

# Writing a Successful NIH Mentored Career Development Grant (K Award)

## *Hints for the Junior Faculty Surgeon*

*Malcolm V. Brock, MD, FACS,\* and Michael Bouvet, MD, FACS†*

**Abstract:** Surgery is a labor-intensive, time-consuming profession. Young faculty members in surgery are saddled with many clinical time constraints that often allow precious few moments for academic pursuits. Consequently, K award submissions from surgeons trail nonsurgeons. The National Institutes of Health (NIH), however, is actively trying to encourage participation of surgeons in basic science research, translational research, clinical outcomes research, and even in prevention/control research. But, at the same time, the NIH has newly implemented a policy that has made the grant review process more restrictive by only allowing 2 submissions of any grant application. It is imperative, therefore, for junior faculty surgeons to learn “grantsmanship” and have the ability to construct succinct, competitive K award grants. Although most of this information is public knowledge and made available by the NIH itself, many of the practical points presented here are tailored to the special needs of clinically active surgical researchers. Often, these “hints” are buried on expansive websites that require considerable time to read and navigate. The authors have a long combined experience on a study section dedicated to adjudicating K awards. The goal of this review is to present concise, useful information about common errors, research plan dos and don’ts, template examples of superior mentored letters, and many other suggestions that may assist any first-time candidate for these awards.

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### THE PROBLEM AND THE OPPORTUNITY

National Institutes of Health (NIH)-sponsored Mentored Career Development Award Grants (also known as “K Awards”) have been a longstanding staple of many investigators in the nonsurgical disciplines. The need for aspiring academic surgeon researchers to know how to write and compete successfully for these awards is now apparent. Surgery is a labor-intensive, time-consuming profession with many constraints on an individual surgeon’s time to give patients the best possible outcomes. In addition, many academic centers monitor a surgeon’s clinical productivity by relative value units, which sometimes can further add to a young surgeon’s sense of the need to trade “hours for dollars” in the operating room. In fact, a 2004 study by Rangel and Moss found that nonsurgeons were 2.5 times more likely than surgeons to apply for any type of NIH Career Development Award.<sup>1</sup> Adding to the feeling among young surgical faculty of limited time for grant writing pursuits is the reality of the newly implemented NIH policy that has made the grant review process more restrictive by only allowing 2 submissions of any grant

application before it is summarily rejected. Juxtaposed against this reality, however, is the NIH’s active pursuit of surgeons and surgical societies seeking partnerships to encourage participation of surgeons in basic science research, translational research, clinical outcomes research, and even in prevention/control research. Two NIH institutes, the National Cancer Institute and the National Institutes of Diabetes and Digestive and Kidney Diseases, have gone even further to entice young urological faculty to apply for their K awards by reducing the minimum protected research time requirement from the conventional 75% to a mere 50% so that urologists would be able to maintain their surgical skills while on their K award.<sup>2</sup>

Given both the credible time constraints faced by young surgeons as well as the opportunities that exist for those interested in pursuing academic medicine, the authors felt there was an imperative to share their combined experience as members of a NIH study section, focused solely on reviewing K awards, to young surgeons with aspiring academic careers. Although most of this information is public knowledge and made available by the NIH itself, some of the valuable nuggets presented here are often buried on expansive websites beneath pages of technical information that require considerable time to read and navigate. It is our aim in this review to present concise, useful information about common errors, research plan dos and don’ts, template examples of superior mentored letters, and many other suggestions that may assist any first-time candidate for these awards. For the reasons previously outlined, never has there been a more critical time for surgeons, in particular, to have all the important details correct in an initial grant submission to the NIH. In the following article, we do not offer a formulaic approach to a successful K award, but rather present critical concepts and important similarities that characterize many grants that garner the coveted fundable score. Although almost all of the “trade secrets” we share in this article may be considered trite and well known by most seasoned mentors, the fast-paced, time-challenged academic environments that are now our reality (especially in surgery), have limited the transmission of these concepts to the mentees. This article hopefully will serve to bridge that gap and help to increase higher levels of good “grantsmanship” among first-time applicants.

Although this article will not review the specific purposes of each of the copious K award mechanisms available, suffice it to say that before putting pen to paper, reading the guidelines and instructions of a particular K award is critically important. The first step in scripting a successful proposal is to choose which award mechanism fits best with your career expectations and your research idea. For example, clinicians pursuing academic careers in laboratory-based health science research would find that an NIH Mentored Clinical Scientist Research Career Development Award (K08) is better suited for their eventual career goals, whereas clinicians interested in a research career focused on working directly with their patients would find that the clinically oriented Mentored Patient-Oriented Research Career Development Award (K23) is a more appropriate funding opportunity. The NIH website, [www.nih.gov](http://www.nih.gov), should be studied carefully, and contacting program officers at the appropriate

From the \*Department of Surgery, Johns Hopkins School of Medicine, Baltimore, MD; and †Department of Surgery, University of California San Diego, La Jolla, CA.

Reprints: Malcolm V. Brock, MD, FACS, Department of Surgery, Johns Hopkins School of Medicine, Division of Thoracic Surgery, 240 Blalock, 600 North Wolfe St, Baltimore, MD 21287. E-mail: mbrock1@jhmi.edu. Michael Bouvet, Department of Surgery, University of California San Diego, 200 West Arbor Drive, San Diego, CA 92103. E-mail: mbouvet@ucsd.edu.

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NIH agency can be very helpful. Remember to involve your mentor in the decision.

### THE CAREER DEVELOPMENT PLAN

The actual K award grant itself is roughly written in 3 broad sections: the Candidate, the Career Development Plan, and the Research Plan. Although each of these sections is crucial to success, most reviewers would agree that the Career Development Plan sets the tone. A well-organized, fluidly written, and impeccably designed Career Development Plan not only dictates a candidate who is conscientious about improving a research skill set fundamental to their eventual success as an independent investigator, but also very concretely communicates to a reviewer that the mentor has been very actively involved in designing the grant. It is also often the first section that is closely read by a reviewer, and as in life, first impressions matter.

### CHOOSING THE MENTOR

Many reviewers believe that the choice of the mentor is the most important factor for success of these awards. Consequently, it must be one of the first decisions of a successful candidate, undertaken long before any first drafts of the proposal, and made after much consideration of both professional and personal attributes, much like how one chooses a date. The word “mentor” originates from Greek mythology in the famous story of the Odyssey and the Trojan War.<sup>3</sup> Odysseus asks his friend, Mentor, to watch over his son, Telemachus, while he was away at the Trojan War. The basic idea is quite applicable to scientific training today in that a more prominent person guides and protects a less experienced protégé through difficult challenges based on the mentor’s experience, his ability, and his willingness to communicate that experience. The National Academy of Science describes mentorship both as a partnership as well as the mentor playing a role as an adviser, teacher, role model, friend, and advocate.<sup>4</sup> Although a K award should be independently written, reviewers expect a mentor’s involvement in critical areas such as advising on important research questions, facilitating research collaborations, helping to outline experimental design, critiquing rough drafts, and so on. In choosing a mentor, keep in mind some of the following that are based on comments by reviewers about mentors:

1. Identify a primary mentor who is a renowned expert in the field you are considering. Remember if members of the review committee know and respect this person’s scientific achievements, this familiarity can be advantageous for your proposal at the time of committee discussion. The mentor should have a substantial track record of NIH funding preferably with a R01 grant as this is widely recognized as the basic qualification of scientific independence. Primary mentors and critical comentors should be on site. Critical experts that are in other institutions should best be referred to as collaborators rather than primary mentors. As face-to-face meetings are such an important aspect of a credible, detailed mentoring plan, the convenience of the primary mentor being in the same institution is self evident.
2. Increasingly, mentoring teams are being proposed which consist of a primary mentor and one or more secondary mentors each with a particular expertise that is critical for the success of the research plan. For those candidates who are new to the cancer field and have developed a relationship with a primary mentor in an area outside of cancer, it is imperative that you have a secondary mentor who is expert in the specific malignancy that you are studying.
3. The frequency of face-to-face meetings with the primary mentor is reviewed very carefully in study sections. Weekly face-to-face

meetings are usually the accepted norm. The mentoring group should also meet together as an ensemble at least once per month with the candidate, if possible. If geographically disparate, the mentoring group should participate in monthly conference calls or even web-based sessions. Reviewers are critical when candidates downplay the importance of these weekly or monthly meetings. Often candidates write that the primary purpose of the meeting is “to monitor progress.” Be more specific and detailed, and encourage your mentors to do the same in their mentor letter. An example of an interaction with a mentor that was well received by reviewers was simply a mentor who carefully explained in his mentor letter that in addition to his face-to-face meetings, he reserved each Sunday night for manuscript corrections by e-mail from his mentees.

4. Because the K awards are mentored grants and the mentor is also being judged, it should be apparent that the mentor letter is an absolutely critical and powerful part of the application. Although length does not always substitute for substance, a detailed mentor letter is often seen by the reviewers as one of the most important markers of success of a K award. A well-written mentor letter denotes that the mentor set aside time to formulate a plan specific to the mentee, write the letter, and hopefully, review the research plan. Some common elements of well-constructed mentor letters that we have read address the following: what considerations were given to choosing the primary mentor and comentors; documents carefully the mentor’s track record in mentoring preferentially in a table; outlines the mentoring philosophy to be used, the time commitments of both mentor and mentee to the relationship, and how the mentee will be supervised; the plan for measuring academic success such as how goals for academic promotion will be achieved; and so on. About once a year, a reviewer will comment that they have reviewed “one of the best mentor letters that I’ve ever seen.” Briefly, these letters are lengthy, sometimes as many as 10 pages single-spaced. Here is a composite of some of the best that we have received. Do not copy these outlines wholesale. They are provided as a guide of how much detail is expected by reviewers on study section. After a brief introduction, the letters are subdivided into the following broad sections: (1) candidate’s qualifications and relationship with the mentor; (2) mentor’s qualifications; (3) philosophy/views on mentoring and mentoring experience-including a table of previous trainees showing their training period, degree earned, research project, funded award, current position; (4) why the mentoring team was chosen and their qualifications; (5) nature and extent of supervision; (6) mentor’s comments on career development plan and research plan including limitations of the plan; (7) measurable milestones and outcomes; (8) timeline of activities; (9) institution’s mentoring policy and experience with previous K awardees; (10) summary.
5. Be careful that your comentors do not copy and paste large sections from your primary mentor’s letter especially if the latter is well written. Multiple letters with the same language are easily recognized and discredited.
6. Either the primary mentor or the institution needs to emphasize their commitment to the candidate in how your time and money will be protected. Institutional commitment from someone senior in the organization is important especially for a surgeon who is contemplating protecting more than 75% of their time in profitable clinical activity. Any institutional commitment must be careful not to imply that the candidate’s position or faculty appointment is contingent on receiving the K Award.
7. For resubmissions, be careful when recycling old mentor letters not only to change the date, but also to update the candidates’ recent achievements/awards and to make some aspect of the

primary mentor's letter as well as comentors' letters responsive to the reviewers.

8. Ensure that the primary mentor reads all the application. It is especially important that he/she catch minor factual, scientific errors, and other technical flaws. In addition to your mentor, have others outside your field read your application for comments. It is especially important for surgeons to consider comments, for example, from basic scientist colleagues, such as on the appropriateness of RNA quality from specific tissue preservation methods for genome wide arrays.

### WRITING THE CAREER DEVELOPMENT PLAN

One of the most fundamental errors encountered in first applications is the candidate's assumption that the Career Development Plan is not as important to the application as the Research Plan. In fact, the exact opposite is probably true. These K awards are primarily mentored-educational grants and consequently, time spent in pursuing scholarship is more important than time spent in research. Do not underemphasize your Career Development Plan at the expense of your research plan. Here is a typical approach to a solid Career Development Plan:

1. Remember the purpose of the K awards is to transition young faculty to research independence over a 5-year period. Explicitly state this goal very early on in your plan and then outline how you intend to achieve this. Remember the government is trying to nurture academics who are pursuing an interest in solving complex medical problems.
2. State short-term, midterm, and long-term goals. Where do you want to go? What areas do you need to develop to get there? Make this clear to the reviewer especially outlining your academic strengths and deficiencies (maybe you have a PhD in anatomy but have no background in biostatistics).
3. Take stock of your current academic deficiencies. Use the award as an opportunity "to customize" a program unique to your needs so that you can spend quality time in only those areas that need strengthening. Ensure that your Career Development Plan increases your exposure to your academic weaknesses. Commonly, candidates are deficient in publishing. The Career Development Plan of such candidates should emphasize grant and manuscript writing seminars/courses. The mentor could assist here by stressing in the mentor letter that once the prerequisite courses have been completed, they will encourage coauthorship with the mentee when writing subject reviews or book chapters. Manuscript planning for publishing the results of the award should be explicitly stated with a timetable for manuscript submission, journals targeted, and so on. Aim to publish as early in the award period as possible so that this could be used as proof of productivity on a subsequent R01 application that you may want to submit before the expiration of your K award.
4. Review your Career Development Plan with your mentor and ensure that you agree fundamentally on all major points. It is critical that your mentor's statement is consistent with your goals and agrees implicitly with your plan. This is consistently checked by reviewers and any ambiguities are often viewed as a lack of communication between mentor and mentee and a real harbinger of a failed mentoring relationship. This ultimately translates in most reviewers minds to a doomed K award project.
5. Propose to obtain a formal academic degree during the award period. This is always viewed as extremely advantageous. Degree programs such as Masters in Public Health or Masters in Clinical Investigation incorporate many courses critical to a

Career Development Plan such as an introduction to basic statistics, epidemiology, and bioethics.

6. Incorporate a carefully structured didactic plan—include a table (state course name, objective, timetable)—make it very detailed and specific with a timeline of exactly when courses will be taken and completed.
7. Compress your didactic courses early into the development plan. A great tactic is to load the plan with epidemiology courses in the first year, and then supplement them in the second year with basic biostatistical courses.
8. Avoid all on-line didactic courses. It is often difficult for the reviewers to judge the quality of online educational activity.
9. Remember you can take too many courses. There is a balance that every junior surgical faculty must have between time spent clinically, in education, and in research. Preserve that balance.
10. Be detailed in how you will spend your time during the graduate training phase of the award. For example, with every educational activity be sure to specify the exact time required for each commitment (hours/wk).
11. Use your training time to learn new critical areas or enhance previously neglected skills that will be critical to your final career. If you lack the appropriate background in your intended area of study, pursue it by participating in graduate level courses in that subject. For example, if you as a surgeon would like to study the effect of nutrition on cancer prevention and you have never formally studied nutrition, rather than relying on a consultant or colleague with that expertise, plan on taking a series of courses on nutrition. This would be viewed by reviewers as a very important criterion for a successful proposal. Another example is that candidates with no background in behavioral science often will construct an award around an interventional behavior trial without proposing courses in interventional behavior in their Career Development Plan.
12. For clinical surgeons, in particular, be very detailed about clinical coverage while you are pursuing your award—how many cases will you perform per week, how many patients will you follow in the hospital, what will be your on-call time, who will take care of your patients if there is one bad outcome postoperatively on a nonclinical day, who will field "callbacks" from ill patients at home, or manage mundane issues such as postoperative wound care? As suggested in the previous section, a primary mentor, comentor, or institutional representative should recognize the special challenges of clinical coverage for practicing surgeons pursuing research and address this specifically in their letters and statements.
13. State clearly how this award will propel you toward milestones for academic promotion.
14. If there is already a relationship established with a primary mentor and if you are coauthors on a manuscript, textbook chapter, or similar publication, emphasize this in the Career Development Plan and show how you will build on this in the future. Be careful if you are still in the same laboratory that you did your postdoctoral fellowship, however, since then you must be very clear how your research will distinguish you from your primary mentor so that you can establish your independence.

### THE CANDIDATE

1. Again, restate that your goal is to be an independent researcher pursuing distinct ideas separate from your mentor. Surgeons especially should emphasize their commitment to pursuing research-oriented academic careers.
2. Using the first person singular tense, tell a narrative about your career's evolution stressing both academic and clinical accomplishments. For surgeons, a logical sequence could be, "I re-



ceived excellent clinical training, but now I want to understand the scientific bases of this disease. I realized during my clinical training that I cannot excise the tumor better, and need to derive the molecular underpinning of cancer to treat the disease further. So, this is how I conceived of my goals in pursuing laboratory-oriented research.”

3. If you received a MD/PhD degree in medical school, are you proposing research related to your PhD thesis work? If your PhD thesis resulted in further scholarship, such as a publication, substantive preliminary data for a grant or a patent, state this emphatically as an important accomplishment.
4. If there is a gap in your career, please explain clearly why this occurred, and just do not gloss over it superficially. Absences for personal reasons, such as a pregnancy or sickness, are not viewed as character failings.
5. If a poor publication record, take the added time to explain why? Then, outline in the Career Development Plan how your dearth in publications will be overcome. For example, you can mention your intent to increase writing/publishing scientific articles after the successful completion of a formal didactic class that is a part of your Career Development Plan.
6. In your biosketch, avoid inappropriately listing book chapters, abstract presentations at meetings, or printed abstracts under the peer-reviewed journal publication list. List them separately.
7. Published manuscripts (or those in print) with the mentor represent powerful preliminary data for the grant since these demonstrate to reviewers that the mentor-mentee relationship not only has been established, but also is in good working order.
8. If at all possible, in between grant submissions, publish at least 1 piece of work with your mentor. Even a small clinical case report or a short review article that only marginally relates to your proposed research demonstrates a mentee's diligence and a mentor's commitment to the whole endeavor. Again, at this stage in most surgeons' career development, it is critical to demonstrate shared goals and obligations of the mentee and the mentor.

## RESEARCH PLAN

1. Although it must be independently written, the research plan should be designed with the mentor and time should be given for him/her to comment extensively on the working drafts before submission. Research plans not reviewed by mentors are very obvious and reflect poorly on the mentor/comentor team. A mentor, for example, can provide very valuable knowledge of what pertinent and important literature must be included. Experts on the study section will immediately recognize which vital papers are being excluded (often their own) and judge accordingly.
2. In the abstract, organize each specific aim, and summarize the background as well as the preliminary data succinctly so that all reviewers can read the grant's specific aims as a single page and have a real appreciation of the grant's outline. The following structure is an example: Hypothesis—one sentence, brief background summary of the specific aim, truncated preliminary data summary, likely experimental anticipated results, interpretation of results, and future directions.
3. When listing specific aims, do not be too ambitious for a career developmental award. At most, list 3 or 4. A common error is to list 3 specific aims and then subdivide them into 4 or 5 subaims. Another frequent faux pas is to list 3 time-consuming specific aims, such as 3 randomized multicenter clinical trials, all to be completed over the course of the grant.
4. Do not have a one hypothesis grant with all of the specific aims connected to the success of the first specific aim. Each specific aim should be able to stand alone. It is viewed as a fatal flaw,

for example, if Specific *AimII* is totally reliant on the successful completion of Specific *AimI*. If Specific *AimI* is not realized, then Specific *AimII* will not occur, and the full execution of the grant is jeopardized.

5. The following point was first forwarded and emphasized by Charles Lowenstein, MD (currently Professor of Medicine at University of Rochester Medical Center), to his graduate students at Johns Hopkins University over 15 years ago, and is printed with his permission. Focus, focus, focus your specific aims, and then organize all sections of the research plan around the aims. The most important aspect of the research grant is that it be focused on a single issue and not cover multiple issues. Connect the background, the preliminary data, and the experimental design back to the specific aims focus.
6. Lowenstein continues by stating that in the research plan, the experimental design is the most important section and must tell a narrative how the work will move forward from the preliminary data with anticipated results and alternative approaches if problems occur. A generalized approach would be “I discovered X, now I will do Y. If the result is A, then I will do B; but if the result is C, then instead I will do D. My controls will be E, F, and of course, G. If problems occur, I will do Z.” Although it is a story, be mechanistic and focused, not descriptive.
7. To keep your narrative clear and to avoid becoming technically abstruse, a useful strategy, before tackling especially difficult sections, is to explain your research plan verbally to a 10-year-old: “I am trying to attack the cancer cells, but if this doesn't work, I have a back-up plan.”
8. How much of the preliminary data are results of your own work? If the data are not the result of your own hand and you do not acknowledge this explicitly because you are trying to impress the reviewers, often the result is the exact reverse. Reviewers are sophisticated enough to know what your mentors are doing, and even what members of the mentor's team are in a position to generate certain data.
9. Remember to italicize and make bold important points/phrases for those reviewers who lack time to be detailed in their review.
10. Limit the use of acronyms—these are vexing, and make the proposal hard to read.
11. In most grants, choosing an appropriate research design is critical, and the reasoning behind deciding on a particular design must be justified. For example, why was a modeling approach chosen instead of a randomized clinical trial-based approach? What are the biases inherent in one versus the other, and how will this affect your anticipated results?
12. With the new shortened grant applications, space will be at a premium. The appendix has no space restriction so you are able to use the appendix to your advantage by filling it with detailed plans of anticipated courses, validated questionnaires for your research studies, etc. Be careful not to put any essential documentation in your appendix because not all reviewers read the appendix thoroughly.
13. For clinic trials, recruitment and retention details will be closely scrutinized. For example, if you are recruiting minorities do you have a plan to use a patient navigator or someone who can speak a foreign language?
14. Do you have a control arm for your study, and do all bench experiments have appropriate controls?
15. Link cohort recruitment or a validation cohort to existing NIH prospective studies to leverage the NIH's funding.
16. If your study is a nested study in a larger grant, remember to provide essential details—sample population, data collection methods, and so on. Be clear how your specific aims differ from the parent grant.

17. Does your research plan or question push the field forward or fill an unknown hole in the literature? What are the applications of this research? An exciting, creative research idea is important even for a K award.
18. The grant should be self explanatory with reviewers not needing to search supplementary material outside of the grant to understand the background or significance of the research.
19. If databases/websites are used in the preliminary data, how have these sources been validated in the past?
20. Are your patient accrual goals too ambitious? What would be the power of your study if your accrual numbers are reduced or not met, ie, 75% of accrual goals attained? Does a K award alone have the adequate resources for your anticipated patient accrual goals or is there the need for supplemental funding?
21. Take advantage of the infrastructure of your institution when designing the research plan. Reviewers often discuss why a candidate did not use the full resources of his institution especially if the university has been designated a “Center of Excellence” in a particular area.
22. Has a statistician been actively involved? Has the statistician helped with sample size calculations etc? Many grants have as their Achilles heel loose statistical sections containing, for example, over optimistic effect sizes of odds ratios (not consistent with what is seen in the literature).
23. Remember to include a data monitoring plan for any intervention, even a behavioral one.
24. Stress the limitations of the research plan. For example, the biases in recruiting English speaking patients only or the deficiencies in using a mouse model that does not quite adequately reflect human disease.
25. For resubmissions, when you are responsive to comments, be meticulous and do not side-step issues. For example, do any of the new comments prompt the creation of a new specific aim? Do not be defiant. Reviewers tend to be punitive to defiant applicants.
26. In response to a reviewer’s comments, the mentor must be fully engaged, read the revised application, and offer suggestions.
27. Be sure that in the 3-page introduction to the resubmitted application, you show clearly that your resubmitted proposal is

very responsive to the reviewers even denoting the page number of the revisions. Revised sections should either be highlighted in yellow or denoted by a vertical line adjacent to the revised portions of the grant proposal for ease of recognition by reviewers.

28. One final note is to start the application process months in advance and aim for a completed first draft 1 month before the official due date.

### SUMMARY

The junior faculty surgeon has many tools at his or her disposal for designing, writing, and successfully competing for a K award. The long clinical experience and unique surgical perspectives of even junior level surgeons can be important attributes to innovative approaches to study many different diseases. With proper mentorship, a well-designed course of didactic study, and a disciplined approach, surgeons can become excellent translational clinician scientists and contribute significantly to our understanding of human disease.

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