

# ORTHOTICS AND PROSTHETICS – M.S.O.P.

Loma Linda offers two educational pathways for completion of a Master of Science in Orthotics and Prosthetics (M.S.O.P.) degree:

**Program director, B.S./M.S.O.P. track**  
Michael Moor

**Program director, M.S.O.P. hybrid track**  
Aileen Kingsley

The B.S./M.S.O.P is a mixed, undergraduate and graduate track, accepting students both with and without a bachelor's degree. This is an on campus, 2½-year (10 quarters) program. Six of the ten quarters are undergraduate level and four quarters are graduate level. This is one of the most robust orthotics and prosthetics curricula in the country with 156 academic units. Undergraduate students will simultaneously earn a B.S. in health sciences, and an M.S.O.P. in Orthotics and prosthetics. Bachelor-prepared students will graduate with an M.S.O.P. degree.

The M.S.O.P/hybrid is a 2-year, blended-learning track. The first year is fully online and the second year in-person on the Mentone campus. This track uses a spiral learning format: the first year in theory; and the second year in-person and in-practice, concentrating on clinical, technical, and patient management skills. Quarters seven and eight include two summative courses in which students demonstrate and test their learning—both in practice and in theory. Students who complete this track will graduate with an M.S.O.P. degree.

The curriculum for both M.S.O.P. tracks is designed according to NCOPE's published 2017 standards of the profession, providing the student with the knowledge, behaviors, and skills required to qualify for acceptance into orthotics and prosthetic residencies, as well as for entry into the clinical practice of orthotics and prosthetics.

## Professional association

Students and graduates are eligible for membership in the American Academy of Orthotics and Prosthetics (AAOP). The objective of the association is to foster development and improvement of service and education. This organization grants membership at a nominal cost to students of approved schools. The student is required to become a member of this association while in the program, and is encouraged to read the *Journal of Orthotics and Prosthetics* as well as attend AAOP-sponsored or AAOP-approved local or national meetings.

## Professional practice requirements

Satisfactory completion of the M.S.O.P. degree curriculum requirements qualifies the student to enter an NCOPE-accredited residency site of their choice. After completing a 12-month prosthetic and a 12-month orthotic residency—or an 18-month combined ortho-prosthetic residency, the resident is eligible to sit for the certification examination offered by the American Board of Certification (ABC) in orthotics and prosthetics. Passing the ABC examination will earn certification in orthotics, certification in prosthetics, or dual certification as a prosthetist-orthotist. In addition to certification, and depending on the state where the certified practitioner intends to practice, it may be necessary for the student to pass a state licensure examination in order to practice their profession.

## Clinical experience

Supervised clinical experience is obtained in a variety of settings during the program through clinical rotations and weekly grand rounds. These ongoing, weekly clinical rotations are an essential part of a student's academic and professional requirements, and prepare them for the final quarter clinical affiliations required for the completion of the M.S.O.P. degree curriculum.

All clinical assignments will be made by the academic coordinator for clinical education. Because of the limited number of local facilities available, assignments cannot be made on the basis of the student's family/marital status or personal preferences. Although the department makes an effort to accommodate the student's preference, the student agrees to accept clinical assignments made by the department at any of the affiliated facilities.

## Program learning outcomes

By the end of this program, the graduate should be able to:

1. Exercise keen insight, progressive care, and critical judgment through careful evaluation in clinical care, skills application, and thinking throughout the profession;
2. Adhere to guiding principles and recognized ethics of the profession;
3. Value and apply new technology, investigation, and knowledge to patient care and the profession through a commitment to discovery and education;
4. Examine the importance of embracing and serving the unmet and ever-changing needs of a diverse world;
5. Participate in teamwork within and across disciplines in all aspects of the profession.

## Accreditation

Accreditation for the entry-level Master of Science in Orthotics and Prosthetics degree was granted on September 23, 2013, by the National Commission on Orthotic and Prosthetic Education (NCOPE), 330 John Carlyle Street, Suite 200, Alexandria, VA 22314; telephone: 703/836-7114; website: <<http://www.ncope.org/>> in collaboration with the Commission on Accreditation of Allied Health Education Programs (CAAHEP), 25400 U.S. Highway 19 North, Suite 158, Clearwater, FL 33763; telephone: 727/210-2350; website: <<https://www.caahep.org/>>.

## Admissions

Admission is based on a selective process. In addition to Loma Linda University (<http://llucatalog.llu.edu/about-university/admission-policies-information/#admissionrequirements>) and School of Allied Health Professions admissions requirements (<http://llucatalog.llu.edu/allied-health-professions/#generalregulationstext>), the applicant to the B.S./M.S.O.P track must also complete the following requirements:

- A minimum of 64 semester or 96 quarter credit units at a regionally accredited college or university.
- A minimum G.P.A. of 3.0 in both science and non-science courses.
- A minimum 80 hours of observational field experience at a minimum of two orthotics and prosthetics facilities of their choice. A letter of attestation from the facility owner or clinical supervisor is needed from each facility prior to the start of the program.

Applicants to the M.S.O.P/hybrid track must complete the following requirements:

- A bachelor's degree from an accredited college or university, or the equivalent of a four (4) year U.S. bachelor's degree from a non-U.S. degree-granting institution that is recognized by the appropriate government agency.
- A minimum G.P.A. of 3.0 in both science and non-science courses.
- A minimum 80 hours of observational field experience at a minimum of two orthotics and prosthetics facilities of their choice. A letter of attestation from the facility owner or clinical supervisor is needed from each facility prior to the start of the program.

The following prerequisites and general education courses will provide the knowledge, behavior, and skills required of students in a professional curriculum in the orthotics and prosthetics program. Individuals who already have an earned bachelor's degree in any field from a regionally accredited institution need to complete only the prerequisites denoted with an asterisk (\*).

The minimum subject admission requirements are listed below.

Note: Grades of C- and below are not transferable for credit.

### **Domain 1: Religion and humanities (20 quarter/14 semester units, minimum)**

#### **Humanities (14 quarter/10 semester units minimum)**

Humanities to include one course in each of the following areas: history, philosophy, and a third area selected from the following.

Fine arts  
Literature  
Modern language  
Performing/visual arts (not to exceed four quarter units)

#### **Religion**

Religion is required only if a student attended a Seventh-day Adventist college or university for a portion of their prerequisites—four quarter units of religion per year. A maximum of eight quarter units may apply toward Domain I.

### **Domain 2: Scientific inquiry and analysis**

Encompasses both the natural and social sciences.

#### **Natural sciences—All courses are required, credits may vary**

\*Human anatomy with laboratory or biology with laboratory

\*Physiology

\*Chemistry with laboratory

\*Physics with laboratory

\*Statistics

#### **Social sciences—Required (12 quarter/8 semester units, minimum)**

General psychology

\*Growth and developmental or abnormal psychology

### **Domain 3: Communication (9 quarter/6 semester units, minimum)**

#### **English**

Complete sequence in English composition that meets the baccalaureate degree requirements

One course in basic communication skills (speech)

### **Domain 4: Health and wellness (3 quarter/2 semester units, minimum)**

Two activity courses in physical education

### **Domain 5: Electives**

Courses in Domain 5: Electives can be used to meet the minimum number of units (96 quarter/64 semester units) required for admission.

For total unit requirements for graduation, see LLU General Education Requirements (<http://llucatalog.llu.edu/about-university/division-general-studies/#courserequirementstext>).

## **Program requirements**

### **B.S./M.S.O.P. track**

#### **Junior Year**

##### **Autumn Quarter**

AHCJ 362	Anatomy	3
AHCJ 375	Physiology	3
ORPR 301	Orthotics and Prosthetics Laboratory and Technical Skills	3
ORPR 305	Orthotic Fitting Techniques	3
ORPR 310	Patient Management, Assessment, and Documentation	3
ORPR 410	Orthotic and Prosthetic Clinical Rotation	1
RELR 427	Crisis Counseling	2

##### **Winter Quarter**

AHRM 471	Statistics and Research for Health Professionals I	3
ORPR 315	Pedorthics	3
ORPR 325	Medical Terminology	3
ORPR 402	Pathology I	3
ORPR 405	Gait Analysis	3
ORPR 410	Orthotic and Prosthetic Clinical Rotation	1
RELE 457	Christian Ethics and Health Care	2

##### **Spring Quarter**

AHRM 472	Statistics and Research for Health Professionals II	3
ORPR 320	Biomechanical Evaluation	3
ORPR 330	Lower Extremity Orthotics I	3
ORPR 340	Lower Extremity Prosthetics I	3
ORPR 410	Orthotic and Prosthetic Clinical Rotation	1
ORPR 414	Kinesiology I	3
RELT 423	Loma Linda Perspectives	2

#### **Senior Year**

##### **Summer Quarter**

AHCJ 422	History of Disability	3
DTCS 301	Human Nutrition	3
ORPR 404	Materials Science in Orthotics and Prosthetics	3
ORPR 410	Orthotic and Prosthetic Clinical Rotation	1
ORPR 415	Lower Extremity Orthotics II	3
ORPR 425	CAD/CAM Technologies	3

##### **Autumn Quarter**

AHCJ 320	ADL and Assistive Devices	3
ORPR 323	Economics, Business Management, and Entrepreneurship	3
ORPR 345	Spinal Orthotics	3

ORPR 410	Orthotic and Prosthetic Clinical Rotation	1	ORPR 516	Orthotics and Prosthetics Materials Science and Technical Skills	2
ORPR 420	Lower Extremity Prosthetics II	3	ORPR 517	Patient Assessment/Kinesiology	2
ORPR 439	Computers and Electronics for O&P Clinicians	3	ORPR 558	Clinical Rotation	1
ORPR 491	Research I	1.5			
<b>Winter Quarter</b>			<b>Autumn Quarter</b>		
AHCJ 315	Psychosocial Aspects of Health Care	3	ORPR 509	Pathology for O and P Professionals	2
ORPR 410	Orthotic and Prosthetic Clinical Rotation	1	ORPR 511	Spinal Orthotics	2
ORPR 430	Upper Extremity Orthotics	3	ORPR 519	Biomechanical Evaluation and Gait Analysis	2
ORPR 435	Upper Extremity Prosthetics	3	ORPR 531	Upper-Extremity Orthotics	2
ORPR 440	Bionics and Cyborg Technology	3	ORPR 535	Upper-Extremity Prosthetics	2
RELE 455	Christian Understanding of Sexuality	2	ORPR 558	Clinical Rotation	1
<b>Total Units:</b>			<b>Winter Quarter</b>		
		<b>102.5</b>	ORPR 524	Psychosocial Aspects of Health Care	2
<b>Graduate Year</b>			ORPR 541	Lower-Extremity Orthotics I	2
<b>Spring Quarter</b>			ORPR 545	Lower-Extremity Prosthetics I	2
AHCJ 516	Clinical Imaging	3	ORPR 558	Clinical Rotation	1
ORPR 510	Advanced Clinical Rotations	1	ORPR 561	Statistics and Research for OP Professionals I	2
ORPR 522	Self-Care Portfolio and Community Outreach	0	<b>Spring Quarter</b>		
ORPR 526	Prosthetics III	3	ORPR 529	Practice Management	2
ORPR 544	Applied Functional Neuroanatomy	3	ORPR 548	Pharmacology in Rehabilitation	2
ORPR 575	Couples, Families, and Disabilities	3	ORPR 551	Lower-Extremity Orthotics II	2
ORPR 592	Research II	1.5	ORPR 555	Lower-Extremity Prosthetics II	2
<b>Summer Quarter</b>			ORPR 558	Clinical Rotation	1
AHCJ 507	Pharmacology in Rehabilitation	3	ORPR 562	Statistics and Research for OP Professionals II	2
ORPR 510	Advanced Clinical Rotations	1	<b>Second Year</b>		
ORPR 528	Prosthetics IV	3	<b>Summer Quarter</b>		
ORPR 522	Self-Care Portfolio and Community Outreach	0	ORPR 512	Spinal Clinical Training	2
ORPR 538	Biomechanics	3	ORPR 513	Spinal Technical Skills	2
ORPR 593	Research III	3	ORPR 530	Patient Management and Documentation	2
RELE 524	Bioethics and Society	3	ORPR 532	Upper-Extremity Orthotics Clinical Training	2
<b>Autumn Quarter</b>			ORPR 533	Upper-Extremity Orthotics Technical Skills	2
AHCJ 545	Legal and Ethical Issues in the Health Professions	3	ORPR 536	Upper-Extremity Prosthetics Clinical Training	2
ORPR 510	Advanced Clinical Rotations	1	ORPR 537	Upper-Extremity Prosthetics Technical skills	2
ORPR 522	Self-Care Portfolio and Community Outreach	2	ORPR 559	Advanced Clinical Rotation	1
ORPR 527	Orthotics III	3	<b>Autumn Quarter</b>		
ORPR 540 <sup>1</sup>	Rehabilitative Care in Developing Nations	3	ORPR 530	Patient Management and Documentation	2
ORPR 506	Advanced Specialty Tracks in Orthotics and Prosthetics	3	ORPR 540 <sup>1</sup>	Rehabilitative Care in Developing Nations	3
<b>Winter Quarter</b>			ORPR 542	Lower-Extremity Orthotics I Clinical Training	2
ORPR 514	Clinical Affiliation	8	ORPR 543	Lower-Extremity Orthotics I Technical Skills	2
<b>Total Units:</b>			ORPR 546	Lower-Extremity Prosthetics I Clinical Training	2
		<b>53.5</b>	ORPR 547	Lower-Extremity Prosthetics I Technical Skills	2
			ORPR 559	Advanced Clinical Rotation	1
			ORPR 564	Research Proposal	2
			<b>Winter Quarter</b>		
			ORPR 530	Patient Management and Documentation	2
			ORPR 552	Lower-Extremity Orthotics II Clinical Training	2
			ORPR 553	Lower-Extremity Orthotics II Technical Skills	2
			ORPR 556	Lower-Extremity Prosthetics II Clinical Training	2
			ORPR 557	Lower-Extremity Prosthetics II Technical skills	2
			ORPR 559	Advanced Clinical Rotation	1
			ORPR 565	OP Clinical and Technical Summative Review and ABC Board Prep	2

<sup>1</sup> Fulfills service learning requirement

### Normal time to complete the program

Two (2) years (six [6] academic quarters) at LLU at the undergraduate level and one (1) year (four [4] academic quarters) at the graduate level; full-time enrollment required

### M.S.O.P./hybrid track

#### First Year

##### Summer Quarter

	Units	
ORPR 507	Anatomy for O and P Professionals	2
ORPR 508	Physiology for O and P Professionals	2

ORPR 575	Couples, Families, and Disabilities	3
REL R 527	Crisis Care and Counseling	3
<b>Spring Quarter</b>		
ORPR 560	Clinical Affiliation	8
ORPR 566	OP Theoretical Summative Review and ABC Board Prep	2
<b>Total Units:</b>		<b>100</b>

<sup>1</sup> Fulfills service learning requirement

### Normal time to complete the program

Two (2) years (8 academic quarters); full-time enrollment required

### Courses

#### ORPR 301. Orthotics and Prosthetics Laboratory and Technical Skills. 3 Units.

Introduces the baseline of material and safety practice of orthotics and prosthetics design, fabrication, and repairs. Provides a solid foundational knowledge of the principles and applications of orthotics and prosthetics materials, technologies, designs, and processes associated with the manufacture of custom devices.

#### ORPR 305. Orthotic Fitting Techniques. 3 Units.

Teaches methods of biometrics, shape capture, and fitting criteria for orthotic devices. Expands knowledge and techniques of applied anatomy in the fitting of orthotic and assistive devices in activities of daily living and patient's occupational needs.

#### ORPR 310. Patient Management, Assessment, and Documentation. 3 Units.

Orthotic and prosthetic patient-care models, patient rights, and ethical practice of care. Advanced principles and processes of patient assessment, management, and complete documentation within the context of interprofessional referrals, interactions, and reimbursement as applied both to the in- and outpatient context.

#### ORPR 315. Pedorthics. 3 Units.

Clinical application of biomechanical interventions of the ankle-foot structure as it refers to walking, medical issues of the foot, and activity levels. Applied anatomical knowledge of the foot and sports medicine within the context of shoes and shoe modifications.

#### ORPR 320. Biomechanical Evaluation. 3 Units.

Establishes orthotic and prosthetic biomechanical principles and interventions in the context of normal body mechanics and musculoskeletal pathologies. Examines how these interventions serve to maximize healing, manage pain, support movement and function. Encompasses whole body considerations for the kinetic effects, including gait, ADL, occupational and recreational functions.

#### ORPR 323. Economics, Business Management, and Entrepreneurship. 3 Units.

Establishes principles of economics, financial management, and law as they apply to health-care settings, including: starting a new service, reimbursement, capital and operational budgeting, reading financial statements, and cost-saving measures.

#### ORPR 325. Medical Terminology. 3 Units.

Language of medicine, including: word construction, word analysis, definitions, and the use of terms related to medical science—specifically to orthotics and prosthetics. Course information organized by body systems. Applies knowledge to documentation, interdisciplinary communication, and medical justification as it applies to orthotic and prosthetic care.

#### ORPR 330. Lower Extremity Orthotics I. 3 Units.

Studies foot and ankle-foot orthoses—including myoelectric orthoses—from an anatomical design and fabrication perspective. Effects of their application to the body kinematics and kinetic chain. Considerations for specific pathological applications, as well as awareness of implied benefits and risks. Outcome measurements for particular static and dynamic designs.

#### ORPR 340. Lower Extremity Prosthetics I. 3 Units.

Studies the etiology of amputations below the knee. Considers surgical and immediate postoperative issues as they relate to patient experience, prosthetic outcome, and gait. Looks at prosthetic component selection; socket, interface, and suspension designs in the context of ambulation levels and activities; and specialty applications. Examines skin and tissue physiology, both from a design and end-user perspective. Considers cost and efficiency based on component selection.

#### ORPR 345. Spinal Orthotics. 3 Units.

Examines spinal anatomy, biomechanics, and pathology. Fabrication, fitting, and application of orthotics following critical and differential diagnoses. Application and proper fitting of halos and cervical, thoracolumbar, and lumbar devices. Special consideration of design, plaster casting techniques, and CAD measurements for management of scoliosis. Interpret standard radiographs, measure and interpret spinal deformities, and recommend appropriate orthotic management.

#### ORPR 402. Pathology I. 3 Units.

Fundamental mechanisms of disease, including cell injury; inflammation, repair, regeneration, and fibrosis; and vascular, cardiac, respiratory, gastrointestinal, hepatobiliary, urinary, reproductive, endocrine, and integumentary pathologies.

#### ORPR 404. Materials Science in Orthotics and Prosthetics. 3 Units.

Introduces the science of materials found in the body and those used to support the body. Includes the composition of common orthopedic and prosthetics materials. Overview of mathematics, physics, simple and complex movement, anatomy, physiology, and thermodynamics which create a rationale behind material and fabrication choices. Addresses chemical composition, stress-strain curves, fatigability, and other essential characteristics considered in orthotic and prosthetic design.

#### ORPR 405. Gait Analysis. 3 Units.

Observation and analysis of normal human locomotion contrasted with pathological gait, and their implications for orthotic and prosthetic interventions and care.

#### ORPR 410. Orthotic and Prosthetic Clinical Rotation. 1 Unit.

Assigns student to a weekly clinic, department, or specialty—with a focus on familiarization with specific orthotic and prosthetic services. Student reports to their cohorts in a once-a-month didactic presentation at the weekly grand rounds, which can include lectures from industry providers on the topic of choice. Site allocation determined by program director; student accountable to quarterly assigned clinical supervisor.

#### ORPR 414. Kinesiology I. 3 Units.

Introduces advanced kinesiology topics, including movement science dealing with the behavioral basis of motor control and motor learning from an information-processing perspective. Kinesiology from an O&P perspective focusing primarily on the lower limbs, with some introduction to upper limb involvement.

**ORPR 415. Lower Extremity Orthotics II. 3 Units.**

Advanced study of knee-ankle-foot orthoses, knee orthoses, hip orthoses, reciprocating gait orthoses, and standing frames from an anatomical design and fabrication perspective. Effects of their application to the body kinetic chain. Considers specific pathological applications, including implied benefits and risks. Outcome measurements for particular static and dynamic designs. Introduces CAD/CAM technologies both for image capture and fabrication.

**ORPR 420. Lower Extremity Prosthetics II. 3 Units.**

Etiology of transfemoral amputations. Surgical and immediate postoperative issues related to patient experience, prosthetic outcome, and potential for gait. Prosthetic component selection, socket interface, and suspension designs addressing ambulation levels and activities. Specialty applications. Mechanical, hydraulic, and electronic knee-motion control. Cost and efficiency calculations. CAD/CAM shape capture and fabrication considerations such as mechanical and electronic alignment capture.

**ORPR 425. CAD/CAM Technologies. 3 Units.**

Applications of CAD/CAM technologies used in clinical practice. Use of most common shape/image capture systems, manipulations, and interfaces with the various central fabrication methods. Includes use of CADs/CAMs in orthotics and prosthetics, including foot orthoses, spinal orthoses, cranial helmets and prosthetic limbs. Data storage and manipulation for use in the fabrication process with technical assistance.

**ORPR 430. Upper Extremity Orthotics. 3 Units.**

Applies anatomy, kinesiology, and biomechanics to serve specific upper extremity neuromuscular needs. Determines the use of functional and electrically powered orthoses based on differential diagnoses. Examines myoelectric assisted translateral motion rehabilitation. Teaches function, purpose, and building of wrist- and cable-driven orthoses.

**ORPR 435. Upper Extremity Prosthetics. 3 Units.**

Studies the etiology of upper limb and forequarter amputations. Considers shape capture, socket design, interface, and suspension in the context of cosmetic, body-powered, and myoelectric functional prostheses. Includes special needs adaptations for occupational and sports situations. Give attention to the distinctions of functionality, efficacy, and cost. Studies the bionic arm and hand and the computer training that goes with this particular technology.

**ORPR 439. Computers and Electronics for O&P Clinicians. 3 Units.**

Basic theory of electricity, transistors, computer circuits, and computer programming. Discusses electrons, structure of the atom, resistance, capacitance, Ohm's law, and basic transistor theory. Windows programming. Includes laboratories and three programming assignments.

**ORPR 440. Bionics and Cyborg Technology. 3 Units.**

Examines emerging bionic technologies aimed at merging man with machine. Includes competencies and promotion of these devices in the context of scientific research and potential patient applications. Examines bionic control systems' embedded software development and associated function. Topics include proficiency in the implementation of cybernetic feedback systems in ortho-prosthetic devices.

**ORPR 491. Research I. 1.5 Unit.**

Introduces the scientific method in health science research. Focuses on problem identification, literature review, conceptual framework, identification of variables, statement of hypothesis, experimental design, and analysis and presentation of data. Includes critical evaluation of research literature. Applies the research process to problems in allied health fields, development of a research proposal, pilot testing, testing and data forms, and research implementation in a practice setting. Prerequisite: AHRM 471, AHRM 472.

**ORPR 505. Current Issues in Orthotics and Prosthetics. 3 Units.**

Reviews and discusses concerns and current advances relating to orthotics and prosthetics, e.g., legislation, regulations, education, professional organization, interdisciplinary patient care, and reimbursement issues.

**ORPR 506. Advanced Specialty Tracks in Orthotics and Prosthetics. 3 Units.**

Presents the newest clinical treatment applications over the spectrum of the patient population in the field of orthotics and prosthetics.

**ORPR 507. Anatomy for O and P Professionals. 2 Units.**

Explores anatomy related to skeletal, circulatory, nerve, and muscular systems of the human organism. Addresses anatomical concepts and terminology with relevant joint mechanics, motions, and palpations. Discusses medical effects of procedures and pathologies on body systems. Introduces anatomical considerations for the formulation and implementation of orthotic and prosthetic intervention. Corequisite: ORPR 508.

**ORPR 508. Physiology for O and P Professionals. 2 Units.**

Covers basic chemistry and cell structure, tissue types, and body systems, including skin, muscle, skeleton, nervous, cardiac, respiratory, digestive, and urinary systems, as well as the integration of these systems. Discusses relationships between body systems, and orthotic and prosthetic intervention. Introduces physiological considerations for the formulation and implementation of orthotic and prosthetic intervention. Corequisite: ORPR 507.

**ORPR 509. Pathology for O and P Professionals. 2 Units.**

Presents fundamental mechanisms of disease, including cell injury (inflammation, repair, regeneration, and fibrosis), and vascular, cardiac, respiratory, gastrointestinal, hepatobiliary, urinary, reproductive, endocrine, and integumentary pathologies. Emphasizes orthopedic, neurological, neuromuscular, vascular, and psychological disorders and diseases commonly encountered in orthotic and prosthetic practice. Prerequisite: ORPR 507, ORPR 508.

**ORPR 510. Advanced Clinical Rotations. 1 Unit.**

Clinical experience focusing on familiarization with specific orthotic and prosthetic services. Supervised experience providing comprehensive orthotic and prosthetic clinical care. Opportunities to report in clinical, professional, and private sector settings.

**ORPR 511. Spinal Orthotics. 2 Units.**

Examines spinal anatomy, biomechanics, pathology, clinical assessment, measurement, shape capture, fabrication, and fitting techniques for spinal orthotic intervention. Interprets radiographs for spinal deformities. Considers design, management, and treatment with scoliosis devices. Includes cranial remolding orthosis, facial fracture, and burn orthosis. Covers prefabricated, custom-fit, and custom-fabricated orthotic designs. Introduces CAD/CAM technologies for image capture and fabrication. Prerequisite: ORPR 507.

**ORPR 512. Spinal Clinical Training. 2 Units.**

Applies concepts addressed in ORPR 511 in a clinical setting to perform spinal orthotic management. Analyzes impairments, functional limitations, and patient goals to determine biomechanical objectives. Demonstrates formulation and implementation of spinal orthotic care. Practices patient assessment, shape capture, fitting procedures, and patient management related to spinal orthotic devices. Includes prefabricated, custom-fit, and custom-fabricated orthotic designs. Corequisite: ORPR 513. Prerequisite or concurrent: ORPR 511.

**ORPR 513. Spinal Technical Skills. 2 Units.**

Applies material and mechanical principles to designing and fabricating patient-specific devices. Addresses safety, alignment, and durability needs of spinal user. Utilizes multiple lab and technical skills (plaster modifications, vacuum forming, plastic smoothing, riveting, and metal bending). Expands knowledge of applied anatomy in fitting of spinal orthotics. Assesses device fit/function as well as effects on patient daily living activities. Implements CAD/CAM shape capture methods. Corequisite: ORPR 512. Prerequisite or concurrent: ORPR 511.

**ORPR 514. Clinical Affiliation. 8 Units.**

Establishes a clinical affiliation with a facility that complies with NCOPE residency standards and that has been approved by the Professional Development Committee and the MSOP locally assigned site supervisor. Student completes the 500 clinical contact hours required for graduation.

**ORPR 515. Topics in Orthotics and Prosthetics. 1-6 Units.**

Lecture and discussion related to the practice of orthotics and prosthetics. Content varies from quarter to quarter. (May be repeated for additional credit for a maximum 6 quarter units.).

**ORPR 516. Orthotics and Prosthetics Materials Science and Technical Skills. 2 Units.**

Provides foundational knowledge in mathematics, physics, simple and complex movement, anatomy, physiology, and thermodynamics to create rationale behind material and fabrication choices associated with manufacture of custom orthotic and prosthetic devices. Examines the science of materials and safety practices of orthotics and prosthetics design, fabrication, and repairs.

**ORPR 517. Patient Assessment/Kinesiology. 2 Units.**

Expands on knowledge and techniques of applied anatomy, physiology, and kinesiology to assess a patient's need of orthotic and prosthetic devices. Identifies and practices essential elements of the patient evaluation process. Demonstrates procedures for collection of patient history, performance of physical examination, and administration of outcome measures. Introduces scope of practice and documentation methods for orthotics and prosthetics professionals. Corequisite: ORPR 507.

**ORPR 519. Biomechanical Evaluation and Gait Analysis. 2 Units.**

Covers basic biomechanical principles in the context of normal body mechanics. Establishes baseline knowledge for effective evaluation planning for orthotic and prosthetic care. Examines how interventions maximize healing, manage pain, and support movement and function to the whole body, while considering kinetic effects to gait. Contrasts advanced gait analysis of normal human locomotion with pathological gait to determine proper intervention.

**ORPR 522. Self-Care Portfolio and Community Outreach. 2 Units.**

Inventory of self-care and process to accomplish it. Puts self-care in the context of life-long learning, relational responsibility, and social justice. Applies principles of effective community leadership engagement, locally and globally.

**ORPR 524. Psychosocial Aspects of Health Care. 2 Units.**

Addresses psychosocial topics which optimize therapeutic outcomes. Focuses on clinical competence and professional excellence involving health-care providers affected by pathology, impairment, functional limitation, and/or disability. Recommends roles and intervention strategies for health-care providers, including those practicing orthotics and prosthetics.

**ORPR 526. Prosthetics III. 3 Units.**

Focuses on upper and lower limb amputations and prosthetics. Etiology of hip and transcorporectomy amputations, surgical and immediate postoperative issues related to patient experience, prosthetic outcome, and potential for gait. Includes care of the extreme sports amputee, socket interface, suspension designs, skin and tissue physiology, and mechanical and hydraulic knee-motion control. Introduces CAD/CAM shape capture, and fabrication considering mechanical and electronic alignment capture.

**ORPR 527. Orthotics III. 3 Units.**

Advanced study of myoelectric and electronic control to upper extremity and lower extremity orthoses from a design and fabrication perspective. Effects of their application to the body kinetic chain. Considerations for specific pathological applications; awareness of implied benefits and risks. Studies outcome measurements for particular static, dynamic, and electrodynamic designs, including EFS.

**ORPR 528. Prosthetics IV. 3 Units.**

Reviews case presentations of transtibial and transfemoral amputations. Advanced and alternative socket designs, interface materials, suspension systems, and fabrication techniques; and, shape capture techniques, cast modification, socket fitting techniques, fabrication, static and dynamic alignment, alignment transfer, and observational gait analysis. Prerequisite: ORPR 340, ORPR 420, ORPR 526.

**ORPR 529. Practice Management. 2 Units.**

Studies business practices within the orthotic and prosthetic clinical environment relating to patient care, personnel, financial management, and law as they apply to health-care settings. Explores expectations of orthotists-prosthetists as professionals and their role within society—including scopes of practice and the Code of Professional Responsibility.

**ORPR 530. Patient Management and Documentation. 2 Units.**

Practices communication of treatment plan through ethical documentation, coding, prescription recommendations, compliance with regulatory accrediting agencies, and legal considerations surrounding patient care. Explores billing and coding procedures for federal, state, and third-party regulations associated with orthotic/prosthetic care. Studies professional issues such as scopes of practice, Code of Professional Responsibility, and the role of the orthotist-prosthetist on the health-care team.

**ORPR 531. Upper-Extremity Orthotics. 2 Units.**

Examines upper limb anatomy, biomechanics, pathology, clinical assessment, measurement, shape capture, fabrication, and fitting techniques for orthotic intervention. Considers function and purpose of static and dynamic thermoplastic and conventional upper-extremity orthotic interventions. Includes prefabricated, custom-fit, and custom-fabricated orthotic designs. Prerequisite: ORPR 507.

**ORPR 532. Upper-Extremity Orthotics Clinical Training. 2 Units.**

Applies concepts addressed in ORPR 531 in a clinical setting to perform upper-extremity orthotic management. Analyzes impairments, functional limitations, and patient goals to determine biomechanical objectives. Demonstrates formulation and implementation of upper-extremity orthotic care. Practices patient assessment, shape capture, fitting procedures, and patient management related to upper-extremity orthotic devices. Includes prefabricated, custom-fit, and custom-fabricated orthotic designs. Prerequisite: ORPR 531. Corequisite: ORPR 533.

**ORPR 533. Upper-Extremity Orthotics Technical Skills. 2 Units.**

Applies material and mechanical principles to designing and fabricating patient-specific devices. Addresses safety, alignment, and durability needs of the upper-extremity orthotic user. Utilizes multiple lab and technical skills such as plaster modifications, vacuum forming, plastic smoothing, riveting, and metal bending. Expands knowledge of applied anatomy in the fitting of upper-extremity orthotics. Assesses device fit/function and effects on the patient's activities of daily living. Prerequisite: ORPR 531. Corequisite: ORPR 532.

**ORPR 535. Upper-Extremity Prosthetics. 2 Units.**

Studies etiology, anatomy, biomechanics, clinical assessment, measurement, shape capture, fabrication, fitting techniques, and component selection for upper-limb and forequarter amputations. Considers socket design, interface, and suspension in the context of cosmetic, body-powered, and myoelectric functional prostheses. Includes special needs adaptations for occupational and sports situations. Gives attention to the distinctions of functionality, efficacy, and cost. Prerequisite: ORPR 507.

**ORPR 536. Upper-Extremity Prosthetics Clinical Training. 2 Units.**

Applies concepts covered in ORPR 535 in a clinical setting to perform upper-extremity prosthetic management. Analyzes impairments, functional limitations, and patient goals to determine biomechanical objectives. Demonstrates formulation and implementation of upper-extremity prosthetic care. Practices patient assessment, shape capture, fitting procedures, and patient management related to upper-extremity prosthetic devices. Compares body-powered and external-powered prosthetic control principles. Prerequisite: ORPR 535. Corequisite: ORPR 537.

**ORPR 537. Upper-Extremity Prosthetics Technical skills. 2 Units.**

Applies material and mechanical principles to design and fabricate patient-specific devices. Addresses safety, alignment, and durability needs of the upper-extremity prosthetic user, utilizing multiple lab and technical skills such as plaster modifications, vacuum forming, plastic smoothing, riveting, and lamination. Expands knowledge of applied anatomy in fitting upper-extremity prosthetics. Assesses device fit/function and the effects on the patient's activities of daily living. Prerequisite: ORPR 535. Corequisite: ORPR 536.

**ORPR 538. Biomechanics. 3 Units.**

Development of competencies in biomechanics. Bionic technology, embedded design programming, and fabrication. Robotic actuation and senses. Advanced material use and fabrication techniques.

**ORPR 540. Rehabilitative Care in Developing Nations. 3 Units.**

Examines the physical rehabilitation state of affairs in developing nations. Outlines specific challenges with rehabilitation delivery from logistics, materials, and cost perspectives. Points out alternative methods to maximize rehabilitation with minimal cost.

**ORPR 541. Lower-Extremity Orthotics I. 2 Units.**

Teaches biomechanical orthotic interventions of the foot and ankle from an anatomical design. Covers criteria for orthotic design, material selection, fitting, and outcome measures for specific pathological applications of orthotic intervention. Gives awareness of implied benefits, risks, and effects of orthotic intervention for the foot and ankle to the kinematics and kinetic chain of the body. Includes prefabricated, custom-fit, and custom-fabricated orthotic designs. Prerequisite: ORPR 507.

**ORPR 542. Lower-Extremity Orthotics I Clinical Training. 2 Units.**

Applies concepts addressed in ORPR 541 in a clinical setting to perform lower-extremity orthotic management. Analyzes impairments, functional limitations, and patient goals to determine biomechanical objectives. Demonstrates formulation and implementation of lower-extremity orthotic care. Practices patient assessment, shape capture, fitting procedures, and patient management related to lower-extremity orthotic devices. Includes prefabricated, custom-fit, and custom-fabricated orthotic designs. Prerequisite: ORPR 541. Corequisite: ORPR 543.

**ORPR 543. Lower-Extremity Orthotics I Technical Skills. 2 Units.**

Applies material and mechanical principles to design and fabricate patient-specific devices. Addresses safety, alignment, and durability needs of the lower-extremity orthotic user, utilizing multiple lab and technical skills such as plaster modifications, vacuum forming, plastic smoothing, riveting, and metal bending. Expands knowledge of applied anatomy in the fitting of lower extremity orthotics. Assesses device fit/function and the effects on the patient's activities of daily living. Prerequisite: ORPR 541. Corequisite: ORPR 542.

**ORPR 544. Applied Functional Neuroanatomy. 3 Units.**

Evidence-based coverage of the applied functional neuroanatomy of several common adult progressive and nonprogressive neurological diseases. Emphasizes motor control, stroke, traumatic brain injury, spinal cord injury, multiple sclerosis, Parkinson's disease, Guillian-Barre syndrome, amyotrophic lateral sclerosis, and vestibular pathology. Includes literature review, lecture, discussion, and laboratory sessions.

**ORPR 545. Lower-Extremity Prosthetics I. 2 Units.**

Studies etiology, anatomy, biomechanics, clinical assessment, measurement, shape capture, fabrication, fitting techniques and component selection for transtibial and partial foot amputations. Explains determination of functional level and justification for prosthetic components. Investigates socket design, interface materials, suspension systems, static and dynamic alignment, and observational gait analysis. Offers distinctions of functionality, efficacy, and cost. Prerequisite: ORPR 507, ORPR 519.

**ORPR 546. Lower-Extremity Prosthetics I Clinical Training. 2 Units.**

Applies concepts addressed in ORPR 545 in a clinical setting to perform lower-extremity prosthetic management. Analyzes impairments, functional limitations, and patient goals to determine biomechanical objectives. Demonstrates formulation and implementation of lower-extremity prosthetic care. Practices patient assessment, shape capture, fitting procedures, and patient management related to lower-extremity prosthetic devices. Prerequisite: ORPR 545. Corequisite: ORPR 547.

**ORPR 547. Lower-Extremity Prosthetics I Technical Skills. 2 Units.**

Applies material and mechanical principles to design and fabricate patient-specific devices. Addresses safety, alignment, and durability needs of the lower-extremity prosthetic user. Utilizes multiple lab and technical skills such as plaster modifications, vacuum forming, plastic smoothing, riveting, and lamination. Expands knowledge of applied anatomy in the fitting of lower extremity prosthetics. Assesses device fit/function and the effects on the patient's activities of daily living. Prerequisite: ORPR 545. Corequisite: ORPR 546.

**ORPR 548. Pharmacology in Rehabilitation. 2 Units.**

Discusses principles of pharmacology related to diagnosis, prevention, and treatment of disease, including a presentation of the pharmacology and therapeutic value of drugs used in rehabilitation medicine. Related topics include pharmacokinetics, pharmacodynamics, adverse effects, drug interactions, and drug toxicity—with special consideration given to pediatric and geriatric pharmacology.

**ORPR 551. Lower-Extremity Orthotics II. 2 Units.**

Teaches biomechanical orthotic interventions of the hip, knee, ankle, and foot from an anatomical design. Covers criteria for orthotic design, material selection, fitting, and outcome measures for specific pathological applications of orthotic intervention. Provides advanced study of knee-ankle-foot orthoses, knee orthoses, hip orthoses, reciprocating gait orthoses, and standing frames. Includes prefabricated, custom-fit, and custom-fabricated orthotic designs. Prerequisite: ORPR 507, ORPR 519.

**ORPR 552. Lower-Extremity Orthotics II Clinical Training. 2 Units.**

Applies concepts addressed in ORPR 551 in a clinical setting to perform lower-extremity orthotic management. Analyzes impairments, functional limitations, and patient goals to determine biomechanical objectives. Demonstrates formulation and implementation of lower-extremity orthotic care. Practices patient assessment, shape capture, fitting procedures, and patient management related to lower-extremity orthotic devices. Includes prefabricated, custom-fit, and custom-fabricated orthotic designs. Prerequisite: ORPR 551. Corequisite: ORPR 553.

**ORPR 553. Lower-Extremity Orthotics II Technical Skills. 2 Units.**

Applies material and mechanical principles to design and fabricate patient-specific devices. Addresses safety, alignment, and durability needs of the lower-extremity orthotic user, utilizing multiple lab and technical skills such as plaster modifications, vacuum forming, plastic smoothing, riveting, and metal bending. Expands knowledge of applied anatomy in the fitting of lower-extremity orthotics. Assesses device fit/function and the effects on the patient's activities of daily living. Prerequisite: ORPR 551. Corequisite: ORPR 552.

**ORPR 555. Lower-Extremity Prosthetics II. 2 Units.**

Studies etiology, anatomy, biomechanics, clinical assessment, measurement, shape capture, fabrication, fitting techniques, and component selection for tranfemoral, hip disarticulation, and hemipelvectomy amputations. Explains determination of functional level and justification for prosthetic components. Investigates socket design, interface materials, suspension systems, static and dynamic alignment, and observational gait analysis. Introduces CAD/CAM technologies. Prerequisite: ORPR 507, ORPR 519.

**ORPR 556. Lower-Extremity Prosthetics II Clinical Training. 2 Units.**

Applies concepts addressed in ORPR 555 in a clinical setting to perform lower-extremity prosthetic management. Analyzes impairments, functional limitations, and patient goals to determine biomechanical objectives. Demonstrates formulation and implementation of lower-extremity prosthetic care. Practices patient assessment, shape capture, fitting procedures, and patient management related to lower-extremity prosthetic devices. Prerequisite: ORPR 555. Corequisite: ORPR 557.

**ORPR 557. Lower-Extremity Prosthetics II Technical skills. 2 Units.**

Applies material and mechanical principles to design and fabricate patient-specific devices. Addresses safety, alignment, and durability needs of the lower-extremity prosthetic user, utilizing multiple lab and technical skills such as plaster modifications, vacuum forming, plastic smoothing, riveting, and lamination. Expands knowledge of applied anatomy in the fitting of lower-extremity prosthetics. Assesses device fit/function and the effects on the patient's activities of daily living. Prerequisite: ORPR 555. Corequisite: ORPR 556.

**ORPR 558. Clinical Rotation. 1 Unit.**

Assigns student to a weekly clinic, department, or specialty with a focus on familiarization with specific orthotic and prosthetic services. Students report to cohorts in a monthly didactic presentation during weekly grand rounds, which can include lectures from industry providers on the topic of choice. Site allocation determined by program director; student accountable to quarterly assigned clinical supervisor.

**ORPR 559. Advanced Clinical Rotation. 1 Unit.**

Provides clinical experiences to familiarize students with specific orthotic and prosthetic services, as well as supervised experience with comprehensive orthotic and prosthetic clinical care. Gives opportunities to observe, participate in, and demonstrate entry-level competencies learned in didactic and clinical curriculum. Requires a monthly didactic student presentation during weekly grand rounds, which can include lectures from industry providers on the topic of choice.

**ORPR 560. Clinical Affiliation. 8 Units.**

Requires clinical experience (500 clinical contact hours) in a recognized NCOPE residency facility. Placement must be approved by the Professional Development Committee and the M.S.O.P. locally assigned site supervisor.

**ORPR 561. Statistics and Research for OP Professionals I. 2 Units.**

Presents statistical methods relative to research design for health professionals, with introduction to SPSS statistical package for computer data analysis. Discusses philosophical approaches to scientific inquiry, range of research designs, roles of variables, and ethics. Introduces students to appropriate descriptive statistics and graphs for the different levels of measurement, probability concepts, and the binomial and normal distributions.

**ORPR 562. Statistics and Research for OP Professionals II. 2 Units.**

Provides advanced conceptual frameworks, data analyses, and techniques in quantitative and qualitative research. Emphasizes process for obtaining and using evidence-based research in OP clinical practice. Prerequisite: ORPR 561.

**ORPR 564. Research Proposal. 2 Units.**

Introduces the scientific method in health science research. Focuses on problem identification, literature review, conceptual framework, identification of variables, statement of hypothesis, experimental design, and analysis and presentation of data. Includes critical evaluation of research literature. Applies the research process to problems in allied health fields, development of a research proposal, pilot testing, testing and data forms, and research implementation in a practice setting. Prerequisite: ORPR 561, ORPR 562.

**ORPR 565. OP Clinical and Technical Summative Review and ABC Board Prep. 2 Units.**

Reviews concepts of upper-extremity, lower-extremity, and spinal orthotics and prosthetics clinical and technical skills in preparation for the ABCOP national written simulation and clinical patient management (CPM) exams.



**ORPR 566. OP Theoretical Summative Review and ABC Board Prep. 2 Units.**

Reviews theoretical concepts of upper-extremity, lower-extremity, and spinal orthotics and prosthetics in preparation for the ABCOP national combined OP written multiple-choice exam.

**ORPR 575. Couples, Families, and Disabilities. 3 Units.**

Examines the effects disabilities have on couples and family systems, and contributions family members make to the rehabilitation process of individuals with disabilities. Looks at discourse patterns taking place within a person with a disability, within the person's family and social support system, and among the individual, family, and medical and rehabilitation providers. Addresses the issues of human sexuality, reproduction, and disability.

**ORPR 592. Research II. 1.5 Unit.**

Guides and equips students as they work toward completion of their capstone research thesis, which is presented at the annual Capstone Research Day. Includes data-collection review and completion, APA-style formatting rules, data analysis with application of appropriate statistics, graphing, write up of discussion and results.

**ORPR 593. Research III. 3 Units.**

Culminates all research-track courses in a project comprising a master's degree thesis, a research paper, a presentation, and a poster. Includes data analysis and statistical interpretation.