

Biological Sciences (BS): Integrative Physiology and Neurobiology Concentration

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, different organ systems, links between physiology and behavior, and integration across these systems.

IPN students graduate with the skills to work in industry, government agencies, and other settings. Experiential learning and internships are encouraged and can be incorporated into the degree. Graduates often 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 strongly prepares students to pursue professional degrees in medicine, dentistry, optometry, physician assistant, and many other health-related areas.

Plan Requirements

Code	Title	Hours
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 or BCH 451	General Biochemistry ¹ Principles of Biochemistry	3-4
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

MA 131 or MA 141	Calculus for Life and Management Sciences A Calculus I	3
MA 231 or MA 241	Calculus for Life and Management Sciences B Calculus II	3
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	
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		
IPN Electives (p. 2) ¹		9
Supraorganismal Elective (p. 2) ¹		3
Additional Science & Math Electives (p. 3)		6
GEP Courses		
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)		
World Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/world-language-proficiency/) (verify requirement)		
Free Electives		
Free Electives (12 Hr S/U Lmt)		10

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

Total Hours **120**

¹ A grade of C- or higher is required.

Advanced Writing Requirement Electives

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

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		
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
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
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
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
ANS 225	Principles of Animal Nutrition	3
ANS 230	Animal Nutrition	3
ANT 251	Introduction to Biological Anthropology	3
ANT 421	Human Osteology	3

Take any courses at the 200 level and higher from the following prefixes: AEC, BCH, BEC, BIO, BIT, BSC, CH, DSC, ENT, ES, FW, 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

Hours 15

Spring Semester

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

Hours 15

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

Hours 15

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
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3

Hours 17

Spring Semester

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

Hours 13

Fourth Year

Fall Semester

IPN Elective (p. 2)		3
IPN Elective (p. 2)		3
STEM Elective (p. 3)		3
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3
Free Elective		2-3

Hours 15

Spring Semester

Supraorganismal Elective (p. 2)		3
IPN Elective (p. 2)		3
STEM Elective (p. 3)		3

GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)	3
Free Elective	3
Hours	15
Total Hours	120

¹ A grade of C- or higher is required.

Career Opportunities

IPN students graduate with the skills to work in industry, government agencies, and other settings. Experiential learning and internships are encouraged and can be incorporated into the degree. Graduates often 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 strongly prepares students to pursue professional degrees in medicine, dentistry, optometry, physician assistant, and many other health-related areas.

Career Titles

- Agricultural Sciences Professor
- Agronomist
- Allergists and Immunologists
- Anesthesiologist (MD)
- Anesthesiologist Assistants
- Animal Breeder
- Animal Scientist
- Aquaculture Specialist
- Aquarium Curator
- Biochemist
- Biological Technician
- Biologist
- Biology Professor
- Biomedical Engineer
- Biophysicist
- Biopsychologist
- Botanist
- Cardiologist (MD)
- Clinical Dietitian
- Dentist (DDS)
- Dietitian and Nutritionist
- Environmental Disease Analyst
- Environmental Engineer
- Environmental Research Analyst
- Epidemiologists
- Family Practitioner (MD)
- Fish and Game Warden
- Fish Hatchery Specialist
- Food & Drug Inspector
- Food Science Technicians
- Food Technologist
- Forensic Science Technicians
- General Internists (MD)
- Genetic Counselors

- Geneticist
- Gynecologist (MD)
- Hazardous Waste Management Analyst
- Horticulturist
- Hospitalists
- Industrial Hygienist
- Industrial Waste Inspector
- Low Vision Therapists, Orientation and Mobility Specialists, and Vision Rehabilitation Therapists
- Marine and Aquatic Biologist
- Medical and Scientific Illustrator
- Medical Equipment Technician
- Medical Technologist
- Microbiologist
- Obstetrician (MD)
- Occupational Health and Safety Technicians
- Occupational Physician (MD)
- Oceanographer
- Optometrist
- Park Naturalist
- Pathologist (MD)
- Pediatrician (MD)
- Pharmacist
- Pharmacologist
- Phlebotomist
- Physical Medicine and Rehabilitation Physicians
- Physician Assistant (PA)
- Radiologist (MD)
- Sales Representative (Chemicals & Drugs)
- Soil Conservationist
- Soil Scientist
- Sports Physician (Orthopedist)
- Surgeons (MD)
- Toxicologist
- Urologists
- Veterinarian (VMD)
- Water Pollution Control Inspector
- Wildlife Biologist
- Wildlife Control Agent
- Winemaker / Vintner
- Zoologist

Learn More About Careers

NCcareers.org (<https://nccareers.org/>)

Explore North Carolina's central online resource for students, parents, educators, job seekers and career counselors looking for high quality job and career information.

Occupational Outlook Handbook (<https://www.bls.gov/ooh/>)

Browse the Occupational Outlook Handbook published by the Bureau of Labor Statistics to view state and area employment and wage statistics. You can also identify and compare similar occupations based on your interests.

Career One Stop Videos (<https://www.careeronestop.org/>)

View videos that provide career details and information on wages, employment trends, skills needed, and more for any occupation. Sponsored by the U.S. Department of Labor.

Focus 2 Career Assessment (<https://careers.dasa.ncsu.edu/explore-careers/career-assessments/>) (NC State student email address required)
This career, major and education planning system is available to current NC State students to learn about how your values, interests, competencies, and personality fit into the NC State majors and your future career. An NC State email address is required to create an account. Make an appointment with your career counselor (<https://careers.dasa.ncsu.edu/about/hours-appointments/>) to discuss the results.

Focus 2 Apply Assessment (<https://www.focus2career.com/Portal/Register.cfm?SID=1929>) (Available to prospective students)
A career assessment tool designed to support prospective students in exploring and choosing the right major and career path based on your unique personality, interests, skills and values. Get started with Focus 2 Apply and see how it can guide your journey at NC State.

Bio Careers (<http://biocareers.weebly.com/>)
American Institute of Biological Sciences (<https://www.aibs.org/>)
Federation of American Societies for Experimental Biology (<https://www.faseb.org/>)