**BASIC SCIENCE HANDBOOK**

**University of Washington**

**Department of Pediatrics**

**&**

**Seattle Children’s**

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# **Introduction**

What encompasses basic science research? Basic science research is hypothesis-based research on the fundamental mechanisms controlling cell behavior, homeostasis, and disease pathogenesis, and it spans from the cell to the whole animal, whether it’s a mouse, rabbit, dog, or human and includes fields such as cell and molecular biology, genomics, computational biology, immunology, and integrative physiology. Integrative physiology incorporates in situ cellular and molecular techniques with organ physiology to determine the functional significance of cellular mechanisms in the whole living animal.

## **Purpose of the Handbook**:

1. To provide fellows considering basic science research with some general guidelines and suggestions about getting started.
2. To provide fellows with the expectations during their research fellowship.
3. To provide fellows with resources and information helpful for the research years.

# **Goals of the Basic Science Research Fellowship**

Goal: To acquire the knowledge and skills necessary to conduct independent research and become a successful academic physician-scientist.

This is done by first embarking upon and completing a structured research project. The ultimate goal is to independently generate a hypothesis and then design and conduct experiments to test the hypothesis

As part of this process you will be expected to:

1. Master a variety of techniques and methodologies
2. Develop skills informing testable hypotheses
3. Learn to troubleshoot experiments, design proper controls and interpret data
4. Gain skills in scientific writing and presentation in order to:
	1. Present findings at national meetings b) Publish in peer-reviewed journals
	2. Obtain independent funding.

# **Expectations for Basic Science Research Fellows**

## **Initial Obligations**

1. Identify a primary mentor, generally in your division, and meet with this individual on a regular basis to review progress and plans. It is recommended fellows meet with their primary mentor every other week; not to be less than once a month. Actively seek the guidance of mentors when questions arise and check in regularly even when there are no questions.
2. Identify a Mentoring Committee consisting of at least three faculty members, including your mentor. Schedule meeting with Mentoring Committee two times per year to review progress and goals. Complete/update the Mentoring Plan document before each Mentoring Committee meeting and review at the meeting.
3. Complete the necessary training and approvals for the project

## **Ongoing Obligations**

1. Complete a research project within two years of research training. Submit an abstract and present the study at least once at a national meeting and write at least one first-author manuscript to be submitted for publication in a peer-reviewed journal.
2. Attend and be an active participant in laboratory meetings
3. Submit a grant application

## **Suggested Optional Activities**

1. Identify and attend select seminars of interest in basic science departments (i.e.,Dept of Pathology, Dept of Immunology)
2. Attend and present research at focused scientific meetings

## **Discouraged Activities**

1. Writing review articles except when reviewing the same literature in prep for your research.
2. Regular teaching or extra clinical activities (other than those required).
3. Delivering lectures or seminars in areas not related to your research project.
4. Developing a secondary research project in a completely different area from your primary interest.

Remember, the research fellowship provides you with the most protected time of your research career. Take advantage of that, stay focused, and don’t become distracted.

# **Getting Started: Finding a Lab**

The first decision, and one of the most important decisions, is choosing a mentor and laboratory. In a basic science laboratory, you are in frequent and close contact with the laboratory principal investigator (PI)/mentor and other laboratory members. At the beginning of your research career, you should expect to have frequent interactions with your mentor, ranging from weekly laboratory meetings to almost daily review of data.

Because of this close relationship between mentor and fellow, matching of different personality styles should play a role in determining the success of a mentor-fellow relationship. Frequent and open communication is essential for a successful mentoring relationship.

The PI will provide guidance in terms of developing the research question, study design and technical expertise. Initially, you are not expected to be able to generate your own hypotheses independently; that will come with time. Fellows are generally not expected to have a specific research question or be ready to independently design the experiment at the start of their research training experience.

# **Mentors and Mentoring Committees**

Early in the first year of fellowship the Program Director meets with each fellow to determine their general research interests and direct them to faculty whose research complements their interests. Fellows will then independently arrange to meet with these potential mentors.

Fellows are encouraged to talk to the mentees of a prospective mentor. It is important to identify a mentor with strong mentoring skills, but equally as important to ensure a personality match. Fellows should seek a mentor who will foster their productivity. Be aware of mentors who exhibit the following less-than-ideal characteristics:

1. The avoider or the overcommitted: someone who is not available or accessible.
2. The criticizer: someone who criticizes freely but never makes positive comments.
3. The pushover: someone who compliments but never gives constructive criticism.

## **Primary Mentor Within the Division**

By the end of the clinical year of fellowship, all fellows should have identified one primary research mentor and verified expectations associated with that decision with the individual. This faculty member will be primarily responsible for helping develop and implement a career development plan. Mentors must be able to provide adequate resources, including time, space, supplies, expertise and effort.

## **Primary Mentor Outside the Division**

There is tremendous basic science depth in the University and greater Seattle biomedical community. Fellows are encouraged to collaborate with a variety of faculty both inside and outside their Division. Choosing a primary mentor outside the Division may provide the fellow with direct access to resources and expertise the Division may not be able to provide.

The fellow may identify a primary mentor outside the Division but must also identify a secondary mentor within the Division. The primary mentor in this case will first need to meet with the Program Director to clearly understand their role and responsibilities from the perspective of the Division.

## **Expectations of the Primary Mentor**

The Division’s detailed Mentor Roles and Responsibilities is highlighted below.

1. Work with mentee to jointly complete the division’s official Mentoring Plan template. Review and update this document at each Mentoring Committee meeting.
2. The mentee provides a written summary of each meeting, including action items, and circulates these minutes to all committee members and mentor for comment and approval. Provide final copy for retention and program director review.
3. Help fellows determine their short-and long-term goals and set a timetable for accomplishing these goals, including abstract, manuscript and grant submissions.
4. Help the fellow understand the requirements for appointment to a faculty position at an academic institution.
5. Assist in the identification of interesting and feasible research questions; identify other resources and potential collaborators that may be useful to the fellow’s projects. Help the fellow choose a mechanism for obtaining research training and offer advice in course work choices, if applicable.
6. Establish a plan to learn basic principles of scientific conduct, communication of findings to colleagues, and receipt of constructive feedback.
7. Establish a plan for trainee’s career development in professionalism and mentorship and leadership skills.
8. Provide lab or office space, computer, additional travel funds, access to technician, research coordinator, statistical or database support, if applicable.
9. Meet with the mentee on a regular basis. Every other week is recommended; not to be less than once a month. Ensure Mentoring Committee meetings take place once every six months.
10. Review mentee’s CV with Mentoring Committee.
11. Ensure the trainee receives feedback when presenting to lab meetings, works-in-progress sessions, research conferences, etc.

## **Secondary Mentor**

While choosing a secondary mentor can be valuable, it is only a requirement if the primary mentor is outside the division or if the primary mentor is relatively junior or has a limited record of mentoring. Co-primary mentors are discouraged due to potential confusion of roles.

## **Mentoring Committee**

At the beginning of the research year, fellows will form a Mentoring Committee. Under the direction of the primary mentor, the Mentoring Committee oversees the trainee’s professional development, provides career counseling, and facilitates academic job placement in the latter years of training.

The committee will be composed of three to five members. Once trainees select their primary mentor and possible secondary mentor, the mentor(s) and trainee, identify the additional two to four members of their committee. A member of the committee may be outside the Division, particularly if the scholarly project involves collaboration with outside faculty.

Fellows are required to meet with their committee once every six months and are expected to initiate these meetings. Fellows should arrange their first committee meeting by the fourth month of their first research year and are advised to begin arranging each committee meeting at least two months in advance of the due date. There are several options for arranging meetings; a Doodle poll is convenient for many. To narrow your dates, contact the program administrator to assist.

## **Expectations of the Research Mentoring Committee**

1. Meet once every six months. Review and update the Mentoring Plan at each Mentoring Committee meeting.
2. The mentee provides a written summary of each meeting, including action items, and circulates these minutes to all committee members and mentor for comment and approval. Provide final copy tothe program administrator, for retention and program director review.
3. Help fellows determine their short-and long-term goals and set a timetable for accomplishing these goals, including abstract, manuscript and grant submissions.
4. Help identify interesting and feasible research questions; identify other resources and potential collaborators that may be useful to the fellow’s projects.
5. Review mentee’s CV to refine it for presentation.
6. Facilitate the fellow’s career advancement.
7. Review the requirements for appointment to a faculty position, if desired, and assist with the process of searching for a position.

# **Questions for Fellows to Ask Potential Mentors**

## **Projects**

1. What projects are you working on and in what stage of completion are they? Why is this work important?
2. What questions/project would my medical training and clinical insight be a particular asset for?
3. Do you have a project I can work on with the understanding that I would be first author if I complete the work involved? 5. Are clinical/biological samples currently available?
4. 5. Are you willing to mentor me if I work on data from one of your projects? Are you willing to mentor me if I work on a project that is not one of your projects?
5. 6. What are the major scientific problems in your field and what technical or conceptual advancements does your lab have to overcome these?

## **Mentoring Style/Background**

1. What do you consider your central responsibilities as a research mentor?
2. How would you describe your overall style (hands on/off, formal/informal, etc.)?
3. How often would we meet one-on-one? How often does your lab group meet? If I need more support initially, would I be able to meet with you more frequently?
4. How many people are you currently mentoring? Do you feel you have time right now to take on another mentee? If not, would you be willing to act as a secondary mentor or a member of my mentoring committee?
5. How many fellows/students have you mentored?
6. What has been the success of former postdoctoral fellows in terms of manuscripts, grants, jobs, etc.?
7. Can I meet with your current or past mentees to learn more about the lab environment? (It is useful to speak with current and former postdoctoral fellows in the laboratory to get a perspective on the day-to-day work environment and their overall research experience. This will shed light on the management styles. Tracking down former fellows can be very enlightening as they have a broader perspective. Remember that identifying the right mentor is an individual and personal decision that depends not only on the mentor’s mentoring skills, but also on matching the personalities of the mentor and fellow.)
8. What sort of expectations do you have regarding attendance/general time management (RWIP, additional training requirements, moonlighting, projects with others - including writing projects)? (When meeting prospective mentors outside the Division, particularly if the mentor is not a clinician, make sure the mentor understands and is comfortable with your clinical responsibilities during your research years.)
9. What are your expectations or timeline for the following: grant submissions, manuscripts, reviews, abstracts, presentations, conference attendance (regional/national)?
10. What format do you use to provide feedback to your mentees?

## **Research Environment**

1. What are the resources that will be available to support my training?
2. How many people are in your lab (postdoctoral fellows, research scientists, students)? How is it structured?
3. How many support personnel are in the lab (research scientists/technicians) and will I get support from them?
4. Does the lab participate in translational work or are they all basic science projects?
5. Do members of your lab work together on collaborative projects? If so, how is ownership of ideas/projects determined?
6. What affiliates/colleagues do you work with that can help my education and projects (e.g.,biostatisticians, database folks, collaborators at other sites or in the same field)?
7. Where is the lab and bench space? Would you have a desk and computer for me? (Proximity of the lab to other active labs is important as this fosters collaborations and ensures a critical mass of researchers. Convenient access to core facilities and major equipment will also make your life much easier.)

## **Funding Questions**

1. How are most of your fellows funded after leaving the training grant?
2. If I decide to do a fourth year of fellowship to continue research after completing ACGME training, when should I write a grant to fund that year and what grants might I write?
3. If I decide to do a fourth year of fellowship to continue research after completing ACGME training and don't obtain an independent grant to fund it, what funding options might be available for me?
4. Do you have additional funding available for travel to professional meetings and additional research expenses?

# **Writing a Grant During Research Training**

Fellows are expected to write at least one grant during their research training years. These grants may be to support their salary, to provide funding for research activities, or both. There are many different potential sources for research funding. Some of the common ones are listed below. Fellows should discuss the pros and cons of applying for a grant during the 1st research year and the potential funding sources with their mentors.

When writing a grant, be aware that you need to allow time for the following:

**To complete this sequence in a reasonable timeframe, you should plan to have a first draft of your grant done two months prior to the deadline. Notify potential readers well in advance.**

1. Administrative review, approvals, and completion of forms–Every grant proposal is required to be reviewed by a minimum of four UW offices – this process takes two weeks prior to the grant deadline with all grants required to be completed, finalized and ready to submit three BUSINESS days prior to the grant proposal deadline.
2. Internal scientific review in the following sequence:
3. Your mentor(s)
4. Other faculty members and fellows in the Basic Science Research Training Track
5. Your Mentoring Committee

NOTE: Many fellowship or career development awards require letters of recommendation.

* Ask potential writers in advance if they are able and willing to write a letter of recommendation.
* Provide an up-to-date CV or biographical sketch, draft of the grant or aims with title, any required forms or directions for submission as well as a due date.
* Be prepared to write a draft of the recommendation for your writer – this is a common practice.

Some grant options for salary support:

1. **NIH/NRSA Individual Fellowship Awards(F32)**: Fund stipend on NIH payscale. Deadlines are April, August, December.

# **Writing a Grant to Fund Transition to a Faculty Position**

Fellows interested in a career as a physician-investigator in academic medicine will often write a grant during their 3rd research year that will bridge them into a faculty position. This type of “career development” award may come from the NIH (such as a K08 award or K99/R00 award), or a foundation. Fellows should be talking with their mentor(s) and division leadership early in their research training, but no later than the start of the 3rd research year about these grants. Most career development awards require a commitment for a faculty appointment, but this does not preclude them from being transferred to other institutions.

# **Navigating the NIH Website**

If you're a scientist performing human health-related research, you need to become familiar with the National Institutes of Health (NIH), http://www.nih.gov. NIH funding represents the major source of funding for both clinical and basic research scientists. For many, the first R01 is a milestone in their biomedical research career. In this guide, you will find an overview of NIH granting mechanisms, with particular emphasis on the K, or career development, awards.

## **Types of NIH Funding:**

1. **Fellowships**-Ruth L. Kirschstein National Research Service Award (NRSA)(**T/F series)**: <http://grants.nih.gov/training/nrsa.htm>

The NRSA provides up to three years of support (this includes support from institutional training grants) for full-time research training in areas that reflect the national need for biomedical and behavioral research and is offered by all the NIH institutes and centers. Before submitting an individual (F32) fellowship application, the applicant must identify a sponsoring institution and an individual who will serve as a sponsor (also called mentor or supervisor) and will supervise the training and research experience. This award provides a stipend that varies according to years of postgraduate experience.

*F Kiosk:* <http://grants.nih.gov/training/F_files_nrsa.htm>

*NHLBI supplemental application guidelines:* https://www.nhlbi.nih.gov/grants-and- training/training-and-career-development/nhlbi-research-supplement-application- guidelines

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1. **Career Awards (K series):** <http://grants1.nih.gov/training/careerdevelopmentawards.htm>

These awards provide protected time needed to develop an independent research career (typically 75% time). Candidate must be a US citizen or permanent resident. A career development plan is required and is of high priority.

*K Kiosk:* <http://grants.nih.gov/training/careerdevelopmentawards.htm> *Career award wizard*: Helps you select the right award

<http://grants.nih.gov/training/kwizard/index.htm>

*Awards Data:* Want to know which institute awarded the highest percentage of applications? <http://grants.nih.gov/training/outcomes.htm>

*NHLBI Overview:* Excellent summary of research training programs for postdoctoral individuals and newly independent researchers. <https://www.nhlbi.nih.gov/grants-and-training>

*K08*: (Mentored Clinical Scientist Research Career Development Award) <http://grants1.nih.gov/grants/guide/pa-files/PA-11-193.html>

*K23:* (Mentored Patient-Oriented Research Career Development Award) <http://grants1.nih.gov/grants/guide/pa-files/PA-11-194.html>

K08 and K23 are similar awards that support the development of the independent research scientist. The K23 is designed to support individuals who are committed to patient-oriented research. For the purposes of this award, patient-oriented research is defined as research conducted with human subjects (or on material of human origin such as tissues, specimens, and cognitive phenomena) for which an investigator directly interacts with human subjects. This area of research includes: 1) mechanisms of human disease, 2) therapeutic interventions, 3) clinical trials, and 4) the development of new technologies.

The project period for both awards is 3-5 years depending upon the amount of prior research experience, additional experience needed, and the policy of the NIH institute. Awards are not renewable. Salary and fringe benefits are independently determined by each NIH institute; typically $75,000 + fringe benefits and an annual allocation for research support.

*K99/R00:*

1. **Grant Resources at the NIH**

The Grants Process Overview, <http://grants.nih.gov/grants/grants_process.htm#process>, shows the various phases of a grant, from application planning to award close out. Links to tips on planning, writing, submitting, what happens after submission, as well as award and post-award processes can be found here.

**NIH Research Training & Career Development -** <http://grants.nih.gov/training/>

Career Resources - https://www.training.nih.gov/nih\_resources

Resources for New Investigators - <http://grants.nih.gov/grants/new_investigators/index.htm>

**NIH Guide for Grants and Contracts -** <http://grants.nih.gov/grants/guide/description.htm> This guide is the official publication for NIH medical and behavioral research grant policies, guidelines and funding opportunities.

**Funding Opportunity Announcement (FOA):** A publicly available document by which a Federal agency makes known its intentions to award discretionary grants or cooperative agreements, usually as a result of competition for funds.

**Program Announcement (PA):** Identifies areas of increased priority and/or emphasis on particular funding mechanisms for a specific area of science; usually accepted on standard receipt dates; remains active for three years from date of release unless specified otherwise.

**Request for Applications (RFA):** Identifies a more narrowly defined area for which one or more NIH institutes have set aside funds for awarding grants; single receipt date, specified in RFA.

**Request for Proposals (RFP):** Solicits proposals for a contract; single receipt date, specified in RFP.

Each NIH institute has its own training site detailing training and career awards.

National Heart, Lung, and Blood Institute (NHLBI) - <http://www.nhlbi.nih.gov/funding/index.htm>

National Cancer Institute (NCI) - <http://www.cancer.gov/researchandfunding>

# **Approvals & Compliance Training**

Most research projects will require a variety of approvals for individuals. It is best to start this process as soon as possible, during the clinical year if possible, to avoid delays in starting the research project.

1. **UW Research Required Training Homepage -** excellent starting point with links to appropriate websites, <http://www.washington.edu/research/compliance/required-training/>.
2. **Blood borne Pathogen Training** <http://www.washington.edu/research/compliance/required-training/16>

Initial and annual training is required for anyone working with human blood, blood by-products or human tissue (including human cell lines).

If you have not already completed the initial blood borne pathogen course (which you should have done for the clinical year), then you will need to sign up for the initial course. Otherwise, you will need the annual refresher course.

1. **Radiation Safety** <http://www.washington.edu/research/compliance/required-training/19>

If your work will involve radioactive materials, you are required to complete an initial Radiation Safety Training course. This course is a series of four online modules and one classroom session, covering radiation physics, biological effects of ionizing radiation, lab protection procedures, and rules and regulations.

If you have not yet completed the training, you may work under the direct supervision of laboratory personnel/staff who are already certified for no more than 90 days (three months). If you have had previous training, you may be able to just take the refresher course.

1. **Human Subjects** <http://www.washington.edu/research/compliance/required-training/search?tagged%5B%5D=2>

You will need to complete a human subjects training class. Even if you aren’t currently working with human tissues or human subjects, the training is valuable. You will only need to complete the training once.

Both online and in-person training options are available, <https://www.washington.edu/research/hsd/training/>. In general, the class offered by UW’s Human Subjects Division (HSD) is the preferable option (more enjoyable and more succinct).

**Approvals**

Any project that uses human samples (blood, biopsies, tissue blocks, etc.) will need human subjects approval. If your PI already has approval for the project, a modification will be required to add your name to the list of approved investigators (and you will need to complete the training above). If this is a new project, you will need to obtain human subjects approval. This will take (a lot) longer than you think.

Forms are available at https://www.washington.edu/research/forms-and-templates/ It is worthwhile to discuss your research proposal with the staff at HSD to help you navigate the process.

1. **Animal Use** <http://www.washington.edu/research/compliance/required-training/search?tagged%5B%5D=>4

To work with animals you will need Animal Use Laws and Regulations Training Course (every five years), a general training class followed by facility-specific orientation. There are also animal-specific classes (mouse, rat, rabbit, etc), and additional training courses in different techniques (mouse husbandry, etc.).

For additional information, contact UW’s Animal Use Training Program, <http://depts.washington.edu/auts/>.

**Approvals**

If the protocol is already approved, a modification will be required to add your name to the list of approved investigators (and you will need to complete the training above). If this is a new project, you will need to obtain IACUC approval. This can take longer than you think.

The Office of Animal Welfare (OAW) provides support to the Institutional Animal Care and Use Committee (IACUC) http://depts.washington.edu/oawhome/.

# **Useful UW Resources for the Basic Researcher**

## **Institute of Translational Health Sciences (ITHS)** - <https://www.iths.org/>

ITHS offers researchers a wide variety of resources to facilitate bench to bedside translation. ITHS Services includes pilot funding, clinical research studies and support services, study and data management, including consultation for statistical methods, EMR data extraction, biospecimen acquisitions and management tools, core facilities, and regulatory support for product development.

* ITHS Pilot Funding - <https://www.iths.org/funding>
* ITHS Career Development Resources - <https://www.iths.org/ED#/mentoring/resources>
* UW Medicine Research homepage - <http://www.uwmedicine.org/research/Pages/default.aspx>
* UW Libraries–Research Commons - <http://commons.lib.washington.edu/services/funding-1>
* Faculty Research Career Development Series - [https://www.iths.org/education/professional- development/cds/](https://www.iths.org/education/professional-%20development/cds/)
* Environmental Health and Safety - <https://www.ehs.washington.edu/>
* Human Subjects - <http://www.washington.edu/research/hsd/>
* UW Center for Commercialization - <http://depts.washington.edu/uwc4c/>
* Poster Preparation - <http://depts.washington.edu/uwposter/index.html>

# **Recommended Bibliography**

1. Barker,K.2005.*AttheBench:ALaboratoryNavigator*.ColdSpringHarborLaboratoryPress, Plainview, New York.

Great basic book that introduces the laboratory to newcomers. Very practical information.

1. Hailman,J.P.andK.B.Strier.1997.*Planning,Proposing,andPresentingScienceEffectively: A Guide for Graduate Students and Researchers in the Behavioral Sciences and Biology*. University Press, Cambridge.
2. *MakingtheRightMoves:APracticalGuidetoScientificManagementforPostdocsandNew Faculty.* HHMI 2004 http://www.hhmi.org/educational-materials/lab-management

Excellent practical guide, includes chapters on negotiating a position, staffing your laboratory, technology transfer info, etc.

1. Zeiger, M. 2000. *Essentials of Writing Biomedical Research Papers 2nd Edition*. McGraw-Hill Inc., New York.

Starts with chapters on word choices and sentence structure, then moves to each section of a scientific paper (abstract, introduction, results, etc), with exercises for each chapter.

1. Lang,TA2010.HowtoWrite,Publish,andPresentintheHealthSciences:AGuidefor Physicians and Laboratory Researchers. ACP