

Abstract

While neuroscience is traditionally reserved for higher education, Hisar Schools has successfully implemented a rigorous, multidisciplinary elective course for high school students over the past five years. Moving beyond a standard biological or psychological framework, the curriculum integrates physics, mathematics, computer science, and engineering to address real-world challenges, including applications in neuromarketing. This approach effectively dissolves traditional disciplinary boundaries, offering students a holistic perspective on contemporary scientific inquiry. The core of the program is its strictly research-oriented methodology. The curriculum prioritizes academic literacy and the scientific method. Students are trained to navigate academic databases, utilize advanced AI-driven research tools (e.g., Semantic Scholar, Consensus, NotebookLM), and engage in the ethical use of Large Language Models. The pedagogical cycle culminates in the development of scientific posters and oral presentations, emphasizing the necessity of formal communication in science. Longitudinal feedback from alumni indicates that this "research-first" model significantly eases the transition to university-level academia. Students report a distinct advantage in analyzing primary literature and executing research-based tasks compared to their peers. This presentation outlines the strategic design of the curriculum, the implementation of inquiry-based learning in a secondary setting, and the measurable impact of early exposure to high-level research on student self-efficacy and academic readiness.

Mind Matters : Integrating Advanced Neuroscience into the High School Curriculum

The Structural Problem:

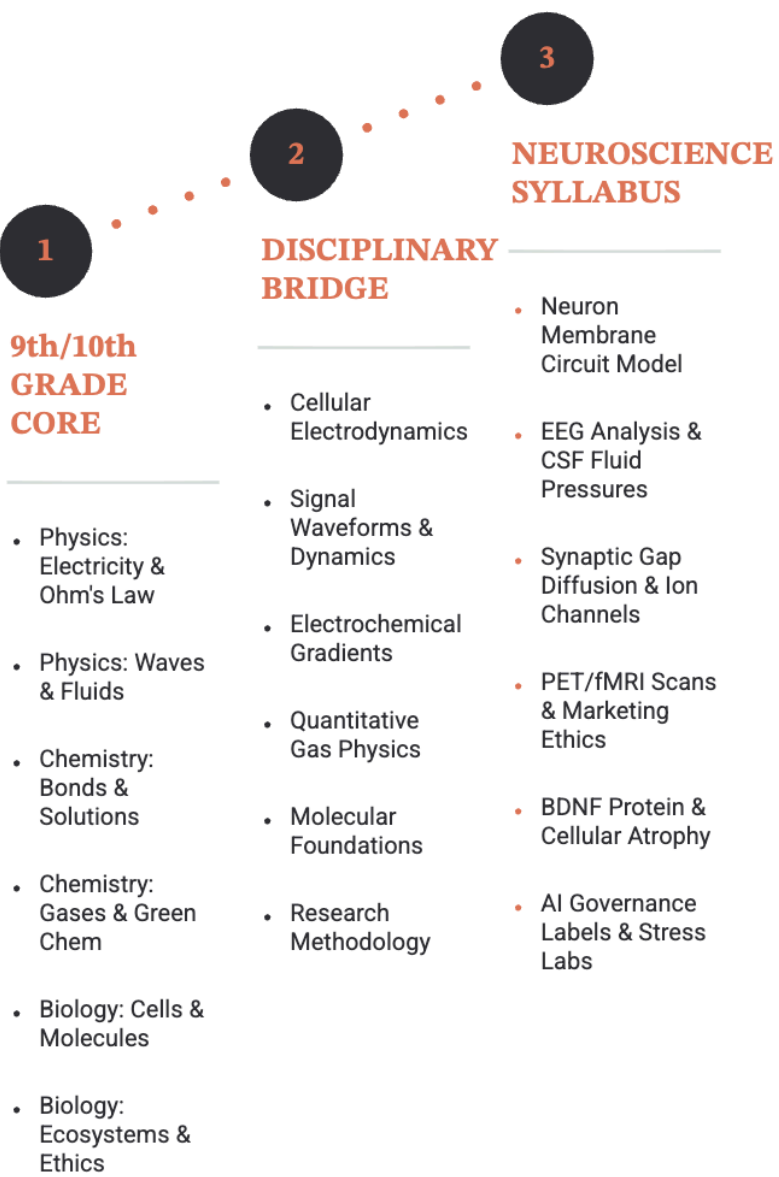
- Isolated Subjects:** In most of the high schools, we split it into separate boxes: Physics, Chemistry, and Biology. Because of this, students cannot see how these fields connect or how they look at the same problem differently.
- The University Gap:** Standard 11th and 12th-grade classes rely on memorizing textbook chapters and abstract examples. However, real university research is complex and mixes many fields together. This sudden change creates a hard transition for students

The Curricular Solution:

- Real Research Early:** Instead of waiting for university, students learn to find real academic papers and read raw data early using simple digital tools like Google Scholar, Consensus and NotebookLM.
- Connecting the Pieces:** We use Neuroscience as a bridge. Students voluntarily take this elective to see how biology, physics, math, data analysis, and ethics work together on real-world problems.

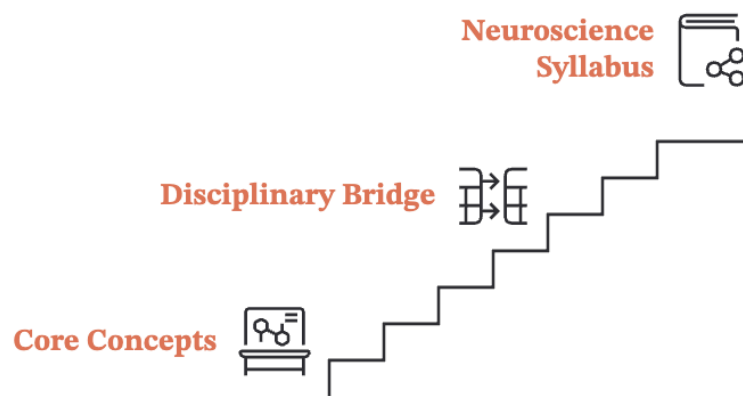
Rather than learning neuroscience through lectures alone, students engaged in authentic scientific practices including literature review, data analysis, experimentation, modelling, scientific communication, and ethical evaluation.

Student Readiness and Prerequisites

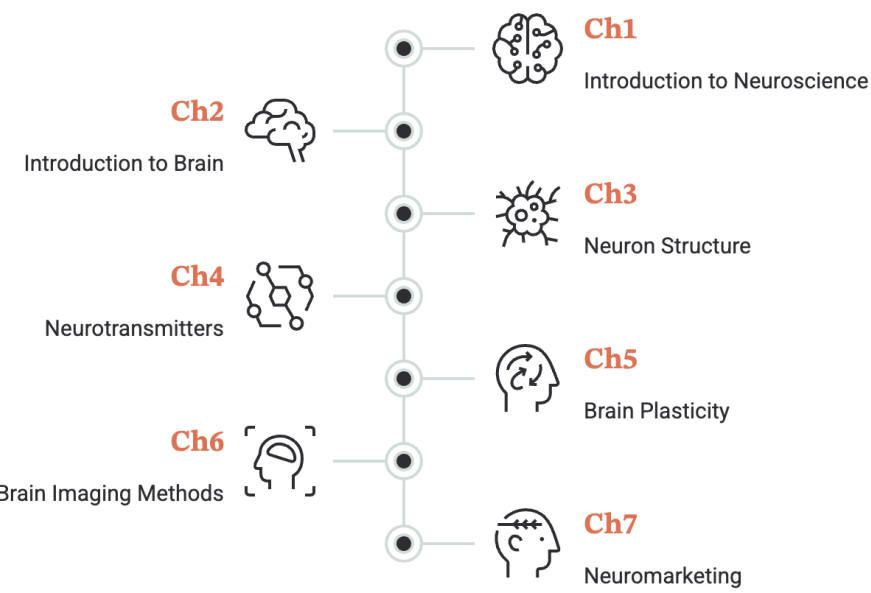


Why 11th & 12th Grade?

- Grade Restriction:** Available exclusively to 11th and 12th-grade students.
- Science Foundation:** Requires completion of 9th and 10th-grade core sciences to develop interdisciplinary, systems-level thinking.
- Technical Readiness:** Aligns with higher-level Math and Computer Science courses taken at this stage.
- Applied Skills:** Ensures students are equipped for the quantitative modeling, coding logic, and data analysis required in the syllabus.



Course Overview



The activities and assignments in this course can be grouped into three main areas:

- Scientific Inquiry
- Applied Neuroscience
- Scientific Communication & Societal Impact

Scientific Inquiry:

Students investigate neuroscience through research papers, scientific databases, AI-assisted literature analysis, and data interpretation.

- Examples:
- Neuroplasticity Research Groups
 - Plastic Brain Project
 - Driving Behaviour & Brain Imaging

Experimental & Applied Neuroscience:

Students apply neuroscience concepts through experiments, clinical cases, modelling, and real-world applications.

- Examples:
- Split Brain Experiment
 - Brain Imaging Challenge
 - Jody Miller Case
 - Neuromarketing Activities
 - Stroop Test

Scientific Communication & Societal Impact:

Students communicate evidence-based findings and evaluate the ethical and social implications of neuroscience.

- Examples:
- Neuralink Project
 - Neurotransmitter Presentation
 - Charles Whitman Project
 - Drugs Poster

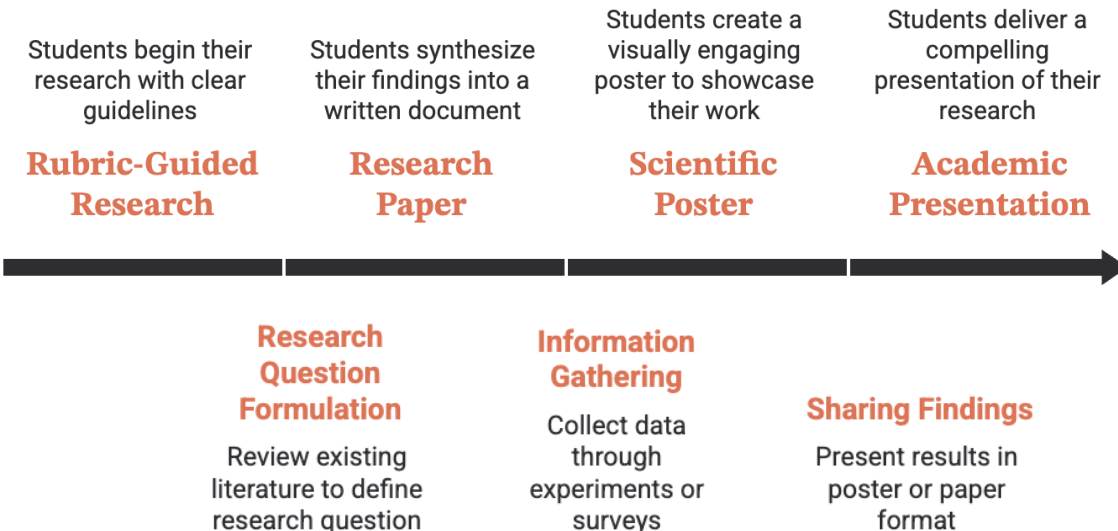
Structure of the class activities:



How Do Students Learn Research in Neuroscience Course?

Students learn to:

- Search scientific literature
- Use AI-supported research tools
- Analyze figures and data
- Cite sources correctly
- Communicate scientific findings



QR for the rubric and student works:



Research Pathway in Neuroscience Research Groups

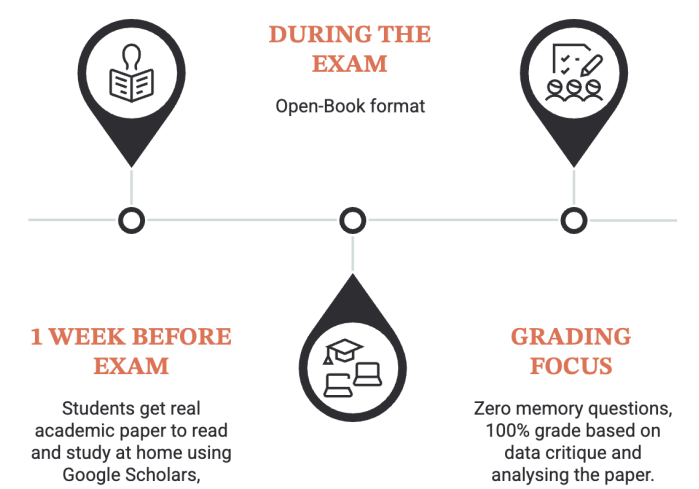
Grade 9: Literature search, Reading scientific papers, Summarizing findings, Introduction to AI-supported research tools
Grades 10-12: Follow a structured research pathway.

Course Policies & Grading

Assessment Structure:

- 75% Performance-Based Assessment
 - Research Papers
 - Scientific Posters
 - Scientific Presentations
- 25% Classroom Participation
- 2 Exams per Semester

Written Exams Process:



Results

Within an elective system offering more than 65 courses, enrollment in Neuroscience remained stable, while participation in neuroscience research projects increased from 1 to 10 students between 2021 and 2026.

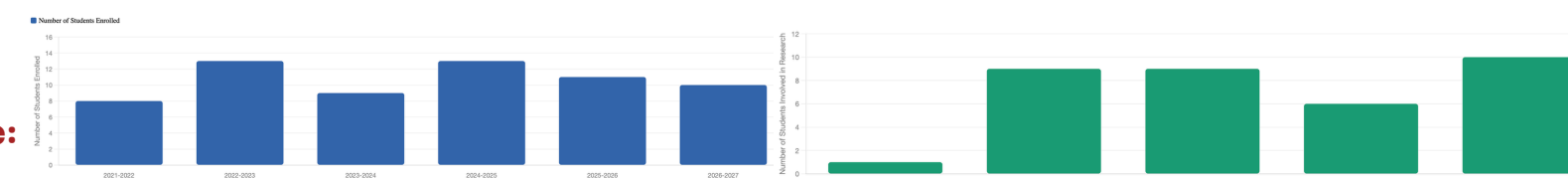


Figure 1: Number of Students Enrolled in the Neuroscience Elective Course (2021-2026)

Research Impact: 35+ students participated in neuroscience research; participation increased from 1 to 10 students, and student research teams produced 20 publications.

Conclusion

Rather than relying primarily on lectures and content delivery, the Neuroscience course was designed to engage students in research, experimentation, and scientific communication. Through literature reviews, case studies, laboratory activities, presentations, and research projects, students take an active role in constructing their own understanding of neuroscience. This approach encourages

- interdisciplinary thinking,
- introduces students to academic research at an early stage, and
- helps them develop skills that extend beyond the classroom.

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