



# How to Conduct Meaningful Research: How Not to Reinvent Just Another Wheel

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What research is meaningful to you can mean very different things at different stages of your career. For many, their research careers began in medical school with a scramble to get involved in any project possible, trying to make connections, improve your resume, and secure a coveted residency position. Small tasks thrown your way—a case report, a literature review, some chart review—serve as launching pads for research opportunities. Many find themselves jumping at every opportunity, and quickly stretched thin across random unconnected projects with completely separate mentors. Meaning is derived not from the work itself or the question being asked, but the access and accolades that research enables.

As a resident, some old habits remain, and you again say yes to anything an attending suggests. But increasingly, meaning in research is derived from your clinical work. You have a patient in

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“Why do so few scientists make significant contributions and so many are forgotten in the long run?” —Richard Hamming [1]

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front of you, and you want to do the right thing to help them, but you are uncertain. For an eloquent region tumor, should you go for a total resection risking collateral damage, or just go subtotal and be safe and leave the rest for adjuvant therapy? For a basal ganglia hemorrhage that's decompensating, should you just do a craniotomy to decompress or go after that deep clot? For a ruptured aneurysm, should it get a definitive clip now or is it okay to place a few coils for dome protection and then re-assess in a few months? Your attendings know some of the answers, but more and more often you find yourself wondering why, how, or where did these decisions come from. You start reading, looking through the literature, and find that often no one knows for sure. These are the questions that can drive research that is meaningful to you. Whenever you are faced with a tough clinical decision, there is probably an underlying research question. When answering a clinical question could change patient care, think about how you might best study that question. Whenever something is unclear, opinions differ, and the experts hem and haw, the opportunity for meaningful research becomes clear.

Meaningful research can also come from your firsthand experience treating patients. You're heading to the OR for an emergent shunt revision. The patient has been getting more and more obtunded as the CSF builds up. Much like a cardiologist can tinker with medications for optimal cardiac rhythm, what if there was a medication you could give to slow down CSF accumulation and maybe avoid a shunt in the first place? Can we build a better shunt, one that doesn't fail as often? Find those moments when you wonder why, and if we can do better, because that is where you will find questions and research that are meaningful to you.

And it is in these small, personal meanings that the big meanings take root. The monk who grows peas turns into the foundation of genetics. The father who wanted to help his son took to developing the one-way valve to shunt CSF away from his brain. The doctor who notices a pattern in which patients develop puerperal fever after childbirth gets everyone to wash their hands. Much of science is the accumulation of small discoveries, but with luck and planning, those small steps build to something big. A review article can help you understand a topic, followed by a case series of your own experience, all of which informs a pro-

spective study where you set out to specifically explore one or two new directions.

Courage is also important to research. The courage to push forward to complete a project, to be confident in your results, to describe your work in a manuscript, to present your findings at a conference. Once you believe your work is meaningful, then you can try to convince others to think the same. If you always tell yourself that it's only the people at top schools that can publish in the fancy journals, then that's the way it will be.

Don't just jump at the first idea. Once you get into residency, you have the freedom to pause, catch your breath, and pick a problem. No longer should you be doing a case series just because you can.

Motivation, strong rationale, clinical necessity, and impact are all major requirements for meaningful research pursuits; yet, research projects, specifically those that are beyond the routine case series and retrospective chart reviews, are heavily dependent on funding and infrastructure. Funding does not only entail monetary support for project execution, but also represents commitment from residents and their mentors to execute the planned studies within a defined timeframe, and accountability toward the funding agency.

At a resident level, funding opportunities could help either with supporting dedicated research time off of clinical duties, or securing equipment, lab space, data management and analysis, effort for collaborators and consultants, etc. Despite the impetus and imperative for training physician-scientists during residency, the opportunities for residents to secure independent research funding is very limited and, in many cases, restricted to internal grants and small budget organization grants. To date, there are no restrictions from the National Institutes of Health (NIH) preventing residents from applying for research grants that are beyond fellowship awards. However, given the lack of a faculty appointment, inability to dedicate a specific effort for research, difficulty to convince reviewers of research commitment during residency, and other restrictions, residents still have limited chances in successfully securing extramural funding for research projects even if they have substantial prior experience in grantsmanship or independent research. Residents will find themselves looking for

funding opportunities at two fronts: training grants and research grants. For the former, fellowship grants whether sponsored by the NIH (e.g., F32 or R25) or specialty-specific organizations will support your dedicated research time to pursue meaningful research.

Now that you have your time protected for research, the next step is to make sure the research project is itself supported. You may want to join a clinical or basic science lab with robust funding and whose projects align with your pursuit or who are willing to support preliminary data for your innovative idea. Alternatively, you may not be able to find this group at your institution. In this event, you will find yourself bound to finding a mentor at your department that is willing to support your project. The faculty mentor, whether a basic scientist or clinical researcher, will then be your route to apply for research grant funding that will support your research. Depending on the breadth of your project, your target funding opportunities could range from small data analysis grants (e.g., R03) that can support small projects to larger budget grants (e.g., R21 and R01 or equivalent) that require strong collaboration and supporting data.

Establish a research mentor early. Choose someone with a successful track record. Ensure they have time to devote and meet on a regular basis. Assume ownership to your projects and always complete what you start.

Beyond residency, choose a research career because you love research—not to get a job. An academic path will impact your personal time, income, accountability, and stress.

### **Key Points**

1. Meaningful research often comes from clinical experiences.
2. Find a mentor who is available, experienced, and thoughtful.

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## **Reference**

1. Hamming R. “You and Your Research.” Presentation at Bell Communications Research Colloquium Seminar, March 7, 1986. <http://www.cs.virginia.edu/~robins/YouAndYourResearch.html>. Accessed 7/15/20.