SAINT LOUIS UNIVERSITY.

Program-Level Assessment: Annual Report

Program Name (no acronyms): Neuroscience	Department: Interdisciplinary: Biology & Psychology
Degree or Certificate Level: B.S.	College/School: Arts & Sciences
Date (Month/Year):	Assessment Contact: Drs. Tony Buchanan & Judith Ogilvie

In what year was the data upon which this report is based collected? AY 2020-21

In what year was the program's assessment plan most recently reviewed/updated?

1. Student Learning Outcomes

Which of the program's student learning outcomes were assessed in this annual assessment cycle? (Please list the full, complete learning outcome statements and not just numbers, e.g., Outcomes 1 and 2.)

2. Students will be able to synthesize information to formulate hypotheses, design experiments and engage in scientific research.

2. Assessment Methods: Artifacts of Student Learning

Which artifacts of student learning were used to determine if students achieved the outcome(s)? Please describe and identify the course(s) in which these artifacts were collected. Clarify if any such courses were offered a) online, b) at the Madrid campus, or c) at any other off-campus location.

Our assessment plan calls for collecting information from two sources to assess Learning Outcome #2: NEUR 3550: Neuroscience Lab and the Senior survey.

For NEUR 3550: Neuroscience Lab, students performed an independent project in which they were required to synthesize information, formulate hypotheses, design and perform experiments, and give a presentation on their results. The instructor, Dr. Alaina Baker-Nigh, developed a rubric, which she used to grade the presentations. Three sections of this lab course were taught in Fall 2020 with approximately 24 students in each section. Students were split into two groups attending in person on alternating weeks (A/B days) with a total of 17 student lab groups. Students in all sections had the same instructor and were given the same assignment so results were combined.

For the Senior survey, students were asked a series of self-assessment questions about how much research knowledge they gained from their coursework and laboratory experience.

Madrid courses and off-campus locations are not applicable to this assessment report.

3. Assessment Methods: Evaluation Process

What process was used to evaluate the artifacts of student learning, and by whom? Please identify the tools(s) (e.g., a rubric) used in the process and **include them in/with this report document** (do not just refer to the assessment plan).

We used a rubric to assess student performance on a cell culture based independent project in NEUR 3550: Neuroscience Laboratory (see attached). Dr. Baker-Nigh collected, assembled, and analyzed the data. Three rubric categories ("Procedure," "Data Presentation," and "Conclusions & Future Directions") were identified as most relevant to Program Learning Outcome #2. Results from the 17 student lab groups were averaged to assess competency. The "Procedure" category assessed experimental design, as students described the original experiments they had carried out in each independent project. The "Data Presentation" category assessed hypothesis formulation as well as

research engagement, as students stated the hypothesis that their experiment was designed to test and then described and interpreted the results of each project. The "Conclusions & Future Directions" category assessed experimental design, as students described original follow-up experiments that could be conducted in response to each project's results.

Students were asked for self-assessment about their gain of skills on a Senior Survey. They were also asked which courses were most beneficial for attaining these skills. All Neuroscience majors are required to take NEUR 4900: Neuroscience Seminar during one of their final two semesters prior to graduation. A link to the Senior Survey was posted in the LMS course site prior to the last class period. Before the conclusion of the last class period (online in 2020-21), the instructor explained the importance of the survey then posted the link again in the chat allowing class time for students to complete the survey. Drs. Buchanan and Ogilvie were involved in writing the survey questions, collecting the data, and analysis. The questions used for this assessment are attached.

4. Data/Results

What were the results of the assessment of the learning outcome(s)? Please be specific. Does achievement differ by teaching modality (e.g., online vs. face-to-face) or on-ground location (e.g., STL campus, Madrid campus, other off-campus site)?

From the Neuroscience Lab, assessment is based on group presentations following experimental modules in which each student lab group formulates an indpendent experiment involving cell culture neurite growth. Students worked in groups of 3-4. Student performance was assessed based on the attached rubric. Scores were based on student description of laboratory procedures, presentation of data, as well as organization, grammar, accuracy, and overall quality. Average student performance data were between 86% and 97% (see Table 1 for details).

Self-assessment questions from the senior survey asked how much students gained in research knowledge from their coursework and laboratory experience (see Table 3 for details). 100% of graduating Neuroscience majors reported some gain in their ability to synthesize information to formulate hypotheses and engage in scientific research; 98% reported gain in their ability to design experiments. Students indicated that PSY 2050: Foundations in Research Methods and Statistics and NEUR 3550: Neuroscience Laboratory were the two most beneficial courses in aquiring these skills. We consider these results to be well above the 'proficient' level of competency (defined as 75% correct performance).

The majority of students, 78%, reported a large or very large gain in their ability to synthesize information and formulate hypotheses (see Table 4). This is a higher gain than we observed the last time we assessed this learning outcome in 2018 (78% in 2021 versus 63% in 2018). A large or very large gain in their ability to design experiments was reported by 45% of students in the current year versus 55% in 2017-18. Notably, 82% of 2021 respondents indicated a large or very large gain in their overall ability to engage in scientific research compared to 67% in 2018.

Finally, responses indicated that 61% of our graduating class of 2021 participated in research with a SLU faculty member, compared to 80% in 2018. Of those who did not, 76% conducted research in a classroom setting. Thirty percent presented their research at a symposium or conference, compared to 50% in 2018, and 12% published their research.

5. Findings: Interpretations & Conclusions

What have you learned from these results? What does the data tell you?

For student performance in the Neuroscience Laboratory, we define the 'proficient' level of competency as a score of 75% correct performance. Minimum student performance met this level in all three areas; average and median performance was well above the proficient level of competency. The senior survey supports this observation.

Comparing these data to results from 2017-18 (Table 1), we note an improvement with procedure while data presentation scores were lower. As a result of the reduction in face-to-face time, a second major independent project was replaced with alternative activities in the current cycle. This shift allowed more class time for drafting hypotheses and procedures. On the other hand, students struggled more than usual generating meaningful and complete figures for presentation, possibly because they were only in the lab on alternate weeks.

From the senior survey, we learned that students identified PSY 2050: Foundations of Research Methods & Statisitcs and NEUR 3550: Neuroscience Laboratory as the two most beneficial courses for achieving these learning objectives, with the former rated somewhat higher (Table 2).

From the Senior Survey, student participation in research was decreased from 2018, most likely as a result of limited opportunities due to the COVID-19 pandemic. However participation in research in a classroom setting increased from 55% to 76%. This likely represents a greater effort to include more independent projects in Biology laboratory experiences as well as in the Neuroscience Lab.

6. Closing the Loop: Dissemination and Use of Current Assessment Findings

A. When and how did your program faculty share and discuss these results and findings from this cycle of assessment?

Data was shared and discussed at the Neuroscience faculty meeting on Sept 3, 2021. This meeting was held in a hybrid format with four faculty in person and three on zoom. The laboratory instructor noted that the growth of the neuroscience program has required expanding the number of lab sections from two in our previous assessment, to three sections in this year's assessment, and now four sections in the current year. As a result, we anticipate multiple instructors going forward, so it will be important to ensure that is taken into account in planning and in future assessements. It was noted that in previous year's assessment of LO1, the assessment process enabled us to identify variance between two instructors for sections of a course. The instructors were able to coordinate and modify their courses accordingly. Finally, one faculty member raised a concern about carving out class time for students to complete the Senior Survey. However, the instructor felt that only minimal time was required and it was not a problem.

B. How specifically have you decided to use these findings to improve teaching and learning in your program? For example, perhaps you've initiated one or more of the following:

Changes to the Curriculum or Pedagogies	• Course content • Teaching techniques • Improvements in technology • Prerequisites	• Course sequence • New courses • Deletion of courses • Changes in frequency or scheduling of course offerings
Changes to the Assessment Plan	• Student learning outcomes • Artifacts of student learning • Evaluation process	• Evaluation tools (e.g., rubrics) • Data collection methods • Frequency of data collection

Please describe the actions you are taking as a result of these findings.

Overall, both indirect (self-reported) and the direct data indicate that we are successfully achieving Learning Outcome #2. We are especially pleased that the NEUR 3550: Neuroscience Laboratory is contributing to LO2 in a meaningful way. The Neuroscience Laboratory course will return to full capacity weekly meetings in AY 2021-22. This will allow students the opportunity to perform two independent research projects, instead of one, and improve their skills over the course of the semester. The instructor noted the decrease in performance on data presentation and plans to focus on that aspect in providing feedback to students.

Although we noted on the senior survey that many students included PSY 2050: Foundations of Research Methods & Statisitcs as well as NEUR 3550: Neuroscience Laboratory as an important course for gaining these skills, we will continue to assess this learning objective in the latter course. Because of the interdisciplinary nature of the Neuroscience program and the collaborative nature of the Neuroscience Lab, collection of classroom artifacts exclusively from Neuroscience majors is not a realistic goal. However, NEUR 3550 is comprised primarily of neuroscience majors (49 neuroscience majors out of 52 total students, 94.2%), unlike PSY 2050, which includes a mix of psychology and other majors. The non-majors have taken all of the required prerequisites, including NEUR 3400: Introduction to Neuroscience I, so we feel that this is a realistic assessment.

The Psychology department has been challenged to provide enough sections of PSY 2050 to accommodate the growing number of Neuroscience majors. As a result, the Neuroscience Program curriculum has been modified beginning in 2021-22 to allow students to fulfill a statistics requirement with either PSY 2050 or with MATH 1300: Elementary Statistics with Computers. Recognizing that this change could have an impact on this learning objective, we have met with the instructors of STAT 1300. They have proposed that students in the class will be able to select one of several datasets for statistical analysis in the class. We have provided them with a list of datasets and possible resources to support this goal.

In an effort to increase opportunities for undergraduate neuroscience majors to participate in authentic research, the we plan to work with the Henry and Amelia Nasrallah Center for Neuroscience, which includes 63 faculty across six schools/colleges at Saint Louis University, to increase opportunities for students, particularly in research labs on the medical campus.

If no changes are being made, please explain why.

7. Closing the Loop: Review of Previous Assessment Findings and Changes

A. What is at least one change your program has implemented in recent years as a result of assessment data?

In previous years, we have distributed the Senior Survey to all graduating Neuroscience Students near the end of the Spring Semester. Last year we noted a very low response rate. As a result, we modified our assessement program to distribute the survey at the end of the term for students enrolled in NEUR 4900: Neuroscience Seminar, allowing class time for the students to start the survey.

B. How has this change/have these changes been assessed?

We assessed the response rate to the survey.

C. What were the findings of the assessment?

This greatly increased the response rate from ~40-50% to 91% (Table 5).

D. How do you plan to (continue to) use this information moving forward?

We plan to continue to set aside some time in NEUR 4900 for students to begin the survey.

IMPORTANT: Please submit any assessment tools (e.g., rubrics) with this report as separate attachments or copied and pasted into this Word document. Please do not just refer to the assessment plan; the report should serve as a stand-alone document.

Neuroscience Laboratory Cell Culture Neurite Growth **Oral Presentation**	**Name(s):** **Date:**

	Points (100 total)					
Category						**Total**
Introduction (15 points)	• Description of the cell type we used in this lab (5 points)_____ • Why would your experimental variable impact neurite growth? (5 points)_____ • Previously published data relevant to the treatment selected; properly cited (5 points)_____					
Procedure (20 points)	• Description of the cell culture system we used in this lab (5 points)_____ • Includes variables used (5 points)_____ • What concentrations were chosen/details of exposure (5 points)_____ • Rationale for treatment (time period, dose) (5 points)_____					
Data Presentation (20 points)	• Statement of hypothesis (5 points)_____ • Interpretation of data/results is logical (5 points)_____ • Labeled images/well-described behavior (5 points)_____ • Appropriate comparisons (5 points)_____					
Conclusions & Future Experiments (15 points)	• What conclusions can be made from results? (5 points)_____ • What future experiments could be performed? (5 points) _____ • How would you have improved the experiment you designed? (5 points) _____					
Organization & Powerpoint Expertise (15 points)	• Well organized presentation (5 points) _____ • Concise slides (not too much information) (5 points) _____ • Easy to interpret slides (5 points) _____					
Grammar/ Punctuation/ Spelling (5 points)	**5** No grammar, punctuation, or spelling errors	**4** 1-2 grammar, punctuation, or spelling errors	**3** 3-4 grammar, punctuation, or spelling errors	**2** 5-6 grammar, punctuation, or spelling errors	**1** > 6 grammar, punctuation, or spelling errors	
Scientific Accuracy (5 points)	No errors in scientific accuracy	1-2 scientific errors	3-4 scientific errors	5-6 scientific errors	> 6 scientific errors	
Quality of Presentation (Eye contact, speaking presence) (5 points)	Excellent -Little to no reading directly from notes -Exceptional comfort and confidence exhibited	Very good -Little to no reading directly from notes -Comfort and confidence exhibited	Adequate -Some reading directly from notes -Some comfort and confidence exhibited	Poor -Reading mostly from notes -Little comfort or confidence exhibited	Very poor -Reading entirely from notes -No comfort or confidence exhibited	
					TOTAL POINTS	

Senior Survey questions for 2020-21 Neuroscience Assessment

The SLU Neuroscience Faculty are pleased to count you among our majors who will be graduating this year. We would like to know your perceptions about the education and experiences you acquired as a Neuroscience major at Saint Louis University. Your answers to this survey will be confidential.

The purpose of this survey is threefold: (1) assess the effectiveness of the Neuroscience Program in order to inform future improvements, (2) collect data that will support grant applications and other efforts to expand the program (e.g. for student research fellowships), and (3) identify graduating students that may be interested in mentoring other neuroscience majors. We appreciate your cooperation in completing this survey.

In this section, we wish to assess the effectiveness of the Neuroscience Program. Please evaluate to what extent your neuroscience courses have enabled you to gain knowledge, skills, and personal development in the following areas.

Q20. Your ability to synthesize information to formulate hypotheses.

- No gain or very small gain
- Small gain
- Moderate gain
- Large gain
- Very large gain
- Not applicable/prefer not to answer

Q.21 Which of these courses were most beneficial in regard to the above question? (select all that apply)

- General Psychology (PSY 1010)
- Principles of Biology I & II (BIOL 1240/1260)
- Cellular Biochemistry & Molecular Biology (BIOL 3020)
- Cellular Structure & Function (BIOL 3040)
- Foundations of Research Methods & Statistics (PSY 2050)
- Brain, Mind, & Society (PSY 3100)
- Introduction to Neuroscience: Cellular, Molecular, & Systemic (NEUR 3400)
- Introduction to Neuroscience: Behavioral & Cognitive (NEUR 3500)
- Neuroscience Laboratory (NEUR 3550)
- Other Courses? (enter names below)

Q22. Your ability to design experiments.

- No gain or very small gain
- Small gain
- Moderate gain
- Large gain
- Very large gain
- Not applicable/prefer not to answer

Q23. Which of these courses were most beneficial in regard to the above question? (select all that apply)

- General Psychology (PSY 1010)
- Principles of Biology I & II (BIOL 1240/1260)
- Cellular Biochemistry & Molecular Biology (BIOL 3020)
- Cellular Structure & Function (BIOL 3040)
- Foundations of Research Methods & Statistics (PSY 2050)
- Brain, Mind, & Society (PSY 3100)
- Introduction to Neuroscience: Cellular, Molecular, & Systemic (NEUR 3400)
- Introduction to Neuroscience: Behavioral & Cognitive (NEUR 3500)
- Neuroscience Laboratory (NEUR 3550)
- Other Courses? (enter names below)

Q24. Your ability to engage in scientific research.

- No gain or very small gain
- Small gain
- Moderate gain
- Large gain
- Very large gain
- Not applicable/prefer not to answer

Q25. Which of these courses were most beneficial in regard to the above question? (select all that apply)

- General Psychology (PSY 1010)
- Principles of Biology I & II (BIOL 1240/1260)
- Cellular Biochemistry & Molecular Biology (BIOL 3020)
- Cellular Structure & Function (BIOL 3040)
- Foundations of Research Methods & Statistics (PSY 2050)
- Brain, Mind, & Society (PSY 3100)
- Introduction to Neuroscience: Cellular, Molecular, & Systemic (NEUR 3400)
- Introduction to Neuroscience: Behavioral & Cognitive (NEUR 3500)
- Neuroscience Laboratory (NEUR 3550)
- Other Courses? (enter names below)

In this section, we are interested in collecting data that can be used in grant applications and other efforts to gain more resources for the Neuroscience program, including student research and career planning.

Q32. Did you conduct research and, if so, where did it take place? Include research for which you were paid, were a volunteer, or received credit.

- Yes, Biology Department
- Yes, Psychology Department
- Yes, SLU School of Medicine
- Yes, other, please specify
- No

Q33. If you answered No to the previous question, did you conduct research in a class?

- Yes

- No

Q34. Did you present your research at a symposium or conference?

- Yes
- No

Q35. Did you publish your research?

- Yes, it was published in:
- No

Table 1: Average Percent Performance for NEUR 3550 Independent Lab Projects, AY 2020-21			
	Procedure	*Data Presentation*	*Conclusions/ Future Directions*
avg	**97%**	**86%**	**96%**
min	90%	75%	87%
max	100%	95%	100%
median	100%	85%	100%

Table 2: Average Percent Performance for NEUR 3550 Independent Lab Projects, AY 2017-18			
	Procedure	*Data Presentation*	*Conclusions/ Future Directions*
avg	**92%**	**94%**	**96%**
min	70%	75%	73%
max	100%	100%	100%
median	95%	95%	100%

Table 3: Senior Survey Results, AY 2020-21

Question	Student Response					N
	no gain or very small	*small gain*	*moderate gain*	*large gain*	*very large*	
Your ability to synthesize information to formulate hypotheses.	0%	5%	17%	41%	37%	41
Your ability to design experiments.	2%	12%	17%	29%	16%	41
Your ability to engage in scientific research.	0%	10%	8%	41%	41%	39

	Yes, with Biology faculty	*Yes, with Psychology faculty*	*Yes, at SLU SOM*	*Yes (other)*	*No*	
Did you conduct research while at SLU?	15%	24%	7%	15%	39%	46
If you answered No to the previous question, did you conduct research in a class?				76%	24%	29
Did you present your research at a symposium or conference?				30%	70%	40
Did you publish your research?				12%	88%	41

Your ability to synthesize information to formulate hypotheses.		
Foundations of Research Methods & Statistics (PSY 2050)	82.93%	34
Neuroscience Laboratory (NEUR 3550)	70.73%	29
Principles of Biology I & II (BIOL 1240/1260)	36.59%	15
Introduction to Neuroscience: Behavioral & Cognitive (NEUR 3500)	26.83%	11
Cellular Structure & Function (BIOL 3040)	24.39%	10
Cellular Biochemistry & Molecular Biology (BIOL 3020)	21.95%	9
Introduction to Neuroscience: Cellular, Molecular, & Systemic (NEUR 3400)	21.95%	9
Brain, Mind, & Society (PSY 3100)	19.51%	8
General Psychology (PSY 1010)	17.07%	7
Other courses	14.63%	6

Your ability to design experiments.		
Foundations of Research Methods & Statistics (PSY 2050)	85.37%	35
Neuroscience Laboratory (NEUR 3550)	80.49%	33
Other courses	17.07%	7
Principles of Biology I & II (BIOL 1240/1260)	14.63%	6
Cellular Structure & Function (BIOL 3040)	12.20%	5
General Psychology (PSY 1010)	9.76%	4

Introduction to Neuroscience: Cellular, Molecular, & Systemic (NEUR 3400)	9.76%	4
Introduction to Neuroscience: Behavioral & Cognitive (NEUR 3500)	9.76%	4
Cellular Biochemistry & Molecular Biology (BIOL 3020)	7.32%	3
Brain, Mind, & Society (PSY 3100)	2.44%	1

Your ability to engage in scientific research.		
Foundations of Research Methods & Statistics (PSY 2050)	68.29%	28
Neuroscience Laboratory (NEUR 3550)	63.41%	26
Other courses	29.27%	12
Introduction to Neuroscience: Cellular, Molecular, & Systemic (NEUR 3400)	21.95%	9
Introduction to Neuroscience: Behavioral & Cognitive (NEUR 3500)	21.95%	9
Brain, Mind, & Society (PSY 3100)	17.07%	7
Cellular Structure & Function (BIOL 3040)	14.63%	6
Cellular Biochemistry & Molecular Biology (BIOL 3020)	12.20%	5
General Psychology (PSY 1010)	9.76%	4
Principles of Biology I & II (BIOL 1240/1260)	9.76%	4

Table 4: Senior Survey Results, AY 2017-18

Question	**Student Response**				
	no gain or very small gain	***small gain***	***moderate gain***	***large gain***	***very large gain***
Your ability to synthesize information to formulate hypotheses.	0%	5%	32%	36%	27%
Your ability to design experiments.	0%	9%	36%	32%	23%
Your ability to engage in scientific research.	0%	19%	14%	38%	29%

	Yes, with Biology faculty	***Yes, with Psychology faculty***	***Yes, at SLU SOM***	***Yes, other***	***No***
Did you conduct research while at SLU?	20%	28%	16%	16%	20%
If you answered No to the previous question, did you conduct research in a class?				55%	45%
Did you present your research at a symposium or conference?				50%	50%

Table 3: Senior Survey Response Rate			
Year	Number of Responses	Number of Graduates	Response Rate
2019	20	51	39.21%
2020	22	43	51.16%
2021	43	47	91.48%