

Commentary

Neuroscience Milestones: Developing Standardized Core-Competencies for Research-Based Neuroscience Trainees

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In the medical field, the implementation of Milestones by the Accreditation Council for Graduate Medical Education (ACGME) has provided a common understanding among clinical and academic supervisors and trainees related to the development of core competencies during graduate medical training. These Milestones help establish developmental trajectories and aspirational goals for the trainee. Unfortunately, training in graduate and postgraduate neuroscience lacks a standardized developmental progression of competencies or outcomes expected of trainees. Without such standardizations, it may be difficult for both the mentor and trainee to identify levels of improvement, which may impact the trainee's future success. Here, we discuss the value of developing a nonexhaustive framework that may be used to evaluate trainees with the expectation that it will provide a template to help with the development of future neuroscientists.

Introduction

In 2013, the Accreditation Council for Graduate Medical Education (ACGME) implemented milestones to be used for educational, assessment, and accreditation purposes; these milestones are now commonly used to assess the developing clinical and professional skills of graduate medical trainees in various residency and fellowship programs (Holmboe et al., 2016; Edgar et al., 2020). These milestones provide narrative descriptions of six general core competencies that include medical knowledge, patient care, interpersonal and communication skills, practice-based learning and improvement, professionalism, and systems-based practice, as well as various sub-competencies tailored to the specific medical specialty (Holmboe et al., 2016). All competencies were carefully crafted in specialty-specific workgroups and are continually refined based on quantitative and qualitative research to provide a shared model of professional development and advancement of physicians in clinical residency and fellowship programs.

Similar to graduate medical education, graduate education in the field of neuroscience is an intensely formative process that requires graduate and often postdoctoral training to develop technical and scientific skill, enhance personal attributes, and establish readiness for independence. Currently, the field of neuroscience is rapidly expanding with newly acquired conceptual knowledge as well as technical innovations that encompass multiple scientific disciplines, including physics, mathematics, engineering, as well

as the social sciences and humanities (Akil et al., 2016). The growth of the field as well as the expanding job opportunities available are making it more and more difficult for trainees and mentors to identify core competencies that define the expertise required to advance neuroscience in the 21st century (Akil et al., 2016). Additionally, as competition for funding increases, mentors are forced to focus on grant applications rather than laboratory management and mentoring (Barres, 2013). For trainees, often, there is a focus on productivity that is supported by the number and/or impact of publications. However, productivity may be hindered by the project and/or resources available, making it difficult to evaluate trainees for their overall development, especially between institutions and laboratories. Importantly, there are many attributes that must be developed for graduate and postdoctoral trainees, which, when developed, will enable them to effectively contribute to the workforce.

Consequently, we propose the consideration of a similar framework to the ACGME Milestones for neuroscience training programs. This would allow mentors and trainees to educate and learn within a standardized developmental framework. Implementing these milestones would not add excessive time constraints on mentors and trainees, but rather would facilitate discussion surrounding shared developmental goals, expectations, and expected competencies of the Ph.D. in neuroscience. Below, we discuss the potential benefits and barriers that may be encountered on implementing these milestones within the field.

What could be gained by implementing standardized milestones in the field of neuroscience?

The intent of the milestones would be to provide a framework for developmental assessments related to key attributes required of a scientist holding a Ph.D. in neuroscience. These milestones would not represent all dimensions required of a Ph.D., nor would they be designed to be relevant in other contexts. Rather, they would provide a standardized "blueprint" for mentors and trainees to

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use to follow the professional development of the trainee throughout the course of the training period both within and between institutes. Milestones typically consist of knowledge, skills, attitudes, and other attributes organized into a developmental framework. Within the field of neuroscience, these milestones may consist of core competencies that cover Scientific Knowledge, Systems-Based Practice (Safety and quality improvement for self, staff, and species), Practice-Based Learning, and Professionalism, all of which have been proposed for the natural sciences previously (Verderame et al., 2018).

The development and implementation of a standardized set of core competencies and sub-competencies across institutions would benefit trainees and mentors. For trainees, these core competencies would provide increased transparency in terms of their performance requirements, encourage self-assessment and self-directed learning, and enable the trainee to receive feedback that is less likely based on bias, rater errors, and/or inaccuracy. Additionally, standardized milestones between institutions would enable the trainee to focus on continuous improvement when progressing from graduate to postdoctoral training. Moreover, if conflict were to arise between the trainee and the mentor, the milestones would provide the ombudsman with records of objective data, which may assist in conflict resolution. For mentors, the milestones would provide a guide for focused development as well as explicit expectations of trainees. Additionally, the milestones would facilitate better assessments and help identify underperformers at an early state. Furthermore, the milestones would provide mentors with a blueprint for how a mentor should focus their training of young scientists, which may be particularly helpful for an early-stage investigator who may feel ill equipped in the role of mentor. Overall, it would be expected that the implementation of a milestone framework would benefit both trainees and mentors by providing improved training outcomes, which would enable trainees to make effective contributions to the workforce at a time when there is expansion of career opportunities in neuroscience in both private and public sectors.

What hurdles to implementing standardized milestones in the field of neuroscience would need to be considered?

Implementing standardized core competencies in the field of neuroscience would not come without difficulty. It would likely require a collaborative effort across institutions and among neuroscientists. For example, the ACGME Milestones were created by 916 volunteers representing >250 institutions over 100 meetings, which totaled ~1500 volunteer hours (Nasca et al., 2012; Swing et al., 2013). ACGME Milestones workgroups were comprised of a variety of representatives, including those from the accreditation council, individual certification boards, program director groups, practicing physician volunteers, and at least one resident or fellow trainee and a public member (Holmboe and Iobst, 2020). We acknowledge that the collective time and educational commitment of the many faculty within the field to develop these milestones may be significant. However, there is likely a large enough cohort of academic scientists interested in the educational and professional progression of trainees at large, that those volunteering to participate would not experience pressure to minimize the training of their own current junior scientists.

Not only would it take time to identify and develop the milestones, but it would also require a significant transformation of educational culture in the midst of resistance from critics. Arguments against implementing standardized milestones may

include that they are less efficient and do not rely on the wisdom or experience of faculty members. Additionally, the many subfields within neuroscience and the expansion of job opportunities may cause some to argue that milestones are too reductionistic and oversimplified, leading to the development of subspecialty competencies that result in substantial variability from the standardized milestones. However, these potential drawbacks, as shown by the ACGME (Edgar et al., 2018), can be overcome with continuous quality improvement through meetings, focus groups, and visits to sponsoring institutions.

An example of a core competency framework for neuroscience

Below, we have provided an example of a milestone framework for neuroscience to provide a clear and concrete starting point for discussion. Importantly, this example of core competencies as well as the structure of this framework is closely adapted from the ACGME Milestones (<https://www.acgme.org/what-we-do/accreditation/milestones/overview>) (Holmboe and Edgar, 2022). As such, we acknowledge that our example would require significant revision from individuals within the neuroscience field, from both a content and process perspective. However, implementing a model similar to the ACGME Milestones (Holmboe et al., 2016; Edgar et al., 2020) would confer additional benefits, including those that would allow physician scientists to implement one evaluation system for medical and neuroscience graduate and post-graduate trainees.

First, we start with a description of the structure of this framework, again adapted from the ACGME (Holmboe et al., 2016; Edgar et al., 2020), followed by an example template for each core competency (see Tables 1–11). Each competency is assessed via a combination of knowledge, skills, and attitudes arranged in a progressive continuum.

Similar to the ACGME Milestones framework (Holmboe et al., 2016; Edgar et al., 2020), tracking from Level 1 to Level 5 is synonymous with moving from novice to expert in the field of neuroscience. These levels do not correspond with post-graduate year of education, as placement and progression may vary depending on a specific trainee's previous and current experiences. Selection of a level implies that the trainee substantially demonstrates the sub-competencies within that level, as well as those in lower levels.

Scientific knowledge

Scientific knowledge consists of two core competencies. The first focuses on key aspects of scientific training, including an understanding of methodological and statistical approaches, the application of rigor and reproducibility, and conceptual knowledge/critical thinking (Table 1). The second focuses on scientific dissemination through scientific writing and oral communication (Table 2).

Systems-based practice

Systems-based practice refers to the ability to demonstrate awareness and responsiveness to the larger context and the system of the research institution (Tables 3–5). This aspect of training is often overlooked, but implementing systems-based practices as a core competency has the potential to teach trainees the value of working effectively within various environments that are designed to improve outcomes and ensure quality and safety. For example, in the laboratory setting, data collection requires the trainee to coordinate activities and comply with policies implemented by the Department of Environmental Health and Safety (e.g., animal research, chemical hygiene, hazard communication, laboratory responsibilities, etc.), Institutional

Table 1. Scientific knowledge 1: experimental design^a

Level 1	Level 2	Level 3	Level 4	Level 5
(A) Describes basic components and features related to the implementation of methodological approaches related to their research project	Describes detailed components related to the implementation of methodological approaches related to their research project	Compares the selection of methodological approaches and how each will provide rigor and reproducibility of the results as well as appropriately address the hypothesis	Explains how implementation of methodological approaches will provide rigor and reproducibility of the results as well as appropriately address the hypothesis	Engages in scholarly activity related to the implementation of innovative methodological approaches
(B) Lists statistical approaches implemented within the scope of the research project	Describes basic concepts related to statistical approaches implemented within the scope of the research project	Explains detailed concepts of statistical approaches implemented within the scope of the research project	Uses appropriate statistical approaches and implements them correctly to permit conclusions with wide validity	Incorporates new statistical developments into existing knowledge base
(C) Identifies the requirement of control and experimental groups	Lists control and experimental groups that fall within the scope of the research project	Identifies control and experimental groups that fall within the scope of the research project that permit direct testing of the hypothesis with a yes or no outcome	Justifies the use of control and experimental groups that fall within the scope of the research project that permit direct testing of the hypothesis with a yes or no outcome	Integrates expertise with new knowledge to design experiments that are simple, cost-effective, and provide results that are easy to interpret
(D) Lists features related to proper data sharing	Asks questions and demonstrates adequate problem-solving abilities	Demonstrates conceptual knowledge related to the research project	Engages in scientific discussion that incorporates critical thinking of previous and current scientific results	Logically organizes new ideas based on previous and current scientific results while including innovative future directions that will contribute significantly to the neuroscience field

Comments:

Not yet completed Level 1 []

Not yet assessable []

A: Application of methodological approaches in neuroscience; B: Application of statistical approaches; C: Application of rigor and reproducibility; D: Conceptual knowledge, rationalization, critical thinking.

^aAdapted from the ACGME (<https://www.acgme.org/what-we-do/accreditation/milestones/overview/>).**Table 2. Scientific knowledge 2: scientific dissemination^a**

Level 1	Level 2	Level 3	Level 4	Level 5
(A) Identifies the requirement of clear and concise scientific writing	Identifies the requirement of accurate and objective scientific writing	Demonstrates objectivity and accuracy in their scientific writing	Explains research findings clearly, concisely, accurately, and objectively	Integrates previous findings with current knowledge that is organized and easy to read and understand
(B) Lists components for proper oral presentations	Identifies characteristics of good oral presentations (e.g., organization, clear and rational thought progression, transitions, avoid filler words, eye contact) with justification	Demonstrates thoughtful preparation for proper oral presentations and engages in logical delivery of ideas and scientific results	Demonstrates expertise and professionalism during question-and-answer sessions	Role models or mentors others on the practice of good oral presentation

Comments:

Not yet completed Level 1 []

Not yet assessable []

A: Application of scientific writing; B: Application of oral communication.

^aAdapted from the ACGME (<https://www.acgme.org/what-we-do/accreditation/milestones/overview/>).

Animal Care and Use Committee, and/or the Internal Review Board. Learning to comply with policies and work effectively with individuals within these departments promotes a required level of professionalism as well as a decreased risk of restrictive penalties brought on by non-compliance, thus promoting efficient data acquisition for the trainee and other laboratory members.

Practice-based learning and improvement

Here, we define practice-based learning and improvement as a core competency that encourages the trainee to identify and evaluate their strengths and weaknesses through self-reflection and through feedback from peers and mentors (Table 6). The purpose of this core competency is to promote continued growth throughout the training period as well as to promote habits that will encourage life-long learning. To achieve this, in general, this core competency starts by encouraging continued improvement. As the trainee develops, the trainee is able to openly accept feedback and

independently create a plan to improve. This competency is closely adapted from the ACGME Milestones (Holmboe and Edgar, 2022), as it is a universal skill and fundamental attribute that extend beyond specialty and field.

Professionalism

This core competency consists of three parts. The first focuses on professional behavior and ethical principles (Tables 7–9). The second focuses on accountability. The third focuses on the well-being of the trainee. Under *Professional Behavior and Ethical Principles*, the trainee is encouraged to demonstrate professional behavior (e.g., respectful and courteous conduct), take responsibility for their lapses in professionalism, and demonstrate knowledge in core ethical principles and well as take actions to implement these principles. As the trainee progresses through this core competency, they will begin to recognize situations that trigger lapses in professional behavior and design solutions both within the microsystem (e.g., within the laboratory) as well as at a systems level (e.g., within the institution). Under *Accountability*,

Table 3. Systems-based practice 1: safety and quality improvement (self and staff)^a

Level 1	Level 2	Level 3	Level 4	Level 5
(A) Demonstrates knowledge of common laboratory safety events	Identifies system factors that lead to laboratory safety events	Participates in analysis of laboratory safety events (simulated or actual)	Conducts analysis of laboratory safety events and offers error prevention strategies (simulated or actual)	Actively engages teams and processes to improve systems to prevent laboratory safety events
(B) Demonstrates knowledge of how to report laboratory safety events	Reports laboratory safety events through institutional reporting systems (simulated or actual)	Participates in disclosure of laboratory safety events to principal investigator (PI) and appropriate departments (simulated or actual)	Discloses laboratory safety events to PI and appropriate departments (simulated or actual)	Role models or mentors others in the disclosure of laboratory safety events
(C) Demonstrates knowledge of basic quality improvement methodologies and metrics	Describes local quality improvement initiatives	Participates in local quality improvement initiatives	Demonstrates the skills required to identify, develop, implement, and analyze a quality improvement project	Creates, implements, and assesses quality improvement initiatives at the institutional or community level

Comments:

Not yet completed Level 1 []

Not yet assessable []

A: Analyzes self or team members' safety events; B: Appropriately discloses self or team members' safety events; C: Participates in quality improvement.

^aAdapted from the ACGME (<https://www.acgme.org/what-we-do/accreditation/milestones/overview/>).**Table 4. Systems-based practice 2: safety and quality improvement (test species), if applicable^a**

Level 1	Level 2	Level 3	Level 4	Level 5
(A) Demonstrates knowledge of common test species safety events	Identifies system factors that lead to test species safety events	Participates in analysis of test species safety events (simulated or actual)	Conducts analysis of test species safety events and offers error prevention strategies (simulated or actual)	Actively engages teams and processes to improve systems to prevent test species safety events
(B) Demonstrates knowledge of how to report test species safety events	Reports test species safety events through institutional reporting systems (simulated or actual)	Participates in disclosure of test species safety events to PI and appropriate departments (simulated or actual)	Discloses test species safety events to PI and appropriate departments (simulated or actual)	Role models or mentors others in the disclosure of test species safety events
(C) Demonstrates knowledge of basic quality improvement methodologies and metrics	Describes local quality improvement initiatives	Participates in local quality improvement initiatives	Demonstrates the skills required to identify, develop, implement, and analyze a quality improvement project	Creates, implements, and assesses quality improvement initiatives at the institutional or community level

Comments:

Not yet completed Level 1 []

Not yet assessable []

A: Analyzes test species safety events; B: Appropriately discloses test species safety events; C: Participates in quality improvement.

^aAdapted from the ACGME (<https://www.acgme.org/what-we-do/accreditation/milestones/overview/>).**Table 5. Systems-based practice 3: role in working at a systems or interinstitutional level^a**

Level 1	Level 2	Level 3	Level 4	Level 5
(A) Identifies key components of the complex research system	Describes how components of a complex research system are interrelated, and how this impacts research productivity and rigor and reproducibility	Discusses how individual research affects the broader system	Manages various components of the complex research system to provide high-value, efficient, and effective research output and rigor and reproducibility	Advocates for or leads systems change that enhances high-value, efficient, and effective research output and rigor and reproducibility
(B) Identifies basic knowledge domains for effective transition to postdoctoral or other next level training	Identifies barriers to research in different research systems	Engages with colleagues in shared decision-making and advocates for appropriate conduct of research	Advocates for equality in research	Participates in advocacy activities for equality in research
(C) Identifies funding sources and budgeting limitations	Demonstrates use of information technology and documentation required for research practice	Describes core administrative knowledge needed for transition to the next level	Analyzes individual research patterns and professional requirements in preparation for research practice	Educates others to prepare them for transition to the next level

Comments:

Not yet completed Level 1 []

Not yet assessable []

A: Understanding and working within a research institute; B: Research financing and advocacy; C: Transition to the next level of training.

^aAdapted from the ACGME (<https://www.acgme.org/what-we-do/accreditation/milestones/overview/>).

the trainee is encouraged to perform tasks and responsibilities in a timely manner with appropriate attention to detail. As the trainee progresses, they will show an ability to navigate problems and identify solutions as well as display increasing autonomy in the completion of projects. Under *Well-Being*,

the trainee is encouraged to recognize the importance of their health and professional fulfillment. In doing so, they are encouraged to independently develop plans to promote personal and professional growth. Additionally, the trainee is encouraged to identify positive or negative factors that affect well-being

Table 6. Practice-based learning and improvement: reflective practice and commitment to personal growth^a

Level 1	Level 2	Level 3	Level 4	Level 5
Accepts responsibility for personal and professional development by establishing goals	Demonstrates openness to performance data (feedback and other input) in order to inform goals	Seeks performance data episodically, with openness and humility	Intentionally seeks performance data consistently with openness and humility	Role models consistently seeking performance data with openness and humility
Identifies the factors that contribute to gap(s) between one's expected and actual performance	Analyzes and reflects on the factors that contribute to gap(s) between one's expected and actual performance	Analyzes, reflects on, and institutes behavioral change(s) to narrow the gap(s) between one's expected and actual performance	Challenges one's own assumptions and considers alternatives in narrowing the gap(s) between their expected and actual performance	Coaches others on reflective practice
Actively seeks opportunities to improve	Designs and implements a learning plan, with prompting	Independently creates and implements a learning plan	Uses performance data to measure the effectiveness of the learning plan and, when necessary, improves it	Facilitates the design and implementation of learning plans for others

Comments:

Not yet completed Level 1 []

Not yet assessable []

^aAdapted from the ACGME (<https://www.acgme.org/what-we-do/accreditation/milestones/overview/>).**Table 7. Professionalism 1: professional behavior and ethical principles^a**

Level 1	Level 2	Level 3	Level 4	Level 5
Identifies and describes core professional behavior	Demonstrates professional behavior in routine situations	Demonstrates professional behavior in complex or stressful situations	Recognizes situations that may trigger professionalism lapses and intervenes to prevent lapses in self and others	Role models professional behavior and ethical principles
Recognizes that one's behavior in professional settings affects others	Takes responsibility for own professionalism lapses and responds appropriately	Describes when and how to appropriately report professionalism lapses in others, including strategies for addressing common barriers to reporting	Responds appropriately to professionalism lapses of colleagues	Identifies and seeks to address system-level factors that induce or exacerbate ethical problems or impede their resolution
Demonstrates knowledge of core ethical principles	Analyzes straightforward situations using ethical principles	Analyzes complex situations using ethical principles	Recognizes and uses appropriate resources for managing and resolving ethical dilemmas as needed (e.g., ethics consultations, literature review, risk management/legal consultation)	

Comments:

Not yet completed Level 1 []

Not yet assessable []

^aAdapted from the ACGME (<https://www.acgme.org/what-we-do/accreditation/milestones/overview/>).**Table 8. Professionalism 2: accountability/conscientiousness^a**

Level 1	Level 2	Level 3	Level 4	Level 5
Takes responsibility to complete tasks and responsibilities, identifies potential contributing factors for lapses, and describes strategies for ensuring timely task completion in the future	Performs tasks and responsibilities in a timely manner with appropriate attention to detail in routine situations	Performs tasks and responsibilities in a timely manner with appropriate attention to detail in complex or stressful situations	Recognizes when others are unable to complete tasks and responsibilities in a timely manner and assists in problem solving	Takes ownership of system outcomes
	Accepts the role within the research project and takes responsibility (under supervision) for ensuring that all aspects related to their role receive the best possible attention	Is recognized by self, laboratory members, and PI as the primary source for information related to a research project	Displays increasing autonomy and leadership in taking responsibility for ensuring the completion of the research project	Serves as a role model in demonstrating responsibility for ensuring that the research project is performed with the utmost attention to detail

Comments:

Not yet completed Level 1 []

Not yet assessable []

^aAdapted from the ACGME (<https://www.acgme.org/what-we-do/accreditation/milestones/overview/>).

Table 9. Professionalism 3: well-being^a

Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes the importance of addressing personal and professional well-being	Lists available resources for personal and professional well-being Describes institutional resources designed to promote well-being	With assistance, proposes a plan to promote personal and professional well-being Recognizes which institutional factors affect well-being	Independently develops a plan to promote personal and professional well-being Describes institutional factors that positively and/or negatively affect well-being	Creates institutional level interventions that promote colleagues' well-being Describes institutional programs designed to examine systemic contributors to burnout

Comments:

Not yet completed Level 1 []

Not yet assessable []

^aAdapted from the ACGME (<https://www.acgme.org/what-we-do/accreditation/milestones/overview/>).**Table 10. Interpersonal and communication skills 1: interprofessional and team communication^a**

Level 1	Level 2	Level 3	Level 4	Level 5
Uses language that values all members of the research team	Communicates information effectively with all research team members	Uses active listening to adapt communication style to fit team needs	Coordinates recommendations from different members of the research team to optimize research output and rigor and reproducibility of results	Role models flexible communication strategies that value input from all research team members, resolving conflict when needed
Recognizes the need for ongoing feedback with the research team	Solicits feedback on performance as a member of the research team	Communicates concerns and provides feedback to peers and learners	Respectfully communicates feedback and constructive criticism to superiors	Facilitates regular research team-based feedback in complex situations

Comments:

Not yet completed Level 1 []

Not yet assessable []

^aAdapted from the ACGME (<https://www.acgme.org/what-we-do/accreditation/milestones/overview/>).**Table 11. Interpersonal and communication skills 2: communication within the scientific system^a**

Level 1	Level 2	Level 3	Level 4	Level 5
Accurately records information in the scientific notebook	Demonstrates organized diagnostic and logical reasoning through previous published findings	Concise reports diagnostic and logical reasoning in the scientific notebook and manuscript	Communicates clearly and concisely, in an organized written form, including anticipatory guidance	Contributes to departmental or organizational initiatives to improve communication systems
Safeguards laboratory data and patient personal health information (if applicable)	Uses documentation shortcuts accurately and appropriately to enhance efficiency of communication	Appropriately selects forms of communication based on context	Achieves written or verbal communication that serves as an example for others to follow	Facilitates dialogue regarding systems issues among larger community stakeholders
Communicates about administrative issues through appropriate channels, as required by institutional policy	Respectfully communicates concerns about the system	Uses appropriate channels to offer clear and constructive suggestions to improve the system	Initiates difficult conversations with appropriate stakeholders to improve the system	

Comments:

Not yet completed Level 1 []

Not yet assessable []

^aAdapted from the ACGME (<https://www.acgme.org/what-we-do/accreditation/milestones/overview/>).

within a microsystem or at the institution level and describe them in a professional manner. Like Practice-Based Learning and Improvement, these three competencies are closely adapted from those of the ACGME (Holmboe and Edgar, 2022), as they are universal skills and fundamental attributes that extend beyond specialty and field.

Interpersonal and communication skills

Finally, Interpersonal and Communication Skills is a core competency consisting of two parts. The first part focuses on team communication so that the trainee is able to focus on the development of effective communication skills with other research team members (Table 10). These skills should foster an environment where individuals feel comfortable providing both positive and constructive feedback as well as communicating concerns to peers, mentors, and upper-level management (Table 10). The second part focuses on communication at the scientific level

(e.g., record keeping and organization) as well as at the institutional level (Table 11). In general, this core competency is designed to highlight the importance of transparency in research as well as to emphasize the importance of working in an environment with effective communication between individuals with all levels of expertise.

In conclusion, the Milestones created by the ACGME were developed to remove unwanted and unwarranted variability in educational and clinical outcomes (Holmboe et al., 2015). Here, we have proposed the consideration of a similar milestones framework in the field of neuroscience to enable trainees and mentors to focus on standard core competencies, which would help to facilitate the further development of neuroscience trainees.

We have provided an example of what these core competencies may look like for the field of neuroscience. Overall, the

proposed core competencies are broad to encompass the ever-growing job opportunities of neuroscientists with graduate or post-graduate education. Importantly, these core competencies do not need to be restrictive to the field of neuroscience. As it has recently been proposed, a general competency-based assessment may be beneficial to objectively develop Ph.D. students and early career scientists within the natural sciences, thus ensuring clear training goals (Verderame et al., 2018).

Overall, the graduate and post-graduate neuroscience milestones would be designed to assist trainees and mentors to identify attributes that are typically required for future success. The field as a whole would need to determine whether this framework should remain as a developmental tool or be used as a measure for graduation. Additionally, incorporating these milestones would allow time for collaborative discussion between mentors and trainees as well as the development of action plans, which would allow for continued growth of the graduate or post-graduate neuroscientist. Moreover, these milestones would be built on a dynamic framework with the ability to evolve and adapt to the ever-growing and changing field of neuroscience. Implementation of a milestones framework across institutions may be a difficult hurdle to overcome, but this has the potential to greatly improve the training, mentoring, and educational experience for all involved.

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