

**UCSD  
Undersea and Hyperbaric  
Medicine  
Fellowship Program**

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# **UCSD Undersea and Hyperbaric Medicine Fellowship Program**

## **Program Summary**

The UCSD Undersea and Hyperbaric Medicine Fellowship is designed to provide Board certified/board eligible physicians licensed in the US the opportunity to be educated and trained in the theory and practice of diving and hyperbaric medicine. Individuals successfully completing the one-year ACGME accredited fellowship should obtain sufficient didactic and practical knowledge to work efficiently and competently in a hyperbaric clinical and research environment and to act in a supervisory capacity of a hyperbaric chamber.

The UCSD Fellowship in Undersea and Hyperbaric Medicine is a 12 month fellowship program that incorporates training in all aspects of hyperbaric and diving medicine. Each fellow spends 6 months at UCSD on the hyperbaric medicine service, 1 month at Paradise Valley Hospital at the Hyperbaric Medicine and Wound Care Center, 1 month at the Encinitas Wound Center, 1 months of dedicated research time, 2 months of elective time and 4 weeks of vacation. The program is designed to train 2 fellows annually. There are at least 5 hours per week of planned educational experiences and the fellows participate in formal didactic teaching programs and teach undersea and hyperbaric medicine to medical students, residents, and community organizations. The fellowship program is closely associated with the UCSD Department of Emergency Medicine Residency Program.

The UCSD hyperbaric chamber is a large multiplace chamber at UCSD Medical Center that is capable of treating a full range of conditions amenable to hyperbaric oxygen therapy. Chamber staff is on call 24 hours per day, 7 days per week for the treatment of diving casualties and other emergent hyperbaric cases. UCSD Medical Center has a full service clinical laboratory and radiologic services including digital x-rays, CT scan, MRI, and ultrasound available 24 hours per day. There is a 20-bed SICU, 13-bed CCU, 6-bed MICU, 8-bed burn unit, Neonatal Intensive Care Unit (NICU), and a step down intermediate care unit, in addition to telemetry and floor beds. Full outpatient facilities are available at UCSD including clinics in orthopedic surgery, plastic surgery, vascular surgery, and wound clinic. The UCSD Occupational and Environmental Medicine Center serves as the outpatient clinic for our Diving Medicine Clinic. Our fellows perform fitness to dive evaluations for commercial and scientific divers, as well as sport divers for clearance to dive or diving problems. The San Diego Regional Poison Center is located at UCSD Medical Center and provides 24-hour on-call services for carbon monoxide poisoning. Fellows and attending physicians at UCSD work closely with the Diver Alert Network (DAN) providing telephone consultations and treatment recommendations for injured divers worldwide.

## **ACGME Accreditation**

The UCSD Undersea and Hyperbaric Medicine fellowship is accredited by

ACGME for 2 one-year fellowship positions annually as of July 2006.

### **Program Curriculum Goals**

At the completion of the fellowship, the hyperbaric fellow will:

1. Develop the knowledge base and clinical skills necessary to:
  - a. Evaluate and prescribe appropriate HBO therapy for all the medical conditions currently accepted by the UHMS as amenable to hyperbaric oxygenation.
  - b. Manage patients during hyperbaric treatments
  - c. Evaluate and treat diving related illnesses
2. Discuss investigational indications for the use of HBO and areas of future research.
3. Possess the administrative skills needed to provide medical direction for a HBO chamber.
4. Develop requisite academic skills to be an effective researcher and teacher in diving and hyperbaric oxygen therapy.

### **Fellowship Experiences**

The HBO fellowship will provide the following experiences to achieve curriculum goals:

1. HBO clinical service
  - a. HBO clinic once per week
  - b. Supervision of daily chamber operation and treatments
  - c. HBO emergency call
  - d. HBO consultation service
  - e. Participation in diving medicine clinic once per week
2. Didactic curriculum and HBO core lecture series.
3. Development of HBO lectures for core curriculum, community hospitals
4. Monthly HBO journal club
5. Monthly HBO case conference
6. Required HBO research project to be completed within the one year term
7. Participation in UHMS
8. Submission of research for presentation at the annual UHMS meeting
9. Participation in the San Diego County Coroners committee for the investigation of diving fatalities.
10. Participation in the Scripps Institute of Oceanography Diving Program.
11. Participation in the San Diego Regional Poison Center
12. Rotation at Pomerado Hyperbaric Center for monoplace experience
13. Rotation at Paradise Valley Hospital Wound Center
14. Rotation at UCSD Encinitas Wound Center
15. Opportunities for clinical elective experience with the US Navy, NOAA Aquarius Habitat, UCSD Center for Diving Excellence, etc.

### **Instructional Objectives for Fellowship Training**

1. List the approved indications for hyperbaric oxygen therapy
2. Cite the contraindications and side effects of HBO

3. Describe the physiologic effects of HBO by preparing a one hour lecture for students/residents
4. Provide a brief description of the history of hyperbaric medicine
5. Evaluate patients and decide whether HBO therapy is appropriate
6. Prescribe the correct HBO treatment protocol for a given indication
7. Perform noninvasive measurements of tissue oxygenation and use the results to predict which patients might respond to HBO
8. Obtain informed consent following discussion with patients regarding risks and benefits associated with HBO therapy.
9. Demonstrate operation of all equipment commonly used in the multiplace HBO chamber
10. Discuss monoplace operation and emergency procedures
11. Describe the care of critically ill and injured patients in the chamber, and perform appropriate management including patient monitoring, use of medications under pressure, airway, ventilatory, and cardiovascular support
12. Discuss factors that will enhance outcome of chamber resuscitations
13. Cite methods of psychological preparation and support for pediatric and adults undergoing HBO treatments
14. Discuss investigational areas for the use of hyperbaric medicine and develop a one hour didactic presentation for two of these areas
15. Design a research project that can be completed within the one year fellowship in one of the investigational areas for HBO
16. Identify potential health hazards in recreational divers by performing dive physicals in weekly dive clinics.
17. Describe the physiologic effects of pressure and immersion
18. Discuss decompression theory
19. Describe the pathophysiology and treatment of decompression illness
20. Demonstrate knowledge of diving tables and historical features of dive history
21. Demonstrate proficiency in a comprehensive neurologic exam
22. Demonstrate proficiency in myringotomy and chest tube placement
23. Demonstrate appropriate professional conduct, humanistic qualities, and teamwork

### **Core Content Outline**

1. History of pressure therapy in medicine
2. Physiologic effects of hyperbaric oxygen
  - a. Inhibition of electrokinetic effects at blood bubble interface
  - b. Increase in healing of hypoxic wounds
  - c. Inhibition of Clostridial alpha toxin
  - d. Lessening carbon monoxide toxicity
  - e. Influence on various blood cells
  - f. Vasoconstriction
  - g. Decrease in edema in burns and post-ischemic tissue
  - h. Preservation of tissue flaps
  - i. Decrease in lipid peroxidation

- j. Role of HBO in ischemia reperfusion injuries
- 3. Mechanical effects of pressure
  - a. Crushing bubbles
  - b. Inert gases, supersaturation, re-dissolving nitrogen
- 4. Oxygen toxicity
- 5. Multiplace chamber operation
  - a. Equipment considerations
  - b. Patient considerations
  - c. Emergency procedures
- 6. Monoplace chamber operation
  - a. Equipment considerations
  - b. Patient considerations
  - c. Emergency procedures
- 7. Approved indications for hyperbaric oxygen therapy
  - a. Air or gas embolism
  - b. Carbon monoxide poisoning/cyanide poisoning
  - c. Clostridial myonecrosis
  - d. Acute traumatic ischemias
  - e. Decompression sickness
  - f. Enhancement of healing in selected problem wounds
  - g. Exceptional blood loss
  - h. Intracranial Abscess
  - i. Necrotizing soft tissue infections
  - j. Refractory osteomyelitis
  - k. Radiation tissue damage
  - l. Compromised skin grafts and flaps
  - m. Thermal burns
  - n. Central retinal artery
  - o. Sensori-neural hearing loss
- 8. Contraindications and side effects of HBO
  - a. Absolute
    - i. Untreated pneumothorax
    - ii. Selected medications
  - b. Relative
    - i. COPD with CO<sub>2</sub> retention, bullous disease
    - ii. High fever
    - iii. Seizure disorder
    - iv. Recent thoracic surgery
    - v. Ear or sinus surgery
    - vi. vi. Congenital spherocytosis
    - vii. vii. Optic neuritis
    - viii. viii. Claustrophobia
  - c. Side effects
    - i. Barotrauma (otic, sinus, pulmonary)
    - ii. Visual refractive changes
    - iii. Oxygen induced seizures and other CNS effects

- iv. Claustrophobia
  - v. Pulmonary oxygen toxicity
- 9. Tissue oxygen measurements
  - a. Ankle brachial index
  - b. Transcutaneous oximetry
- 10. Investigational areas
  - a. Ischemia reperfusion injury
  - b. Myocardial infarction
  - c. Cerebrovascular accident
  - d. Brown recluse spider bites
  - e. Severe closed head injury
  - f. Mucormycosis
- 11. Administrative aspects of chamber operation
  - a. Guidelines for hyperbaric facilities
  - b. Economic aspects
  - c. Quality assessment
  - d. Peer review
- 12. Care of the critically ill patient in a hyperbaric chamber
  - a. Drugs and critical care equipment under pressure
  - b. Nursing considerations
  - c. Resuscitation management
- 13. Hyperbaric medicine in pediatric practice
  - a. Indications for HBO in children
  - b. Special contraindications
  - c. Psychological preparation and support
- 14. Physiologic effect of pressure and immersion
  - a. Physics of diving
  - b. Hypothermia and hyperthermia
  - c. High pressure nervous syndrome
  - d. Breath-hold diving
- 15. Decompression Theory
  - a. Inert gas exchange
  - b. Mechanisms of bubble formation
  - c. Saturation decompression theory
  - d. Repetitive diving
  - e. Surface decompression
  - f. Bubble detection
  - g. Mixed gas diving
  - h. Altitude diving, flying after diving
- 16. Pathophysiology and Treatment of Decompression Illnesses
  - a. Signs and symptoms of decompression sickness and AGE
  - b. Mechanisms of gas entry and distribution
  - c. Effects of bubbles
  - d. Dysbaric osteonecrosis
  - e. Barotrauma
  - f. Treatment of decompression illnesses

17. Health hazards in divers
  - a. Medical examination and standards for hyperbaric exposure: military, commercial, recreational, scientific, hyperbaric personnel
  - b. Recognition and treatment of hazardous marine life injuries

### **Evaluation Procedures**

1. Core faculty will complete monthly evaluations of performance with regard to how well the fellow has met instructional objectives
2. Fellowship director will meet informally as well as formally on a quarterly basis. Written evaluations will be completed on a semi annual basis
3. The fellow will be evaluated on the quality of research completed and on formal research presentations
4. Successful completion of the fellowship will be ultimately determined by the fellowship director and core HBO faculty
5. The hyperbaric medicine fellow will evaluate all components of the fellowship as well as core faculty

### **Application Process:**

Please send your CV and a cover letter indicating your interest in our fellowship program by email to [pwitucki@ucsd.edu](mailto:pwitucki@ucsd.edu). At least 2 letters of recommendation are required prior to interview. Interviews are generally conducted in the fall and early winter but can be arranged at any time.

### **Core Faculty**

Fellowship Director: Pete Witucki, M.D.

Director: Hyperbaric Medicine Division: Ian Grover, M.D.

Hyperbaric attending staff:

- Karen Van Hoesen, MD
- Marc Hare, MD
- Steve Hayden, M.D.
- Jake Jacoby, M.D.
- Emi Latham, M.D.
- Jim Killeen, M.D.
- Anthony Medak, M.D.
- Tom Neuman, M.D.
- Brian Snyder, M.D.
- Pete Witucki, MD
- Ceasar Anderson, MD
- Chris Tomaszewski, MD
- Davut Savaser, MD
- Jose Evangelista, MD