

Biological Sciences (BS): Integrative Physiology and Neurobiology Concentration

To see more about what you will learn in this program, visit the Learning Outcomes website (<https://apps.oirp.ncsu.edu/pgas/>)!

The B.S. in Biological Sciences with a concentration in Integrative Physiology and Neurobiology (IPN) provides a comprehensive grounding in the principles of physiology and neuroscience, as well as in-depth exposure to the application of those principles in understanding whole-animal function, links between physiology and behavior, and the ways in which animals cope with challenges presented by their environments.

IPN students graduate with the skills to work in industry and government agencies. Graduates may also choose to continue their education by pursuing advanced degrees in many areas of the life sciences, including neuroscience, endocrinology, cell biology, and physiology. The IPN concentration also prepares students to pursue degrees in medicine, dentistry, and other health-related areas.

Plan Requirements

| Code | Title | Hours | Counts towards |
|------------------------------------|---|-------|----------------|
| Exploring the Life Sciences | | | |
| LSC 103 | Exploring Opportunities in the Life Sciences | 1 | |
| Writing | | | |
| | Advanced Writing Requirement Elective (p. 2) ¹ | 3 | |
| | Cannot be double-counted for a GEP requirement. | | |
| Biological Sciences | | | |
| LSC 101 | Critical and Creative Thinking in the Life Sciences ¹ | 2 | |
| BIO 181 | Introductory Biology: Ecology, Evolution, and Biodiversity ¹ | 4 | |
| BIO 183 | Introductory Biology: Cellular and Molecular Biology ¹ | 4 | |
| BIO 414 or BIO 416 | Cell Biology ¹ Cancer Cell Biology | 3 | |
| BIO 424 | Endocrinology ¹ | 3 | |
| BIO 488 | Neurobiology ¹ | 3 | |
| BCH 351 | General Biochemistry ¹ | 3-4 | |

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| or BCH 451 | Principles of Biochemistry | |
| GN 311 | Principles of Genetics ¹ | 4 |
| GN 312 | Elementary Genetics Laboratory ¹ | 1 |
| Select one of the following Physiology courses: ¹ | | 4 |
| BIO 240 | Principles of Human Anatomy & Physiology (A): Nervous, Skeletal, Muscular, & Digestive Systems | |
| BIO 245 | Principles of Human Anatomy & Physiology (B): Endocrine, Cardiovascular, Respiratory & Renal Systems | |
| ZO 250 | Animal Anatomy and Physiology | |

Physical & Mathematical Sciences

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|------------------------------|---|---|
| MA 131 | Calculus for Life and Management Sciences A | 3 |
| or MA 141 | Calculus I | |
| MA 231 | Calculus for Life and Management Sciences B | 3 |
| or MA 241 | Calculus II | |
| CH 101 | Chemistry - A Molecular Science | 3 |
| CH 102 | General Chemistry Laboratory | 1 |
| CH 201 | Chemistry - A Quantitative Science | 3 |
| CH 202 | Quantitative Chemistry Laboratory | 1 |
| CH 221 | Organic Chemistry I | 3 |
| CH 222 | Organic Chemistry I Lab | 1 |
| CH 223 | Organic Chemistry II | 3 |
| CH 224 | Organic Chemistry II Lab | 1 |
| Select one of the following: | | 4 |
| PY 211 | College Physics I | |

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| PY 205 & PY 206 | Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory | |
| Select one of the following: | | 4 |
| PY 212 | College Physics II | |
| PY 208 & PY 209 | Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory | |
| ST 311 | Introduction to Statistics | 3 |

Major Electives

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| IPN Electives (p. 3) ¹ | 9 |
| Supraorganismal Elective (p. 4) ¹ | 3 |

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| Additional Science & Math Electives (p. 4) | 6 |
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GEP Courses

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| ENG 101 | Academic Writing and Research ¹ | 4 |
| GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/) | 6 | |
| GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/) | 6 | |
| GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/) | 2 | |
| GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/) | 3 | |
| GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/) | 3 | |
| GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement) | | |

Foreign Language Proficiency
(<http://catalog.ncsu.edu/undergraduate/gep-category-requirements/foreign-language-proficiency/>) (verify requirement)

Free Electives

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|--------------------------------|----|
| Free Electives (12 Hr S/U Lmt) | 10 |
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These electives cannot be taken at an elementary level after you have taken comparable coursework at a more advanced level. Students interested in graduate school or professional school should check the courses required for admission to the programs to which they plan to apply

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| Total Hours | 120 |
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¹ A grade of C- or higher is required.

Advanced Writing Requirement Electives

| Code | Title | Hours | Counts towards |
|---------|--|-------|----------------|
| BIO 267 | Research in the Life Sciences I: Research Skills | 3 | |
| COM 211 | Argumentation and Advocacy | 3 | |
| ENG 214 | Introduction to Editing | 3 | |
| ENG 232 | Literature and Medicine | 3 | |
| ENG 287 | Explorations in Creative Writing | 3 | |
| ENG 288 | Fiction Writing | 3 | |
| ENG 289 | Poetry Writing | 3 | |
| ENG 292 | Writing About Film | 3 | |
| ENG 316 | Introduction to News and Article Writing | 3 | |
| ENG 323 | Writing in Rhetorical Traditions | 3 | |
| ENG 331 | Communication for Engineering and Technology | 3 | |
| ENG 332 | Communication for Business and Management | 3 | |
| ENG 333 | Communication for Science and Research | 3 | |
| ENG 381 | Creative Nonfiction Writing Workshop | 3 | |

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| ENG 388 | Intermediate Fiction Writing Workshop | 3 |
| ENG 389 | Intermediate Poetry Writing Workshop | 3 |
| ENG 416 | Advanced News and Article Writing | 3 |
| ENG 417 | Editorial and Opinion Writing | 3 |
| ENG 422 | Writing Theory and the Writing Process | 3 |
| ENG 425 | Analysis of Scientific and Technical Writing | 3 |
| ENG 426 | Analyzing Style | 3 |

IPN Electives

Code Title Hours Counts towards

Students can use up to 3 hours of Experiential Learning (BSC 492, BSC 493, BSC 494, BSC 497 or BSC 498) toward IPN Electives.

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| AEC 515 | Fish Physiology | 3 |
| ANS 220 | Reproductive Physiology | 3 |
| ANS 221 | Reproductive Physiology Lab | 1 |
| ANS 415 | Comparative Nutrition | 3 |
| ANS 452 | Comparative Reproductive Physiology and Biotechnology | 3 |
| ANS 515 | Comparative Nutrition | 3 |
| ANS 552 | Comparative Reproductive Physiology and Biotechnology | 3 |
| BIO 361 | Developmental Biology | 3 |
| BIO 418 | Cell Biology Research Lab | 2 |
| BIO 432 | Evolutionary Medicine | 3 |
| BIO 434 | Hormones and Behavior | 3 |
| BIO 444 | The Biology of Love and Sex | 3 |
| BIO 483 | Capstone Course in Integrative Physiology and Neurobiology | 3 |

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|---------|---|---|
| BIT 464 | Protein Purification | 2 |
| BIT 466 | Animal Cell Culture Techniques | 2 |
| BIT 471 | RNA Interference and Model Organisms | 2 |
| BIT 564 | Protein Purification | 2 |
| BIT 566 | Animal Cell Culture Techniques | 2 |
| BIT 571 | RNA Interference and Model Organisms | 2 |
| ENT 503 | Insect Morphology and Physiology | 3 |
| FW 515 | Fish Physiology | 3 |
| GN 434 | Genes and Development | 3 |
| GN 441 | Human and Biomedical Genetics | 3 |
| GN 453 | Personal Genomics | 3 |
| GN 456 | Epigenetics, Development, and Disease | 3 |
| GN 541 | Human and Biomedical Genetics | 3 |
| MB 441 | Immunology | 3 |
| NTR 415 | Comparative Nutrition | 3 |
| NTR 419 | Human Nutrition and Chronic Disease | 3 |
| NTR 515 | Comparative Nutrition | 3 |
| PHY 452 | Comparative Reproductive Physiology and Biotechnology | 3 |
| PHY 503 | General Physiology I | 3 |
| PHY 504 | General Physiology II | 3 |
| PHY 524 | Comparative Endocrinology | 3 |
| PHY 552 | Comparative Reproductive Physiology and Biotechnology | 3 |
| PO 415 | Comparative Nutrition | 3 |

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|-----------------------------------|---|-----|
| PO 466 | Animal Cell Culture Techniques | 2 |
| PO 515 | Comparative Nutrition | 3 |
| PO 524 | Comparative Endocrinology | 3 |
| PSY 502 | Physiological Psychology | 3 |
| TOX 401 | Principles of Toxicology | 4 |
| TOX 501 | Principles of Toxicology | 4 |
| Research/Professional Exp. | | |
| BSC 492 | Professional Experience | 1-3 |
| BSC 493 | Research Experience | 1-3 |
| BSC 494 | Teaching Experience | 1-3 |
| BSC 497 | Biological Sciences Honors Project Part 1 | 3 |
| BSC 498 | Biological Sciences Honors Project Part 2 | 3 |

Supraorganismal Electives

| Code | Title | Hours | Counts towards |
|---------|---|-------|----------------|
| AEC 360 | Ecology | 4 | |
| AEC 419 | Freshwater Ecology | 4 | |
| AEC 441 | Biology of Fishes | 3 | |
| AEC 442 | Biology of Fishes Laboratory | 1 | |
| AEC 460 | Field Ecology and Methods | 4 | |
| AEC 501 | Avian Ecology | 4 | |
| AEC 519 | Freshwater Ecology | 4 | |
| BIO 270 | Introduction to Evolution | 3 | |
| BIO 330 | Evolutionary Biology | 3 | |
| BIO 432 | Evolutionary Medicine | 3 | |
| BIO 440 | The Human Animal: An Evolutionary Perspective | 3 | |
| ENT 425 | General Entomology | 3 | |
| FOR 565 | Plant Community Ecology | 4 | |
| FW 353 | Wildlife Management | 3 | |

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| MEA 220 | Marine Biology | 3 |
| NR 406 | Conservation of Biological Diversity | 3 |
| PB 360 | Ecology | 4 |
| PB 400 | Plant Diversity and Evolution | 4 |
| PB 403 | Systematic Botany | 4 |
| PB 503 | Systematic Botany | 4 |
| PP 222 | Kingdom of Fungi | 3 |
| ZO 317 | Primate Ecology and Evolution | 3 |
| ZO 333 | Captive Animal Biology | 3 |
| ZO 350 | Animal Phylogeny and Diversity | 4 |
| ZO 402 | Invertebrate Biology | 4 |
| ZO 410 | Introduction to Animal Behavior | 3 |

Additional STEM Electives

Code Title Hours Counts towards

Take any courses at the 200 level and higher from the following prefixes: AEC, BCH, BEC, BIO, BIT, BSC, CH, DSC, ES, GN, MA, MB, MEA, NTR, PB, PY, ST, TOX, ZO

Semester Sequence

This is a sample.

First Year

| Fall Semester | Hours |
|---|-------|
| LSC 101 Critical and Creative Thinking in the Life Sciences | 2 |
| BIO 181 Introductory Biology: Ecology, Evolution, and Biodiversity ¹ | 4 |
| CH 101 Chemistry - A Molecular Science ¹ | 3 |
| CH 102 General Chemistry Laboratory ¹ | 1 |
| MA 131 Calculus for Life and Management Sciences A ¹ | 3 |
| LSC 103 Exploring Opportunities in the Life Sciences | 1 |
| GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/) | 1 |

| Spring Semester | Hours |
|---|-------|
| BIO 183 Introductory Biology: Cellular and Molecular Biology ¹ | 4 |
| CH 221 Organic Chemistry I ¹ | 3 |
| CH 222 Organic Chemistry I Lab ¹ | 1 |

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|---------|--|---|
| ENG 101 | Academic Writing and Research | 4 |
| MA 231 | Calculus for Life and Management Sciences B ¹ | 3 |

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|--------------|-----------|
| Hours | 15 |
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Second Year

Fall Semester

| | | |
|--------|---|---|
| ZO 250 | Animal Anatomy and Physiology | 4 |
| CH 223 | Organic Chemistry II ¹ | 3 |
| CH 224 | Organic Chemistry II Lab ¹ | 1 |
| ST 311 | Introduction to Statistics ¹ | 3 |

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|---|--|---|
| GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/) | | 3 |
|---|--|---|

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|---|--|---|
| GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/) | | 1 |
|---|--|---|

| | |
|--------------|-----------|
| Hours | 15 |
|--------------|-----------|

Spring Semester

| | | |
|---------------|---|---|
| GN 311 | Principles of Genetics ¹ | 4 |
| GN 312 | Elementary Genetics Laboratory ¹ | 1 |
| Free Elective | | 3 |
| CH 201 | Chemistry - A Quantitative Science ¹ | 3 |
| CH 202 | Quantitative Chemistry Laboratory ¹ | 1 |

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| GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/) | | 3 |
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| | |
|--------------|-----------|
| Hours | 15 |
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Third Year

Fall Semester

| | | |
|-----------------------|--|-----|
| PY 211 | College Physics I ¹ | 4 |
| BCH 351 or BCH 451 | General Biochemistry ¹ or Principles of Biochemistry | 3-4 |
| BIO 488 | Neurobiology ¹ | 3 |
| BIO 424 | Endocrinology ¹ | 3 |

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| GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/) | | 3 |
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|--------------|--------------|
| Hours | 16-17 |
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Spring Semester

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|---|---------------------------------|---|
| PY 212 | College Physics II ¹ | 4 |
| Cell Biology Requirement (p. 1) | | 3 |
| Advanced Writing Elective (p. 2) | | 3 |
| GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/) | | 3 |

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|--------------|-----------|
| Hours | 13 |
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Fourth Year

Fall Semester

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| IPN Elective (p. 3) | | 3 |
| IPN Elective (p. 3) | | 3 |
| STEM Elective (p. 4) | | 3 |
| GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/) | | 3 |

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|---------------|--|-----|
| Free Elective | | 2-3 |
|---------------|--|-----|

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|--------------|--------------|
| Hours | 14-15 |
|--------------|--------------|

Spring Semester

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|---------------------------------|--|---|
| Supraorganismal Elective (p. 4) | | 3 |
|---------------------------------|--|---|

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|---------------------|--|---|
| IPN Elective (p. 3) | | 3 |
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| | | |
|----------------------|--|---|
| STEM Elective (p. 4) | | 3 |
|----------------------|--|---|

| | | |
|---|--|---|
| GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/) | | 3 |
|---|--|---|

| | | |
|---------------|--|---|
| Free Elective | | 3 |
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| | |
|--------------|-----------|
| Hours | 15 |
|--------------|-----------|

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|--------------------|----------------|
| Total Hours | 118-120 |
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¹ A grade of C- or higher is required.

Career Opportunities

IPN concentration students graduate with the skills to work in industry and government agencies. Graduates may also choose to continue their education by pursuing advanced degrees in many areas of the life sciences, including neuroscience, endocrinology, cell biology, and physiology. The IPN concentration also prepares students to pursue degrees in medicine, dentistry, and other health-related areas.