

2018-2019 UAMS Graduate School Catalog Addendum

April 2, 2019

Biomedical Informatics Certificate Coursework

Biomedical Informatics Core:..... (3 hours)

Practicum Project:..... (3 hours)

Certificate Coursework:..... (9 hours)

Certificate coursework consists of eight credit hours of relevant coursework, usually from the specialty track courses, chosen by the student and the student's Advisor to meet the student's personal educational goals.

UAMS Biomedical Informatics Graduate Program Goals:

Doctoral graduates will possess the knowledge and skills to pose compelling scientific questions and new methods in Biomedical Informatics and design, conduct and report the research that answers them.

Masters graduates will be able to to characterize problems in Biomedicine and apply biomedical informatics principles and methods to design, develop, implement and evaluate promising solutions to them. They will be able to manage and participate in applied or research Biomedical Informatics projects as a member of an interdisciplinary team.

Certificate graduates will possess an understanding of theories, methods and data common across multiple subdomains of Biomedical Informatics. They will possess the knowledge and skills to apply them in a targeted area of their choosing. Certificate graduates will have the knowledge and tools to continue their professional development.

CRI Track Objectives:

Develop and maintain understanding of current information related challenges and state of the art solutions in clinical research. Example challenges in clinical research include:

- Using clinical or clinical study data to support research design and planning
- Identification and engagement of potential participants for research
- Integration of patient care and research processes
- Automation of research processes
- Collection, processing and integration of existing data and new data from multiple sources for use in clinical studies
- Data quality assurance and control in clinical studies
- Using data to support study operations, management, institutional oversight and regulatory decision-making
- Curation, discoverability and sharing data and results from studies
- Educating clinical investigators and research teams in data collection, handling and use
- Educating the next generation of CRI professionals and researchers

Analyze challenges in clinical studies and identify those amenable to information-based interventions

Identify, interpret and apply regulations relevant to clinical studies.

Formulate solutions based on Biomedical Informatics theories, methods, and evidence to challenges in clinical studies.

Develop and implement solutions to challenges in clinical studies.

Evaluate solutions to challenges in clinical studies.



Graduate School

Clinical Research Informatics (CRI) Curriculum

Clinical Research Informatics (CRI) Curriculum
MS ≥ 36 hours, PhD ≥ 55 hours (inclusive of the MS hours)

Biomedical Informatics Core:(13 hours)

- BMIG 5001 Data, Information and Knowledge Representation..... (3 hours)
- BMIG 5101 Foundations of Biomedical Informatics: Sequences & Biologic Information.. (2 hours)
- BMIG 5102 Foundations of Biomedical Informatics: Clinical Information..... (2 hours)
- BMIG 5103 Foundations of Biomedical Informatics: Public Health Information..... (2 hours)
- BMIG 5010 Project Rotation in Biomedical Informatics..... (2 hours)*

*two rotations required for the core for a total of 4 credit hours

Background necessary for research area(MS 6 hrs, PhD ≥ 6 hrs)

Clinical Research Informatics students need a solid background in both the biomedical and computational sciences. Required background courses starting in Fall 2018 are listed below. Students often need additional background courses depending on their prior coursework and chosen research area.

- (1) Biomedical sciences
 - BMIG 5002 Biomedicine for Informaticists..... (3 hours)
- (2) Computational sciences
 - BMIG 5003 Computational Methods for Informaticists..... (3 hours)

Specialty Track Courses:(MS 8 hrs, PhD ≥ 9 hrs)

- BMIG 6011 Clinical Research Informatics..... (3 hours)
- BMIG 6010 Information Systems in Clinical Research..... (3 hours)
- BMIG 5112 Introduction to Human Computer Interaction..... (3 hours)
- BMIG 5016 Clinical and Translational Research..... (1 hour)
- BMIG 5017 Clinical Data Standards..... (1 hour)
- BMIG 5013 Health Information Systems..... (1 hour)
- BMIG 6012 Data Warehousing, Aggregation, and Reporting..... (1 hour)
- BMIG 6110 Fundamentals of Managing Research Data..... (3 hours)
- BMIG 6112 Clinical Research Informatics Synthesis..... (3 hours)

Research Methods and Conduct:(MS 9 hrs, PhD ≥ 28 hrs)

- BMIG 6050 Research Design..... (3 hours)
- PCOL 5211 – 5241 Scientific Communication and Ethics..... (4 semesters, 1 hour each)
- BMIG 5800 Thesis Research..... (6 hours)
- BMIG 6800 Dissertation Research..... (≥ 18 hours PhD)
- BMIG 6215 Research..... (0 hours MS, variable hours PhD)
- BIOM 5190 Research and Application Seminar..... (0 hour MS, 3 hours PhD)

Free Electives:(MS 0 hrs, PhD 0 hrs)

Chosen based on need to support master's or doctoral research.

Clinical Research Informatics Track by Semester (Master's Degree)

Year 1: Fall

Course ID	Title	Credit Hours
BMIG 5002	Biomedicine for Informaticists	3
BMIG 5001	Data, Information and Knowledge Representation	3
BMIG 5102	Foundations of Biomedical Informatics: Clinical Information	2
Total Credit Hours		8

Year 1: Spring

Course ID	Title	Credit Hours
BMIG 5003	Computational Methods for Informaticists	3
BMIG 5103	Foundations of Biomedical Informatics: Public Health Information	2
BMIG 5010	Project Rotation in Biomedical Informatics	2
Total Credit Hours		7

Year 1: Summer

Course ID	Title	Credit Hours
BMIG 6110	Fundamentals of Managing Research Data	3
BMIG 5010	Project Rotation in Biomedical Informatics	2
BMIG 6050	Research Design	3
Total Credit Hours		8

Year 2: Fall

Course ID	Title	Credit Hours
BMIG 6011	Clinical Research Informatics	3
BMIG 6010	Information Systems in Clinical Research	3
BMIG 5101	Foundations of Biomedical Informatics: Sequences & Biologic Information	2
Total Credit Hours		8

Year 2: Spring

Course ID	Title	Credit Hours
BMIG 6XXX	Clinical Research Informatics Synthesis	3
Total Credit Hours		3

Year 2: Summer

Course ID	Title	Credit Hours
BMIG 5800	Thesis Research	6
Total Credit Hours		6

Total Credit Hours 36-46

Required Courses; [Track specialty courses \(dependent on career goals\)](#)

UAMS Biomedical Informatics Graduate Program Goals:

Doctoral graduates will possess the knowledge and skills to pose compelling scientific questions and new methods in Biomedical Informatics and design, conduct and report the research that answers them.

Masters graduates will be able to characterize problems in Biomedicine and apply biomedical informatics principles and methods to design, develop, implement and evaluate promising solutions to them. They will be able to manage and participate in applied or research Biomedical Informatics projects as a member of an interdisciplinary team.

Translational Bioinformatics (TBI) Track Objectives:

To integrate information about molecular entities (DNA, RNA, proteins, small molecules, and lipids) with information about clinical entities (patients, diseases, symptoms, laboratory tests, pathology reports, clinical images, and drugs), and use this to improve patient care and our understanding of biology.

Current TBI challenges apply across the breadth of Biomedical Informatics and include but are not limited to:

- Integration of genomic data in clinical research design and planning.
- Integration of other 'omic data (transcriptomics, proteomics, metabolomics) in clinical research design and planning.
- Collection, processing and integration of biological sequence data from multiple sources for use in clinical studies including existing data and new data
- Data quality for biological sequences used in clinical studies.
- Using biological sequence data to support study operations, management, institutional oversight and regulatory decision-making
- Curation, discoverability and sharing sequence data and results from studies
- Educating clinical investigators and research teams on current methodologies in genomics, transcriptomics, proteomics, and how to extract relevant clinical information and incorporate this into medical records.
- Educating the next generation of TBI professionals and researchers.



Translational Bioinformatics (TBI) Curriculum

Translational Bioinformatics (TBI) Curriculum
MS 36 hours, PhD ≥ 55 hours (inclusive of the MS hours)

Biomedical Informatics Core:(19 hours)

- BMIG 5001 Data, Information and Knowledge Representation (3 hours)
- BMIG 5002 Biomedicine for Informaticists (3 hours)
- BMIG 5003 Computational Methods for Informaticists (3 hours)
- BMIG 5101 Foundations of Biomedical Informatics: Sequences & Biologic Information (2 hours)
- BMIG 5102 Foundations of Biomedical Informatics: Clinical Information (2 hours)
- BMIG 5103 Foundations of Biomedical Informatics: Public Health Information (2 hours)
- BMIG 5010 Project Rotation in Biomedical Informatics (2 hours) *

* two rotations required for the core for a total of 4 credit hours

Specialty Track Courses:(MS ≥ 10 hrs, PhD ≥ 10 hours)

- BMIG 5014 BioConductor for Genome-scale data (1 hour)
- BMIG 5015 Introduction to Biological Network Analysis (1 hour)
- BMIG 5210 Genomics and Metagenomics (3 hours)
- BMIG 5211 Scientific Data Visualization (1 hour)
- BMIG 6111 Comparative Microbial Genomics (3 hours)
- BMIG xxx Fundamentals of the Human Microbiome (3 hours)

Research Methods and Conduct:(MS 5-7 hours, PhD ≥ 21 hours)

BMIG 5190 Research and Application Seminar (1 hour MS, 3 hours PhD)

- BMIG 5800 Thesis (6 hours MS)
- BMIG 5801 Capstone Course (3 hours Professional MS only)
- BMIG 6050 Research Design (2 hours PhD)
- BMIG 6101 Fundamentals of Managing Research Data (3 hours)
- BMIG 6800 Dissertation research (≥18 hours PhD)
- PCOL 5211 – 5241 Scientific Communication and Ethics (MS 1, PhD 4 semesters, 1 credit hour each)

Free Electives:(MS 3 hours, PhD 0-6 hours)

Chosen based on need to support Masters or Doctoral research. This may include course listed below.

- BMIG 5014 Anatomy for Imaging (3)
- BMIG 6102 Semantic Web (3 hours)
- BMIG Special Topics (1-3 hours)
- BIOC 6102 Special Topics in Biochemistry: Proteomics (3 hours)
- BIOC 504V Biochemical Methods (3 hours)
- BIOC 5203 Biochemical Methods (3 hours)
- NUTR 5110 Nutrition and Metabolism Macronutrients (3 hours)
- PHYO 5143 Gene Expression (3 hours)
- PSGP 6110 Pharmacogenetics of Drug Metabolism and Transport (3 hours)
- PSGP 6111 Advanced Pharmacogenetics and Pharmacogenomics (3 hours)

Sample TBI Informatics Track Plan by Semester

Year 1: Fall

Course ID	Title	Credit Hours
BMIG 5001	Data, Information and Knowledge Representation	3
BMIG 5002	Biomedicine for Informaticists	3
BMIG 5211	Scientific Data Visualization	1
BMIG 5101	Foundations of Biomedical Informatics: Sequences & Biologic Information	2
Total Credit Hours		9

Year 1: Spring

Course ID	Title	Credit Hours
BMIG 5003	Computational Methods in Biomedical Informatics	3
BMIG 5103	Foundations of Biomedical Informatics: Public Health Information	2
BMIG 6111	Comparative Microbial Genomics	3
BIOM 5190	Research and Application Seminar	1
Total Credit Hours		9

Year 2: Fall

Course ID	Title	Credit Hours
BMIG 5010	Project Rotation in Biomedical Informatics	2
BMIG 5102	Foundations of Biomedical Informatics: Clinical Information	2
BMIG 5015	Introduction to Biological Network Analysis	1
BINF 5210	Genomics and Metagenomics	3
BMIG 5014	BioConductor for Genome-scale data	1
Total Credit Hours		9

Year 2: Spring

Course ID	Title	Credit Hours
BMIG 5010	Project Rotation in Biomedical Informatics	2
PCOL 5211	Scientific Communication and Ethics	1
BMIG xxx	Thesis Research	3
	Fundamentals of the Human Microbiome	3
Total Credit Hours		9

Total Credit Hours 36

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Clinical Informatics (CI) Track Objectives:

Develop and maintain understanding of current information related challenges and state of the art solutions in clinical and clinical system environment. Example challenges in clinical and clinical system environment include:

- Using clinical system and external data to support the mission of the clinical enterprise
- Develop communication and leadership skills needed to identify and include appropriate clinical and operational subject matter experts in CI projects
- Using data, workflow, and usability analysis to optimize clinical system build for clinical use
- Automation of analytic and clinical transformation processes
- Collection, processing, analysis, and integration of existing data and new data from multiple sources for use in supporting clinical care decision making, continuous clinical quality improvement, clinical efficiency and access, clinical cost containment, patient satisfaction, management, institutional oversight, assessment of quality-metric based financial risk, regulatory decision-making, and patient health literacy and participation in care
- Data quality assessment, assurance, governance, and control in clinical systems and clinical data repositories
- Curation, discoverability and sharing clinical data and results from clinical transformation and clinical system usability projects
- Developing new methods for analysis of clinical and clinical system data
- Analyze data to identify challenges in clinical practice and clinical systems and identify those amenable to information-based interventions
- Identify, interpret, and apply regulations relevant to clinical data use in the healthcare environment
- Develop and implement solutions based on Biomedical Informatics theories, methods, and evidence to challenges in clinical practice and clinical systems
- Using data, workflow, and usability analysis to evaluate the effectiveness of solutions to challenges in clinical practice and systems
- Educating clinical and operational transformation teams in data collection, handling, governance, and use
- Educating the next generation of CI professionals and researchers



Graduate School

Clinical Informatics (CI) Curriculum

Clinical Informatics (CI) Curriculum

MS 36 hours, PhD \geq 55 hours (inclusive of the MS hours)

Biomedical Informatics Core:(19 hours)

BMIG 5001 Data, Information and Knowledge Representation (3 hours)

BMIG 5002 Biomedicine for Informaticists (3 hours)

BMIG 5003 Computational Methods for Informaticists (3 hours)

BMIG 5101 Foundations of Biomedical Informatics: Sequences & Biologic Information (2 hours)

BMIG 5102 Foundations of Biomedical Informatics: Clinical Information (2 hours)

BMIG 5103 Foundations of Biomedical Informatics: Public Health Information (2 hours)

BMIG 5010 Project Rotation in Biomedical Informatics (2 hours) *

* two rotations required for the core for a total of 4 credit hours

Specialty Track Courses:(MS \geq 10 hrs, PhD \geq 10 hours)

BMIG 5013 Health Information Systems (1 hour)

BMIG 5017 Clinical Data Standards (1 hour)

BMIG 5112 Human/Computer Interaction (3 hours)

BMIG 5115 Healthcare in the US (1 hour)

BMIG 5116 Managing Organizations, People, and Projects (1 hour)

BMIG 5211 Scientific Data Visualization (3 hours)

BMIG 6012 Data Warehousing, Aggregation, and Reporting (1 hour)

BMIG 6013 Health Informatics Quality & Pt Safety (1 hour)

BMIG 6110 Clinical Decision Support (3 hours)

Research Methods and Conduct:(MS 7 hours, PhD \geq 21 hours)

BMIG 5190 Research and Application Seminar (1 hour MS, 3 hours PhD)

BMIG 5800 Thesis (6 hours MS)

BMIG 5801 Capstone Course (3 hours Professional MS only)

BMIG 6050 Research Design (3 hours PhD)

BMIG 6101 Fundamentals of Managing Research Data (3 hours)

BMIG 6800 Dissertation research (\geq 18 hours PhD)

PCOL 5211 – 5241 Scientific Communication and Ethics (MS 1, PhD 4 semesters, 1 credit hour each)

Free Electives:(MS 0 hours, PhD 0-6 hours)

Chosen based on need to support Masters or Doctoral research. This may include course listed below.

BMIG 5014 Anatomy for Imaging (3)

BMIG 5015 Introduction to Biological Network Analysis (1 hour)

BMIG 5113 Clinical Imaging Informatics (3 hours)

BMIG 6011 Clinical Research Informatics (3 hours)

BMIG 6102 Semantic Web (3 hours)

BMIG 6210 Research Imaging Informatics (3 hours)

BMIG 6220 Neuroimaging and Connectomics (3 hours)

BMIG Special Topics (1-3 hours)

Sample Clinical Informatics Track Plan by Semester

Year 1: Fall

Course ID	Title	Credit Hours
BMIG 5001	Data, Information and Knowledge Representation	3
BMIG 5002	Biomedicine for Informaticists	3
BMIG 5017	Clinical Data Standards	1
BMIG 5102	Foundations of Biomedical Informatics: Clinical Information	2
Total Credit Hours		9

Year 1: Spring

Course ID	Title	Credit Hours
BMIG 5003	Computational Methods in Biomedical Informatics	3
BMIG 5103	Foundations of Biomedical Informatics: Public Health Information	2
BMIG 5112	Human/Computer Interaction	3
BIOM 5190	Research and Application Seminar	1
Total Credit Hours		9

Year 1: Summer

Course ID	Title	Credit Hours
BMIG 5103	Health Information Systems	1
BMIG 5115	Healthcare in the US	1
Total Credit Hours		2

Year 2: Fall

Course ID	Title	Credit Hours
BMIG 5010	Project Rotation in Biomedical Informatics	2
BMIG 5101	Foundations of Biomedical Informatics: Sequences & Biologic Information	2
BMIG 5116	Managing Organizations, People, and Projects	1
BINF 6101	Reasoning Medical Data	3
BMIG 6013	Health Informatics Quality & Pt Safety	1
Total Credit Hours		9

Year 2: Spring

Course ID	Title	Credit Hours
BMIG 5010	Project Rotation in Biomedical Informatics	2
PCOL 5211	Scientific Communication and Ethics	1
BMIG 5800	Thesis Research	3
	Open Elective	1
Total Credit Hours		7

Total Credit Hours 36

Imaging Informatics (II) Curriculum

MS 36 hours, PhD \geq 55 hours (inclusive of the MS hours)

Biomedical Informatics Core:(19 hours)

BMIG 5001 Data, Information and Knowledge Representation (3 hours)

BMIG 5002 Biomedicine for Informaticists (3 hours)

BMIG 5003 Computational Methods for Informaticists (3 hours)

BMIG 5101 Foundations of Biomedical Informatics: Sequences & Biologic Information (2 hours)

BMIG 5102 Foundations of Biomedical Informatics: Clinical Information (2 hours)

BMIG 5103 Foundations of Biomedical Informatics: Public Health Information (2 hours)

BMIG 5010 Project Rotation in Biomedical Informatics (2 hours)*

*two rotations required for the core for a total of 4 credit hours

Specialty Track Courses:(MS \geq 10 hrs, PhD \geq 10 hours)

BMIG 5014 Anatomy for Imaging (3)

BMIG 5017 Clinical Data Standards (1 hour)

BMIG 5113 Clinical Imaging Informatics (3 hours)

BMIG 6210 Research Imaging Informatics (3 hours)

Research Methods and Conduct:(MS 4-7 hours, PhD \geq 20 hours)

PCOL 5211 – 5241 Scientific Communication and Ethics (MS 1, PhD 4 semesters, 1 credit hour each)

BMIG 6050 Research Design (2 hours PhD)

BMIG 5800 Thesis (6 hours MS)

BMIG 5801 Capstone Course (3 hours Professional MS only)

BMIG 6800 Dissertation research (\geq 18 hours PhD)

BIOM 5190 Research and Application Seminar (0 - 2 hours PhD)

Free Electives:(MS 0-3 hours, PhD 0-6 hours)

Chosen based on need to support Masters or doctoral research. This may include course listed below.

BMIG 5015 Introduction to Biological Network Analysis (1 hour)

BMIG 5211 Scientific Data Visualization (3 hours)

BMIG 6102 Semantic Web (3 hours)

BMIG 6220 Neuroimaging and Connectomics (3 hours)

Sample Imaging Informatics Track Plan by Semester

Year 1: Fall

Course ID	Title	Credit Hours
BMIG 5001 (F)	Data, Information and Knowledge Representation	3
BMIG 5002 (F)	Biomedicine for Informaticists	3
BMIG 5017 (F)	Clinical Data Standards	1
BMIG 5102 (F)	Foundations of Biomedical Informatics: Clinical Information	2
Total Credit Hours		9

Year 1: Spring

Course ID	Title	Credit Hours
BMIG 5113 (S)	Clinical Imaging Informatics	3
BMIG 5003 (S)	Computational Methods for Informaticists	3
BMIG 5014 (S)	Anatomy for Imaging	3
Total Credit Hours		9

Year 1: Summer

Course ID	Title	Credit Hours
BMIG 5010 (A)	Project Rotation in Biomedical Informatics	2
Total Credit Hours		2

Year 2: Fall

Course ID	Title	Credit Hours
BMIG 5010 (A)	Project Rotation in Biomedical Informatics	2
BMIG 5101 (F)	Foundations of Biomedical Informatics: Sequences & Biologic Information	2
PCOL 5211 (A)	Scientific Communication and Ethics	1
BMIG 6210 (F)	Research Imaging Informatics	3
Total Credit Hours		8

Year 2: Spring

Course ID	Title	Credit Hours
BMIG 5800 (A)	Thesis Research	6
BMIG 5103 (S)	Foundations of Biomedical Informatics: Public Health Information	2
Total Credit Hours		8

Total Credit Hours 36