December 17, 2015

MEMORANDUM

TO: Gregory Ball  
   Dean, College of Behavioral & Social Sciences

FROM: Elizabeth Beise  
   Associate Provost for Academic Planning and Programs

SUBJECT: Proposal to Modify the Ph.D. in Neurosciences and Cognitive Sciences (PCC log no. 15027)

The proposal to modify the Ph.D. in Neurosciences and Cognitive Sciences has been administratively approved. A copy of the proposal is attached.

The change is effective Spring 2016. Please ensure that the change is fully described in all relevant descriptive materials.

MDC/  
Enclosure

cc: Andrew Harris, Chair, Senate PCC Committee  
Barbara Gill, Office of Enrollment Management  
Reka Montfort, University Senate  
Erin Taylor, Division of Information Technology  
Pam Phillips, Institutional Research, Planning & Assessment  
Anne Turkos, University Archives  
Linda Yokoi, Office of the Registrar  
Alex Chen, Graduate School  
Wayne McIntosh, College of Behavioral & Social Sciences  
Jens Herberholz, Neuroscience and Cognitive Science Program
THE UNIVERSITY OF MARYLAND, COLLEGE PARK
PROGRAM/CURRICULUM/UNIT PROPOSAL

- Please email the rest of the proposal as an MSWord attachment to pcc-submissions@umd.edu.
- Please submit the signed form to the Office of the Associate Provost for Academic Planning and Programs, 1119 Main Administration Building, Campus.

College/School:
Please also add College/School Unit Code-First 8 digits: 1280101
Unit Codes can be found at: https://hyperion.umd.edu/reports/units.htm

Department/Program: 1280106
Please also add Department/Program Unit Code-Last 7 digits:

Type of Action (choose one):
- Curriculum change (including informal specializations)
- Curriculum change for an LEP Program
- Renaming of program or formal Area of Concentration
- Addition/deletion of formal Area of Concentration
- Suspend/delete program

Italics indicate that the proposed program action must be presented to the full University Senate for consideration.

Summary of Proposed Action:
The NACS faculty proposes a change in the format of the NACS qualifying examination to that of a written grant proposal and oral defense of the grant proposal. It has become evident—through Graduate Outcomes Assessment (GOA) reports and faculty & student feedback—that the qualifying exam needs to move away from being a test of knowledge gained in core courses and towards a mechanism to evaluate a student's ability to apply that knowledge to the development of their PhD dissertation. It is anticipated that this change in format will 1) decrease time to degree, 2) require students to write about and defend their own ideas, 3) allow students to use portions of their qualifying exam for other training-related purposes, 4) require students to confront the broader issues in neuroscience and cognitive science, and 5) give students a skill (writing a grant proposal) that will better prepare them for their professional lives.

Departmental/Unit Contact Person for Proposal: Pam Komarek

APPROVAL SIGNATURES - Please print name, sign, and date. Use additional lines for multi-unit programs.

1. Department Committee Chair: Richard Payne 9-17-15
2. Department Chair: Jens Herberholz 9-16-15
3. College/School PCC Chair KAROL SOLTER 10-20-15
4. Dean Wayne Hendrick 10/20/15
5. Dean of the Graduate School (if required) 12/19/15
6. Chair, Senate PCC Andrew Hess 12/4/2015
7. University Senate Chair (if required) 12/17/2015
8. Senior Vice President and Provost Elizabeth J. Stein 12/17/2015
Overview of NACS Program

The Neuroscience and Cognitive Science (NACS) doctoral program is a campus-wide PhD program that offers interdisciplinary graduate training in seven research focus areas: Cellular & Molecular, Cognition & Emotion, Computational Modeling & Theory, Development & Aging, Disorders & Treatment, Language & Speech, and Sensory & Motor Systems.

Within and across these focus areas, more than 130 faculty advisors lead internationally renowned research programs. Research activities are carried out in laboratories housed in 23 departments and units across the university’s campus as well as at first-class neighboring research institutions such as the National Institutes of Health, Children’s National Medical Center, and Walter Reed National Military Medical Center. Currently 51 students are in the program and 70 students have graduated from the program.

The NACS program’s overall mission is threefold: (1) to provide a core of research and training opportunities for graduate students in neuroscience and cognitive science; (2) to provide formal structures for facilitating interaction and collaboration across disciplines and across the NACS core and the associated disciplines; (3) to foster communication among the diverse elements of the NACS community.

We propose to change the existing Qualifying Exam (QE) to a new format.

Current (old) requirements

- Coursework
  - Two required courses
    - NACS 600 Ethics in Scientific Research
    - NACS640 Foundational Readings Seminar
  - Three of the following five courses (one course from each area)
    - Cognitive Area
      - NACS 642 Cognitive Neuroscience
      - NACS 645 Cognitive Science
    - Neuroscience Area
      - NACS 641 Introduction to Neuroscience
      - NACS 643 Computational Neuroscience
      - NACS 644 Cellular and Molecular Neuroscience
  - Three supplemental courses (minimum of 9 credits)
- First Year Research Project
- Qualifying Exam (written exam given over two days and an oral defense)
- Dissertation Proposal
- PhD Defense

Proposed (new) requirements (change underlined)

- Coursework
  - Two required courses
    - NACS 600 Ethics in Scientific Research
    - NACS640 Foundational Readings Seminar
  - Three of the following five courses (one course from each area)
    - Cognitive Area
      - NACS 642 Cognitive Neuroscience
      - NACS 645 Cognitive Science
- Neuroscience Area
  - NACS 641 Introduction to Neuroscience
  - NACS 643 Computational Neuroscience
  - NACS 644 Cellular and Molecular Neuroscience
    - Three supplemental courses (minimum of 9 credits)
- First Year Research Project
- Qualifying Exam (written grant proposal and an oral defense of the grant proposal)
- Dissertation Proposal
- PhD Defense

**Identification of and Rational for the Change**

**Overview of Change**

The NACS Qualifying Exam (QE) is an important milestone in a student’s progress towards the PhD. The purpose of the current QE is two-fold: 1) to assure that the student has mastered the core material expected of all NACS students, and 2) to assure that the student has the specialized knowledge and skills that will be required for the successful development of a dissertation proposal.

The current QE includes a reading list and two components:

- **Reading List:** The reading list consists of the core list determined by the faculty in that area, and additional readings determined by the student in consultation with his/her committee. The core reading list should make up at least 50% of the student’s reading list. A combined list of 25 articles or chapters is suggested as a guideline for each block of the exam.

- **Written Component:** The written section of the QE has 4 blocks, completed over 2 days in September of the student’s third year. The 4 blocks cover the student’s research area and key concepts covered in three of the following NACS core areas: Systems, Cognitive Neuroscience, Computational Neuroscience, Cellular and Molecular Neuroscience, and Cognitive Science. Students are allowed up to 4 hours for each block of the written section, e.g., 9am – 1pm, 2pm – 6pm. The written section is open-book and open-computer but not open-internet. The written section emphasizes depth and integration of material from the student’s research area and key concepts from the core curriculum.

- **Oral Component:** The written section of the QE is followed by an oral section given 4-6 weeks later. The purpose of the oral section is to expand upon answers to questions in the written section and to review any weaknesses the student revealed in the written section.

As the NACS program has grown over the years, it has become evident—through Graduate Outcomes Assessment (GOA) reports and faculty & student feedback—that the qualifying exam needs to move away from being a test of knowledge gained in core courses and towards a mechanism to evaluate a student’s ability to apply that knowledge to the development of their PhD dissertation.

- **GOA reports indicate that areas is most in need of improvement are 1) making timely progress on research, 2) developing clarity and effectiveness in oral presentations, and 3) developing the ability to articulate the impact of a proposal on a broad scientific field, on clinical outcomes, or on society.**

- **Main concerns expressed by faculty and students are 1) some students are unable to go beyond giving textbook answers, 2) students are revisiting things they should have learned in class, 3) answers are often not clearly written, 4) students display little independent thought, and 5) the QE slows down timely progress in the program because it pulls students off their research for a few months.**
In an effort to address these concerns from faculty, students, and GOA reports, the NACS faculty has voted to approve a change in format of the NACS qualifying examination to that of a written grant proposal and oral defense of the grant proposal. It is anticipated that this change in format will improve the QE in the following ways:

- It will decrease time to degree since it will focus on topics related to the student's own research.
- It will require the students to write about and defend their own ideas.
- It will require independent thinking from the students.
- It will allow the students to use portions of the QE for other training-related purposes. They could modify the QE and submit it as a grant proposal. The extended background/significance section could be submitted as a review paper. Sections of the QE could be eventually incorporated into the student's dissertation proposal.
- Having the students include a Future Goal (broad concepts and technologies outside of their own field) will require them to confront the broader issues in neuroscience and cognitive science. It could also inspire ideas for a post-doc position or a research area of their own.
- It will give students a skill (writing a grant proposal) that they will apply again and again in the future. This will better prepare the students for their professional lives.

In summary, this change in format of the QE will provide a mechanism to determine whether the student not only has the critical thinking and creative skills necessary to complete a PhD degree, but also has the ability to integrate information from the literature as well as the student's coursework. Most importantly, it will show whether the student can apply this information to their research. Since the focus of the QE will be on the student's research, the change in format should promote timely progress on research, reduce time to degree, improve clarity and effectiveness in the oral defense, and result in a project that the student can use for other research purposes. With the future goal component, the change should also advance the student's ability to articulate broader impacts of research. In addition, the change should foster independent thinking and provide the important skill of grant writing that the student can apply in their future career.

**Detailed Description of the new QE format**

The qualifying examination will include two components:

1. A written grant proposal
2. An oral defense of the grant proposal

The written grant proposal is intended as a hypothetical but feasible demonstration of the student's ability to identify gaps in the research literature and to propose solutions within an area of research that the student and their advisor see as relevant to the student's eventual Dissertation Proposal. The Guidelines and Grading Rubric encourage a broad proposal with multidisciplinary components that are not necessarily limited to what the student can achieve in their home laboratory or work group. Elements of this written grant proposal can be incorporated into the student's later Dissertation Proposal, where the emphasis should then be on the feasibility, likely success and significance of experiments to be performed under the guidance of the student's advisor and on the interpretation of preliminary data.

The written grant proposal and its evaluation are modeled on those typically used by major funding agencies in the USA, but with a greater emphasis on the background, significance and impact of the proposed work. The Committee will review and evaluate the written grant proposal, making a decision as to whether the proposal is defensible in the oral component.

The oral defense will place particular emphasis on the student's knowledge of background material, including relevant coursework, techniques and analytical methods, as well as the historical context and the broad significance of the proposed work.
Guidance for Students
Primary guidance for the development of the grant proposal rests with the student’s mentor(s) and committee members, subject to the guidelines below. The student will also have access to the NACS Grants Development Specialist for discussions and workshops concerning the general format and style of successful grant proposals, keeping within the guidelines below.

Written Grant Proposal
Guidelines
- The grant proposal should take a broad approach to addressing an important problem or a critical barrier to progress within the student’s research area. It can be related to the research project the student is already independently working on or on a submission for external funding. It should not include grant proposals that the student has written for a previous course or examination that the student has taken.
- The student decides on the topic of the grant proposal. There must be consensus amongst the student, the advisor, and committee members as to the suitability and scope of the topic. The student may have general discussions with his/her mentor or other relevant colleagues during proposal preparation, but the final full-length version should be written independently. The written grant proposal is an examination and must represent the student’s ideas for development of the research project. The student must follow university guidelines for academic integrity in the preparation of the grant proposal (see www.president.uni.edu/policies/ill100A.html).
- The Two Specific Aims within the grant proposal should describe a project that can be carried out within two years. No budget needs to be included in the grant proposal.
- In writing the grant proposal, the student should pay attention to Evaluation Criteria detailed below. Particular emphasis is placed on the Background and Significance section of the proposal. This section is expanded relative to that in an agency grant application.
- Experimental safety, and the use of biomaterials, animals or humans, should adhere to established ethical and safety guidelines, but details of their adherence to those guidelines are not required.
- The grant proposal may be eventually incorporated into the student’s dissertation proposal, where the emphasis should be on the likely success of experiments and on the interpretation of preliminary data.

Format
The grant proposal should include the following elements:
- Abstract / Lay Summary (1 page)
  - Provide a brief summary of the grant proposal (background, specific aims, approaches used, and future goal) that is targeted to a general audience.
- Two Specific Aims (1 page)
  - State broad objectives. Do not subdivide specific aims (e.g. Aim 1b etc.). Describe concisely the specific hypothesis to be tested and what the research is intended to accomplish.
  - In addition to following the guidelines above, students should consider the following questions concerning their Specific Aims:
    - What is the fundamental problem that will be addressed?
    - Why is testing the hypothesis, solving the problem, or making these observations important for your field of research?
    - Does the proposed research challenge an existing concept or seek to establish a new idea?
    - What is original about the approach?
- One Future Goal (1 page)
  - Must include broad concepts and technologies outside the student’s own field.
  - Must adopt an interdisciplinary approach (for example a systems-level or computational approach to a cellular neuroscience project or a cognitive neuroscience approach to a cognitive science project). If both specific aims are interdisciplinary, it is not necessary for the future goal to adopt an interdisciplinary approach.
• Background and Significance (8-10 pages)
  o Summarize the background to the grant proposal. Critically evaluate the history of relevant work in the research field and the state of existing knowledge. Critically evaluate the history and utility of techniques to be used in the project. Identify gaps in knowledge or techniques that the proposal is intended to fill. Justify the importance of the research described by relating the specific aims to broad, long-term scientific objectives.
  o In addition to following the guidelines above, students should consider the following questions concerning the background and significance of their proposal:
    ▪ How does previous work in your research field inform your proposal?
    ▪ How does work done in fields of research or on societal issues outside of your discipline inform your proposal?
    ▪ What impact does your proposal have beyond your laboratory group?
    ▪ Does your proposal have clinical significance or an impact on society?
    ▪ Are there gaps in current knowledge that the proposal is designed to address?
    ▪ Do your proposed techniques have limitations or distinct advantages compared to others?

• Research Design and Methods (5-7 pages)
  o Describe the research design and procedures to be used to accomplish the specific aims of the project. Include the means by which the data will be collected, analyzed, and interpreted. Describe any new methodology and its advantages over existing ones. Discuss potential difficulties and limitations of the proposed procedures and alternative approaches to achieve the aims.
  o In addition to following the guidelines above, students should consider the following questions concerning their Research Design and Methods:
    ▪ How do your design and its methods achieve your specific aims? Will your conclusions be definitive?
    ▪ Does the approach overcome existing challenges or barriers in the research field?
    ▪ If your methodology is new, what is innovative about your approach?

• Literature Cited [unlimited pages]
  o Provide a complete bibliography of literature cited including authors’ names, title of publication, year, journal or book title, volume, and page numbers. Citations must be listed alphabetically in the reference list and as author(s) and year(s) in the text.

• The document should be formatted as indicated below:
  ▪ 15-20 pages, excluding figures and references.
  ▪ 12 point Arial font
  ▪ .75” margins all around
  ▪ Single line spacing

Evaluation Process
• The student, advisor, and committee must reach consensus on a tentative title for the grant proposal before the end of April in the student’s second year. It is the student’s responsibility to email the title to the NACS Office.
• Each committee member will read the grant proposal and complete an electronic Scoring Rubric Form. On the form the committee member will provide a rating score of 1-5 (Poor to Excellent) for 14 criteria. A Total Score (the average of the 14 rating scores) will be automatically calculated on the electronic Scoring Rubric Form. Each committee member will also complete a Written Grant Proposal Comments Form. On the form the committee member will provide a ½ - 1 page review of the grant proposal, which should include specific feedback to the student in preparation for the Oral Defense (if the grant proposal is acceptable) or a rewrite of the grant proposal (if the grant proposal is rejected).
• The Committee must meet (either in person or through electronic communication) to discuss the Total Scores on the Scoring Rubric Forms. At the meeting the student’s advisor will transfer the committee
members' Total Scores from the Scoring Rubric Forms into a QE Written Proposal Decision Form and calculate an average, which will serve as the Overall Score on the written grant proposal.

- The student must receive an Overall Score of 3.0 or above in order for the written grant proposal to be accepted. Acceptance indicates that the grant proposal is defensible at the Oral Defense.
- The Committee Chair will forward all Scoring Rubrics Forms, all Written Grant Proposal Comments Forms, and the QE Written Grant Proposal Decision Form to the NACS Office. The NACS office will then forward all Written Grant Proposal Comments Forms and the QE Written Grant Proposal Decision Form to the student.
- Grant Proposal Accepted
  - If the Committee accepts the grant proposal, the student proceeds to the Oral Defense.
- Grant Proposal Rejected
  - If the Committee rejects the grant proposal, the student will have one month to rewrite the grant proposal. The student must immediately schedule a meeting with his/her mentor(s) to discuss the Overall Score, the comments, and the work needed to re-write the grant proposal, subject to the Guidelines above. The student can rewrite the grant proposal one time only.
  - If the grant proposal is rejected a second time, the student will not be permitted to continue in the Ph.D. program. The student may submit a petition to NACS to complete a terminal Master's Degree.

Criteria
The Committee will evaluate the written grant proposal on the criteria shown below using a rating scale of Excellent = 5 points, Very Good = 4 points, Good = 3 points, Fair = 2 points, Poor = 1 point for each item. The student must receive an Overall Score (average of each committee member's Total Score) of 3.0 in order for the written grant proposal to be found Acceptable.

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<th>Background and Significance</th>
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<td>1  The student displays an adequate knowledge of the history of the research field.</td>
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<td>2  The student identifies gaps in current knowledge that the proposal is designed to address.</td>
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<td>3  The student displays an adequate and critical knowledge of the techniques to be deployed and their history.</td>
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<td>4  The project addresses an important problem or a critical barrier to progress in the research field.</td>
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<td>5  The project has impact beyond its research field.</td>
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<th>Specific Aims, Future Goal, and Research Design and Methods</th>
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<td>6  The strategy, methodology, and analyses are well-reasoned and appropriate to accomplish the specific aims of the project.</td>
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<td>7  The results of the project are definitive.</td>
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<td>8  The grant proposal successfully integrates interdisciplinary concepts or technologies.</td>
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<td>9  Potential problems, alternative strategies, and benchmarks for success are presented.</td>
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<td>10  Risky aspects are managed well.</td>
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<td>11  The future goal includes broad concepts and technologies outside the student's own field.</td>
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<td>Presentation</td>
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<td>12 The writing is clear.</td>
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<td>13 The writing appropriately uses language.</td>
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<td>14 The writing appropriately uses terminology.</td>
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**Oral Defense**

**Preparation**
- Students should pay careful attention to issues raised on the Comments Forms. In addition, students should be familiar with background publications that provide the foundation for their grant proposal, and with current literature that pertains to their specific aims and their future goal. Students should also be familiar with the rationale for any experimental or analytical techniques that they propose. Students may be asked to defend their choice of methodologies, discuss the rationale for and creativity of the proposed research, and discuss strengths and limitations.

**Format**
- The student is expected to begin the oral defense with a 30 minute presentation that summarizes the written grant proposal.
- The oral defense is expected to be between 1 ½ to 2 hours in length. This includes the student’s presentation and questions from the Committee during and after the presentation.
- At the conclusion of the oral defense, the student is excused from the room so that the Committee can discuss the student’s performance.

**Evaluation**

**Process**
- Each committee member will complete a Scoring Rubric Form for the Oral Defense. On the form the committee member will provide a rating score of 1-5 (Poor to Excellent) for 7 criteria. Each committee member will also complete an Oral Defense Comments Form. On the form the committee member will provide a ½ - 1 page review of the oral defense.
- After the student has left the meeting room, each committee member will calculate a Total Score (average of the 7 rating scores). The advisor will calculate an Overall Score by averaging the Total Scores, and will indicate the Overall Score and the decision in the QE Decision Form. The outcome of the QE Decision is explained to the student when the student returns to the meeting room.
- The oral defense is evaluated as “Pass” or “Fail” by the Committee. The student must receive an Overall Score of 3.0 or above in order to receive a “Pass” on the oral defense. A “Pass” indicates that the student achieved a high standard of scholarship, and that the student has passed the entire Qualifying Examination.
- Fail: If the Committee assigns a “fail” outcome, the student can repeat the oral defense once. If the Committee assigns a “fail” outcome a second time, the Committee must recommend to the Graduate Director that 1) the student be withdrawn from the program immediately or 2) the student be allowed to complete a terminal master’s degree.
- The Committee Chair will forward all Scoring Rubrics Forms, all Oral Defense Comments Forms, and the QE Decision Form to the NACS Office. The NACS office will then forward all Oral Defense Comments Forms and the QE Decision Form to the student.

**Criteria**

The oral defense will evaluate the student’s knowledge and depth of understanding of the written grant proposal. The Committee will evaluate the oral defense on the criteria shown below using a rating scale of Excellent = 5 points, Very Good = 4 points, Good = 3 points, Fair = 2 points, Poor = 1 point for each item. The student must receive an Overall Score (average of each committee member’s Total Score) of 3.0 to receive a
"Pass" on the Oral Defense. A "Pass" indicates that the student achieved a high standard of scholarship, and that the student has passed the entire Qualifying Exam.

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**Timetable**

All NACS core course requirements must be completed before the date of the oral defense. The qualifying examination process begins in the Spring Semester of the student's second year in the program and, without retaking parts of the examination, will be completed before the end of November of the fall semester of the student's third year in the program.

- The NACS Office distributes a copy of the qualifying exam guidelines and timeline to the students and Committee by the end of February.
- Students must submit a tentative title for their grant proposal, approved by their advisor and committee, to the NACS office before the end of April.
- Students submit the written grant proposal to their Committee by the end of August. They also submit a copy of the written grant proposal to the NACS Office.
- The Committee evaluates the written grant proposal and indicates the outcome by the end of September.
- The Oral Defense takes place by the end of November.
- If the student fails the oral defense, the repeat of the oral defense must occur by the end of January.
- If the Committee rejects the written grant proposal, the student must rewrite and submit the grant proposal to the Committee by the end of November. The Committee evaluates the re-written grant proposal and indicates the outcome by the end of December. If the grant proposal is accepted, the oral defense takes place by the end of January. If the student fails the oral defense, the repeat of the oral defense must occur by the end of February.

**Sample Program under the Proposed Requirements**

**Year One**

**Fall:**
- NACS640: Foundational Readings Seminar (2 credits); no prerequisite
- NACS641: Introduction to Neuroscience (4 credits); no prerequisite
- Begin First Year Research Project

**Spring:**
- NACS600: Ethics in Scientific Research (2 credits); no prerequisite
NACS644: Cell and Molecular Neuroscience (4 credits); prerequisite NACS641
Complete First Year Research Project

Year Two
Fall: NACS645: Cognitive Science (4 credits): no prerequisite
First supplemental course (3-4 credits)
Spring: Second supplemental course (3-4 credits)
Third supplemental course (3-4 credits)

Year Three
Qualifying Exam

Year Four
Dissertation Proposal Defense and Advance to Candidacy

Year Five
PhD Defense

Acknowledgement regarding Students Currently Enrolled

Students enrolled in the NACS program prior to the effective date of this curriculum change may complete their program under the old requirements if they wish.