VTTP 123 Foundations of Physiology  
Credits 3. 3 Lecture Hours.  
Introduction to fundamental concepts in physiology and the practice of physiology research through exploration of mathematical models used in physiology research; emphasis on prediction of complex adaptive behavior in health and disease from elementary math, physics, chemistry and biology.

VTTP 223 Design of Experiments for Physiology Research  
Credits 3. 2 Lecture Hours. 2 Lab Hours.  
Team or group formulation and refinement of novel hypotheses and design of controlled in vitro experiments; emphasis on production of publishable research in physiology.  
Prerequisite: VTTP 123 or approval of instructor.

VTTP 224 In Vitro Experimentation in Physiology Research  
Credits 3. 2 Lecture Hours. 2 Lab Hours.  
Team or group collection, analysis and interpretation of data from in vitro experiments; emphasis on production of publishable research in physiology.  
Prerequisite: VTTP 223 or approval of instructor.

VTTP 234 Design of Models for Physiology Research  
Credits 3. 3 Lecture Hours.  
Team or group design of novel models of physiological systems to predict homeostatic behavior arising from the interaction of subsystems; emphasis on production and formal presentation of basic research in physiology.  
Prerequisite: VTTP 123 or approval of instructor.

VTTP 235 Analysis and Validation of Models for Physiology Research  
Credits 3. 3 Lecture Hours.  
Team or group analysis and validation of models of physiological systems to explain disease states and design potential clinical interventions; emphasis on production of publishable applied research in physiology.  
Prerequisite: VTTP 234 or approval of instructor.

VTTP 281 Seminar  
Credits 4. 4 Other Hours.  
Exposure to scientists from a variety of biomedical disciplines through attendance at seminars followed by review and discussion of current scientific work in physiology and related subjects, and subsequent student seminar presentations.  
Prerequisites: Freshman or sophomore classification; approval of instructor.

VTTP 285 Directed Studies  
Credits 0 to 4. 0 to 4 Other Hours.  
Course for freshman and sophomore students who desire additional laboratory work in physiology to supplement required courses.  
Prerequisites: Freshman or sophomore classification; approval of department head.

VTTP 289 Special Topics in...  
Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.  
Selected topics in an identified area of veterinary physiology and pharmacology. May be repeated for credit.
VTPP 434 Physiology for Bioengineers I  
Credits 4.3 Lecture Hours. 1 Lab Hour.  
Cellular anatomy, cellular physiology and biochemistry; systems analysis of digestive, endocrine and musculoskeletal system function including information related to gross anatomy, histology and disease states; quantitative aspects of physiology and engineering applications to clinical medicine.  
Prerequisites: Junior or senior classification; biomedical engineering major or approval of instructor.

VTPP 435 Physiology for Bioengineers II  
Credits 4.3 Lecture Hours. 1 Lab Hour.  
A systems analysis of nervous, cardiovascular, respiratory and urinary function including information related to gross anatomy, histology and disease states; quantitative aspects of physiology and engineering applications to clinical medicine.  
Prerequisites: VTPP 434; junior or senior classification.

VTPP 438 Analysis of Genomic Signals  
Credits 3.2 Lecture Hours. 2 Lab Hours.  
Overview of current high throughput technology for data acquisition and analysis of genomic signals (e.g. mRNA or proteins); emphasis on the microarray technology, methods for analyzing microarray data, and approaches to model the underlying phenomena from the systems biology perspective.  
Prerequisites: Junior or senior classification; BIMS 320/GENE 320 or GENE 320/BIMS 320 and BIOL 111, BIOL 112 or BIOL 213 or equivalent; STAT 302 or equivalent.

VTPP 439 Non-Coding RNA's  
Credits 3.3 Lecture Hours.  
Advanced topics in noncoding RNA's in gene regulation; investigation of the role of noncoding RNAs and epigenetic regulatory factors in modulating gene expression, physiological functions and disease development.  
Prerequisite: Junior or senior classification or approval of instructor.

VTPP 444 Practicum in Biomedical Research  
Credits 3.3 Other Hours.  
Team or group development of sustainable collaborations that include biomedical research, high-impact educational practices and community service; focus on connecting research experience to future career goals.  
Prerequisites: VTPP 423 and VTPP 427 or VTPP 434 and VTPP 435; junior or senior classification.

VTPP 450 Stem Cell Physiology  
Credits 3.3 Lecture Hours.  
Advanced topics in stem cell biology; exploration of mammalian stem cells, stem cell characteristics, cell differentiation potency, molecular basis of stem cell signaling, regulatory pathways, research tools and experimental models.  
Prerequisite: Junior or senior classification or approval of instructor.

VTPP 452 Fetal and Embryo Physiology  
Credits 3.3 Lecture Hours.  
Introduction to the physiologic processes driving embryonic development and pregnancy; focus on embryo implantation, establishment of the placenta, development of the fetal circulatory systems and the molecular processes governing embryo differentiation and development; special emphasis on the major organ systems affected by pediatric disease and on the actions of teratogens.  
Prerequisite: BICH 410 or equivalent, or approval of instructor.

VTPP 481 Seminar  
Credits 4.4 Other Hours.  
Exposure to scientists from a variety of biomedical disciplines through attendance at seminars followed by review and discussion of current scientific work in physiology and related subjects, and subsequent student seminar presentations.  
Prerequisites: Junior or senior classification; approval of instructor.

VTPP 485 Directed Studies  
Credits 0 to 4.0 to 4 Other Hours.  
Course for junior and senior students who desire additional laboratory work in physiology to supplement required courses.  
Prerequisites: Junior or senior classification and approval of department head.

VTPP 489 Special Topics in...  
Credits 1 to 4.1 to 4 Lecture Hours. 0 to 4 Lab Hours.  
Selected topics in an identified area of physiology, pharmacology, endocrinology or toxicology. May be repeated for credit.  
Prerequisite: Junior or senior classification.

VTPP 491 Research  
Credits 0 to 4.0 to 4 Other Hours.  
Laboratory and/or field research supervised by a faculty member.  
Prerequisites: Junior or senior classification; approval of instructor.