

Junior Faculty Research Career Development in the Era of COVID-19

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This article is written from my perspective as the director of a Phase 1 Centers of Biomedical Research Excellence (COBRE) grant that established the Cognitive and Neurobiological Approaches to Plasticity Center (CNAP; www.k-state.edu/cnap) in July 2017. CNAP is located within the Department of Psychological Sciences on the central campus of Kansas State University (K-State) in Manhattan, Kansas. CNAP researchers study cognitive and neural plasticity in animal models, as well as conduct basic and clinical research in humans. Phase 1 research has focused on a variety of brain regions and circuits associated with diseases and disorders that impair healthy brain function (**Figure 1**). Researchers have studied multiple diseases and disorders in humans and in animal models, including alcohol and substance abuse, obesity, autism spectrum disorders, Parkinson's disease, Alzheimer's disease, hearing disorders, post-traumatic stress disorder, and attention deficit/hyperactivity disorder.

CNAP Mission

The fundamental mission of the CNAP COBRE program is to develop faculty research careers, with particular emphasis on aiding them in securing R01-level extramural research funding. We support faculty through two funding

mechanisms: (1) research project grants supply two to three years of funding at \$125-\$160K per year, and (2) pilot grants provide one to two years of funding at \$25-\$100K per year. Both grant mechanisms set expectations that the supported faculty member should regularly apply for extramural grants. CNAP faculty have full access (without any user fees) to outstanding core facilities that provide access to cutting-edge technologies and techniques. Core facilities include a Behavioral Neuroscience (BN) Core that supports animal neuroscience research, an Electroencephalography (EEG) Core that supports human cognitive neuroscience research, and a Neuroinformatics (NI) Core that supports data storage, handling, and analysis for large neuroscience data sets. Dedicated technician support and scientific skills training ensure that core facility users have the necessary tool kit to take full advantage of the core facilities. In addition, our Scientific Exchange Network consists of multiple centers and core facilities in the region and

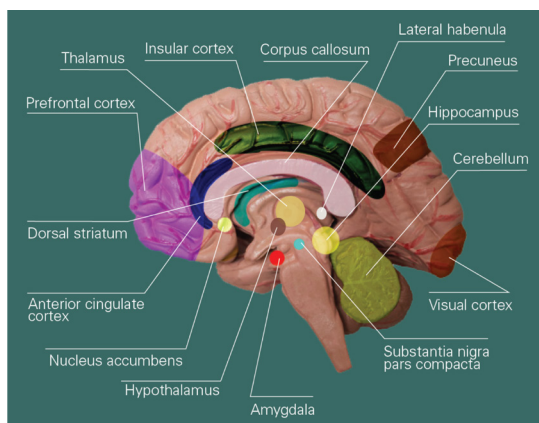


Figure 1. Brain regions and circuits that have been studied by CNAP-funded junior investigators conducting research on cognitive and neural plasticity.

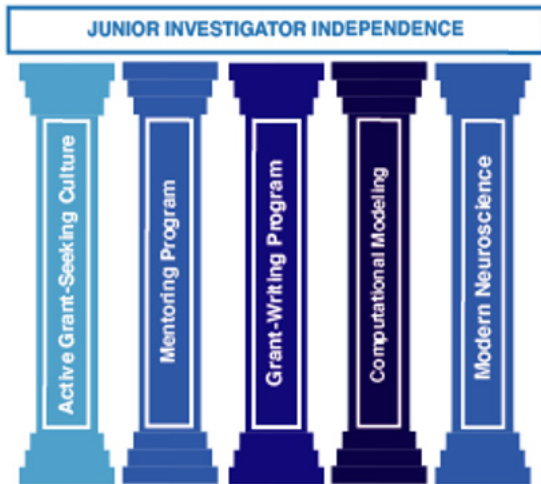


Figure 2. Five pillars of success to promote investigator transition to independence.

facilitates access to additional research facilities and training.

To maximize our ability to support junior faculty in their quest to obtain independent R01-level funding for their research programs, CNAP uses a faculty development model that involves five pillars of success to support junior investigators (Figure 2).

- Pillar 1: Our first initiative early in Phase 1 was to establish an active grant-seeking culture which substantially increased proposal submissions over the first three years of COBRE support (see Table 1). Increased proposal submissions increase the likelihood of investigator independence

by creating more opportunities for success.

- Pillar 2: We established an outstanding mentoring program to ensure strong support for junior investigator development. Mentors, who are recruited nationally for their research expertise and strong faculty mentoring track records, meet at least monthly with CNAP faculty and provide support for research program development, feedback on manuscript and grant submissions, and guidance for career development.

- Pillar 3: We implemented a grant writing program to increase the quality of grant proposals. The grant writing program has evolved and developed over time into a scalable, formal program designed to promote high-quality applications. We supply a library of materials, including examples of successful grants and common supporting materials (biosketches, facilities, equipment, and budgets). We also facilitate researchers in obtaining scientific pre-reviews, and we conduct thorough in-house technical reviews of grant proposals.

- Pillar 4: Advanced computational modeling is a growing priority area for funding agencies, and the CNAP NI Core supplies cutting-edge technologies to support neural computation, advanced statistical modeling, and machine learning approaches.

Year	Present	Pubs	Proposals		Awards	
			#	\$	#	\$
1	9	0	0	\$ -	0	\$ -
2	36	4	11	\$ 9,415,632	3	\$ 2,086,310
3	46	14	32	\$ 14,922,661	13	\$ 1,675,310
4	41	25	41	\$ 21,698,536	10	\$ 868,183
5	6	4	8	\$ 5,694,115	5	\$ 3,598,959
Total	138	47	92	\$ 51,730,944	31	\$ 8,228,762

Table 1. Total presentations, publications, proposals, and awards directly supported by CNAP.

We anticipate that many grant agencies will expect applicants to routinely incorporate these methods within the next few years, so we aim to put our investigators ahead of the curve so they can write competitive applications with a high degree of scientific rigor.

- Pillar 5: Access to modern neuroscience techniques through the BN and EEG Cores provide the final pillar of success. These techniques ensure that researchers can collect data using cutting-edge neuroscience techniques so that they can compete for R01-level funding.

COVID-19 Impacts on CNAP Research

On March 12, 2020, K-State President Richard Myers announced that the university would close the campus to in-person classes starting on March 16. Restrictions on research facilities followed soon after. At the time when COVID-19 began to unfold, we were just entering the final quarter of Year 3 and CNAP had graduated one investigator to R01 status, three other investigators had received extramural grants, and one further investigator had received a competitive score on an R21 grant. Our conference presentations and grant proposals were rapidly escalating. The research cores were successfully creating thriving research environments with rapid increases in users. Overall, we were well on track to be competitive for having our COBRE grant renewed for a second phase of funding.

The implications of COVID-19 for CNAP-supported research were substantial and profound.

Human research was strongly impacted in the following ways:

- Prior to COVID-19 onset, Psych Sciences supported a large subject pool consisting of students enrolled in undergraduate courses who could participate in research for course credit. With students not returning to

campus, the subject pool became unavailable for in-person research, and this remained the case until August 2021.

- Many of the CNAP-supported research projects involved testing higher-risk groups such as older adults. Those projects have been unable to conduct in-person research since March 2020.

- The EEG Core facility was closed to in-person research from March to August 2020 and then operated under restrictions that limited research capacity from September 2020 to August 2021, resulting in a slower pace of research than normal. This facility continues to operate with many precautions, including mask-wearing and additional cleaning. This facility has not had any known or suspected cases of transmission of COVID-19 at any point during the pandemic, so the safety protocols have been highly effective.

Animal research was also heavily affected, but in different ways:

- The BN Core remained open throughout the pandemic, but from March to August 2020 researchers were only able to complete ongoing live animal research. New studies were not permitted. In addition, researchers were only allowed to conduct work with brain samples if that work was time sensitive (i.e., samples would be lost if not processed). From September 2020 to May 2021, the BN Core returned to supporting the normal range of research activities but with restrictions on research capacity (e.g., animal numbers) and staffing to facilitate social distancing. These measures translated into a slower pace of research than normal.

- Animal facilities at some of our partner organizations that CNAP-funded faculty relied on were closed from March to August 2020, so

those faculty were more heavily affected.

- Since June 2021, the BN Core has been gradually ramping up research and staffing to return to pre-COVID activity levels. The core continues to operate with additional precautions, such as mask wearing, additional cleaning, etc. This core has not been associated with a single instance of COVID-19 transmission throughout the pandemic, so the safety measures were highly effective.

In addition, both animal and human research laboratories were affected by:

- Undergraduate research assistants having limited access to the campus. There were many undergraduates working in laboratories, and they were not allowed to participate in on-site research from March to August 2020 and then only in limited numbers from August 2020 to May 2021. The loss of undergraduate assistants affected junior faculty more significantly as the staffing of their laboratories was not as developed. Junior faculty didn't have the graduate students and research staff that senior faculty could rely on.

- Loss of time-sensitive materials, such as chemicals and reagents that expired.

- Challenges with supply chains, which delayed deliveries of critical materials.

- Struggles with poor remote access to data, software, and other resources. In some cases, the challenges were due to issues with home internet access or speed. In other cases, the software, data, or other resources were on campus computers and could not easily be transferred.

- Conference and workshop cancellations, which resulted in loss of opportunities for professional development and networking opportuni-

ties. This loss affected junior faculty more heavily than senior faculty as networking and professional development are often more critical to early-stage career development.

- Workload issues, including having to redirect significant time to retooling courses and increased administrative burdens due to COVID-related emergency planning.

- Childcare challenges due to daycare and school closures. Faculty with young children suddenly had to take on the responsibility for childcare and home-schooling.

As a result of these varied and substantial impacts, we suspect that the pandemic suppressed our graduation of faculty to extramural funding. Data collection was slowed to varying degrees from March 2020 until August 2021 when the university fully phased out of COVID-19 related restrictions on research. The COVID-19 restrictions translated to delays in submitting and resubmitting grants. We were on track to have an even larger increase in Year 4 proposals (see **Table 1**), but this was not fully realized. In addition, the delays in data collection most likely diminished the quality of proposals by reducing the amount of preliminary data included. You can see evidence of this effect in the suppression of funded grants in Year 4 (**Table 1**).

It is not surprising that we saw these adverse effects on the productivity of our project and pilot grant leaders as there are many reports of the negative impact of COVID-19 on junior investigators, particularly in STEM fields such as neuroscience ("A conversation on the effects of the COVID-19 pandemic on junior researchers' careers with funders and university leaders," 2021; Lowe-Power et al., 2021; Myers et al., 2020; National Academies of Sciences & Medicine, 2021).^{1,2,3,4} Neuroscience has been one of the most heavily affected disciplines because of the reliance on access to special (often vulnera-

ble) populations and highly specialized equipment and facilities (Myers et al., 2020).

CNAP COVID-19 Mitigation Strategies

Because we were nearing the end of Year 3, and some projects were scheduled to end, our first COVID-mitigation strategy was to grant an automatic no-cost extension for up to 12 months for all grants that were scheduled to end on May 31, 2020. Because COBRE funds do not automatically carry over, this meant we had to use Year 4 funds to cover these extensions and thus couldn't fund as many new awards in Year 4. However, we felt it was critical to support the junior faculty that were being actively funded to ensure that their grants could be successfully completed.

One challenge that some researchers faced was that they were funding salaries for staff who were unable to work at full capacity. We were able to turn this challenge into an advantage by using central funds to partially fund the salary of a technician in a senior faculty's laboratory who was not working at full capacity. Their time was used to cover animal care and daily research activities in junior investigator laboratories, thus partially mitigating the impact of the loss of undergraduate student support on their laboratory functioning. We also purchased laptops, special software, and portable equipment to support remote work. The CNAP core facility directors developed alternative plans for supporting research, including shifting training workshops to remote format, extensive development of safety protocols for in-person animal and human research, and developing innovative tools to support remote analytics.

Our most extensive mitigation strategy involved the transition of human research to a remote testing format. Given the complex nature of CNAP research, which often involves dynamic tasks with video stimuli, precisely timed stimuli,

rapid decisions, and/or eye tracking measures, the transition to remote testing required overcoming significant technical challenges. We were able to transform several research programs to a remote testing format. For example, one project involved testing older adults and their ability to use their knowledge of familiar tasks to promote everyday memories. This study involved training older adults to learn a new skill and then testing their ability to dynamically recognize key elements in a subsequent video demonstration of that skill. Another task involved simulating eye movements using a mouse-blur paradigm where individuals can clarify a small part of an image to simulate an eye movement. This task was superimposed on video stimuli while participants were making decisions. To our knowledge, the mouse blur task has never been used with video stimuli, so our study resulted in a technological breakthrough in generating a new methodology. Although the transition to remote testing required several months of intensive programming and troubleshooting, we were able to promote the success of our human researchers working with vulnerable populations much more quickly than would otherwise have been the case.

Following completion of the transition to remote human research, we created an online course to provide step-by-step instructions for experiment set-up in different platforms, disseminate special research materials that our team created, supply code for custom programs, and provide tutorials for specialized tools required for remote research. These resources have been disseminated to our broader CNAP research community so that other researchers can benefit from the tools that we created.

Another key mitigation strategy that we employed was to create alternative research plans that could be enacted to deal with COVID-19 challenges. Each funded

project and pilot grant leader developed a set of emergency plans for their research programs in July 2020 and these were submitted to our COBRE program officer for approval. The plans were developed in close consultation with their mentors. This provided an avenue for researchers to have funding agency-approved alternative plans, timelines, and strategies to ensure they could be successful even in the face of ongoing challenges.

The COBRE program has extensive evaluation and reporting requirements, and the projects, pilot grants, and core facilities are evaluated three times per year. We practice strong transparency in our evaluations with clear expectations and well-prescribed assessment practices. Because we had developed mitigation strategies, we were able to tie those into the evaluations. We were already collecting reports on challenges and proposed changes and this reporting was expanded to include COVID-19 challenges and enacting of alternative plans. We continued to evaluate as normal otherwise and were pleased to discover that our faculty were in many cases faring surprisingly well. I have been amazed by the creativity and tenacity shown by CNAP junior faculty in facing the challenges of COVID-19. In cases where faculty were struggling, the regular evaluations provided an avenue to gather information on the ongoing challenges and adapt our mitigations to get those faculty back on track relatively quickly. In addition, we were able to assess the efficacy of our mitigation strategies so we could adapt as needed or continue elements that were working well.

Impact of COVID-19 on Women Junior Faculty

While there have been impacts of COVID-19 on most researchers, women in STEM fields such as neuroscience reported larger decreases in productivity than any other group (National Academies of Sciences & Medicine, 2021; Reardon, 2021). One major reason for this

difference is that women are more likely to be responsible for childcare and elder care. As COVID-19 resulted in school and daycare closures, 71% of female researchers reported increased childcare demands (Reardon, 2021).⁵ As early evidence of the impact of the pandemic on women scientists, first-authored journal articles by women decreased by 14% in March and April of 2020 in comparison to the same timeframe in 2019 (Andersen et al., 2020).⁶ An additional study found that female scientists overall showed a 5% larger decline in research time than male scientists, and female scientists with children under five years of age experienced the largest impact on their research time (Myers et al., 2020).

In terms of CNAP outcomes, we noted that several of our female faculty were struggling with special challenges caused by the pandemic. We engaged our mitigation strategies to partially offset some challenges. For example, we were able to provide significant staff support (by re-directing technician time) for two of our female junior faculty for covering animal care and basic research activities. This helped offset the combined effects of the loss of undergraduate support, increased workloads, and increased childcare demands.

Over Years 1-4 of CNAP, we have funded 14 grants to 11 faculty and have delivered approximately 48% of our project and pilot grant support to female junior faculty. Because our sample size is relatively small, we are unable to analyze the data by year, but we can see overall performance trends (Table 2). The female faculty delivered more presentations but had fewer publications (even when controlling for differences in support). Regarding grants, the male faculty submitted more grants, but the female faculty submitted many more large grants. Female faculty funding rates were lower, but their total dollars were higher. Overall, the patterns suggest that the

	Present	Pubs	Proposals		Awards	
			#	\$	#	\$
Female	57	15	28	\$ 26,856,783	5	\$ 2,577,091
Male	52	20	38	\$ 8,525,853	18	\$ 1,448,733
Total	109	35	66	\$ 35,382,636	23	\$ 4,025,824

Table 2. Products generated by grant-support male and female junior faculty over CNAP Years 1-4.

female faculty were aiming higher in the grant domain.

We have also been able to make close individualized observations of the effects of COVID-19 on CNAP junior faculty and feel that many of our mitigations were successful in reducing the gender gap, and in reducing COVID-19 impacts on research productivity generally.

Institutional Support

As an incubator for faculty development, the CNAP center provides a means to understanding the impacts of COVID-19 on faculty and assessing the effects of mitigation strategies on key outcomes. There are many lessons that we can learn from our COBRE that could potentially be applied at the broader institutional level.

One key lesson that we learned is that evaluations, when conducted with the goal of promoting success, can be an important tool for assessing COVID-19 impacts and efficacy of mitigation strategies. Another significant lesson is the importance of developing alternative plans and transparent guidelines to account for COVID-19 impacts within evaluations. Assessment guidelines can be adapted at institutions to address challenges by incorporating COVID-19 impact statements. Short-term alterations in metrics for quantitative measures of productivity may also be warranted. For example, evaluations could focus on article submissions rather than publications to account for reduced research time and other delays. Similarly, grant submissions may be a better indicator than funded

proposals. This can accommodate challenges that junior faculty may have experienced in having limited preliminary data to support their proposals, which may have decreased their competitiveness. We found in Year 4 that funded proposals decreased, but grant submissions increased (Table 1). This suggests that the reduction in funded proposals was not a product of decreased efforts to obtain funding.

Most institutions granted automatic tenure-clock extensions. While this measure can help some faculty, tenure clock extensions by themselves are likely insufficient (Butler, 2021).⁷ Because COVID-19 affected researchers in many ways, promotion and tenure expectations should be tailored to reflect individual experiences. For example, faculty could develop individualized plans and goals that could be used as yardsticks for assessment with COVID-19 impacts factored in. The plans and goals can be tuned to reflect differences in access to resources and opportunities because of the pandemic. We found that individualized COVID-19 plans allowed our COBRE center to maximize support of junior faculty and promoted adaptability in pursuing solutions.

We also found that delivering automatic no-cost extensions to our Year 3 grants meant that the research activities on those projects were completed in Year 4. Without those extensions, this outcome would not have been possible. At the institutional level, universities should automatically extend expiration dates on start-up funds. Universities could also

advocate for faculty to receive additional extensions to their extramural funding contracts.

Another key factor with the COBRE mechanism is that project leaders must devote at least six months of effort per year to their projects. This ensures that faculty have protected time so that they can focus on developing their research careers. The standard teaching load at K-State is 2-2 but COBRE project leaders have a 1-1 teaching load. This led to some buffering of the impacts of COVID-19 on increasing workloads, particularly in the teaching domain. For faculty who did not have the benefit of protected time, institutions should consider granting one to two semesters of release time from teaching and service expectations so that faculty can work to regain their pre-COVID research career trajectories. These could be treated as pre-tenure sabbaticals to promote faculty in their ability to achieve tenure on their pre-COVID timelines.

COVID-19 Silver Linings

Although the pandemic produced widespread negative impacts on our CO-

BRE center, we also experienced multiple benefits. We now have excellent platforms for conducting high-quality remote cognitive testing of human participants. And those platforms have created opportunities to access populations that are not widely available for in-person research (e.g., under-represented groups, individuals with diseases and disorders, and individuals outside northeastern Kansas). In addition, the development of remote analytics tools significantly increased research capacity as researchers can now conduct advanced modeling techniques either on-site or remotely. We were able to buffer faculty against major career impacts and, in doing so, learn new ways of supporting junior faculty. We also developed more flexible and responsive decision-making strategies that will allow us to respond better to future challenges. In the long-term, these positive outcomes could be translated into new approaches to faculty development and evaluation within their institutions that could significantly benefit faculty research career development in general.

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