



# Commission on Accreditation of Allied Health Education Programs

## Standards and Guidelines for the Accreditation of Educational Programs in Perfusion

Essentials/Standards initially adopted in 1980; revised in 1989, 1994, 2000, 2005, 2012, and 2019  
by the:

American Academy of Cardiovascular Perfusion  
American Association for Thoracic Surgery  
American Board of Cardiovascular Perfusion  
American Society of Extracorporeal Technology  
Perfusion Program Directors' Council  
Society of Cardiovascular Anesthesiologists  
Society of Thoracic Surgeons  
Accreditation Committee – Perfusion Education  
and  
Commission on Accreditation of Allied Health Education Programs

The Commission on Accreditation of Allied Health Education Programs (CAAHEP) accredits programs upon the recommendation of the Accreditation Committee – Perfusion Education (AC-PE).

These accreditation **Standards and Guidelines** are the minimum standards of quality used in accrediting programs that prepare individuals to enter the Perfusion profession. Standards are the minimum requirements to which an accredited program is held accountable. Guidelines are descriptions, examples, or recommendations that elaborate on the Standards. Guidelines are not required, but can assist with interpretation of the Standards.

**Standards** are printed in regular typeface in outline form. *Guidelines* are printed in italic typeface in narrative form.

### Preamble

The Commission on Accreditation of Allied Health Education Programs (CAAHEP), the Accreditation Committee-Perfusion Education, the American Academy of Cardiovascular Perfusion, the American Association for Thoracic Surgery, the American Board of Cardiovascular Perfusion, the American Society of Extracorporeal Technology, the Perfusion Program Directors' Council, the Society of Cardiovascular Anesthesiologists, and the Society of Thoracic Surgeons cooperate to establish, maintain and promote appropriate standards of quality for educational programs in perfusion and to provide recognition for educational programs that meet or exceed the minimum standards outlined in these accreditation **Standards and Guidelines**. Lists of accredited programs are published for the information of students, employers, educational institutions and agencies, and the public.

These **Standards and Guidelines** are to be used for the development, evaluation, and self-analysis of perfusion programs. On-site review teams assist in the evaluation of a program's relative compliance with the accreditation **Standards**.

### Description of the Profession

A perfusionist is a skilled allied health professional trained and educated specifically as a member of an open-heart, surgical team responsible for the selection, setup, and operation of a mechanical device commonly referred to as the heart-lung machine. During open heart surgery, when the patient's heart is immobilized and cannot function in a normal fashion while the operation is being performed, the patient's blood is diverted and circulated outside the body through the heart-lung machine and returned again to

the patient. In effect, the machine assumes the function of both the heart and lungs. The perfusionist is responsible for operating the machine during surgery, monitoring the altered circulatory process closely, taking appropriate corrective action when abnormal situations arise, and keeping both the surgeon and anesthesiologist fully informed. In addition to the operation of the heart-lung machine during surgery, perfusionists often function in supportive roles for other medical specialties in operating mechanical devices to assist in the conservation of blood and blood products during surgery, and provide extended, long-term support of patients' circulation outside of the operating room environment.

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## I. Sponsorship

### A. Sponsoring Institution

A sponsoring institution must be at least one of the following:

1. A post-secondary academic institution accredited by an institutional accrediting agency that is recognized by the U.S. Department of Education, and authorized under applicable law or other acceptable authority to provide a post-secondary program, which awards a minimum of a certificate at the completion of the program.
2. A hospital, clinic or medical center accredited by a healthcare accrediting agency or equivalent that is recognized by the U.S. Department of Health and Human Services and authorized under applicable law or other acceptable authority to provide healthcare, which awards a minimum of a certificate at the completion of the program.
3. A branch of the U.S. Armed Forces which awards a minimum of a certificate at the completion of the program.
4. A foreign post-secondary academic institution acceptable to CAAHEP that is authorized under applicable law or other acceptable authority to provide a postsecondary program, which awards a minimum of a baccalaureate degree equivalent to a United States degree at the completion of the academic program.

### B. Consortium Sponsor

1. A consortium sponsor is an entity consisting of two or more members that exists for the purpose of operating an educational program. In such instances, at least one of the members of the consortium must meet the requirements of a sponsoring institution as described in I.A.
2. The responsibilities of each member of the consortium must be clearly documented in a formal affiliation agreement or memorandum of understanding, which includes governance and lines of authority.

### C. Responsibilities of Sponsor

1. The Sponsor must ensure that the provisions of these **Standards** are met.
2. The Sponsor must ensure that the graduates of the program have obtained or will obtain a baccalaureate degree upon completion of the program.

*A Master's degree awarded by the Sponsor is preferred.*

## II. Program Goals

### A. Program Goals and Outcomes

There must be a written statement of the program's goals and learning domains consistent with and responsive to the demonstrated needs and expectations of the various communities of interest served by the educational program. The communities of interest that are served by the program must include, but are not limited to, students, graduates, faculty, sponsor administration, employers, physicians, and the public.

Program-specific statements of goals and learning domains provide the basis for program planning, implementation, and evaluation. Such goals and learning domains must be compatible with the mission of the sponsoring institution(s), the expectations of the communities of interest, and nationally accepted standards of roles and functions. Goals and learning domains are based upon the substantiated needs of health care providers and employers, and the educational needs of the students served by the educational program.

**B. Appropriateness of Goals and Learning Domains**

The program must regularly assess its goals and learning domains. Program personnel must identify and respond to changes in the needs and/or expectations of its communities of interest.

An advisory committee, which is representative of at least each of the communities of interest named in these **Standards**, must be designated and charged with the responsibility of meeting at least annually, to assist program and sponsor personnel in formulating and periodically revising appropriate goals and learning domains, monitoring needs and expectations, and ensuring program responsiveness to change.

*Advisory committee meetings may include participation by synchronous electronic means.*

**C. Minimum Expectations**

The program must have the following goal defining minimum expectations: “To prepare competent entry-level perfusionists in the cognitive (knowledge), psychomotor (skills), and affective (behavior) learning domains.”

Programs adopting educational goals beyond entry-level competence must clearly delineate this intent and provide evidence that all students have achieved the competencies prior to entry into the field.

*Nothing in this Standard restricts programs from formulating goals beyond entry-level competence.*

**III. Resources**

**A. Type and Amount**

Program resources must be sufficient to ensure the achievement of the program’s goals and outcomes. Resources must include, but are not limited to: faculty; clerical and support staff; curriculum; finances; offices; classroom, laboratory, and ancillary student facilities; clinical affiliates; equipment; supplies; computer resources; instructional reference materials; and faculty/staff continuing education.

**B. Personnel**

The sponsor must appoint sufficient faculty and staff with the necessary qualifications to perform the functions identified in documented job descriptions and to achieve the program’s stated goals and outcomes.

**1. Program Director**

**a. Responsibilities**

The program director must be responsible for the organization, administration, periodic review, continued development and general effectiveness of the program. The clinical assignment of the program director must allow adequate time for administrative and teaching responsibilities.

**b. Qualifications**

The program director must possess at a minimum, the following:

- 1) degree at an equivalent level to what the program confers;
- 2) five years of professional experience as a perfusionist; and
- 3) two years of experience as an instructor in an accredited educational program or experience in instructional methodology, curriculum design, program planning and counseling.

In addition to the above qualifications, if the program director also serves as the Clinical Coordinator, the Program Director must hold current American Board of Cardiovascular Perfusion certification as a perfusionist.

*The program director should hold an advanced degree.*

*Years of professional experience and experience as an instructor need not be summative.*

## 2. Clinical Coordinator

### a. Responsibilities

The clinical coordinator must be responsible for evaluating and assuring clinical education effectiveness. A schedule of regular contact with the clinical affiliates and documentation of all contact must be maintained.

The clinical coordinator must assist the program director and other program officials regarding perfusion education.

*Contact with clinical affiliates may include, but is not limited to, clinical visits, teleconferences, and written correspondence.*

### b. Qualifications

The clinical coordinator must possess at a minimum, the following:

- 1) Current certification as a perfusionist by the American Board of Cardiovascular perfusion or within the first five years after obtaining CCP Emeritus status;
- 2) Five years of professional experience as a perfusionist; and
- 3) Two years of experience as an instructor in an accredited educational program in perfusion.

*The program director may also serve as the clinical coordinator provided the qualifications of both are met.*

*Years of professional experience and experience as an instructor need not be summative.*

## 3. Medical Advisor

### a. Responsibilities

The medical advisor must participate in planning, organizing, conducting, revising, and evaluating the perfusion education program.

### b. Qualifications

The medical advisor of the program must:

- 1) be a practicing physician, currently licensed in the United States; and
- 2) hold a valid board certification in a related medical specialty.

*Thoracic surgery and anesthesiology are examples of related medical specialties.*

## 4. Clinical Instructors

### a. Responsibilities

The clinical instructor(s) must provide students with appropriate and adequate clinical instruction/supervision and must evaluate student clinical competence.

Sufficient time for accomplishing the clinical objectives must be provided. The clinical instructor(s) must communicate regularly with the program officials.

At least one clinical instructor must be designated as site coordinator at each clinical affiliate to facilitate communication and appropriate site orientation/training, and summary student evaluation.

### b. Qualifications

A clinical instructor must be:

- 1) certified as a perfusionist by the American Board of Cardiovascular Perfusion;
- 2) knowledgeable and effective in teaching the subjects assigned, and
- 3) knowledgeable of the program goals, clinical objectives, and clinical evaluation system.

*Clinical instructors should participate periodically in teaching methodology continuing education.*

## 5. Didactic Instructors

### a. Responsibilities

Didactic instructors must be responsible for teaching each course assigned by the program director, evaluating students and reporting their progress as required by the sponsor, and cooperating with the program director in periodic review and revision of course materials.

### b. Qualifications

Didactic instructors must be:

- 1) effective in teaching the subject(s) assigned; and
- 2) knowledgeable of the program goals, clinical objectives, and clinical evaluation system.

## C. Curriculum

The curriculum must ensure the achievement of program goals and learning domains. Instruction must be an appropriate sequence of classroom, laboratory, and clinical activities, and must include simulated clinical scenarios. Instruction must be based on clearly written course syllabi that include course description, course objectives, methods of evaluation, topic outline, and competencies required for graduation.

*High fidelity extracorporeal simulation is recommended.*

The program must demonstrate by comparison that the curriculum offered meets or exceeds the content requirements of the latest edition of the AC-PE Approved Cardiovascular Perfusion Curriculum (see Appendix B).

## D. Resource Assessment

The program must, at least annually, assess the appropriateness and effectiveness of the resources described in these Standards. The results of resource assessment must be the basis for ongoing planning and appropriate change. An action plan must be developed when deficiencies are identified in the program resources. Implementation of the action plan must be documented and results measured by ongoing resource assessment.

## IV. Student and Graduate Evaluation/Assessment

### A. Student Evaluation

#### 1. Frequency and purpose

Evaluation of students must be conducted on a recurrent basis and with sufficient frequency to provide both the students and program faculty with valid and timely indications of the students' progress toward and achievement of the competencies and learning domains stated in the curriculum.

*The program should demonstrate appropriate strategies for communicating with each individual student his or her standing in the program. The demonstration should include a plan for routine communication, a copy of all forms used in communicating, a description of how the department and institution handles problem or failing students, a description of the appeals process, and student evaluation of the communication process. Each student file should contain copies of all communication regarding standing.*

#### 2. Documentation

Records of student evaluations must be maintained in sufficient detail to document learning progress and achievements.

### B. Outcomes

#### 1. Outcomes Assessment

The program must periodically assess its effectiveness in achieving its stated goals and learning domains. The results of this evaluation must be reflected in the review and timely revision of the program.

Outcomes assessments must include, but are not limited to: national credentialing examination(s) performance, programmatic retention/attrition, graduate satisfaction, employer satisfaction, job (positive) placement, and programmatic summative measures, including: cardiopulmonary bypass; mechanical circulatory support; autotransfusion/blood conservation/product management; and performance of laboratory analysis of blood gases, electrolytes, hematocrit/hemoglobin. The program must meet the outcomes assessment thresholds.

*“Positive placement” means that the graduate is employed full or part-time in a related field; and/or continuing his/her education; and/ or serving in the military. A related field is one in which the individual is using cognitive, psychomotor, and affective competencies acquired in the educational program.*

## **2. Outcomes Reporting**

The program must periodically submit to the AC-PE the program goal(s), learning domains, evaluation systems (including type, cut score, and appropriateness), outcomes, its analysis of the outcomes, and an appropriate action plan based on the analysis.

Programs not meeting the established thresholds must begin a dialogue with the AC-PE to develop an appropriate plan of action to respond to the identified shortcomings.

## **V. Fair Practices**

### **A. Publications and Disclosure**

1. Announcements, catalogs, publications, and advertising must accurately reflect the program offered.
2. At least the following must be made known to all applicants and students: the sponsor's institutional and programmatic accreditation status as well as the name, mailing address, web site address, and phone number of the accrediting agencies; admissions policies and practices, including technical standards (when used); policies on advanced placement, transfer of credits, and credits for experiential learning; number of credits required for completion of the program; tuition/fees and other costs required to complete the program; policies and processes for withdrawal and for refunds of tuition/fees.
3. At least the following must be made known to all students: academic calendar, student grievance procedure, criteria for successful completion of each segment of the curriculum and for graduation, and policies and processes by which students may perform clinical work while enrolled in the program.
4. The sponsor must maintain, and make available to the public, current and consistent summary information about student/graduate achievement that includes the results of one or more of the outcomes assessments required in these Standards.

*The sponsor should develop a suitable means of communicating to the communities of interest the achievement of students/graduates (e.g. through a website or electronic or printed documents).*

### **B. Lawful and Non-discriminatory Practices**

All activities associated with the program, including student and faculty recruitment, student admission, and faculty employment practices, must be non-discriminatory and in accord with federal and state statutes, rules, and regulations. There must be a faculty grievance procedure made known to all paid faculty.

### **C. Safeguards**

The health and safety of patients, students, faculty, and all participants associated with the educational activities of the students must be adequately safeguarded.

During clinical instruction in which the student is operating extracorporeal circulation equipment, there must be direct one-to-one supervision by a clinical instructor. The clinical instructor and physician in charge of the procedure must be responsible for patient safety.

All activities in the program must be educational and students must not be substituted for staff.

*Programs should provide a rest period for consecutive work as established by professional guidelines.*

**D. Student Records**

Satisfactory records must be maintained for student admission, advisement, counseling, and evaluation. Grades and credits for courses must be recorded on the student transcript and permanently maintained by the sponsor in a safe and accessible location.

**E. Substantive Changes**

The sponsor must report substantive change(s) as described in Appendix A to CAAHEP/AC-PE in a timely manner. Additional substantive changes to be reported to AC-PE within the time limits prescribed include:

1. Change in certification status of the Program Director
2. Change in certification status of the Clinical Coordinator

**F. Agreements**

There must be a formal affiliation agreement or memorandum of understanding between the sponsor and all other entities that participate in the education of the students describing the relationship, roles, and responsibilities of the sponsor and that entity.

## APPENDIX A

### Application, Maintenance and Administration of Accreditation

#### A. Program and Sponsor Responsibilities

##### 1. Applying for Initial Accreditation

- a. The chief executive officer or an officially designated representative of the sponsor completes a “Request for Accreditation Services” form and returns it electronically or by mail to:

**Accreditation Committee-Perfusion Education**  
**10940 S Parker Road, Suite 455**  
**Parker, CO 80134**

The “Request for Accreditation Services” form can be obtained from the CAAHEP website at: [Request for Accreditation Services1 \(caahep.org\)](http://caahep.org/Request-for-Accreditation-Services1)

**Note:** There is **no** CAAHEP fee when applying for accreditation services; however, individual committees on accreditation may have an application fee.

- b. The program undergoes a comprehensive review, which includes a written self-study report and an on-site review.

The self-study instructions and report form are available from the Accreditation Committee-Perfusion Education. The on-site review will be scheduled in cooperation with the program and Accreditation Committee-Perfusion Education once the self-study report has been completed, submitted, and accepted by the Accreditation Committee-Perfusion Education

##### 2. Applying for Continuing Accreditation

- a. Upon written notice from the Accreditation Committee-Perfusion Education, the chief executive officer or an officially designated representative of the sponsor completes a “Request for Accreditation Services” form, and returns it electronically or by mail to:

**Accreditation Committee-Perfusion Education**  
**10940 S Parker Road, Suite 455**  
**Parker, CO 80134**

The “Request for Accreditation Services” form can be obtained from the CAAHEP website at: [Request for Accreditation Services1 \(caahep.org\)](http://caahep.org/Request-for-Accreditation-Services1)

- b. The program may undergo a comprehensive review in accordance with the policies and procedures of the Accreditation Committee-Perfusion Education.

If it is determined that there were significant concerns with the conduct of the on-site review, the sponsor may request a second site visit with a different team.

After the on-site review team submits a report of its findings, the sponsor is provided the opportunity to comment in writing and to correct factual errors prior to the Accreditation Committee-Perfusion Education forwarding a recommendation to CAAHEP.

##### 3. Administrative Requirements for Maintaining Accreditation

- a. The program must inform the Accreditation Committee-Perfusion Education and CAAHEP within a reasonable period of time (as defined by the committee on accreditation and



CAAHEP policies) of changes in chief executive officer, dean of health professions or equivalent position, and required program personnel (Refer to Standard III.B.).

- b. The sponsor must inform CAAHEP and the Accreditation Committee-Perfusion Education of its intent to transfer program sponsorship. To begin the process for a Transfer of Sponsorship, the current sponsor must submit a letter (signed by the CEO or designated individual) to CAAHEP and the Accreditation Committee-Perfusion Education that it is relinquishing its sponsorship of the program. Additionally, the new sponsor must submit a "Request for Transfer of Sponsorship Services" form. The Accreditation Committee-Perfusion Education has the discretion of requesting a new self-study report with or without an on-site review. Applying for a transfer of sponsorship does not guarantee that the transfer will be granted.
- c. The sponsor must promptly inform CAAHEP and the Accreditation Committee-Perfusion Education of any adverse decision affecting its accreditation by recognized institutional accrediting agencies and/or state agencies (or their equivalent).
- d. Comprehensive reviews are scheduled by the Accreditation Committee-Perfusion Education in accordance with its policies and procedures. The time between comprehensive reviews is determined by the Accreditation Committee-Perfusion Education and based on the program's on-going compliance with the Standards, however, all programs must undergo a comprehensive review at least once every ten years.
- e. The program and the sponsor must pay Accreditation Committee-Perfusion Education and CAAHEP fees within a reasonable period of time, as determined by the Accreditation Committee-Perfusion Education and CAAHEP respectively.
- f. The sponsor must file all reports in a timely manner (self-study report, progress reports, probation reports, annual reports, etc.) in accordance with Accreditation Committee-Perfusion Education policy.
- g. The sponsor must agree to a reasonable on-site review date that provides sufficient time for CAAHEP to act on an Accreditation Committee-Perfusion Education accreditation recommendation prior to the "next comprehensive review" period, which was designated by CAAHEP at the time of its last accreditation action, or a reasonable date otherwise designated by the Accreditation Committee-Perfusion Education.

Failure to meet any of the aforementioned administrative requirements may lead to administrative probation and ultimately to the withdrawal of accreditation. CAAHEP will immediately rescind administrative probation once all administrative deficiencies have been rectified.

#### **4. Voluntary Withdrawal of a CAAHEP- Accredited Program**

Notification of voluntary withdrawal of accreditation from CAAHEP must be made by the Chief Executive Officer or an officially designated representative of the sponsor by writing to CAAHEP indicating: the desired effective date of the voluntary withdrawal, and the location where all records will be kept for students who have completed the program.

#### **5. Requesting Inactive Status of a CAAHEP- Accredited Program**

Inactive status for any accredited program may be requested from CAAHEP at any time by the Chief Executive Officer or an officially designated representative of the sponsor writing to CAAHEP indicating the desired date to become inactive. No students can be enrolled or matriculated in the program at any time during the time period in which the program is on inactive status. The maximum period for inactive status is two years. The sponsor must continue to pay all required fees to the Accreditation Committee-Perfusion Education and CAAHEP to maintain its accreditation status.

To reactivate the program the Chief Executive Officer or an officially designated representative of the sponsor must provide notice of its intent to do so in writing to both CAAHEP and the Accreditation Committee-Perfusion Education. The sponsor will be notified by the Accreditation Committee-Perfusion Education of additional requirements, if any, that must be met to restore active status.

If the sponsor has not notified CAAHEP of its intent to re-activate a program by the end of the two-year period, CAAHEP will consider this a "Voluntary Withdrawal of Accreditation."

## **B. CAAHEP and Committee on Accreditation Responsibilities – Accreditation Recommendation Process**

1. After a program has had the opportunity to comment in writing and to correct factual errors on the on-site review report, the Accreditation Committee-Perfusion Education forwards a status of public recognition recommendation to the CAAHEP Board of Directors. The recommendation may be for any of the following statuses: initial accreditation, continuing accreditation, transfer of sponsorship, probationary accreditation, withhold of accreditation, or withdrawal of accreditation.

The decision of the CAAHEP Board of Directors is provided in writing to the sponsor immediately following the CAAHEP meeting at which the program was reviewed and voted upon.

2. Before the Accreditation Committee-Perfusion Education forwards a recommendation to CAAHEP that a program be placed on probationary accreditation, the sponsor must have the opportunity to request reconsideration of that recommendation or to request voluntary withdrawal of accreditation. The Accreditation Committee-Perfusion Education's reconsideration of a recommendation for probationary accreditation must be based on conditions existing both when the committee arrived at its recommendation as well as on subsequent documented evidence of corrected deficiencies provided by the sponsor.

The CAAHEP Board of Directors' decision to confer probationary accreditation is not subject to appeal.

3. Before the Accreditation Committee-Perfusion Education forwards a recommendation to CAAHEP that a program's accreditation be withdrawn or that accreditation be withheld, the sponsor must have the opportunity to request reconsideration of the recommendation, or to request voluntary withdrawal of accreditation or withdrawal of the accreditation application, whichever is applicable. The Accreditation Committee-Perfusion Education's reconsideration of a recommendation of withdraw or withhold accreditation must be based on conditions existing both when the Accreditation Committee-Perfusion Education arrived at its recommendation as well as on subsequent documented evidence of corrected deficiencies provided by the sponsor.

The CAAHEP Board of Directors' decision to withdraw or withhold accreditation may be appealed. A copy of the CAAHEP "Appeal of Adverse Accreditation Actions" is enclosed with the CAAHEP letter notifying the sponsor of either of these actions.

At the completion of due process, when accreditation is withheld or withdrawn, the sponsor's Chief Executive Officer is provided with a statement of each deficiency. Programs are eligible to re-apply for accreditation once the sponsor believes that the program is in compliance with the accreditation Standards.

**Note: Any student who completes a program that was accredited by CAAHEP at any time during his/her matriculation is deemed by CAAHEP to be a graduate of a CAAHEP-accredited program.**

## APPENDIX B

### Curriculum Outline for Educational Programs in Perfusion

The following is an outline of the curriculum content required for educational programs in Perfusion. It does not contain the complete curriculum content required to demonstrate compliance with Standard III.C.1. The complete curriculum is specified in the latest edition of the 'AC-PE Approved Cardiovascular Perfusion Curriculum' and is available at <http://ac-pe.org/>.

#### 1. Curriculum Requisites

The following curriculum requisites must either be met prior to the perfusion education program or be presented as course work; they must include but are not limited to college level content in the following:

- a. Anatomy and pathology
- b. Physiology
- c. Chemistry
- d. Pharmacology
- e. Mathematics
- f. Physics

*Biochemistry should be incorporated into the curriculum.*

*Tests used to assess prerequisite knowledge or advanced standing should be nationally recognized and accepted.*

#### 2. Clinical Cases

Clinical case availability must be adequate to support the number of students admitted to the program. The minimum number of cardiopulmonary bypass cases performed prior to graduation, and clinical pediatric cases requiring cardiopulmonary bypass observed or performed prior to graduation, must be consistent with eligibility requirements defined by the American Board of Cardiovascular Perfusion.

*There should be an equitable distribution of available clinical cases among the students. A student's involvement in cardiopulmonary bypass should include but not be limited to the following:*

- a. preoperative preparation
- b. perfusion equipment selection and assembly
- c. perfusion management and decision making

*Case requirements should be consistent with certification exam eligibility requirements as defined by the American Board of Cardiovascular Perfusion.*

#### 3. Curriculum Content Outline

##### a. Unit I: Basic Science

##### 1) Cardiovascular Anatomy

- a) Mediastinum Cardiovascular Anatomy: This unit identifies the position of the heart in the thoracic cage, the surrounding structures and the exterior anatomy of the heart.
- b) Heart: This unit identifies the anteroposterior view of the heart, the chamber locations, and the internal features of each of the chambers and great vessels.
- c) Cardiac Arteries, Veins, and Microcirculation: This unit presents the names and locations of major cardiac arteries and veins and introduces myocardial microcirculation.
- d) Conduction System: This unit identifies the major pathways of the electrical conduction through the heart.
- e) Major Arteries, Veins, and Branches: This unit identifies the names and locations of major arteries, arterial branches, major veins, and venous branches through the body.
- f) Developmental and Cardiac Embryology: This unit identifies the embryological development of the heart.
- g) Vascular Embryology: This unit identifies the embryological development of the vasculature.

##### 2) Pathology and Surgical Repair

- a) Adult Cardiac Valvular Pathology and Surgical Repair: This unit identifies adult valvular cardiac surgical pathology.
  - b) Adult Coronary Artery Pathology: This unit identifies adult coronary surgical pathology.
  - c) Perfusion Techniques for Aortic Aneurysm Dissections: Thoracic and Thoracoabdominal: This unit introduces adjunctive techniques of extracorporeal circulation for temporary compensation of loss or compromised hemodynamic and oxygenation to a localized area of patient's body required by corrective surgery of thoracic and thoracoabdominal aneurysms.
  - d) Congestive Heart Failure: This unit introduces the etiology and presentation of congestive heart failure.
  - e) Congenital Heart Defects: Left to Right Shunts: This unit introduces the anatomy, pathological presentation and surgical correction of congenital left to right shunts.
  - f) Congenital Heart Defects: Cyanotic Anomalies: This unit introduces the anatomy, pathological presentation and surgical correction of congenital cyanotic anomalies.
  - g) Congenital Heart Defects: Obstructive Anomalies: This unit introduces the anatomy, pathological presentation and surgical correction of obstructive anomalies.
  - h) Congenital Heart Defects: Miscellaneous Anomalies: This unit introduces the anatomy, pathological presentation and surgical correction of miscellaneous congenital anomalies.
- 3) Physiology
- a) Cardiovascular Physiology: This unit introduces cardiovascular physiology.
  - b) Cardiovascular Hemodynamics: This unit introduces cardiovascular hemodynamics.
  - c) Renal Physiology: This unit presents the basics of renal physiology.
  - d) Ventilation, Oxygenation, Respiration: This unit presents the basics of pulmonary physiology.
  - e) Myocardial Physiology: This unit describes myocardial metabolism, myocardial electrical potentials, and the pathophysiology of myocardial ischemia.
  - f) Hematology: This unit introduces the cellular components of blood and the collection, processing and storage of individual blood components.
  - g) Coagulation Management: This unit describes the process of and management of hemostasis as applicable to the practice of perfusion care.
- 4) Pharmacology
- a) Pharmacodynamics & Pharmacokinetics: This unit describes the effect of cardiopulmonary bypass on the pharmacodynamics and pharmacokinetics of drugs used during open-heart surgical procedures.
  - b) Pharmacology of Anesthetic Agents: This unit introduces the pharmacologic agents and techniques used during cardiac surgery.
  - c) Anti-arrhythmic Pharmacology: This unit presents the names, uses, and mechanism of action of antiarrhythmic drugs used during cardiac surgery.
  - d) Inotropic and Vasopressor Pharmacology: This unit presents the names, uses, and mechanism of action of cardiotropic drugs used during cardiac surgery.
  - e) Vasodilators: This unit describes vasodilators, their mechanism of action and their role in managing hypertensive states and congestive heart failure.
  - f) Pharmacological Treatment of Congestive Heart Failure (CHF): This unit presents the basic pharmacological agents used for treatment of heart failure.
  - g) Antimicrobial Agents/Antibiotics: This unit introduces the basics of antimicrobial therapeutics and introduces organismal contamination during open heart surgery and its therapeutic treatment with antimicrobials.
  - h) Anticoagulants: This unit describes the pharmacology of anticoagulants.
  - i) Heparin Induced Thrombocytopenia (HIT): This unit describes the immunological basis and the clinical approach to HIT.
  - j) Antithrombin Deficiency: This unit introduces AT deficiency and describes its management.
  - h) Chemotherapeutic, Immunosuppressive, Diabetic, and Miscellaneous Agents: This unit introduces chemotherapeutic, immunosuppressive and diabetic agents.
- 5) Physics: This unit introduces principles and concepts from physics and relates them to extracorporeal circulation.

- 6) Chemistry: This unit introduces principles and concepts from chemistry and relates them to extracorporeal circulation.
  - 7) Mathematics: This unit identifies mathematical computations commonly associated with cardiopulmonary bypass.
  - 8) Immunology
    - a) Immunology of Blood Contact with Artificial Materials: This unit illustrates the pathways responsible for an immunological response to blood contact with artificial materials.
    - b) Immunology of Reperfusion Injury: This unit describes the basic immunological basis for reperfusion injury.
- b. Unit 2: Perfusion Techniques
- 1) Extracorporeal Circuit Components for Cardiopulmonary Bypass
    - a) Perfusion Circuits: This unit describes the individual circuit components for cardiopulmonary bypass.
    - b) Tubing: This unit introduces the variety of tubing types used in cardiopulmonary bypass circuits.
    - c) Pumps: This unit introduces the various types of pumps used during cardiopulmonary bypass.
    - d) Extracorporeal Filters  
This unit introduces the various types of filters used during cardiopulmonary bypass.
    - e) Oxygenators  
This unit introduces the variety of oxygenators used in cardiopulmonary bypass circuits.
    - f) Heat Exchangers  
This unit introduces the various types of heat exchangers used during cardiopulmonary bypass.
    - g) Reservoirs  
This unit introduces the various types of reservoirs used during cardiopulmonary bypass.
    - h) Hemoconcentrators/Ultrafilters/Dialysis  
This unit introduces the various types of extracorporeal filtration devices and techniques that can be used for the cardiac patient.
  - 2) Cardiopulmonary Bypass Techniques
    - a) Conduct of Cardiopulmonary Bypass: This unit introduces the sequence of events associated with a generic CPB procedure.
    - b) CPB Cannulation and Monitoring: This unit describes methods of cannulating for CPB and presents the physiologic monitoring of the cardiac surgery patient.
  - 3) Adequacy of Perfusion: This unit identifies the parameters monitored to determine adequacy of perfusion.
  - 4) Myocardial Preservation
    - a) Cardioplegia Administration Techniques: This unit presents the physiological and technical considerations associated with cardioplegia administration.
    - b) Cardioplegia Solutions: This unit defines the purpose of various components used in cardioplegia solutions and their role in reducing ischemic and reperfusion injury.
  - 5) Systemic Hypothermia: This unit describes the physiologic basis of and the technical considerations associated with systemic hypothermia.
  - 6) Blood Conservation Techniques
    - a) Standards for Perioperative Autologous Blood Collection and Administration: This unit defines the AABB Standards for Perioperative Autologous Blood Collection and Administration.
    - b) Hemodilution: This unit describes the physiological effects of hemodilution.
    - c) Intraoperative Autotransfusion: This unit describes indications, contraindications, equipment operation, product storage and quality control issues related to cell washing.
      - (1) High Volume Autologous Platelet Concentration: This unit describes the use of the Intraoperative Autotransfusion device as a possible source for large volume platelet concentration.

- d) Low Volume Autologous Platelet Concentration Systems: This unit describes the use of low volume Autologous Platelet Separators.
  - e) Pharmacological Interventions: This unit presents the pharmacological options available to reduce blood loss.
- 7) Special Considerations in Perfusion
- a) Malignant Hyperthermia: This unit defines malignant hyperthermia, identifies the symptoms of a malignant hyperthermic event, the conditions which may predispose a patient to malignant hyperthermia, considerations for CPB and the treatment.
  - b) Perfusion of the Pregnant Patient: This unit details the specific perfusion techniques for the pregnant patient.
  - c) Sickle Cell and other Blood Disorders: This unit provides a detailed description of blood disorders that may affect perfusion techniques.
  - d) Jehovah's Witness Patients: This unit provides a guide to good practice for the surgical management of Jehovah's Witnesses and other patients who decline transfusion.
  - e) Emerging Technologies/Techniques: This unit provides a place for the discussion of new technologies and techniques which may not be widely used in practice yet, but should be considered for inclusion in future revisions of this document. At this point, these technologies and techniques should be included as an overview, not an in depth topic until their validity and widespread use is confirmed.
- 8) Crisis Resource Management: This unit details the components of crises and crisis management.
- 9) Adjunctive Techniques
- a) Assisted Venous Drainage: This unit details assisted venous drainage techniques.
  - b) Selective Cerebral Perfusion: This unit details the concepts and techniques for cerebral perfusion.
- 10) Patient Monitoring: This unit describes the systems used for patient monitoring during open-heart surgical procedures.
- 11) Organ Transplantation
- a) Heart Transplantation: Donor Recipient Considerations: This unit introduces the donor and recipient selection considerations as they relate to heart transplantation.
  - b) Lung and Heart-Lung Transplantation: This unit introduces the donor and recipient selection considerations as they relate to lung and heart-lung transplantation.
  - c) Liver Transplantation – Perfusion Support: This unit presents the rationale and technique to support orthotopic liver transplantation.
  - d) Solid Organ Procurement: This unit presents the rationale and technique to support organs for transplantation.
- 12) Cancer Therapeutics
- a) Isolated Limb Perfusion (ILP): This unit presents the rationale and technique used for the delivery of cytotoxic drug delivery in the treatment of extremity sarcomas.
  - b) Hyperthermic Intraperitoneal Chemotherapy (HIPEC): This unit presents the rationale and technique used for the delivery of hyperthermic intraperitoneal chemotherapy.
- c. Unit 3: Mechanical Assist
- 1) Extracorporeal Life Support Techniques: This unit presents the history and basic concepts of ECMO.
  - 2) Intra-Aortic Balloon Pumping (IABP): This unit introduces the theory and practice of intra-aortic balloon pumping.
  - 3) Ventricular Assist Devices (VADs): This unit describes patient selection, surgical implantation, and patient management for a variety of different VAD techniques.
- d. Unit 4: Principles of Laboratory Analysis

- 1) Overview – Laboratory Analysis: This unit introduces the use of laboratory tests in clinical practice.
  - 2) Laboratory Analysis – Special Chemistry: This unit describes methodology used to monitor acid-base status in the clinical setting.
  - 3) Laboratory Analysis – Blood Chemistry: This unit describes the laboratory test used in diagnosing specific disease states.
  - 4) Laboratory Analysis – Coagulation & Hematology: This unit describes tests used in assessing coagulation in the clinical setting.
- e. Unit 5: Biomedical Engineering
- 1) Biomedical Instrumentation: This unit presents the theory and application of biomedical instrumentation.
  - 2) Biophysical Transport Phenomenon: This unit introduces the core principles of biophysical transport phenomenon.
  - 3) Biomedical Electrical Safety: This unit introduces electrical safety as it pertains to patients and operating room personnel.
  - 4) Medical and Diagnostic Imaging Technology: This unit introduces the various imaging technologies utilized in medicine with particular emphasis on those utilized in the diagnosis and treatment of cardiothoracic disorders.
- f. Unit 6: Safety
- 1) Blood/Fluid Exposure: This unit describes the importance of standard precautions.
  - 2) Patient Safety: This unit describes standard practice with regard to conducting safe perfusion.
- g. Unit 7: Continuous Quality Assurance
- 1) CQI for the Perfusionist: This unit provides the definition and implementation of CQI in health care.
- h. Unit 8: Ethics
- 1) Medical Ethics: This unit introduces contemporary issues related to medical ethics.
- i. Unit 9: History
- 1) Historical Development of Perfusion: This unit describes the key historical discoveries and events in cardiac surgery as it relates to perfusion.
- j. Unit 10: Research
- 1) Introduction to Research Methods: This unit introduces the foundational knowledge base for research methodology in the clinical and biological sciences.
- k. Unit 11: Business Practices
- 1) Business Practices Regulatory Agencies: This unit introduces the various regulatory agencies with oversight responsibilities within the domain of the perfusionist and describes the responsibilities of the perfusionist in complying with his/her employing institution's policies and procedures.
- l. Unit 12: Emergency Preparedness: This unit describes the various types of disasters and the need for emergency preparedness. The various options for management of patients and the role of the perfusionist during the treatment of patients in these situations will be discussed.