Carnegie Mellon University

Academic Year 2024-2025

Dietrich College of Humanities and Social Sciences
Neuroscience Institute

Doctoral Student Handbook

Degree Programs Covered by This Handbook:
Ph.D. in Neural Computation
Ph.D. in Neural Computation and Machine Learning
Ph.D. in Neural Computation and Statistics
Ph.D. in Systems Neuroscience

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SECTION 1: Welcome & Introduction

We extend to you a warm welcome to the Neuroscience Institute and Carnegie Mellon University. We are thrilled to have you join our academic community.

This handbook serves as a comprehensive resource to guide you through your graduate studies. It contains essential information about our department, university policies, academic requirements, and available resources. While this handbook is specific to your academic experience in the department, it is just one element of the Graduate Student Handbook Suite. There are several other resources within the suite that you should consult when needed:

- University-Wide Graduate Student Handbook (Office of Graduate & Postdoctoral Affairs)
- The Word Student Handbook

As you embark on this exciting journey, remember that our department is committed to providing you with the support and mentorship necessary to achieve your academic and professional goals. We encourage you to explore the opportunities available to you, both within and outside of the classroom.

We are confident that your time here will be both rewarding and enriching. Please do not hesitate to reach out to our faculty and staff if you have any questions or require assistance.

1.1: Ph.D. in Neural Computation

Neuroscientists are applying new technologies to acquire and analyze large data sets, as well as amassing knowledge of neural circuitry in a variety of brain areas. As a consequence, the need for quantitative models to understand the great complexities of neurobiological systems has never been greater, and quantitative methods are centrally important in the field of neuroscience. In some respects, neuroscience has historically been ahead of much of biology in adopting and valuing quantitative approaches. There have been important advances through the use of quantitative methods in neurophysiology, and there has been a continuing stream of related work within applied mathematics and physics. More recently, engineers, computer scientists, and statisticians have contributed to the field, expanding further the definition of computational neuroscience. Nevertheless, the number of investigators with the requisite skills actively engaged in this domain of research is relatively small. There is a widely recognized need for increased training in the application of computational, mathematical, and statistical methods to biology and medicine, and to problems in neuroscience in particular.

The Program in Neural Computation (PNC) trains students with backgrounds in quantitative disciplines in the growing field of computational neuroscience and also provides them the essential background in experimental neuroscience. The training environment of the PNC brings the strengths of the unique neuroscience community of both Carnegie Mellon University (CMU) and the University of Pittsburgh (Pitt). The PNC is administered by the Neuroscience Institute at Carnegie Mellon and benefits from a close relationship with the Center for the Neural Basis of Cognition (CNBC), an integrative center spanning both CMU and Pitt. All PNC students are by extension members of the CNBC. We offer three degrees: a Ph.D. in Neural Computation, a Joint Ph.D. in Neural Computation and Statistics, and a Joint Ph.D. in Neural Computation and Machine Learning. In this document we outline both the course requirements and program milestones that a PNC student in any of the degree programs must complete during the course of their PhD training.

1.2: Ph.D. Program in Systems Neuroscience

Our brains contain 100 billion neurons, connected by 100 trillion synapses. Although these numbers are daunting at first, neurons are hierarchically organized into specialized units called neural circuits. In 2013 President Obama launched the BRAIN initiative to "accelerate the development and application of new technologies…that show how individual brain cells and complex neural circuits interact at the speed of thought." This goal is at the core of Neuroscience Institute, an institute that unites CMU's strengths in experimental and computational approaches to study how neural interactions form the building blocks of complex behaviors and thoughts.

In the past decade, technological advances such as optogenetics, CLARITY, light-sheet microscopy, and 2-photon microscopy/calcium imaging have revolutionized our ability to visualize neural activity in time and space, and propelled Systems Neuroscience to the forefront of contemporary neuroscience research. These technological advances have created a demand for new approaches to acquire and quantify large-scale data such as non-invasive recordings, dense electrode recordings, and advances in signal detection and machine learning algorithms.

The Program in Systems Neuroscience (PSN) trains students with backgrounds in biology and neuroscience disciplines in the growing field of quantitative systems neuroscience and also provides them the essential background in experimental neuroscience**.** The training environment of the PSN brings the strengths of the unique neuroscience community of both Carnegie Mellon University (CMU) and the University of Pittsburgh (Pitt). The PSN is administered by the Neuroscience Institute, and benefits from a close relationship with the Center for the Neural Basis of Cognition (CNBC), an integrative center spanning both CMU and Pitt. All PSN students are by extension members of the CNBC. In this document we outline both the course requirements and program milestones that a PSN student must complete during the course of their PhD training.

SECTION 2: Program Vision, Mission, and Values

2.1: Vision

Carnegie Mellon University will have a transformative impact on society through continual innovation in education, research, creativity, and entrepreneurship.

2.2: Mission

- **Research:** Conducting interdisciplinary research that harnesses CMU's core strengths in cognitive science, computation, data science, biology and engineering to understand and improve brain function in both healthy and diseased brains
- **Technology:** Inventing and applying the next generation of neural technologies and tools
- **Collaboration:** Transcending traditional disciplines to tackle fundamental problems
- **Education:** Creating leaders with the cross-disciplinary skills and knowledge to use neural sciences to solve tomorrow's problems
- **Outreach:** Engaging the community to communicate the importance of basic and applied neural sciences and the unique contributions of NI

2.3: Values

- **Boldness:** The courage to take risks and challenge convention
- **Innovation:** A creative atmosphere that fosters impactful discovery
- **Teamwork:** An interdisciplinary culture that nurtures the sharing of ideas and knowledge

- **Inclusivity:** A respectful environment that values and supports all faculty, staff and students
- **Diversity:** Finding strength in different backgrounds, viewpoints and experiences
- **Ethics:** Recognition of the responsibility implicit in our work

SECTION 3: Degrees Offered

- Ph.D. in Neural Computation
- Ph.D. in Neural Computation and Machine Learning
- Ph.D. in Neural Computation and Statistics
- Ph.D. in Systems Neuroscience

SECTION 4: Departmental Personnel

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Neuroscience Institute Directories

NI Staff Directory

Neural Computation Training Faculty

Systems Neuroscience Training Faculty

SECTION 5: Doctoral Degree Requirements

5.1: Residency Requirements

The university requires PhD students to have a minimum of one year in residency on a CMU campus. If your program has additional residency requirements, detail them here.

U.S. government regulations require F-1 and J-1 international students to be enrolled in an in-person degree program, with in-person expectation coursework. Even though this immigration requirement is specifically for international students, residency requirements in a degree program must be consistent for both international and domestic students.

5.2: Required Units for Degree Attainment

Students must complete 396 units of coursework to earn a PhD from the Neuroscience Institute. This includes 3 years of full-time study (fall, spring, and summer) plus one additional year of fall and spring coursework.

5.3: Ph.D. in Neural Computation

Course Requirements

Students must complete the three-core course requirement to gain graduate level training in the following four areas: cell and molecular neuroscience, systems neuroscience, cognitive neuroscience, and computational neuroscience. Courses fulfilling this requirement include:

Recommended courses fulfilling this requirement include

- 03-762 Advanced Cellular Neuroscience (CMU) or NROSCI 2100/2101 Cellular and Molecular Neurobiology (Pitt)
- 03-763 Systems Neuroscience (CMU) or NROSCI 2102 Systems Neuroscience (Pitt)
- 86-765 Foundations of the Neural Basis of Cognition

Computational Neuroscience
Students are required to take at least three computational neuroscience courses, including mathematical, statistical and computational approaches.
To complete the computational requirement, students must take:

- 36-759 Statistical Models of the Brain (CMU)

Two additional computational electives selected by the student.
Recommended courses fulfilling the computational elective requirement include:

- 10-733 Representation and Generation in Neuroscience and AI (CMU)
- 15-686 Neural Computation (CMU)
- 15-883 Computational Models of Neural Systems (CMU)
- 18-698/42-632 Neural Signals Processing (CMU)
- 42-665 Brain-Computer Interface: Principles and Applications (CMU)
- 85-719 Introduction to Parallel Distributed Processing (CMU)
- 86-631 Neural Data Analysis (CMU)
- 86-675 Computational Perception (CMU)
- 86-752 Principles of NeuroAI (CMU)
- BIOENG 2650 Mathematical Models of Biological Learning (Pitt)
- MATH 3370 Mathematical Neuroscience

Quantitative Methods

Students must take at least two graduate level courses in one quantitative subject (e.g. math, computer science or statistics) to ensure depth of knowledge in this area. Courses listed above under the Computational Neuroscience requirement are not eligible to fulfill this requirement. Under the quantitative methods requirement, we have identified two examples of focus areas, but students may propose their own sequences.

Dynamical Systems focus

MATH 2940 Applied Stochastic Methods (PITT)
MATH 2950 Applied Math Methods (PITT)

Statistics and Machine Learning focus

10-701 or 10-715 Machine Learning (CMU)
36-705 Intermediate Statistics (CMU)
36-707 Regression Analysis (CMU)

Other foci, including “brain imaging and signal processing” have been discussed and may be added as recommended course sets, subject to approval by the program co-directors. Note that to be eligible to take some of these courses, students might first need to complete course pre-requisites. These pre-requisites would not count towards the two-course depth requirement.

Program Milestones

Progress in the program is tracked based in part on students' successful completion of program milestones. A committee selected by the student and approved by the program co-directors evaluates the performance on milestones. Failure to pass a milestone will result in a student being placed on probation. Specific conditions for removal of probation will be specified by the program co-directors along with a set of deadlines for meeting these conditions. Failure to meet these conditions constitutes grounds for dismissal from the program.

First year research requirement: By the end of the first calendar year in the program, all students are required to complete a computational project. This project will be evaluated by a committee consisting of at least three faculty, two of whom are not one of the student's advisors, and of whom at least two are PNC training faculty. The project requires the student to identify a biological problem, understand the data collection process, articulate the goals of building a model or performing a particular kind of analysis and implement this computational approach. In some cases, this project may be a precursor to the student's eventual thesis project. This project cannot substantially overlap with a project completed for a class, although it may be on the same topic as a class project, provided that it represents a substantial extension of that work.

Students should begin formally discussing this research project no later than the end of the spring term. Initial steps should include forming this committee and organizing a meeting to discuss/outline the project with your committee. The makeup of this committee should be approved by the program co-directors. At this first meeting the committee should approve the project proposal or indicate steps necessary to identify a new project. Then, before the start of the fall term, students must schedule a committee meeting where they present/defend their results. This meeting should occur by the end of the summer, and certainly no later than Sept 15 of the second year. The initial part of this meeting involves a 30 minute presentation by the student, which is open to the public. This will be followed by a meeting with the committee and the student, during which the committee will ask detailed questions about the work. Based on this meeting, the committee will evaluate the student's work and will decide whether a student passes, fails or needs to revise the project, subject to re-evaluation. Questions about the content of the presentation should be raised by the student with committee members well before the evaluation meeting. In the event of a pass, the student should have the committee sign a milestone completion form, which should be turned in to the Academic Program Manager. The form can be found on the NI Intranet.

Second year research requirement: In the second year, students are expected to work on research about 1/3 of their time during the academic year and full time during the summer. By the end of the second full year in the program all students are required to complete a deeper computational project. The student's work on the project should demonstrate that the student has 1) the ability to analyze and interpret experimental data in a particular area 2) the ability to develop and implement a computational approach incorporating the relevant level of biological detail and 3) the ability to organize, interpret and present the results of the computational work. This project should be a body of work suitable for publication. It is expected that this work will be written up as a manuscript suitable for submission to a journal in the relevant field; a draft of this manuscript must be submitted to the committee at least a week in advance of the meeting. In most cases this project will be on an area related to the student's eventual thesis project.

The evaluation of this milestone is similar to that of the first year milestone described above. The committee makeup follows the same requirements as for the first year milestone, though it does not have to be the same people. Students are recommended but not required to organize a meeting to

discuss/outline the project with their committee. At this first meeting the committee would approve the project proposal or indicate steps necessary to identify a new project. Then students must schedule a committee meeting at which they will present/defend their results. This meeting should occur by the end of the summer, and certainly no later than Sept 15 of the third year. The initial part of this meeting involves a 30 minute presentation by the student, which is open to the public. This seminar must be advertised to the PNC community at least one week prior to the event. (To advertise, send the talk announcement including the date, time, place, title, abstract, and faculty committee to the PNC graduate program coordinator.) This will be followed by a meeting with the committee and the student, during which the committee will ask detailed questions about the work. Based on this meeting, and the submitted manuscript draft, the committee will evaluate the student's work and will decide whether a student passes, fails or needs to revise the project, subject to re-evaluation. In the event of a pass, the student should have the committee sign a milestone completion form, which should be turned in to the Academic Program Manager. The form can be found on the NI Intranet.

Ph.D. Thesis proposal: Required coursework should be completed by the end of the third year. During the fourth year a Ph.D. candidate should present a thesis proposal to his or her thesis committee and the community. This proposal contains both a written and oral component. Both components of the thesis proposal should include: a succinct summary of the proposed research problem; the significance of the proposed research; a review of relevant literature relating to the problem; a review of the candidate's work leading up to the thesis, including preliminary results; a clear statement of remaining research; and a tentative schedule for completing the work. The oral component should consist of a roughly 40-minute presentation by the student. The proposal document must be submitted to the thesis committee at least one week prior to the public presentation. The format of the written proposal is at the discretion of the advisor according to the norms of the particular sub-discipline, but a reasonable guide is the equivalent of an R01 grant application.

Advising on scheduling the proposal, and guiding in the formation of the dissertation committee, is the thesis advisor's responsibility. The thesis committee should be composed of at least four members, one being an external member and at least two being PNC training faculty. The external member is typically from outside the two participating Universities. All thesis committees are subject to approval by the PNC Program Directors.

Ph.D. Thesis Defense: Normally, the dissertation is completed during the student's fifth year. The student should set up a pre-defense meeting with their committee members six months prior to their defense. The final defense is a public presentation, in accordance with the College and University requirements for the Ph.D. This presentation is typically 45 minutes in length, followed by an open question and answer period from the audience. At the end of the public Q&A, the student will address any comments or questions from the committee in a private session. It is the candidate's responsibility to ensure that the College and University's guidelines are followed for publicity of the defense and the availability of the thesis document at least two weeks prior to the defense. Note that the defense must be held at least 21 days before the date the degree is awarded.

Collaboration with experimentalists

One critical aspect of a successful training program for computational neuroscience is to give students a detailed understanding of how the experimental data they are analyzing or modeling are collected. This allows students to appreciate the limitations of the experimental data (such as sources of variability), appreciate what kinds of experiments can and cannot be done and aid in their ability to

interact with experimentalists. This also increases the relevance of the student's computational-based research and increases the overall caliber of the student's PhD dissertation.

All students in the PNC are encouraged to do experimental work and/or to collaborate closely with experimentalists. Students working in different areas will have different needs in terms of the extent of their involvement collecting experimental data. Some students will be in laboratories in which both experimental and computational work is being performed and will gain experience in both approaches throughout their training. If the experimental work involves animals, such students are expected to master, in addition to experimental procedures, basic principles governing animal care and oversight of animal welfare. Students working in a strictly computational lab are expected to do a 10-week rotation in an experimental lab with the intent to begin (or continue) a collaboration with that lab. The goal of this rotation is that students should be sufficiently well trained that they can design and carry out their own experiments. The student is responsible for meeting this requirement, and it should be discussed with the student's advisor not later than by the end of the first year. Note that the experimental rotation may serve as a major component of either the first-year or second-year research requirement but that this is not necessarily the case.

5.4: Ph.D. in Neural Computation and Machine Learning

Course Requirements

Neural Computation Course Requirements
Students must complete the four-core course requirement to gain graduate level training in the following four areas: cell and molecular neuroscience, systems neuroscience, cognitive neuroscience, and computational neuroscience. Courses fulfilling this requirement are:

- 03-762 Advanced Cellular Neuroscience
- 03-763 Systems Neuroscience
- 86-765 Foundations of the Neural Basis of Cognition
- 36-759 Statistical Models of the Brain

Machine Learning Course Requirements
The ML requirements for graduation with a Joint-ML PhD degree are the same as those for the regular ML PhD requirements (including the requirement for the PhD thesis committee composition), with only the following differences:

- A Joint-ML PhD thesis will be a contribution to the combination of Machine Learning and the other field.
- The single elective course, the speaking and writing skills requirements, and the Data Analysis requirement (10718) may be satisfied within the student's home department.
- A Joint-ML PhD student is still required to TA twice, but only one TA-ship has to be within MLD

Any substitutions or exemptions from coursework must be recommended by the student's advisor and approved by the PNC program co-directors and the co-directors of graduate studies in MLD.

Program Milestones

First year research requirement: By the end of the first calendar year in the program, all students are required to complete a computational project. This project will be evaluated by a committee

consisting of at least three faculty, two of whom are not one of the student's advisors, and of whom at least two are PNC training faculty. The project requires the student to identify a biological problem, understand the data collection process, articulate the goals of building a model or performing a particular kind of analysis and implement this computational approach. In some cases, this project may be a precursor to the student's eventual thesis project. This project cannot substantially overlap with a project completed for a class, although it may be on the same topic as a class project, provided that it represents a substantial extension of that work.

Students should begin formally discussing this research project no later than the end of the spring term. Initial steps should include forming this committee and organizing a meeting to discuss/outline the project with your committee. The makeup of this committee should be approved by the program co-directors. At this first meeting the committee should approve the project proposal or indicate steps necessary to identify a new project. Then, before the start of the fall term, students must schedule a committee meeting where they present/defend their results. This meeting should occur by the end of the summer, and certainly no later than Sept 15 of the second year. The initial part of this meeting involves a 30 minute presentation by the student, which is open to the public. This will be followed by a meeting with the committee and the student, during which the committee will ask detailed questions about the work. Based on this meeting, the committee will evaluate the student's work and will decide whether a student passes, fails or needs to revise the project, subject to re-evaluation. Questions about the content of the presentation should be raised by the student with committee members well before the evaluation meeting. In the event of a pass, the student should have the committee sign a milestone completion form, which should be turned in to the Academic Program Manager. The form can be found on the NI Intranet.

Second year research requirement: In the second year, students are expected to work on research about 1/3 of their time during the academic year and full time during the summer. By the end of the second full year in the program all students are required to complete a deeper computational project. The student's work on the project should demonstrate that the student has 1) the ability to analyze and interpret experimental data in a particular area 2) the ability to develop and implement a computational approach incorporating the relevant level of biological detail and 3) the ability to organize, interpret and present the results of the computational work. This project should be a body of work suitable for publication. It is expected that this work will be written up as a manuscript suitable for submission to a journal in the relevant field; a draft of this manuscript must be submitted to the committee at least a week in advance of the meeting. In most cases this project will be on an area related to the student's eventual thesis project.

The evaluation of this milestone is similar to that of the first year milestone described above. The committee makeup follows the same requirements as for the first year milestone, though it does not have to be the same people. Students are recommended but not required to organize a meeting to discuss/outline the project with their committee. At this first meeting the committee would approve the project proposal or indicate steps necessary to identify a new project. Then students must schedule a committee meeting at which they will present/defend their results. This meeting should occur by the end of the summer, and certainly no later than Sept 15 of the third year. The initial part of this meeting involves a 30 minute presentation by the student, which is open to the public. This seminar must be advertised to the PNC community at least one week prior to the event. (To advertise, send the talk announcement including the date, time, place, title, abstract, and faculty committee to the PNC graduate program coordinator.) This will be followed by a meeting with the committee and the student, during which the committee will ask detailed questions about the work. Based on this meeting, and the submitted manuscript draft, the committee will evaluate the student's work and will decide whether a student passes, fails or needs to revise the project, subject to re-evaluation. In the

event of a pass, the student should have the committee sign a milestone completion form, which should be turned in to the Academic Program Manager. The form can be found on the NI Intranet.

Ph.D. Thesis proposal: Required coursework should be completed by the end of the third year. During the fourth year a Ph.D. candidate should present a thesis proposal first to his or her thesis committee and then to the NI and MLD community.

A thesis committee will be formed and should be composed of at least four members, one of whom is an external member (typically from outside CMU and Pitt); two must be PNC training faculty; two must be MLD faculty; and at least one CMU or Pitt member must be from a discipline outside of statistics and computer science. The thesis committee is subject to approval by the PNC training faculty and the MLD faculty.

The thesis proposal contains both a written and oral component. Both components should include: a succinct summary of the proposed research problem; the significance of the proposed research; a review of relevant literature relating to the problem; a review of the candidate's work leading up to the thesis, including preliminary results; a clear statement of remaining research; and a tentative schedule for completing the work. It should also conform to the stylistic requirements for thesis proposals in MLD. The proposal document must be submitted to the thesis committee at least one week prior to the public presentation. The thesis committee must offer its preliminary approval of the proposal. The student then arranges to present the proposal publicly, so that NI and MLD faculty and other community members can attend. Formal approval is conferred by the MLD faculty and the PNC training faculty.

Ph.D. Thesis Defense: Normally, the dissertation is completed during the student's fifth year. The student should set up a pre-defense meeting with their committee members six months prior to their defense. The final defense is a public presentation, in accordance with the College and University requirements for the Ph.D. This presentation is typically 45 minutes in length, followed by an open question and answer period from the audience. At the end of the public Q&A, the student will address any comments or questions from the committee in a private session. It is the candidate's responsibility to ensure that the College and University's guidelines are followed for publicity of the defense and the availability of the thesis document at least two weeks prior to the defense. Note that the defense must be held at least 21 days before the date the degree is awarded.

Collaboration with experimentalists

One critical aspect of a successful training program for computational neuroscience is to give students a detailed understanding of how the experimental data they are analyzing or modeling are collected. This allows students to appreciate the limitations of the experimental data (such as sources of variability), appreciate what kinds of experiments can and cannot be done and aid in their ability to interact with experimentalists. This also increases the relevance of the student's computational-based research and increases the overall caliber of the student's PhD dissertation.

All students in the PNC are encouraged to do experimental work and/or to collaborate closely with experimentalists. Students working in different areas will have different needs in terms of the extent of their involvement collecting experimental data. Some students will be in laboratories in which both experimental and computational work is being performed and will gain experience in both approaches throughout their training. If the experimental work involves animals, such students are expected to master, in addition to experimental procedures, basic principles governing animal care and oversight

of animal welfare. Students working in a strictly computational lab are expected to do a 10-week rotation in an experimental lab with the intent to begin (or continue) a collaboration with that lab. The goal of this rotation is that students should be sufficiently well trained that they can design and carry out their own experiments. The student is responsible for meeting this requirement, and it should be discussed with the student's advisor not later than by the end of the first year. Note that the experimental rotation may serve as a major component of either the first-year or second-year research requirement but that this is not necessarily the case.

Applying to the Joint PNC/ML program

To apply to the Joint-PNC/ML program, a student already enrolled in the PNC program must:

- Take 10715, 36705, 10716 and earn at least a grade of A- in your first attempt to take each course. Letter grades are required. (Students who took courses before June 2023, will be Grandfathered in under the previous of B+ for the courses already taken.)
- Identify an MLD Core Faculty member who agrees to serve as their MLD mentor. The mentor will help guide the ML portion of the student's research, represent the student at the MLD student evaluation meetings, become a member of the student's thesis committee, and generally advocate for the student within MLD.

Applications should be emailed to the MLD PhD Program Administrator (with the PNC PhD Program Administrator cc'd), and must include:

- Student's CV
- Statement of Research Interests (one page will do)
- CMU Transcripts (unofficial will do)
- A short paragraph of recommendation from the home PhD Advisor (or PhD program Director if advisor has not yet been assigned)
- Brief email from the MLD Mentor confirming their willingness to serve in that role.

The MLD admissions committee may request additional information as needed.

Interested students are encouraged to apply as early as possible in their graduate studies, so that their research direction can be informed by their interactions with their MLD mentor. They should apply as soon as they satisfy the above requirements, typically at the end of the first or else second year of their PhD program. Later applications will also be considered as long as they are made before the student's thesis proposal.

Applications must be submitted by May 31 to be considered for admission by the immediately following Fall semester.

Once admitted to the Joint-ML PhD program, in addition to being reviewed at their home department, the student's progress will also be reviewed by the MLD faculty at their regular student evaluation meetings, where the student will be represented by their MLD mentor. The student's advisor may also be present for this review.

5.5: Ph.D. in Neural Computation and Statistics

Course Requirements

Students must complete the four-core course requirement to gain graduate level training in the following four areas: cell and molecular neuroscience, systems neuroscience, cognitive neuroscience, and computational neuroscience. Courses fulfilling this requirement include:

- 03-762 Advanced Cellular Neuroscience
- 03-763 Systems Neuroscience
- 86-765 Foundations of the Neural Basis of Cognition
- 36-759 Statistical Models of the Brain

To meet the course requirements for the PhD in Statistics, students must take:

- 36-705: Intermediate Statistics (year 1)
- 36-707: Regression Analysis (year 1)
- 36-708: Statistical Machine Learning (year 1)
- 36-709: Advanced Statistics I (year 1)
- 36-710: Advanced Statistics II (year 2)
- 36-750: Statistical Computing (year 1)
- 36-757: Advanced Data Analysis (year 1)

See https://www.cmu.edu/dietrich/statistics-datascience/academics/phd/core/index.html for details. Any substitutions or exemptions from coursework must be recommended by the student's advisor and approved by the PNC co-directors and the director of graduate studies in Statistics.

Program Milestones

The milestones listed below are stated as requirements, but some flexibility is likely to be necessary. In individual cases exceptions may be granted by the PNC training faculty and the Statistics faculty. In such cases clear alternative deadlines must be established and communicated in writing to the student.

First year research requirement: By the end of the first calendar year in the program, all students are required to complete a computational project. This project will be evaluated by a committee consisting of at least three faculty, two of whom are not one of the student's advisors, and of whom at least two are PNC training faculty. The project requires the student to identify a biological problem, understand the data collection process, articulate the goals of building a model or performing a particular kind of analysis and implement this computational approach. In some cases, this project may be a precursor to the student's eventual thesis project. This project cannot substantially overlap with a project completed for a class, although it may be on the same topic as a class project, provided that it represents a substantial extension of that work.

Students should begin formally discussing this research project no later than the end of the spring term. Initial steps should include forming this committee and organizing a meeting to discuss/outline the project with your committee. The makeup of this committee should be approved by the program

co-directors. At this first meeting the committee should approve the project proposal or indicate steps necessary to identify a new project. Then, before the start of the fall term, students must schedule a committee meeting where they present/defend their results. This meeting should occur by the end of the summer, and certainly no later than Sept 15 of the second year. The initial part of this meeting involves a 30 minute presentation by the student, which is open to the public. This will be followed by a meeting with the committee and the student, during which the committee will ask detailed questions about the work. Based on this meeting, the committee will evaluate the student's work and will decide whether a student passes, fails or needs to revise the project, subject to re-evaluation. Questions about the content of the presentation should be raised by the student with committee members well before the evaluation meeting. In the event of a pass, the student should have the committee sign a milestone completion form, which should be turned in to the Academic Program Manager. The form can be found on the NI Intranet.

Second year research requirement: In the second year, students are expected to work on research about 1/3 of their time during the academic year and full time during the summer. By the end of the second full year in the program all students are required to complete a deeper computational project. The student's work on the project should demonstrate that the student has 1) the ability to analyze and interpret experimental data in a particular area 2) the ability to develop and implement a computational approach incorporating the relevant level of biological detail and 3) the ability to organize, interpret and present the results of the computational work. This project should be a body of work suitable for publication. It is expected that this work will be written up as a manuscript suitable for submission to a journal in the relevant field; a draft of this manuscript must be submitted to the committee at least a week in advance of the meeting. In most cases this project will be on an area related to the student's eventual thesis project.

The evaluation of this milestone is similar to that of the first year milestone described above. The committee makeup follows the same requirements as for the first year milestone, though it does not have to be the same people. Students are recommended but not required to organize a meeting to discuss/outline the project with their committee. At this first meeting the committee would approve the project proposal or indicate steps necessary to identify a new project. Then students must schedule a committee meeting at which they will present/defend their results. This meeting should occur by the end of the summer, and certainly no later than Sept 15 of the third year. The initial part of this meeting involves a 30 minute presentation by the student, which is open to the public. This seminar must be advertised to the PNC community at least one week prior to the event. (To advertise, send the talk announcement including the date, time, place, title, abstract, and faculty committee to the PNC graduate program coordinator.) This will be followed by a meeting with the committee and the student, during which the committee will ask detailed questions about the work. Based on this meeting, and the submitted manuscript draft, the committee will evaluate the student's work and will decide whether a student passes, fails or needs to revise the project, subject to re-evaluation. In the event of a pass, the student should have the committee sign a milestone completion form, which should be turned in to the Academic Program Manager. The form can be found on the NI Intranet.

Note that the second year research requirement also counts to satisfy the Advanced Data Analysis project required by Statistics.

Ph.D. Thesis proposal: Required coursework should be completed by the end of the third year. During the fourth year a Ph.D. candidate should present a thesis proposal first to his or her thesis committee and then to the NI and Statistics community. The student will have two joint advisors, one from Statistics and the other a NI faculty member from outside of Statistics. A thesis committee will be formed and should be composed of at least four members, one of whom is an external member

(typically from outside CMU and Pitt); two must be PNC training faculty; two must be Statistics faculty; and at least one CMU or Pitt member must be from a discipline outside of statistics. The thesis committee is subject to approval by the PNC Program Directors and the Department of Statistics faculty.

The thesis proposal contains both a written and oral component. Both components should include: a succinct summary of the proposed research problem; the significance of the proposed research; a review of relevant literature relating to the problem; a review of the candidate's work leading up to the thesis, including preliminary results; a clear statement of remaining research; and a tentative schedule for completing the work. It should also conform to the stylistic requirements for thesis proposals in the Department of Statistics. The proposal document must be submitted to the thesis committee at least one week prior to the public presentation. As in the Department of Statistics, the thesis committee must offer its preliminary approval of the proposal following a meeting that is open to other faculty. The student then arranges to present the proposal publicly, so that NI and Statistics faculty and other community members can attend. Formal approval is conferred by the Statistics faculty and the PNC Program Directors.

Ph.D. Thesis Defense: Normally, the dissertation is completed during the student's fifth year. The student should set up a pre-defense meeting with their committee members six months prior to their defense. The final defense is a public presentation, in accordance with the College and University requirements for the Ph.D. This presentation is typically 45 minutes in length, followed by an open question and answer period from the audience. At the end of the public Q&A, the student will address any comments or questions from the committee in a private session. It is the candidate's responsibility to ensure that the College and University's guidelines are followed for publicity of the defense and the availability of the thesis document at least two weeks prior to the defense. Note that the defense must be held at least 21 days before the date the degree is awarded.

Collaboration with experimentalists

One critical aspect of a successful training program for computational neuroscience is to give students a detailed understanding of how the experimental data they are analyzing or modeling are collected. This allows students to appreciate the limitations of the experimental data (such as sources of variability), appreciate what kinds of experiments can and cannot be done and aid in their ability to interact with experimentalists. This also increases the relevance of the student's computational-based research and increases the overall caliber of the student's PhD dissertation.

All students in the PNC are encouraged to do experimental work and/or to collaborate closely with experimentalists. Students working in different areas will have different needs in terms of the extent of their involvement collecting experimental data. Some students will be in laboratories in which both experimental and computational work is being performed and will gain experience in both approaches throughout their training. If the experimental work involves animals, such students are expected to master, in addition to experimental procedures, basic principles governing animal care and oversight of animal welfare. Students working in a strictly computational lab are expected to do a 10-week rotation in an experimental lab with the intent to begin (or continue) a collaboration with that lab. The goal of this rotation is that students should be sufficiently well trained that they can design and carry out their own experiments. The student is responsible for meeting this requirement, and it should be discussed with the student's advisor not later than by the end of the first year. Note that the experimental rotation may serve as a major component of either the first-year or second-year research requirement but that this is not necessarily the case.

5.6: Ph.D. in Systems Neuroscience

Course Requirements

Students must complete the four-core course requirement to gain graduate level training in the following four areas: cell and molecular neuroscience, systems neuroscience, cognitive neuroscience, and computational neuroscience. Courses fulfilling this requirement, and a suggested order in which to take them include:

- 03-762 Advanced Cellular Neuroscience
- 03-763 Systems Neuroscience
- 86-765 Foundations of the Neural Basis of Cognition
- 36-759 Statistical Models of the Brain

Additional Course Requirements

- 03-747 Proposal Preparation and Peer Review
- 03-755 Graduate Research Seminar (3 units) x 2 semesters
- 03-750 Biology Departmental Research Seminar (1 unit) x 2 semesters

Statistics requirement

- 36-600: Statistical Learning for Non-Statistics Graduate Students
  OR
- 36-749 Experimental Design for Behavioral and Social Sciences

Two graduate-level elective courses in Neuroscience. Possible elective courses include:

- 02-620 Machine Learning for Scientists
- 02-719 Genomics and Epigenetics of the Brain
- 10-701 Introduction to Machine Learning
- 10-733 Representation and Generation in Neuroscience and AI
- 15-883 Computational Models of Neural Systems
- 36-617 Applied Linear Models
- 36-700 Probability and Mathematical Statistics
- 38-610, 611 Programming for Data Scientists & Large-Scale Computing
- 38-615 Computational Modeling, and Machine Learning in Science
- 38-616 Neural Networks and Deep Learning in Science
- 42-632 Neural Signal Processing
- 86-631 Neural Data Analysis
- 86-675 Computational Perception
- 86-783 Neural Engineering Laboratory

Other elective courses may be proposed, subject to approval of the program directors.

Program Milestones

Progress in the program is tracked based in part on students' successful completion of program milestones. A committee selected by the student and approved by the program director evaluates the performance on milestones. Failure to pass a milestone will result in a student being placed on probation. Specific conditions for removal of probation will be specified by the program director along with a set of deadlines for meeting these conditions. Failure to meet these conditions constitutes

grounds for dismissal from the program.

First year research requirement: By the end of the first academic year the expectation is that, in most situations, students will have chosen a thesis lab and will be able to critically summarize their research experiences over the first 9-12 months. The first milestone requires students to give an oral presentation summarizing the background and significance of their proposed research topic, to be evaluated by a committee consisting of at least 3 faculty, 2 of whom must be PSN core faculty. The presentation will include a critical analysis of at least one relevant published paper (chosen in consultation with the thesis advisor) that motivates the research question, and a summary of any work accomplished to date during one of the laboratory rotations. The initial part of this meeting (lasting ~30 minutes) will be a presentation by the student, which is open to the public. This will be followed by a closed meeting with the committee and the student, during which the committee will ask detailed questions about the presentation and the work. The committee will evaluate the student's work and will decide whether a student passes, fails, or needs to revise the project, subject to re-evaluation. In the event of a pass, the student should have the committee sign a milestone completion form.

Second year research requirement: During the fall semester of year 3 of the program, students will submit a written and oral presentation of their thesis work to date. Future directions can be discussed, but emphasis will be on work completed to date and the student's ability to formulate, test, interpret, and communicate a scientific research question. A three-person committee, comprised of the advisor and at least one PSN Training Faculty, will evaluate the student's progress to date, and will decide whether a student passes, fails, or needs to revise the project, subject to re-evaluation. This research requirement must be completed before the end of the fall semester.

One month before the oral presentation, students will meet with their committees to present their Specific Aims (a written version should be provided to the committee at least 1 week before the meeting). The Specific Aims should be a 1-page summary of the proposed project. During the committee meeting, students should make a 15-minute presentation of the project, using 3-5 slides for illustration. After verbal approval from the committee, students will then have up to 1 month to prepare their written reports and full oral presentation.

The written report should follow the style of an NIH grant proposal with a specific aims page, works cited page(s), and a research proposal with a maximum length of 6 single-spaced pages (11pt. font, 0.5 inch margins) consisting of the following parts:

- **Specific Aims (approximately 1 page)**
  State concisely and realistically what your research intends to accomplish and what hypotheses are tested. Write 1-2 general paragraphs introducing the subject and its relevance to biology, and then list three or four specific questions to be addressed. This section is critical because it provides a framework for the reader to appreciate the connections between sections of the proposal.

- **Significance (approximately 1-2 pages)**
  Briefly sketch the background to the proposal, critically evaluate existing knowledge and specifically identify the gaps the project intends to fill, i.e., summarize the general knowledge of the field, and identify where your questions fit in. This critical section displays your knowledge and understanding of the field and its current shortcomings. What are the major unanswered questions? Which ones can be answered with available tools? For which questions must new methods be developed?

- **Research Proposal (approximately 4-5 pages)**
  Discuss in detail the experimental design and the procedures to be used to accomplish the specific aims of the project. Include preliminary data and figures where appropriate. Include potential difficulties and limitations of the proposed procedures and alternative approaches to achieving the aims.

Students may seek guidance and feedback from their advisors about the general scientific directions they wish to take, the design of experiments, and the clarity of their presentations. Participation in the Proposal Preparation and Peer Review Course (03-747) is particularly encouraged. This mini-course introduces second-year students to the structure and preparation of a structured research proposal and formalizes instruction in professional standards in research ethics, CV preparation, and scientific writing and data presentation. Course material is from actual grant proposals, previous years' qualifying exam proposals, primary research publications, and faculty grant proposals. This course is in addition to other resources available within the department and at the university. The written proposal. however, must be primarily the student's work.

Ph.D. Thesis proposal: Required coursework should be completed by the end of the third year. During the fourth year a Ph.D. candidate should present a thesis proposal to his or her thesis committee and the community. The thesis proposal should include: a succinct summary of the proposed research problem; the significance of the proposed research; a review of relevant literature relating to the problem; a review of the candidate's work leading up to the thesis, including preliminary results; a clear statement of remaining research; and a tentative schedule for completing the work. The proposal should be limited to 15 pages, plus references, figures, or online appendices. The proposal document must be submitted to the thesis committee at least one week prior to the public presentation.

Advising on scheduling the proposal, and guiding in the formation of the dissertation committee, is the thesis advisor's responsibility. The thesis committee should be composed of at least four members: the advisor, at least one additional PSN training faculty member, and one external member. The external member is typically from outside the two participating Universities. All thesis committees are subject to approval by the PSN training faculty.

Ph.D. Thesis Defense: Normally, the dissertation is completed during the student's fifth year. The student should set up a pre-defense meeting with their committee members six months prior to their defense. The final defense is a public presentation, in accordance with the College and University requirements for the Ph.D. This presentation is typically 45 minutes in length, followed by an open question and answer period from the audience. At the end of the public Q&A, the student will address any comments or questions from the committee in a private session. It is the candidate's responsibility to ensure that the College and University's guidelines are followed for publicity of the defense and the availability of the thesis document at least two weeks prior to the defense. Note that the defense must be held at least 21 days before the date the degree is awarded.

5.7: Protocol for Evaluation of Transfer Credit

The program co-directors will review petitions for transfer credit on a case by case basis. Courses will be evaluated based on course level, topics covered, grade received, and credits earned. Courses below the graduate level will not be considered. Students must receive a grade of B or better for the transfer credit to be eligible for review. A course syllabus should be submitted as part of the review process.

5.8 Training in Responsible Conduct of Research

All students must complete Responsible Conduct of Research (RCR) training by the end of their second year. This training helps you understand ethical research practices.

There are two options to fulfill this requirement:

1. **Carnegie Mellon Libraries RCR Seminar Series:** This series offers workshops on various research ethics topics in half day training sessions. **Attending the entire series** will satisfy the RCR training requirement. More details and registration information can be found here: https://library.cmu.edu/services-overview/workshops-training#rc
2. **University of Pittsburgh Clinical and Translational Science Institute (CTSI) Seminar Series:** This series offers seminars on RCR topics at the University of Pittsburgh. You need to **attend at least 13 seminars** within one semester to fulfill the requirement. Explore the program details and register for individual seminars here: https://ctsi.pitt.edu/education-training/responsible-conduct-of-research-training/

Additionally, all students must participate in the three CNBC Ethics Brain Bag Discussions in their third year. These informal presentations serve as a refresher for the core ethics training you received earlier.

5.9: Teaching Requirements/Opportunities

In order to build skills in teaching, mentoring, communication and management skills, each student will be required to serve as a teaching assistant for two courses during their career as a graduate student in the program. The ideal scenario would include one introductory level course and one advanced level course. The time commitment for TA-ship should be roughly 12 hours per week. The student will receive a formal evaluation from the course instructor each semester they serve as a Teaching Assistant. Students must receive a satisfactory evaluation to receive credit for the semester. Students in joint degree programs will split their TA responsibilities between NI and the joint department.

TA Requirements for Specific Programs:

- **PNC Students:** Two semesters for NI
- **PNC/ML Students:** One semester in ML, one semester for NI
- **PNC/Stats Students:** One semester in statistics, one semester for NI
- **PSN Students:** Two semesters for NI

Graduate students are required to have a certain level of fluency in English before they can instruct in Pennsylvania, as required by the English Fluency in Higher Education Act of 1990. Through this Act, all institutions of higher education in the state are required to evaluate and certify the English fluency of all instructional personnel, including teaching assistants and interns. The full university policy can be reviewed here.

The fluency of all instructional personnel will be rated by Language Support in the Student Academic Success Center to determine at what level of responsibility the student can TA. In addition to administering the International Teaching Assistant (ITA) Test (a mandatory screening test for any non-native speaker of English), Language Support in the Student Academic Success Center helps teaching assistants who are non-native English speakers develop fluency and cultural understanding to teach successfully at Carnegie Mellon. Visit the Student Academic Success Center website for

additional information.

Alternate TA Fulfillment: PNC/PSN Outreach Ambassador

To join the Alternate TA Fulfillment program, the student must fill out a template petition and submit it to the Neuroscience Institute Student Organization (NISO) & Melissa Stupka by the end of the first academic year of the program (summer after 1st year of classes). This petition will indicate the student's interest in the alternate TA-ship, as well as a rough timeline of when they will complete the required activities and what types of activities they are interested in. To receive credit for the program, they must complete all requirements before their thesis proposal.

There are a few options for fulfilling the requirements for the alternate TA-ship, which are listed below. If a student feels strongly about another option not listed, they may petition the NISO Outreach and Diversity Committee and faculty for a new event. At the end of each semester, the regular NI student progress report will include a section for students in the alternate TA-ship to indicate which events they completed during the semester. After each event is completed, the students who attended will fill out a Google Form so that the events are tracked in a Google Sheets document, managed by NISO. This allows students and faculty to view their progress at any time. Although this tracking is available, the responsibility to complete events in a timely manner ultimately falls on the student.

When the student completes the TA-ship, they will turn in a final portfolio, detailing the events and experiences they had throughout their alternate TA-ship. This must be completed before the student's thesis proposal. This portfolio will be validated by the faculty program directors for official TA-ship credit.

List of TA Fulfillment Options:

- TA an NI class for 2 semesters (regular TA, must be done at least once)
- TA an NI class for 1 semester + any one of the following:
    - Serve as a TA for the PNC/PSN summer orientation, 2x
    - Serve as a TA for the NI Undergrad summer program, 2x
    - Serve as a TA for Neuromatch Academy summer program, 1x
    - Implement and lead 9 outreach events to teach younger students about neuroscience. Examples:
        - Backyard brains events at local Pittsburgh schools
        - Plan and host a SciTech day at the Carnegie Science Center
        - Plan and host a Saturday session at the Gelfand Center

5.10: Resources and Regulations Governing Research at Carnegie Mellon

Office of Sponsored Programs

Office of Research Integrity & Compliance

Intellectual Property Policy

Policy on Restricted Research

Human Subjects in Research Policy

5.11: Internship/Co-op Requirements and Opportunities

NI students may wish to participate in paid internships at off-campus organizations. Internships must be approved by the student's advisor and the co-directors of the graduate program. Internships are

typically undertaken during the summer semester, but can take place at other times with approval. NI will enroll all students who are pursuing an internship for a 3-unit credit bearing internship course (86-799 Internship for Graduate Students). This internship will appear on a student's transcript. Internships taken during the summer months will not incur tuition, internship experiences outside of the summer months may require full time tuition. The work for the internship must be appropriate to the goals of the academic program and be approved by the student's advisor.

International students are required to consult with the Office of International Education for eligibility for work authorization before starting or seeking an internship/co-op or consulting opportunity. International students will benefit from proactively reviewing OIE guidance regarding off-campus work authorization. Off-campus work authorization processing times can take several weeks or months, and international students will benefit from starting the off-campus work authorization process as early as possible.

SECTION 6: Department Policies & Protocols

6.1: Petition Procedures

Students who wish to make changes in any of the graduate procedures or guidelines in this handbook should contact the Program Co-Directors.

6.2: Department Policy for Withdrawing from a Course

Any student who wishes to withdraw from a course must consult with their advisor first. After that, the student will need to notify the graduate program director and Academic Program Manager to be informed of the process to withdraw from the course.

6.3: New Policies / "Grandfather" Policy

When policies are changed it is because the department believes the new rules offer an improvement. However, students currently enrolled whose degree program is affected by a change in policy may choose to be governed by the older policy that was in place at the time of their matriculation. In case degree requirements are changed and certain courses are no longer offered, the department will try to find some compromise that allows those students to satisfy the original requirements.

6.4: Time Away from Academic Responsibilities

Students with graduate assistantships are expected to continue with their research during academic breaks (including summer months) with the exception of official University holidays. Students need to consult their faculty advisor about coverage if they have challenges with taking time off during University Holidays. For example, if experiments are running that need to be monitored continuously, students should speak with their faculty about arrangements to take an equal number of days off at another time.

Paid time off for personal business or vacations generally is not included as part of a graduate's financial support. A supported graduate student who wants to take a short break (one or two weeks) must get approval for that break from his/her advisor and, if required by the terms of the student's support package, must make up the work.

Supported graduate students wishing to take longer periods of personal time off must do so without financial support. The advisor will notify the Department's Business Office of any such arrangements

so that an appropriate adjustment in the student's support can be processed.

The timing and length of any time off must be approved in advance by the advisor before travel commitments are made. Before absences, the student must discuss with the supervising faculty member(s) ways to ensure that his/her progress is satisfactory and that research and/or teaching responsibilities can be met satisfactorily. Students with TA responsibilities are expected to be on campus to attend any department required TA training and at the end of the semester to finish grading or other duties assigned by the department.

6.5: Role of an Advisor and Advisor Assignments

Selection and change of thesis advisor

At all times during their graduate training, students will be engaged in research under the supervision of a faculty advisor. This advisor is responsible for the academic and financial support of the student. During the first year of the program students will complete 2 rotations with faculty advisors who will guide the student in selecting courses and help form his or her initial research project. By the end of the summer following the first-year students must identify a thesis advisor, which in many cases will be one of their rotation advisors. Occasionally, a student's faculty advisor may be changed (see below); most often this change occurs because of a change in the student's research interests. If the advisor must change for any reason, it is the responsibility of the student to identify a new advisor who is willing and able to provide academic and financial support. This advisor must then be approved by the program co-directors and the director of the Neuroscience Institute.

A student may voluntarily change advisors with the mutual consent of the new advisor, the program co-directors and the director of the Neuroscience Institute. An advisor may terminate his or her supervision of and responsibility for a student after written notification of the problems, which may include lack of effort, lack of research progress, lack of research aptitude, failure to obey policy or procedures, failure to comply with University regulations, or behavior detrimental to the laboratory or program. Consideration of this action must be brought to the attention of the student, the program co-directors and the Neuroscience Institute Director. A student who no longer has an advisor will be given two weeks to find a new advisor. Students without advisors after this time may be terminated from the program.

Individual Development Plan (IDP)

Individual Development Plans (IDPs) are meant to promote professional and personal growth by formally documenting goals and facilitating dialogue, collaboration, and accountability between advisors and advisees. Carnegie Mellon has developed a set of templates that can be used by doctoral students and their advisors to create an Individual Development Plan. You can find the templates here: https://www.cmu.edu/graduate/professional-development/index.html

6.6: Review/Redress of Academic Conflicts

Grievances within the department

From time to time students may have complaints about some aspect of their training. Graduate students are encouraged to discuss such concerns with any faculty member, especially their advisors or the program co-directors. The Neuroscience Institute tries to solve problems informally, but there may come a time when a problem arises that cannot be resolved through informal procedures. To provide for this situation, there is a formal grievance procedure.

The process will commence when a student files a grievance in writing with the director of the

Neuroscience Institute. The grievance will be discussed by a three-person board including the director of the Neuroscience Institute and two faculty members selected by the director. The board will render a written recommendation, with copies sent to the student, the office of the Dean of Dietrich College, and those against whom the grievance was brought (if specific individuals are involved). No person against whom the grievance is brought will have a role in investigating it. If the director is among those against whom the grievance is brought, then the Dean will be asked to designate another senior faculty member from the Neuroscience Institute to substitute for the co-director on the three-person board.

University policies and agreements governing student, staff, and faculty rights supersede this procedure. If a satisfactory settlement is not reached through the activity of the three-person board described above, the student may bring the grievance to the Dean and, subsequently, to the Provost. In this case the grievance board's written recommendation will be part of the preliminary background information reviewed by the Dean or Provost or other University official before any action is taken.

The student may withdraw the grievance at any point throughout the Departmental investigation.

Grievances within Dietrich College
Any graduate student who has exhausted normal grievance procedures within the Department may present a grievance to the office of the Dean of the College. The Dean may request statements or testimony from other parties involved, and will consider the grievance in an ad hoc committee composed of the Dean, a faculty member from a department not involved in the grievance and a graduate student from a second uninvolved department. The committee will present its decision in writing to all parties involved.

See also: Summary of Graduate Student Appeal and Grievance Procedures for University policies and procedures.

SECTION 7: Grading & Evaluation

7.1: Grading Scale/System
The department uses the University grading system which ranges from R to A+. Individual required courses must receive a grade of B or better in order to count toward degree completion.

7.2: Department Policy on Grades for Retaking a Course
Students who do not successfully complete a course (grade below B) can retake the course for credit.

7.3: Department Policy on Pass/Fail, Satisfactory/Unsatisfactory
Required courses are not offered pass/fail; students must receive a letter grade.

7.4: GPA Requirements and QPA Requirements for Graduation
Individual required courses must receive a grade of B or better in order to count toward degree completion. There is no specific GPA/QPA requirement for graduation.

7.5: Graduate Student Academic Standing

A student's academic standing is determined based on their adherence to graduate handbook requirements, committee and advisor interactions, research progress, conceptual thinking development, and working relationship with the advisor.

Satisfactory Progress:

- Meets all graduate handbook requirements.
- Regularly meets with the committee and advisor.
- Engages in sufficient research.
- Develops independent conceptual thinking.
- Maintains a constructive working relationship with the advisor.

With Concerns: A student may be placed on "with concerns" status for one or both of the following reasons:

- **Non-compliance with requirements:** Failure to meet a graduate student requirement, such as committee meetings, milestone approvals, or thesis proposal.
- **Overall progress concerns:** Deficiencies in research progress, course performance/completion, teaching responsibilities, or failure to address committee feedback.

If concerns persist for a semester, the student will be placed on **Unsatisfactory** status. The committee will outline specific concerns, remediation procedures, and evaluation methods in the evaluation letter.

Extenuating Circumstances: In cases of physical health, mental health, family, or personal emergencies, the advisor and student can petition the graduate committee for an additional semester to address concerns without being placed on Unsatisfactory status. Workload is not considered an extenuating circumstance.

Unsatisfactory: After being designated "with concerns" for one semester, a student will be placed on **Unsatisfactory** status if they fail to address the concerns. This can lead to **probation**.

Probation(n-1): Probation is assigned to students who have not addressed the identified concerns of the evaluation committee from the prior semester. This typically indicates that the student is unlikely to complete their Ph.D. or conduct independent research. Behaviors that lead to probation may include:

- Insufficient research work or progress.
- Inability to develop independent conceptual thinking.
- Problematic relationships with the advisor, students, or committee.
- Violations of university community standards or the Carnegie Mellon Code.

See section 6.6: Review/Redress of Academic Conflicts for appeal process.

See also: Summary of Graduate Student Appeal and Grievance Procedures for University policies and procedures.

7.6: Regular Reviews and Evaluations by Department

Students are required to complete a summary of their activities—including research, teaching, presenting at conferences—twice per year. The summary is to be submitted via an online system (https://gsaudit.cs.cmu.edu) and includes goals for the past semester, areas of strength, areas of improvement, advances in professional development, special projects, goals for the upcoming semester, and completion of required milestones. The summary is required to be entered in the online system no later than 1 week prior to the graduate evaluation meeting.

Twice per year (August and January), the faculty as a whole meet to review each student's performance. Results of the review are communicated to the student in a letter that can be viewed in the online system. This meeting serves to monitor the student/advisor relationship, to ensure that students are treated equitably in the evaluation process, and to determine whether the student is progressing adequately in the program. The meeting also serves to bring to the faculty's attention students who are failing to meet formal requirements. Students not receiving satisfactory performance in the January review will be reviewed by the Program Directors in May.

Each student is assigned a status based on their performance during the previous semester at the graduate evaluation meetings.

**There may be specific circumstances in which a student is automatically placed on probation after violating a university standard. These circumstances will be evaluated by the graduate program co-directors and department head.

If the student does not have Satisfactory Academic Standing, the specific concerns of the committee will be outlined in the evaluation letter along with procedures for remediation and evaluation. These concerns must be remedied to the satisfaction of the advisor and the program co-directors. Exceptions to the policy can only be made with the full approval of the student's committee and the graduate committee.

Details on the standings and how they are handled are in the previous section titled, “Satisfactory Academic Standing.”

7.7: Termination of a Student from the Graduate Program

Students may be terminated from the Graduate Program for failure to achieve a “B” or better in two required core courses or one of these courses on successive occasions, failure to pass any program milestone, failure to make adequate progress in research, failure to find/maintain an acceptable research advisor, breaches in ethical conduct such as plagiarism or for conduct detrimental to the program. Except for instances involving breaches in legal or ethical behavior, students will not be terminated from the Program without first being notified in writing that they have been placed on probation. This written communication will include a description of the reason(s) for placing the student on probation, and the goals that the student must accomplish in order to regain good standing in the Program.

When a student who is not on probation fails a program milestone, the student will be placed on probation and given a second opportunity to pass that milestone. The student will receive a written communication from the committee that evaluated performance on the exam detailing the deficiencies in performance and what must be accomplished to satisfy these concerns. A second failure of the same milestone constitutes grounds for termination from the Program. When a student who is already on

probation fails one of the major examinations, the student may or may not be given a second opportunity to pass that examination, at the discretion of the NI training faculty.

In all cases, the termination of a student requires a decision by the training faculty and acceptance of a recommendation for dismissal by the Director of the Neuroscience Institute. Terminations are final.

SECTION 8: Funding & Financial Support

8.1: Statement of Department Financial Support

The department uses a number of sources to fund graduate students, including tuition allocations from the administration, training grants, research grants, and departmental fellowships for tuition and stipend. Students are encouraged to seek outside funding – under the direction and guidance of their advisor and committee—for tuition, stipends, research and travel. From these various sources, the department provides all students who remain in good standing, academically, at least five years of tuition and five 12-month stipends (including summer semesters). The department will inform students in writing about any change in anticipated financial support as soon as information is available.

8.2: Stipend and Tuition

Support for the 2024-2025 year is as follows: stipend $3,166.77 per month ($38,000 per year), tuition $51,500 per year, and Activity Fees $973 per year. Graduate students in the Neuroscience Institute are paid on a semi-monthly schedule from August 16 - August 15 with the first pay date on 9/1. Please see the semi-monthly student worker pay calendar for specific payment dates: https://www.cmu.edu/hr/service-center/payroll/payroll-calendars.html

8.3: Health Insurance Requirement

Carnegie Mellon requires that all students carry health insurance. University Health Services contracts with insurance companies to provide students with medical, dental and vision health insurance. For information regarding plans and premiums, please visit the University Health Services website. If students are already insured, they must submit a waiver to University Health Services. Waivers are subject to approval and must be returned to University Health Services by a certain deadline. Students can check to see if their waiver has been granted via Student Information Online by going to the 'Campus Life' tab.

Doctoral students who have not waived the Student Healthcare Insurance Program (SHIP) by August 15 will see a credit of 100% of the insurance plan fee applied to their student account by the end of August, which applies only to the individual premium for medical coverage. While the 100% individual premium support only applies to doctoral students, their family members can still enroll in the university health plan. Note: The health insurance credit is a non-qualified scholarship, and is considered taxable income by the Internal Revenue Service (IRS) to all students who receive it.

If your enrollment status or location changes in the spring and you choose to enroll in the university health plan for the spring semester (during the open enrollment period in January) then a prorated credit will be applied to your student account to correspond with the individual health insurance premium cost charged.

When a cancellation is approved by University Health Services, Student Financial Services will make

the corresponding adjustment to the charge and support adjustment accordingly.

8.4: Travel/Conference Funding

Students who have new work to share should typically be able to attend at least one conference per year to present their results. In general, we expect the student's advisor (or research grant supporting the work to be presented) will support these costs. Students in PNC and PSN can request a $500 travel award once per academic year for a research or professional development related conference/workshop.

Requests will be approved based on the following criteria:

- The student has good academic standing in their program.
- Their advisor is cc'ed on the request.
- The request is within departmental and university policies and guidelines.

All requests should be submitted to Melissa Stupka in advance of the conference/workshop and include:

- Conference name, location, dates
- Total cost estimate

Other Funding Resources:
CMU Graduate Student Conference Funding
https://www.cmu.edu/graduate/funding/conference.html

8.5: Computer Funding

First year PNC/PSN Students are eligible for a one-time purchase of a computer for education and research purposes. Students will be able to select from 3 standard options. Options for standard computer models can be found on the NI Intranet. To request a computer purchase, students should contact Melissa Stupka.

If none of the standard options will suit your needs, you can purchase a computer and be reimbursed up to $1000. You will need to have the computer approved by Melissa Stupka before making any purchases. We may not be able to process the reimbursement if you fail to get prior approval.

More information: https://intranet.ni.cmu.edu/graduate-student-computer-policy/

8.6: Additional Sources of Internal & External Financial Support

CMU Conference Funding:
https://www.cmu.edu/graduate/funding/conference.html

CMU Funding Opportunities & Fellowships:
https://www.cmu.edu/graduate/funding/index.html

More information can be found on the NI Intranet:
https://intranet.ni.cmu.edu/graduate-student-funding-opportunities/

8.7: Department Policy on Outside Employment

Neuroscience Institute PhD Students enrolled in our program and funded by research grants,

fellowships or other funding mechanisms are expected to spend all their work time on their academic activities towards completing their degree. Outside paid work is not normally compatible with full time PhD student status. However, in some circumstances the Neuroscience Institute may permit full-time PhD students to devote up to 8 hours per week (averaged over any one semester) to outside, paid, professional activities, where that activity is consistent with the student's role as a member of the student body, and where that activity also enhances the contribution of the student to the university. To obtain that permission, a student must apply ahead of time by filling out the NI PhD Student Consulting Agreement. Of course, the student must also make sure they comply with all applicable U.S. laws, including specific terms of their visa, if applicable.

International Students will have to contact OIE and fill out the CPT Form.
https://www.cmu.edu/oie/foreign-students/docs/cpt-advisor-recommendation.pdf

8.8: Requirements for the Continuation of Funding

Students are typically funded for 5 years. However, they must be in good standing with the program in order to continue to receive stipend and tuition funding. Students are evaluated twice per semester and will receive written notification of their standing.

8.9: Emergency Funding Policy for NI Graduate Students

The Neuroscience Institute recognizes that unforeseen financial hardships may arise during graduate studies. To provide support in such circumstances, NI offers an emergency funding program. Eligible expenses include, but are not limited to, unexpected medical bills, immediate household necessities (rent, utilities, food), and other urgent financial obligations.

Application Process:
Graduate students requiring emergency funds should submit a written request to the Academic Program Manager. Requests under $500 will be processed and approved by the Academic Program Manager. For requests exceeding $500, approval from both the Academic Program Manager and the Department Head is necessary.

The request should provide a concise explanation of the financial emergency and its impact.

See also CMU Student Emergency Support Funding:
https://www.cmu.edu/student-affairs/dean/loans/

SECTION 9: Training Faculty

Any potential PhD thesis advisor must be a member of the NI approved training faculty. Training faculty will be drawn from Pitt and CMU. Training faculty from the two campuses will be treated equally in every respect, including availability and cost of students.
Neural Computation Training Faculty
Systems Neuroscience Training Faculty

SECTION 10: Other Resources

10.1: Center for the Neural Basis of Cognition

Students are highly encouraged to join the Center for the Neural Basis of Cognition (CNBC), a joint interdisciplinary neuroscience program between Carnegie Mellon University and the University of Pittsburgh, that provides exposure to the broader Pittsburgh neuroscience community. The CNBC provides a graduate certificate program with requirements that heavily overlap with those of the PNC and PSN programs, offers satellite activities that foster students' professional and scientific development, and accepts proposals for seed funding to support career development and build interdisciplinary collaboration. The CNBC website (http://www.cnbc.cmu.edu) provides more information and a link to apply.

10.2: Neuroscience Institute Intranet

The intranet includes many helpful resources including facilities information, graduate student resources, IT help/tech info, department logos and more.

Useful Intranet Links:

- https://intranet.ni.cmu.edu/
- https://intranet.ni.cmu.edu/category/graduate-student-resources/
- https://intranet.ni.cmu.edu/milestone-defense-completion-forms/
- https://intranet.ni.cmu.edu/category/cmni-logos-unitmark-and-letterhead/

10.3: Neuroscience Institute Student Organization

The NI students are organized by the Neuroscience Institute Student Organization (NISO), made by and for CMU neuroscience students. The purpose of NISO is to organize social, career-building, and outreach events for all cohorts of NI graduate students across both PNC and PSN, fostering camaraderie and giving back to our community. We also represent the needs, wants, and concerns of graduate students in our program, serving as a bridge between students and faculty.

Contact: Reece Keller (rdkeller@andrew.cmu.edu)

10.4: Purchasing and Reimbursement Procedures and Policies

Students should consult with the Academic Program Manager prior to making any purchases that will require departmental funds.