GETTING FUNDED

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Getting funded is still possible for cardiothoracic surgeons. You must have a clear hypothesis, have an organized approach, and develop excellent preliminary data. Most important, you need to apply to get funded. (*J Thorac Cardiovasc Surg* 2000;119:S26-8)

To perform basic research, you must have the background and the help of a faculty mentor. The most important initial step is to get the proper support, which involves some protected time and institutional support, from the Department Chair or Division Head.

Protected time is critical. The research experience during surgical residency or even before that time may not be complete, and further supervised training with 2 years of partially protected time in a new faculty position is needed. At least one half of the new faculty member's time must be devoted to an investigative career. The major responsibility for doing this belongs to the investigator. It is certainly easy to make bedside rounds, hang out in the cardiac catheterization laboratory, or spend all of your time in the operating room; but this approach will lead to almost certain academic failure. Institutional support requires at least 3 years of some start-up funds, laboratory space, and a technician. It is unrealistic to think that you will get significant research funding in anything less than 2 to 3 years. Finally, the new investigator needs to locate a senior colleague with similar research interests and an excellent track record of scientific achievement and funding to help the research get started.

It is important to carefully decide on the specific area of investigation that you wish to pursue. It should be clinically relevant. It may not be terribly important to study, for example, the lymphatic system of the heart in general. It will not hold your interest and probably not do a whole lot for the future of cardiac surgery. However, if the cardiac lymphatics are implicated in postpump myocardial dysfunction, this may be perfectly relevant and of interest. It is critically important to have a specific hypothesis that needs to be tested and

that is relevant to your research. This is opposed to doing a set of studies and observing what happens. The latter is poor science and is not likely to provide any information that is publishable or fundable. In addition, if you compete with the basic scientist on his or her own terms and do try to do research that they do well, you will not be able to win this competition. The basic scientist will have much more time than you will. To be most creative, the surgeon needs to relate his or her clinical time to research time. The strength of the clinician investigator is an understanding of the clinical problem, something the basic scientist often lacks. The basic scientist's strength lies in research methods. Therefore collaboration between clinician and basic scientist can be very successful.

You must develop the tools to do research. It may be that you will have to use molecular techniques. Here is an excellent example to develop a collaboration. There are several reasons for this. It is difficult to succeed at both basic research and clinical surgery: A collaborator makes success more likely by removing basic research or other obstacles in the way of the investigation; the collaborator may share the cost of the research, and finally, it is a lot of fun to have a collaborator. It keeps you interested in your research, and as important as any other reason, the National Institutes of Health (NIH) likes collaborations. A collaborator can be a basic scientist or senior faculty member in your department. Again, this collaborator has to have demonstrated success in research and success in getting funded. Unfortunately, these types of individuals are harder to partner with. The individual who has never been successful has the most time to help you. The collaborator will also help you design your research and support the research with equipment. The collaborator should have the ability to critique applications, review manuscripts, and tell you honestly when you are wrong and need to change the focus of your research.

Strategy for getting funded

As you begin your research career, you must aim at getting funded. The only way that you will be able to support a significant research laboratory is to eventually get NIH funding. Certainly, funding from industry is

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helpful, but often this comes with strings attached. You must learn the methods needed and develop sufficient preliminary data to prove to your eventual reviewer that you can do the studies. Most importantly, you must publish. Anyone can write down the proper methods in a grant. However, proof of the ability to do the investigation is demonstrated by a successful series of publications. This is critical to eventual funding. It also demonstrates to the reviewer a work ethic and suggests that you will not waste the funding that is awarded. Preliminary data and a strong group of publications are probably the most important facets to submit for a successful grant.¹

You must assume that some grants will be turned down; therefore you must submit multiple grants. There is nothing wrong with doing this. You merely must tell the funding agency that you have submitted other grants in the same area and that you will turn 1 or the other down, depending on whether you get funded. It is always helpful to begin with starter grants. There are usually institutional funds available locally. The local heart associations, lung associations, and cancer societies are extremely helpful. Industrial sources are possible. An important new source is The Thoracic Surgery Foundation for Research and Education. However, if you are going to stay in academia for the long term, you will need to go to the NIH. You should get to know the systems to which you are applying. You should visit the NIH and talk to individuals in the Institute who will provide your funding. You also need to know the study sections to which your grant will be submitted. For cardiac surgery, the study sections are surgery and biomedical engineering or surgery, anesthesia, and trauma. Each has members who are cardiothoracic surgeons. However, most individuals in these study sections are not; at least one half of them are basic scientists. You may direct your grants to 1 of those 2 study sections, if you wish. If you choose general thoracic surgery, you will often apply to other study sections that relate to the National Cancer Institute.

The NIH has several selected funding opportunities. The KO8 is a mentored clinical scientist development award that requires that 75% of the investigator's time be devoted to research. This means that you must have a senior mentor, but it does give you 5 years of funding. The issue for surgeons, of course, is the 75% time devoted to research. Another possibility along the same lines is the K23, which is a mentored patient-oriented research award. The NIH is trying to develop more funding for clinical trials and clinical research. This has the same type of funding but requires a 75% commitment to clinical or translational research.

Eventually, most investigators apply for RO1s. These are research grants for 3 to 5 years that pay somewhere between \$100,000 to \$200,000 per year, depending on the cost of the research. The time commitment is from 10% to 50%. The good news for cardiothoracic surgeons is that the 2 institutes that have the most funding at the NIH are the Cancer Institute, with 19% of the total of NIH funding, and the National Heart, Lung and Blood Institute, with 11% of the total funding. The funding at the NIH is at the best levels that it has been for many years. There was a \$100,000,000 increment in the 1998 budget and another \$117,000,000 increment in the 1999 budget.²

An important source of funding both for residents in research training and junior faculty member is the Thoracic Surgery Foundation for Research and Education. This foundation was initiated in 1993 by a joint effort of The American Association for Thoracic Surgery and The Society of Thoracic Surgeons. It now has assets of over \$8,000,000 that are derived primarily from donation by physicians and industry. It provides initial research grants (approximately \$50,000) and career development awards to young cardiothoracic faculty members, based on the quality of the application. There are, in addition, funds in the Foundation for specific purposes such as The Braunwald Awards in honor of Nina S. Braunwald, the first woman surgeon in the United States, that are restricted to female applicants. More details can be obtained by writing to the Thoracic Surgery Foundation for Research and Education.

Writing the grant and interpreting the review

There are several excellent books that relate to grant writing.³ However, in brief, you must start with a clear hypothesis and specific aims. The budget should be realistic and not inflated. An inflated budget always incites the ire of the reviewer. You must clearly define your ability to do the studies and have adequate preliminary data on the subject at hand. Your own publications that relate to your grant are extremely helpful and demonstrate peer review of work that you have already done in the area. You should do an adequate, but not exhaustive, review of the literature. Most importantly, do not be sloppy. You will need to write clearly and concisely and have no spelling or typing errors. Attention to detail is most important. You must know the methods. You must know the strengths and weaknesses of your model and give alternatives that demonstrate that you really understand the literature. Finally, you must be able to give a clear outline of the approach that you will take if some of the work you do turns out to be unfruitful.

Grants Funded

Fig 1. Grants funded by William Baumgartner.

Many flaws are noted from the standpoint of the reviewer. The most common ones include lack of focus and an inability to adequately describe and plan the amount of work that you wish to do. A poorly designed grant will describe an exhaustive amount of work to be done in 4 years, which in fact could not be done in a lifetime. This demonstrates to the reviewer that you do not have a realistic approach or ability to do the work that you describe. Lack of preliminary data and publications in a proposed field of inquiry are a critical deficit. A poorly written grant tends not to be looked on favorably, and poor models are also critical faults. Finally, lack of institutional support or support by your mentors or by your Department Head can often be obvious and fatal flaws in obtaining a grant.

It is also important to know how to interpret the review. Reviews come back with a score for the top 50%; the bottom 50% are triaged. Triage is not a death sentence. I, personally, had a grant triaged, turned it around, and got it funded at the fifth percentile. Any score in the upper third is great and likely will get funded on this round or the next. The reviewer, if he or she has done the job well, will give you help in how to turn the grant around. You should pay attention to the reviews and respond to them dispassionately, item by item. If you totally disagree with the statements of the reviewer, it is perfectly all right to say that on your resubmission, but it is not helpful to get personal about it. Finally, and most importantly, you should continue to be productive even while the grant is being revised. It is important that the reviewer know that you are continuing to publish and develop new data.

If you are fortunate enough to have been funded, you will eventually have to do a competitive renewal (ie, in 3-4 years you will have to submit your grant and have

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Fig 2. Grants funded by author.

it re-reviewed). It is helpful to have demonstrated productivity specifically with publications. You should have demonstrated that you have completed your previous specific aims, and if not completely, you need to be very specific as to why not. You must demonstrate a logical transition to your future investigations. However, if your previous grant has been mostly unsuccessful, it is probably worthwhile to start over and develop a new set of hypotheses and a new submission.

Conclusion

You need to apply to get funded. Most successful investigators have been turned down on multiple grants, have continued to do their research, and have reapplied for funding until successful. It often takes years to get significant NIH funding (Figs 1 and 2). You must not take personally the critiques and negative reviews. It is important to get excellent collaboration and set aside enough time to be able to successfully do the work.

The research that surgeons need to do is translational (this is now the buzzword at the NIH) so that we are in an excellent position for funding. We probably cannot compete directly with basic scientists in terms of pure basic research, but we do not need to. The translation of basic principles and the translation to the surgical arena is critically important for better patient care.

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