

APPLIED BIOMEDICAL SCIENCES (ABMS)

ABMS 5290. Capstone in Healthcare & Biomedicine. 2 Hours.

Students work closely with faculty advisors and industry mentors to tackle a relevant issue within their chosen track. This project involves research, problem-solving, and the development of practical solutions that address real-world biomedical challenges. Prerequisites: Completion of core courses and track-specific courses. Credit: 2 hours.

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ABMS 5301. Advanced Biomedical Sciences & Translational Medicine. 3 Hours.

Students examine key biological processes, including genetics, immunology, and pathophysiology, and their implications for human health. Students also explore the latest advancements in translational medicine, bridging the gap between laboratory research and clinical applications. Topics may include biomarker discovery, precision medicine, drug development, and innovative therapeutic strategies. Through case studies and discussions, students analyze real-world examples of how scientific discoveries translate into medical advancements.

ABMS 5302. Biomedical Data & Digital Health Applications. 3 Hours.

Students explore the role of technology in modern healthcare, including the collection, analysis, and application of health data to improve patient care and clinical outcomes. Topics may include health informatics, the structure and function of electronic health records (EHRs), interoperability challenges, and emerging mobile health applications (mHealth). Students examine telemedicine systems, wearable health monitoring technologies, applications of artificial intelligence in healthcare, and the ethical frameworks guiding digital health innovations. Students gain hands-on experience with health data analytics tools and examine case studies demonstrating the impact of digital health on patient-centered care. Credit: 3 hours.

ABMS 5303. Principles of Clinical & Biomedical Regulations. 3 Hours.

Students gain an overview of key regulatory frameworks, including patient privacy laws, drug and device approval pathways, and global data protection standards. They examine the roles of regulatory agencies, the fundamentals of compliance, and the processes that shape clinical research and medical practice. Topics may include informed consent, clinical trial oversight, healthcare disparities, and the ethical and regulatory challenges posed by emerging technologies such as artificial intelligence. Through case studies and policy analysis, students develop a working knowledge of how regulatory science influences modern healthcare systems and drives biomedical innovation. Credit: 3 hours.

ABMS 5304. Research Methodology & Scientific Communication. 3 Hours.

Students develop proficiency in formulating research questions, selecting appropriate study designs, and applying statistical methods for data analysis, including hypothesis testing, biostatistics, systematic reviews, and meta-analyses. They practice ethical conduct, learn to navigate regulatory requirements, and uphold research integrity. Students also build skills in scientific communication through manuscript preparation, grant writing, and professional presentations. Critical appraisal of scientific literature and the translation of research findings for diverse audiences are integral parts of the course. Credit: 3 hours.

ABMS 5305. Clinical Research & Experimental Design. 3 Hours.

Students examine a range of study designs, including observational (cohort, case-control) and interventional (randomized controlled trials), and learn how to select the most appropriate design based on specific research questions. Students apply key statistical concepts such as sample size calculation, power analysis, and data analysis techniques relevant to clinical trials. They investigate how artificial intelligence tools can enhance clinical research and experimental design. Ethical and regulatory considerations, including informed consent, participant safety, and data integrity are addressed. Through case studies, students analyze how experimental findings inform medical practice, health policy, and clinical guidelines, bridging the gap between scientific research and real-world healthcare implementation.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5306. Biomarker Discovery & Precision Medicine. 3 Hours.

Students explore the cutting-edge field of precision medicine, which tailors' medical treatments to the individual based on genetic, environmental, and lifestyle factors. They investigate the role of biomarkers in identifying disease risk, monitoring progression, and guiding treatment decisions, particularly in oncology, cardiology, and neurology. Students study the discovery, validation, and clinical application of biomarkers for disease detection, prognosis, and therapeutic response. Through case studies, they analyze how biomarkers are integrated into personalized treatment strategies and examine the challenges and regulatory considerations involved in developing biomarker-based diagnostics and therapies.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5307. Translational Medicine and Drug Development. 3 Hours.

Students gain a comprehensive understanding of translational medicine and the process of transforming basic scientific discoveries into clinical applications, with a particular focus on drug development. They examine the stages of drug discovery, from target identification and preclinical testing to phase I–III clinical trials. Students address the scientific, regulatory, and ethical challenges involved in developing new therapies and study topics such as the role of biomarkers in clinical trials, the integration of personalized medicine in drug development, and the influence of regulatory agencies (e.g., FDA) on drug approval processes. They also consider patient advocacy, public health implications, and the use of artificial intelligence tools in translational medicine and drug development.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5308. Omics Technologies & Personalized Therapies. 3 Hours.

Students explore the latest advancements in omics technologies, genomics, proteomics, metabolomics, and transcriptomics, and their applications in personalized medicine. They learn how these technologies are used to profile molecular data at the individual level, enabling the identification of disease mechanisms and the development of targeted therapies. Students apply omics data to design personalized treatment strategies that improve patient outcomes, particularly in cancer, cardiovascular disease, and neurological disorders. They also investigate the integration of omics data with clinical decision-making, use AI and bioinformatics tools for data analysis, and examine the challenges of translating omics findings into clinical practice.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5309. Fundamentals of Artificial Intelligence in Healthcare. 3 Hours.

Students are introduced to the foundational concepts of Artificial Intelligence (AI), with a specific focus on healthcare applications. They study core AI principles such as machine learning algorithms, supervised and unsupervised learning, neural networks, deep learning, and data-driven decision-making. Students examine how these technologies are applied to address real-world healthcare challenges, including diagnostics, treatment planning, and operational efficiency. Through case studies, they gain insights into both the potential and the limitations of AI in healthcare.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5310. Predictive Analytics & Clinical Decision Support. 3 Hours.

Students explore advanced techniques for statistical modeling and risk prediction, applying them to predict patient outcomes, identify high-risk individuals, and guide clinical interventions. They study regression models, decision trees, random forests, and neural networks, using these methods in clinical scenarios. Students also examine how predictive models integrate with clinical decision support tools to deliver real-time recommendations for healthcare professionals, ultimately improving decision-making, reducing errors, and enhancing patient care.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5311. Artificial Intelligence in Medical Imaging & Diagnostics. 3 Hours.

Students explore the integration of artificial intelligence techniques in medical imaging across radiology, pathology, ophthalmology, and dermatology. Topics may include deep learning methods for image segmentation, detection, and classification to assist in identifying abnormalities such as tumors, lesions, and retinal disorders. Students evaluate challenges and ethical considerations associated with AI-driven diagnostics and review case studies demonstrating improvements in diagnostic accuracy and treatment planning.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5312. Natural Language Processing for Healthcare. 3 Hours.

Students apply natural language processing (NLP) techniques to analyze unstructured healthcare text, including electronic health records (EHRs), medical literature, and patient-provider communication. Topics may include text mining, entity recognition, sentiment analysis, and automated medical coding to extract meaningful insights from large volumes of clinical data. Students examine how NLP enhances clinical documentation, supports evidence-based decision-making, and advances healthcare research. Ethical considerations, including patient privacy and data security in NLP applications, are integrated throughout the course.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5313. Medical Product Development & FDA Regulations. 3 Hours.

Students examine regulatory processes for the development and approval of medical products with an emphasis on U.S. Food and Drug Administration (FDA) requirements. Topics may include pre-clinical studies, Investigational New Drug (IND) applications, clinical trial phases, and New Drug Application (NDA) or Premarket Approval (PMA) submissions. Students analyze FDA oversight of labeling, post-market surveillance, and adverse event reporting. Students investigate regulatory pathways for medical devices, drugs, biologics, and combination products, and evaluate common challenges companies encounter in achieving compliance.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5314. Clinical Trials & Post-market Surveillance. 3 Hours.

Students explore the design, management, and regulatory requirements of clinical trials to ensure the safety and efficacy of new medical products. Topics may include clinical trial phases from preclinical studies through Phase I, II, III, and post-market Phase IV evaluations. Students apply principles of trial design such as randomization, blinding, sample size determination, and ethical protections including informed consent and patient safeguarding. Students assess post-market surveillance systems that monitor continued product safety and effectiveness, including adverse event reporting, risk management, and FDA oversight of product recalls.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5315. Pharmaceutical & Biotechnology Regulatory Science. 3 Hours.

Students examine the regulatory landscape of the pharmaceutical and biotechnology industries with a focus on the scientific principles guiding regulatory practices. Topics may include regulatory frameworks for pharmaceutical drugs, biologics, gene therapies, and biosimilars, as well as preclinical research, clinical development phases, regulatory filings, and Biologic License Applications (BLAs). Students evaluate challenges faced by biotechnology companies in meeting FDA and international regulatory standards. Students also analyze emerging trends such as orphan drug development, personalized medicine, and global regulatory harmonization.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5316. Quality Assurance & Risk Management in Healthcare. 3 Hours.

Students examine quality assurance principles, regulatory compliance, and risk management strategies in healthcare settings with an emphasis on patient safety and continuous quality improvement. Topics may include healthcare regulations, accreditation standards, compliance frameworks, quality metrics, and methods for evaluating clinical and operational performance. Students assess healthcare risks, implement mitigation strategies, and analyze case studies and regulatory scenarios to identify best practices in quality and safety management.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5317. Health Information Systems & Electronic Health Records. 3 Hours.

Students analyze the role of health information systems in transforming healthcare with emphasis on Electronic Health Records (EHRs). Topics may include EHR system architecture, design, implementation, data standards, user interface considerations, and integration of patient information across providers to support continuity of care. Students examine the impact of EHRs on patient outcomes. Students evaluate case studies that demonstrate real-world applications, challenges, and the evolving future of health information systems.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5318. Cyber Security & Data Privacy in Healthcare. 3 Hours.

Students examine cybersecurity principles essential for protecting sensitive patient information in healthcare environments. Topics may include encryption, data integrity, threat detection, risk management strategies, and regulatory frameworks such as the Health Insurance Portability and Accountability Act (HIPAA). Students analyze common security risks including data breaches and ransomware attacks and evaluate ethical and legal implications of safeguarding patient data. Students apply case studies to assess best practices for maintaining trust, ensuring compliance, and strengthening healthcare system security.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5319. Wearable & Remote Patient Monitoring Technologies. 3 Hours.

Students explore wearable health devices and remote patient monitoring technologies that are reshaping healthcare delivery. Topics may include sensor-based monitoring of vital signs, physical activity, and chronic disease indicators, along with data analytics and mobile health (mHealth) applications. Students evaluate the integration of these technologies into clinical workflows to support real-time monitoring, preventive care, and reduction of hospital readmissions. Students analyze the impact of wearable health technologies on patient engagement, behavior, and outcomes, and assess ethical considerations such as patient consent and data privacy.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5320. Interoperability & Data Standards in Health Info Technology. 3 Hours.

Students examine the role of interoperability in healthcare information systems to enable secure and seamless data exchange across providers. Topics may include key standards and protocols such as Health Level 7 (HL7), Fast Healthcare Interoperability Resources (FHIR), and Digital Imaging and Communication in Medicine (DICOM). Students evaluate technical, regulatory, and organizational barriers to implementing interoperable systems and investigate strategies that support effective communication and secure patient data transfer. Students analyze case studies and real-world applications demonstrating successful interoperability initiatives.

Prerequisite: ABMS 5301, ABMS 5302, ABMS 5303 & ABMS 5304.

ABMS 5400. Internship in Applied Biomedical Sciences. 4 Hours.

Students gain practical, hands-on experience in professional settings aligned with their selected program track. Topics may include the application of biomedical sciences, healthcare innovation, regulatory affairs, or health technology development in real-world environments. Students apply theoretical knowledge, refine professional skills, and build career-enhancing connections through internships in industry, research institutions, healthcare organizations, or regulatory agencies.

Prerequisite: Completion of core courses and track-specific courses.