," that is, a monetary award for publishing papers, giving presentations, and being awarded grants.² An institution that wants to foster young researchers should have a plan that rewards research or at the very least does not penalize faculty for spending time doing research.

Finally, what is the basis of promotion? Is there a tenure track? Are there minimum requirements in numbers of publications, grants awarded, and so forth required for promotion? These questions are important, and answers should be readily available. You will need to judge whether or not the parameters set by the institution for promotion are realistic goals for your career.

Resources to Ask For

The following discusses important resources you will need to implement a research program. Although you may not be offered all of them, unwillingness by the department or institution you are considering to provide any of these resources should raise red flags.

START-UP FUNDS AND SPACE

This is especially important in basic science research. You will need space to do the experiments, money to buy supplies and equipment, and money to hire a technician. You do not need to have your own laboratory but at least need designated space in one of the department laboratories, preferably the laboratory of someone who can and is willing to act as a mentor. Not only do you need space to do experiments, you also need storage or freezer space and a place for your technician to work or sit with computer access. If you are performing only clinical research, space is not as important, but other resources such as hospital databases and institutional review board (IRB) support should be available.

You should be told up front how long the department is willing to support or fund your research. This will be your deadline for obtaining extramural funding. Most institutions offer between 2 and 5 years of support. An open-ended offer of financial support is also acceptable as long as it has a minimum of 2 years of support. One year is not enough as you will not have time to generate data, write a grant application, and obtain funding in 1 year.

SUPPORT STAFF

Depending on the type of research you are doing, you will need different support staff. For basic science research you need a technician to perform assays and to assist you with assays. You will get nowhere fast if you do all the technical work yourself. This is not to say that you cannot do some of the science yourself, but you will also need help (or someone to finish the assay when the colonic perforation comes into the emergency room). Ideally, you would have your own technician, but at the very least you need to have one you share with at most one other investigator. When considering salary for these people you must remember to factor in benefits, which are usually at least 25 to 30% more in addition to their salary.

For clinical research, you will need to have access to a clinical trial coordinator or assistant. Clinical trials, especially industry ones, require a great deal of paperwork, scheduling of follow-up visits, laboratories, and so on that you will not have time to do. Most industry-sponsored trials will pay for the coordinator's time; however, unless you have several industry trials going on at the same time, you will be unable to pay the whole salary of a coordinator without financial support from the department or institution.

PROTECTED TIME

Protected time is probably the most difficult thing to define and commit to both from an institution or department perspective and from a junior faculty perspective. However, some time free of clinical and administrative responsibilities is necessary for the development of a research program. How much time depends on how much of a role you want research to play in your academic career. Use of and protecting protected time are discussed later.

PART 2: ONCE YOU HAVE THE JOB

Basic Science versus Clinical Research

The first thing to consider is what type of research you want to do and assess what experience doing that type of research you have. You can do pure basic science research, pure clinical research, or a combination of both, often called translational research.

BASIC SCIENCE RESEARCH

Pure basic science research involves "bench top" research, usually with cellular and molecular techniques and possibly with animals. Human subjects are involved only in that they may be the source of tissue, proteins, or DNA. Often this type of research requires some experience, either a research fellowship during your general surgery residency or colon and rectal fellowship or more formal coursework and an advanced degree (master's, Ph.D.).

That being said, it is harder but not impossible to perform basic science research without previous experience. For those with less basic science experience, collaborators and mentors are even more important. If the institution is associated with a graduate school, it may be beneficial to enroll in or at least audit some of the courses. A K08 (see later under grants) from the National Institutes of Health (NIH) is a mentored basic science training research grant that pays for protected time for training and research in the basic sciences.

CLINICAL RESEARCH

To do clinical research you must have access to an established clinical practice to provide the foundation and the subjects for that research.³ If the appropriate population of patients does not exist at your institution, you may need to spend the first few years of your career building a base of patients. If you join an established practice, the patient base may already be present.

There are two main types of clinical research: investigator driven and industry driven. Investigator-driven research is research designed to look at a specific problem or answer a specific question. Prospective randomized trials are the “gold standard,” but they are difficult for young academic surgeons to start on their own. They may also be difficult to design and require significant administrative and statistical support.^{4,5} Many new clinical investigators lack the appropriate training to design these trials. Formal courses in clinical research are available either at specialized meetings or as parts of societal national meetings. Training in the conduct of clinical research including privacy (Health Insurance Portability and Accountability Act) and patients’ safety is often available from the IRB. Retrospective studies and chart reviews are less rigorous but provide the new investigator training in methodology while still being important clinically.³ Outcomes research is also becoming more popular. This involves assessing our practices, that is, costs and length of stay. If this is the type of research that interests you, you must make sure that this information and the appropriate administrative support are available at your institution.⁴

Industry-driven research is designed and sponsored by the company with the goal of proving that its drug or device is safe, effective, and better than what is already available. An example is a trial comparing standard preoperative antibiotics with a new antibiotic, sponsored by the company that makes the new antibiotic. Although this type of study may not be particularly interesting to you from a scientific standpoint, the sponsoring company usually pays a fee for each patient who is enrolled. There are also industry-sponsored trials that are more clinically interesting, such those previously done looking at the efficacy of antiadhesion products (Seprafilm[®], Genzyme, Cambridge, MA). The fees generated from these studies can often be used to offset

some of the costs of unfunded or underfunded investigator-driven clinical trials.

Performing any type of prospective clinical research requires the support of a clinical trial coordinator or nurse. This person will need to be involved in enrolling the patients you have identified, coordinating the trial (e.g., scheduling laboratories, colonoscopies), collecting the data, and completing the paperwork. If the institution has a clinical trials office, it can often be helpful with performing trials. Finally, in designing your own trial, collaborating with a statistician to make sure the power of your trial is correct is mandatory.

TRANSLATIONAL RESEARCH

Translational research is definitely the “buzzword” in research today. Translational research is applying basic science to clinical medicine and is a combination of the preceding types. An example of translational research would be looking at protein markers of tissue damage during diagnostic or therapeutic procedures.

PROTECTING YOUR PROTECTED TIME

This is one of the most difficult aspects of academic research. You must protect your time from the department or administration but also from yourself. Young faculty members want to and need to build a clinical practice. It is hard to turn down or give to a colleague a consultation for a colectomy in a patient with toxic colitis that you know will need an ileal pouch in 6 months. Also, young faculty want to appear eager and available so that consulting physicians will call them. This, however, can impede the development of an active research program. Research time is often eaten up with consultations, doing cases that did not fit on your regular operating room day, completing charts, going to meetings and conferences, and other nonresearch activities.⁶ You must be diligent in using your protected time for research.

The opposite, however, may also be true for new faculty who do not join an overworked practice. They may need several months to a year to build a truly busy clinical practice. The downtime while building the clinical practice can be used to jump-start a research program.⁴ However, once busy, faculty members must continue to protect their time. A final deterrent to protected time is compensation or bonuses based on clinical activity.

Solutions to these issues are not simple. One remedy is to seek funding that partially supports your salary, such as the K series grants from the NIH (see later). Other options include being selfish with your research time by not scheduling meetings on those days and having your colleagues cover any clinical emergencies.

CHOOSING A MENTOR

All young academic surgeons should have someone to help guide them in developing their academic career.

Obviously, the best choice would be a senior colon and rectal surgeon in your department with the same academic interests as you have. Unfortunately, you may not find everything you need in one person. One option in that situation is to have a separate clinical mentor and a research mentor.³

The person you choose to be your mentor should be someone who can help direct your career and outline a 5- to 10-year plan.⁶ He or she can advise you on which hospital committees and national societies to join and help have you nominated to committees in those societies.⁷ The mentor may also pass on writing and speaking opportunities. In addition to helping you write grant applications and manuscripts, your mentor should be able to help direct your research and suggest funding sources and appropriate journals for publishing manuscripts.

GRANT APPLICATION WRITING

Grant application writing can be difficult and time consuming, but the more often you do it the easier it becomes. A well-written, well-thought-out grant application that leads the reader through the grantee's thought process, including the experimental plan and potential outcome, is mandatory for funding. Even if the science is innovative and the preliminary data are spectacular, the research will not be funded if the readers cannot follow or understand the grant application.

Resources for Grant Application Writing Depending on your level of experience, you may want to go to a course, seminar, or lecture on grant application writing. At the very least, reading some of the available guides is helpful. Resources include:

1. Institutional grants and contracts office. For example, our institution maintains a website that has articles on grantsmanship and "guide for writing a funding proposal" that also provides links to other sites (<http://www.hmc.psu.edu/ora/resources/grantsmanship.htm>). Our grants and contracts office offers a seminar in grant writing on a yearly basis. It is likely that your institution has a similar resource.
2. The NIH website (www.nih.gov) has extensive resources for grant writing including tutorials (<http://www.niaid.nih.gov/ncn/grants/default.htm>) such as "How to write a grant application" and "Grant application basics."
3. Specialty societies and national meetings often have a grant writing seminars. For example, a seminar entitled "Grant Writing Symposia for New Investigators" was held at the American College of Surgeons (ACS) meeting in fall 2005.
4. There are also numerous courses offered on line, but the quality and cost effectiveness of these are unknown to the author.

Funding Sources Although NIH funding can be considered the most prestigious, there are many other sources for funding. First, however, there are many types of grants available from the NIH (http://grants1.nih.gov/grants/funding/funding_program.htm). The R01 is the traditional investigator-initiated grant and is usually several hundred thousand dollars a year for several years. These grants are difficult to obtain, especially as the government cuts the budget. They are usually awarded to investigators with extensive preliminary data and a proven track record in the field. An R03 is a grant for smaller, preliminary projects. In addition to its more traditional grants, the NIH has the K series grants, which are mentored career development awards. The ones most applicable to colon and rectal surgeons are K08 and K23. These are mentored clinical scientist (K08) or patient-oriented research (K23) career development awards to develop independent clinical research scientists. The K30 is an institutional program to develop a clinical research curriculum. The NIH also puts out RFAs (requests for applications) and PAs (program announcements) to encourage research in certain subjects.

At the NIH, grant applications are submitted to a study section for review. Choosing the appropriate study section is important because this is also your competition. There are two surgery study sections: Surgery/Biomedical Engineering and Surgery, Anesthesia, and Trauma. There are also study sections dealing with digestive diseases (http://www.csr.nih.gov/Roster_proto/sectionI.asp). Deadlines for submission to the NIH are February 1, June 1, and October 1. Forms, applications, and instructions are available on the website.

Many surgical societies and disease specialty societies (cancer, IBD) offer research funding. The American Society of Colon and Rectal Surgeons (ASCRS) sponsors several types of grants including the limited project grant (LPG), a 1-year (with the possibility for a second year) award, and the Career Development Award. The awards are for research in the field of colon and rectal surgery. Information and applications are available at the website (<http://www.fascrs.org/display-common.cfm?an=18>). Table 1 lists a sample of funding available from the ASCRS and other societies.

Other sources of funding include regional societies such as the Central Surgical Association, funding from the Department of Veterans Affairs (VA) for those with faculty appointments at the VA, and other philanthropic societies. Internal departmental or institutional funding may also exist at your institution. This funding should always be pursued if you or your research qualifies. The competition is reduced because only those within your department or institution are eligible. Funding from these sources often provides money to do the preliminary studies that can be used for future NIH applications.

There are many websites that provide help in finding grant opportunities. One good one is the surgical

Table 1 Society and Organization Funding

Society	Type of Grant	Website
ASCRS	1. LPG 2. Career Development Award	http://www.fascrs.org/displaycommon.cfm?an=18
ACS	See website	http://www.facs.org/
Society of Surgery for the Alimentary Tract	Career Development Award	http://www.ssat.com/cgi-bin/awards_Career_Development.cgi?affiliation==
American Gastroenterologic Society	See website	http://www.gastro.org/wmspage.cfm?parm1=624
Crohn's and Colitis Foundation	See website	http://www.ccfaprofessionals.org/site/c.fqKLLSOvEIH/b.1310803/k.9649/Research_Awards.htm
Broad Foundation	See website	http://www.broadmedical.org/
Association for Academic Surgery	Roslyn Faculty Research Award	http://www.aasurg.org/awards.htm
Society of University Surgeons	1. Junior Faculty Grant Award 2. Clinical Scholar Award	http://www.susweb.org/forms.asp
American Cancer Society	See website	http://www.cancer.org/docroot/RES/RES_5_1.asp?sitearea=RES

This is a limited list of societal and organization funding that may be pertinent to research in colon and rectal surgery. If only one or two grants are offered, they are listed; if not, the reader is referred to the website.

ACS, American College of Surgeons; ASCRS, American Society of Colon and Rectal Surgeons; LPG, limited project grant.

clearinghouse sponsored by the ACS that lists all surgical grants (<http://web.facs.org/grants/default.htm>). Other sources include the Community of Science. Registration is free, and they provide e-mail notification of available funding (<http://www.cos.com/>).

Before You Write the Grant Application There are several things you should do before writing a grant application to make sure you do not waste your time and the reviewers' time. Make sure your project (and you) fit the grant. Many grants are directed at individuals at certain stages in their careers or in specific specialties. Do not apply for a grant that you are not eligible for. Always check the deadlines. Be realistic about the time it will take you to write the proposal, especially if you need to generate more preliminary data.

Writing the Grant Application A large part of grant proposal writing¹ is not what you say but how you say it. Talk to people with experience such as your chair, your mentor, or others who have had success in being funded before you undertake your first grant proposal. If you are writing a basic science grant proposal, it often helps to go to the basic scientists in the institution for advice. Borrow old funded grants to use as a guideline. Even if the topic is completely different, the grants will serve as an outline for formatting. Follow the instructions carefully. With very tight competition for funds, grant applications that do not follow the instructions may not even be reviewed. If the instructions say to use no less than 12 point font and 1 inch margins, do not use 11 point font so that you can squeeze in more text.

When writing the grant proposal, ask yourself, "What is the hypothesis?" The hypothesis must be clearly stated and supported by the background data. Your experiments must be designed to prove the hypothesis. Be clear and precise in your writing. Use the significance and background sections to show that you know the field.¹

Use preliminary data if asked for in the instructions. The amount will depend on the type of grant you are applying for. There are two types of good preliminary data. The first type is preliminary experiments that support your hypothesis or that lead you to your hypothesis. The second type demonstrates your ability to do the experiments suggested. This type of data can be from one of the collaborators on the grant, and the subject of these data does not have to relate to the grant as long as the technique does. When using technique preliminary data, be brief and focus on the technique.

Be able to support your methodology. Why is the method you chose better than the others?¹ Discuss the expected results. Also discuss why the experiments might not work or produce the expected results and what steps you would then take. Make sure you use the correct statistics and explain their use. If your project calls for

complicated statistics or power calculations, it may be beneficial to consult a statistician and to have a letter of support or collaboration from that person. Finally, do not try to fool the reviewers. They may have more experience with your subject than you do, and most likely they have more experience reviewing grant applications than you have writing them.

Have as many people read your grant proposal as possible. Especially look for people who sit on grant review committees. Someone who sits on review committees has a better idea of what types of things are looked upon favorably. Also have someone who is not familiar with your project read the grant proposal to make sure it is understandable to the person who is not immersed in the research. This will help ensure that what you want to say comes across clearly.

COLLABORATIONS

Collaborators are very important. As a busy surgeon, there is only so much time you can spend reading all the literature and designing and doing all the experiments. With collaborators, not only can you get help with your project, particularly if it involves a technique you are not familiar with, but also you can become involved in your collaborators' projects.

Some researchers will want to collaborate with you because they need access to your patients or their tissue or they need your surgical skills to create animal models. As an example, a colleague of mine has a nude mouse model of metastatic colon cancer. The creation of the model requires injection of the tumor cells into the spleen. I do the injections for her. These types of collaborations are easy and often mutually beneficial.

CONCLUSIONS

Research in colon and rectal surgery can be a successful and rewarding. Many of the obstacles to a successful career can be overcome by choosing the suitable environment for your research. Once in the job, finding the right mentor and collaborators and heeding their advice and experience will give the young faculty member the best opportunity to establish a prosperous research career.

DISCLOSURE

The author has no conflicts to disclose in reference to this article.

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