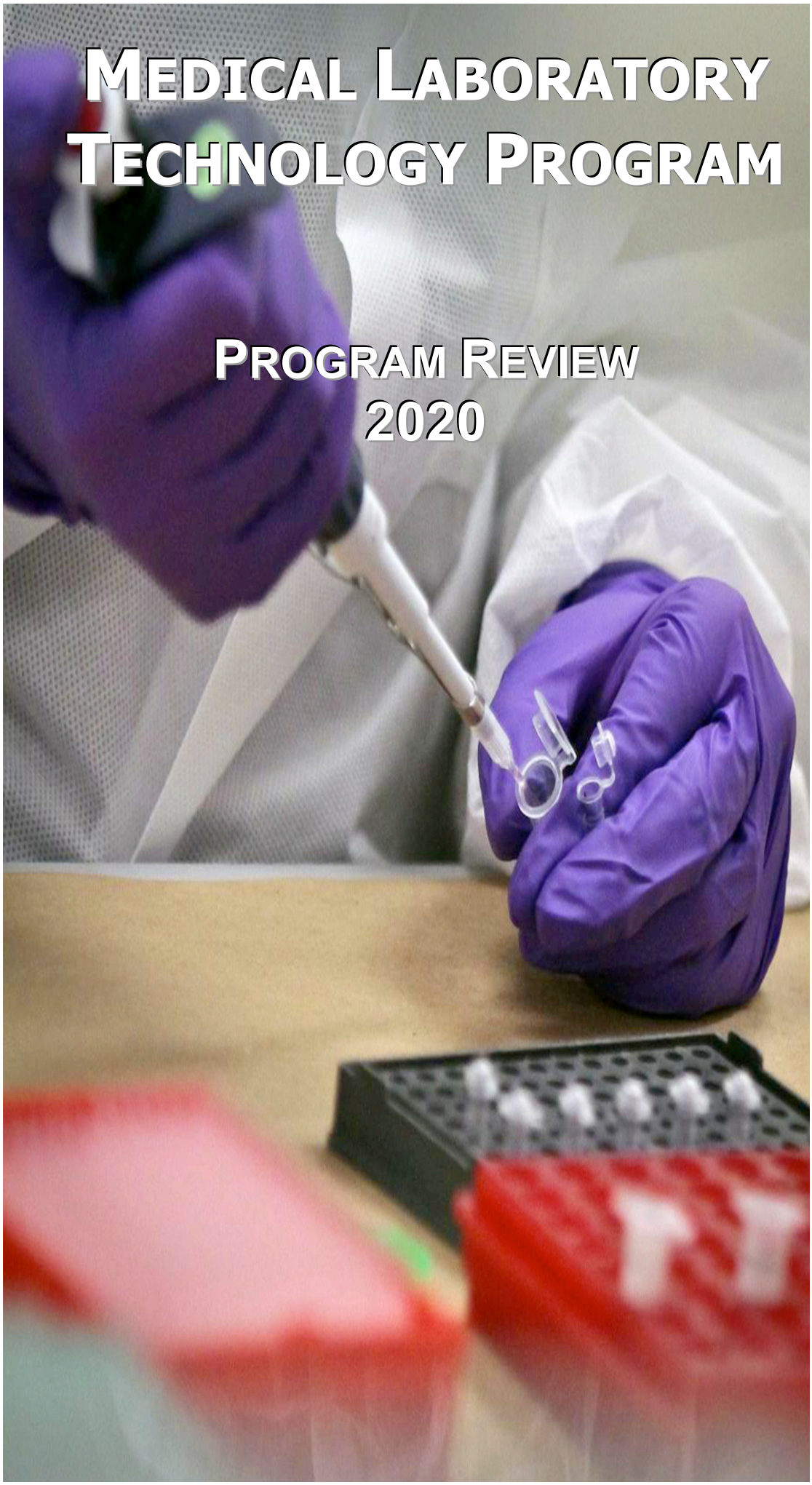
Medical Laboratory Technology Program

Program Review 2020



By the

MLT Program SAC

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1. Program/Discipline Overview:

Introduction

The Profession

Two levels of testing personnel exist in clinical laboratories, the Medical Laboratory Technician (MLT) and the Medical Laboratory Scientist (MLS). The MLT graduates with an Associate of Applied Science degree in Medical Laboratory Technology while the MLS graduates with a Bachelor of Science degree in Medical Laboratory Science. Both are trained to perform routine laboratory testing; however, the MLS receives additional training in other areas such as management. Although some MLT's serve as laboratory managers and department heads (i.e. head of hematology, etc.), most of these positions are held by an MLS.

Laboratory personnel such as Medical Laboratory Technicians examine and analyze a variety of body fluids and other medical specimens. They look for bacteria, parasites, and other infectious microorganisms; analyze the chemical contents of body fluids; match blood for transfusions; and test for drug levels in the blood that demonstrates how a patient is responding to treatment.

Technicians also prepare specimens for examination, count cells, and look for abnormal cells in blood and body fluids. They use microscopes, analytical instruments, and other high-tech laboratory equipment. They also use automated equipment and computerized instruments to test specimens. After testing and examining a specimen, they analyze the data and relay the results to physicians and other health care providers.

Program History

Portland Community College established a Certified Laboratory Assistant Program in 1968 at the request of the medical community of the State of Oregon. In 1970, it was determined that a two-year Medical Laboratory Technology Associate Degree Program would be more appropriate to meet the needs of the medical community. The curriculum was changed to incorporate more basic sciences, communication skills, general education courses and an expanded curriculum in clinical laboratory science. The Program operated as a one-plus-one program until the fall of 1978, at which time the general education, basic sciences and clinical courses were integrated into both the first and second years of the Program. Since that time, the Program's basic structure has remained the same, although regular curriculum adjustments have been made to stay aligned with changing technology and to meet the needs of the medical community served by the Program.

Prior to the period covered by this program review, our MLT Advisory Committee and Oregon's health care community asked that our Program find ways to reach students and laboratories beyond the Portland-Metro area. A distance learning modality was developed, implemented, and initiated in 2005, with the first students graduating 2007. The distance learning option was developed and established to mirror the same structure, curriculum, requirements, expectations and outcomes of the traditional Program. The distance learning option was

eventually discontinued due to low annual enrollment with the last students graduating in 2015.

The Program is accredited by The National Accrediting Agency for Clinical Laboratory Sciences.

National Accrediting Agency for Clinical Laboratory Sciences (NAACLS)
5600 N. River Rd., Suite 720
Rosemont, IL 60018
Phone (773) 714-8880

Program Description and Organization

The MLT Program is a two-year, seven term course of study resulting in an Associate of Applied Science (AAS) degree. To fulfill the requirements of the AAS degree, students must successfully complete 97 credit hours that include 80 credit hours of MLT required courses and 17 credit hours of General Education Courses; some MLT required courses can be used as General Education (*see Current MLT Curriculum in the Appendix A*).

Students must earn a minimum letter grade of C for all courses with the MLT designation to progress through the Program. Upon graduation, students are eligible to take nationally recognized certification examinations.

MLT core courses (80 credits) cover subjects in the areas of clinical chemistry, hematology, body fluids, coagulation, urinalysis, immunology, immunohematology, serology, clinical bacteriology, mycology, parasitology, molecular diagnostics, quality control, laboratory mathematics, safety, professionalism, laboratory operations and clinical laboratory practice. All MLT lectures and laboratory exercises are taught by PCC MLT faculty. Clinical laboratory practice is supervised by trainers from affiliated laboratories under the coordination of the PCC Clinical Laboratory Practice Coordinator (referred to in this document as the CLP Coordinator).

During the first year of the Program students receive in-depth and comprehensive instruction in clinical laboratory science courses. Throughout the second year of the Program students receive instruction in more complex subjects such as immunology and infectious serology and hemostasis. They also perform their clinical internships during this time.

A. What are the educational goals or objectives of this program/discipline?

The MLT Program provides high quality technical education in an atmosphere that recognizes the potential of each student and supports a comprehensive and innovative approach to meet the needs of Oregon's health care community. The Program's goals and objectives are to:

- Act professionally and adhere to ethical & legal responsibilities toward consistent quality patient care.

- Apply knowledge of theory and principles of related content areas (e.g. clinical chemistry, hematology, microbiology, immunohematology, etc.) to the clinical laboratory setting in making appropriate professional decisions.
- Select, prepare, perform, correlate and evaluate appropriate laboratory procedures in a high quality, professional, accurate and timely manner.
- Recognize and identify technical, mechanical and physiological problems within the laboratory and effect resolution of problems according to the protocols of the institution.
- Function effectively as a contributing member of the laboratory team and the broader healthcare delivery system.

How do these compare with national or professional program/discipline trends or guidelines?

The MLT Program goals and objectives reflect the guidelines of our accrediting agency. The Program also receives updates regarding new trends and directions in the field from our national professional societies, the American Society for Clinical Pathology and the American Society for Clinical Laboratory Scientists. In addition, the MLT Advisory Committee advises the Program on needs and changes in the scope of practice in our area affiliate laboratories.

Have they changed since the last review, or are they expected to change in the next five years?

The Program goals and objectives have not changed since the last program review and are not expected to change in the next five years.

B. Briefly describe curricular, instructional, or other changes that were made as a result of your SAC's recommendations in the last program review and/or the administrative response. *(The administrative response can be found opposite your SAC's listing at the web page where the Program Reviews are posted – look for the "AR" pdf).* Note: Any changes NOT made as a result of the last program review should be described in the appropriate section elsewhere in this template.

The faculty works diligently to adapt the curriculum and programmatic structure to make them more student-centered. We continually seek ways to accommodate students with disabilities and make adjustments that assist a diverse student population, such as working students and students with families.

The following is an accounting of the SAC's recommendations and administrative responses from our last program review in 2015.

- SAC recommendation: That we maintain the MLT Student Lab located at Legacy Emanuel Hospital, and by recognizing the unique nature of this facility, the college commits to advocating for its continued use as appropriate.
    - Administrative response: The DOIs understand the importance of simulated "real world" industry experience and support the MLT's collaboration with Legacy Emanuel Hospital to provide lab space and experience for students in the MLT program.
    - Action/Outcome: Legacy Health Systems generously agreed to continue to provide space for the MLT Student Simulation Laboratory (SIM Lab) and it was moved from Legacy Emanuel Hospital to Legacy Good Samaritan Hospital. Both Legacy Health and Sysmex donated instruments and equipment. Thanks to their generosity, we were able to expand the size of the SIM Lab and offer students a more comprehensive laboratory experience in preparation for their clinical rotations.
- SAC recommendation: That the college recognize the laboratory activities associated with MLT classes are taught at a higher level than the current 'Lab A' designation and re-classify them as 'Lab B'.
    - Administrative response: When the Lab B was negotiated in the contract, it only applied (and was funded) for science courses in transfer disciplines, and not labs offered in CTE subject areas. For that reason, this request is subject to contract negotiation and administration.
    - Action/Outcome: The MLT SAC received approval for the designation of Lab A courses to Lab B.
- SAC recommendation: That the college support and help facilitate articulation and other such agreements with other colleges and institutions.
    - Administrative response: The DOIs and Dean of Academic Affairs support the development and maintenance of appropriate articulation agreements to facilitate transfer and improved educational opportunities for PCC students. Work has already begun to reinstate the OIT articulation and investigate the options for students transferring from Clackamas CC and Clark College into the MLT Program.
    - Action/Outcome: Agreements are in place between PCC, OIT, and Clackamas CC.
- SAC recommendation: That the college support the MLT Department in its efforts to research and determine the feasibility of reviving the distance learning program in the future.
    - Administrative response: The DOIs are open to the concept of reviving a collaborative statewide MLT program established on a more cost-

effective and sustainable foundation. PCC can no longer afford to pay for using facilities at other community colleges and partner sites.

- Action/Outcome: No change.

- SAC recommendation: That we maintain our current instructional support staff positions by replacing staff when they retire.
  - Administrative response: The DOIs understand the importance of Instructional Support staff in maintaining the quality and viability of CTE and laboratory programs. Specific staffing requests are prioritized at the campus level and submitted to the district for approval. Despite uncertainty of funding, enrollments, and other variables, refilling the IST position to be made vacant by the upcoming retirement remains a Cascade campus priority.
  - Action/Outcome: No reduction in staffing has occurred.
- SAC recommendation: That the laboratory classroom located in room 213 and the support lab located in room 212, both in Jackson Hall, be remodeled to address safety concerns and space and configuration requirements due to improvements made to instructional delivery.
  - Administrative response: Issues with safety and storage should be addressed immediately with requests to the Director of Allied Health Programs and the Division Dean for AHELS. Investments in other major facilities revisions remain subject to budget and timing considerations, especially in light of ongoing discussions of relocating the MLT Program to a new Health Education Center.
  - Action/Outcome: No remodeling.
- SAC recommendation: That the following technology initiatives be supported:
    1. Replacement of old and failing netbook computers with new laptop computers.
    2. Maintaining use of computer database services for Virtual Lab learning exercises.
    3. Increased use of automated analytical instruments in laboratory exercises.
  - Administrative response: Requests for computers, equipment, and software should be submitted to the Director of Allied Health Programs and the Division Dean for AHELS and will be prioritized along with other campus needs.
  - Action/Outcome: Replacement of old and failing netbook computers with new laptop computers did not occur. Maintaining use of computer database services for Virtual Lab learning exercises did not occur. Increased use of automated analytical instruments in laboratory exercises did not occur.

- SAC recommendation: That the college support faculty and staff endeavors to participate in continuing education activities.
    - Administrative response: The DOIs support funding for professional development through existing college processes at the district (POD), campus, and division levels. The MLT faculty and staff should work with the Director of Allied Health Programs and the Division Dean for AHELS to update professional development goals and plans, which could certainly include participation local trainings offered by our clinical partners.
    - Action/Outcome: Support for faculty and staff to participate in continuing education efforts continues.

2. Outcomes and Assessment: Reflect on learning outcomes and assessment, teaching methodologies, and content in order to improve the quality of teaching, learning and student success.

A. <u>Course-Level Outcomes</u>: The college has an expectation that course outcomes, as listed in the CCOG, are both assessable and assessed, with the intent that SACs will collaborate to develop a shared vision for course-level learning outcomes.

i. What is the SAC process for review of course outcomes in your CCOGs to ensure that they are assessable?

Each instructor is responsible for reviewing and updating course outcomes for the courses they teach. Each CCOG is reviewed at least once every other year. All CCOG's were reviewed this year in preparation for program review. Factors or indicators that may suggest the need to review course outcomes include student and Advisory Committee feedback. Certification examination scores also provide invaluable information due to the fact they are broken down by subject area and can help faculty identify courses that require improvement.

ii. Identify and give examples of changes made in instruction, to improve students' attainment of <u>course</u> outcomes or outcomes of requisite course sequences (such as are found in in MTH, WR, ESOL, BI, etc.), that were made <u>based on the results of</u> <u>assessment</u> of student learning.

MLT department faculty continually monitors students' academic progress by reviewing learning advancement in laboratory activities and performance on formative and summative learning assessments. Additionally, student course evaluations, informal complaints, feedback from the Advisory Committee, and evaluations of specific area scores from certification exams help to identify changes that are required at the course level. Examples include:

- Indicator: By reviewing exam statistics provided by D2L Brightspace, the instructor for microbiology was able to identify specific topics where a large portion of the class performed poorly. A discussion with the class, initiated by the instructor identified that some of the lesson objectives did not align with exam questions.
    - Action: The lesson objectives for microbiology courses were reviewed and revised as necessary to better align with course examinations.
- Indicator: By reviewing student performance on laboratory exercises and practicum exams for microbiology, the instructor observed that application of knowledge improved when students worked more independently and received periodic guidance from the instructor rather than direct instruction.

- Action: The student laboratory manual for microbiology was revised to provide more information about test procedures and testing algorithms. This resulted in more student engagement as active learners by providing more opportunities to analyze new situations, apply their knowledge, and evaluate their results rather than being "given" the information by the instructor. Students also received more hands-on practice performing laboratory procedures resulting in better performance on practicum examinations.

- Indicator: Lower performance by MLT 110 students on examinations.
  - Action: Redesign of the MLT 110 curriculum, which included the following:
    - Converting the course to a hybrid format to increase student access. Lessons are delivered in PowerPoint format in a narrated voice-over design.
    - Curriculum redesign focused on introducing the profession and the relevance of the clinical lab in the broader health care system.
    - Laboratory activities now focus on introducing the basic skills necessary to succeed in the Program and in the laboratory field.

Addressing College Core Outcomes

iii. **Update the Core Outcomes Mapping Matrix.**

See Appendix B

B. Assessment of Core Outcomes (LDC) or Degree and Certificate (CTE) Outcomes.

i. Reflecting on the last five years of assessment, provide a brief summary of one or two of your best assessment projects, highlighting efforts made to improve students' attainment of the Core Outcomes (LDC-DE disciplines) or Degree and Certificate Outcomes (CTE programs). ***(If including any summary data in the report or an appendix, be sure to redact all student identifiers.)***

For the 2017-2018 assessment cycle, the SAC assessed the following degree outcome: "Act professionally and adhere to ethical and legal responsibilities toward consistent quality patient care." For the 2018-2019 assessment cycle, the SAC decided to assess the following degree outcome: "Select, prepare, perform, correlate and evaluate appropriate laboratory procedures in a high quality, professional, accurate and timely manner."

The assessment project design for both projects was based on the following: Each student must complete approximately 800 hours of Clinical Laboratory Practice (CLP) to complete the MLT Program. Laboratory-affiliated trainers (external to PCC) evaluate each student based on the observation of their performance, using the clinical evaluation rubric (*see Appendix C*). The rubric describes 3 levels of achievement (rubric sections), which correlate with the MLT Program Outcomes. The MLT department utilized the data from the CLP evaluations to determine student achievement of Program outcomes. This assessment was performed using data from 2017 and 2018. Evaluations from all students in all areas of the laboratory were utilized for both assessments.

Graduates of the MLT Program are eligible to sit for the National MLT Certification Exam administered by the American Society for Clinical Pathology (ASCP). The competencies tested and described in the ASCP Board of Certification examination content guidelines (knowledge and application, technical skills, problem solving and decision making, communication, and teaching and training responsibilities) are such that they can be used to assess 4 of the MLT Program outcomes. Each year, ASCP distributes a summary of the program results and its comparison to the national results to each program in the country. The MLT department utilizes the data from ASCP exams to compare attainment of degree outcomes by program graduates. These assessments were done using data from 2017 and 2018. Scores from all students that took the ASCP exam were utilized.

Performance benchmarks for each criterion in the student assessment is set at "Satisfactory" using a Likert scale as described in the clinical laboratory practice evaluation rubric (*see Appendix C*).

Fig. 2.1
Clinical Practice Evaluation Scores – 2017

2017 Graduates	BB			CHEM			HCU			MICRO			PHLEB			ALL ROTATIONS		
	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof
2017 CUMMULATIVE	BB			CHEM			HCU			MICRO			PHLEB			ALL ROTATIONS		
	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof
PROGRAM Average	4.2	4.4	4.5	4.3	4.4	4.5	4.2	4.4	4.5	4.3	4.4	4.6	4.3	4.2	4.5	4.3	4.4	4.5
Difference for 2017	3.7%	5.4%	4.5%	1.2%	1.6%	2.3%	2.3%	2.6%	4.9%	8.8%	9.2%	7.2%	2.4%	6.2%	3.3%	3.7%	5.0%	4.4%

Fig. 2.2
Clinical Practice Evaluation Scores – 2018

2018 Graduates		BB			CHEM			HCU			MICRO			PHLEB			ALL ROTATIONS		
		Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof
PROGRAM	Program Avg.	4.4	4.6	4.7	4.3	4.5	4.6	4.3	4.5	4.9	4.5	4.5	4.6	4.6	4.8	4.9	4.4	4.6	4.7
	SD	0.5	0.4	0.4	0.7	0.6	0.5	0.5	0.5	0.9	0.7	0.7	0.5	0.5	0.3	0.3	0.6	0.5	0.6

2018 CUMMULATIVE	BB			CHEM			HCU			MICRO			PHLEB			ALL ROTATIONS		
	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof	Know	Perf	Prof
PROGRAM Average	4.2	4.4	4.5	4.3	4.4	4.5	4.2	4.4	4.6	4.4	4.4	4.6	4.3	4.3	4.5	4.3	4.4	4.5
Difference for 2018	4.7%	4.4%	2.9%	0.2%	2.7%	1.0%	1.1%	2.5%	7.0%	2.1%	1.1%	0.4%	7.4%	12.0%	7.9%	3.1%	4.5%	3.8%

Results from the 2017 and 2018 clinical practice evaluations show that the Program average scores are above the benchmark for all areas assessed, in all clinical practice rotations. Additionally, all students achieved scores above the benchmark in all areas assessed, in all clinical practice rotations (see Fig. 2.1 and Fig. 2.2).

Results from the ASCP board exams also show that the 2017 and 2018 student cohorts achieved scores that are well above the national average (data available upon request).

The MLT Program completed its restructuring project in 2017. Since that time, we have continued to make minor changes to curriculum content and sequence based in part on qualitative data, such as student feedback. Quantitative data in the form of evaluations and certification exam scores continue to indicate consistent student mastery of program outcomes.

ii. Do you have evidence that the changes made were effective by having reassessed the same outcome? If so, please describe briefly.

Since inception of the Student Success Plan in 2018, a review of total grades earned among the MLT courses since 2013 shows a dramatic decline in the number of students earning less than a "C" grade. Subsequently the data also shows a decline in the number of students failing and being dismissed from the MLT Program. Over the time period between 2013 and 2018, failure rates in MLT Program courses ranged from 3% to as high as 17%. The higher percentage of failures occurred in several of the upper level program courses. In particular, these students would have spent time and tuition money on the Program courses to that point and would now not be able to graduate with a degree nor the ability to obtain employment in the field. This system is helping to promote student success and increase graduation rates of the Program.

The Student Success Plan system has been used with no less than 8 students to date, 3 of whom have graduated, passed the board exam, and are now employed. The remaining students are still in the program and progressing satisfactorily through their courses. This system appears to potentially reduce the amount of failure and attrition in the program, as evident by our pre-program, open-enrollment course which has had an average 12% failure rate and an 8% attrition rate (withdrawal) over the last 4 years. The attrition and failure rate of the open-enrollment course is evidence for retaining a closed admissions process. NAACLS requires all MLT training programs to maintain a minimum attrition rate (voluntary or involuntary) and they set a benchmark that 70% of students enrolled within a 3-year period must graduate from the program. Attrition and failure rates higher than 30% generate inspection and a

probationary period that can result in the program's accreditation being revoked.

The Final Exit Interview system has been used four times and has provided a system to allow students who voluntarily withdraw from the program and who are in current good academic standing to be placed on a temporary leave with a guaranteed re-admittance to the Program within one year. This benefits students in that they do not have to apply to be readmitted to the Program, they do not lose the course credits and tuition spent on prior courses, and are able to continue their studies from the point at which they stopped. This system cannot be applied in all cases, but it is a mechanism to help students succeed and the MLT department attempts to implement this system where possible. This system has revealed that many students lack adequate health care insurance and/or are in great financial need. In at least one case, this system allowed for a student to take a medical leave of absence and be readmitted into the next year's cohort.

Prior to 2016, the MLT department curriculum underwent a restructuring and redesign to place all program courses within a closed cohort that is selected by an admissions process. This redesign may also contribute to some of the changes seen in attrition and grade failure throughout the Program, but the exact reason is not clear to us at this time.

iii. Evaluate your SAC's assessment cycle processes. What have you learned to improve your assessment practices and strategies?

The MLT SAC utilizes two primary instruments for collecting the data used in assessment projects. The first instrument is the final evaluation of student performance in Clinical Laboratory Practice (CLP) courses; MLT 271, 272, 273, and 274. Laboratory-affiliated preceptors evaluate each student based on observation of their performance using the clinical evaluation rubric (*see CLP Evaluation Form and Rubric Guidelines in the Appendix C & D)*. The rubric consists of three areas of assessment that correlate with the three learning domains:

- Knowledge & Application of Knowledge – Cognitive domain
- Performance – Psychomotor domain
- Professional Skills – Affective domain

Performance benchmarks for each criterion in the student assessment is set at "Satisfactory" (a score of 3) using a Likert scale as described in the CLP evaluation rubric.

Evaluations from all students in all areas of the laboratory are utilized due to the small sample size. The MLT department utilizes the data from the CLP evaluations to determine the level of achievement in each learning domain for each area of the laboratory.

The results for the last five years demonstrate that the Program average scores are above the benchmark for all areas assessed, in all clinical practice rotations. Additionally, all students achieved scores above the benchmark in all areas assessed, in all clinical practice rotations. Due in large part to the consistency of the results from year-to-year, the SAC is exploring other ways to analyze the data in order to identify areas to make meaningful improvements.

The second instrument used in assessment projects is the Program Performance Report, published by The American Society for Clinical Pathology (ASCP). It is distributed annually to every MLT program whose graduates sit for the MLT Board of Certification exam. Graduates of the PCC MLT Program are eligible to sit for the MLT ASCP board of certification examination as well as equivalent examinations offered through other certification agencies.

The competencies tested and described in the ASCP Board of Certification examination content guidelines (knowledge application, technical skills, problem solving and decision making, communication and, teaching and training responsibilities) are such that they can be used to assess the following MLT Program Outcomes (*see ASCP Exam Content Guidelines in the Appendix E*):

- Apply knowledge of theory and principles of related content areas (e.g. clinical chemistry, hematology, microbiology, immunohematology, etc.) to the clinical laboratory setting in making appropriate professional decisions.
- Select, prepare, perform, correlate and evaluate appropriate laboratory procedures in a high quality, professional, accurate and timely manner.
- Recognize and identify technical, mechanical and physiological problems within the laboratory and effect resolution of problems according to the protocols of the institution.
- Function effectively as a contributing member of the laboratory team and the broader healthcare delivery system.

Data from the Program Performance Reports for the last five years demonstrate that graduates of the Program score, on average, 32% higher than the national average on the exam. Additionally, during the same time period, between 83% and 97% of the Program graduates achieved scores above the national average in each individual area of the exam.

iv. Are there any Core Outcomes that are particularly challenging for your (LDC-DE) SAC to assess, or difficult to align and assess within your (CTE) program? If yes, please identify which ones and the challenges that exist.

The MLT SAC generally finds it more challenging to integrate environmental responsibility into the clinical laboratory curriculum. Laboratory waste such as reagents and test kits, disposable gloves, and instruments all add to the environmental burden and cost of healthcare. The clinical practice courses, MLT 271, 272, 273, and 274 have been identified as the best courses to emphasize environmental awareness related to medical waste. Students explore the necessity, safety risks, and correct disposal and care of all laboratory consumables.

v. CTE only: Briefly describe the evidence you have, determined by direct assessment, that students are meeting your Degree and/or Certificate outcomes.

Degree and Core outcomes are imbedded within the MLT curriculum. The course outcomes for each MLT course have been mapped to each of the program outcomes (*see Mapping of MLT Course Outcomes with MLT Program Outcomes in the Appendix F*). Lecture exam scores are one indicator of students satisfactorily meeting program outcomes. The lab evaluation rubrics contribute towards a student's overall grade in a course, so course pass rates are a second indicator of students meeting our outcomes. All instructors give extensive written feedback to the students in their courses. Students must demonstrate a minimum level of competence and those falling below the minimum level are placed on a student success plan (see section 2.B.i).

A third measure is the feedback we receive from clinical preceptors regarding student performance. The MLT Program has developed extensive evaluation rubrics, which are scored by the clinical preceptors and reviewed by the PCC MLT instructor who handles practicums. Students must demonstrate a minimum level of competence to pass each rotation. Performance benchmarks for each criterion on the student CLP final evaluation is set at "Satisfactory" (a score of 3) using a Likert scale as described in the CLP evaluation rubric. Students falling below the minimum level of competence may require remediation. Student CLP evaluations provide direct evidence that our students are meeting the Program Outcomes (see section 2.B.iii).

3. Other Instructional Issues

A. Please review the data for course enrollments in your subject area. Are enrollments similar to college FTE trends in general, or are they increasing or decreasing at a faster rate?

It is difficult to arrive at a meaningful decision with regards to recent enrollment patterns for our program due to our restructuring efforts between 2014 and 2016. For the 2013-2014 academic year, our student FTE was 79.81 as we had both a first-year cohort and a graduating second-year cohort. However, the following year student FTE dropped to 72.31, a decrease of 9.4%. We did not accept students for a new first-year cohort due to program restructuring activities. For the 2015-2016 academic year, student FTE was 53.81, a 25.6% decrease over the previous year. Though we had accepted a new first-year cohort, we did not have a graduating second-year cohort, nor did we have distance-learning students as that enrollment option was discontinued. In 2016-2017, we saw our FTE jump to 75.58, a 40.5% increase due to having both first and second year cohorts again. In 2017-2018, student FTE dropped slightly to 72.48, a drop of 4.1%

If the 2014-2015 and 2015-2016 academic years are removed from consideration, and student FTE from 2013-2014 (79.81) is compared to FTE for 2016-2017 (75.57), then there is a decrease of 5.4%. The SAC would argue that this decrease is likely due to the discontinuation of the distance-learning option. In any case, college wide FTE is trending downward at essentially the same rate.

The industry continues to undergo lab restructuring and consolidation, reducing the number of available laboratories that may be used for clinical training. This has lead to a reduction in the number of training sites, particularly in microbiology and blood bank. This trend is not unique to our Program, but universal within the field of Medical Lab Science education, even to the point of multiple programs closing their doors. MLT faculty is currently working with MLT Advisory Committee members to alleviate scheduling challenges that will allow us to increase enrollment without overburdening our remaining affiliate sites. The use of SimLab for a portion of the training in these areas is being piloted this spring as a possible means to work around these limitations. Additionally, smaller clinics are being utilized in a greater capacity than in the past, which has freed up training time for students in lab areas that are only offered at a larger site. Faculty will continue to work toward finding a permanent resolution to these challenges, including exploring distance options.

What (if any) factors within control of your SAC may be influencing enrollments in your courses?

The MLT SAC has recently been compelled by the realities of the industry to limit enrollment in the MLT Program courses as described above. Factors affecting enrollment in our one open enrollment course, MLT 110, are more difficult to

elucidate. Prerequisites for MLT 110 may be limiting access to the course, which in turn limits eligibility to the Program.

The MLT SAC has explored considerably what may be affecting our enrollment in MLT 110. Possibilities include:

- High financial cost of course due to 4 credit designation
- Low visibility of the profession in general, and amongst younger students, in particular
- Limited ability for distance students to participate, where jobs are most plentiful
- Student scheduling conflicts between MLT 110 and other courses as well as employment
- Prerequisites for the course may be limiting access:
    - CH 104 or CH 221 or equivalent
    - BI 121 or BI 231 or equivalent
    - MTH 95 or any course for which MTH 95 is a prerequisite
    - WR 121 or equivalent or any course for which WR 121 is a prerequisite

The SAC has worked to address these issues by making a number of recent changes. Among them, decreasing the number of credits in MLT 110 from 4 to 3, changing the course to a hybrid format and rearranging the days the lab section is offered to better align with other college courses. Additionally, SAC is reviewing prerequisites in an effort to lessen restrictions and align with high school course work.

We have also changed the number of credits for some courses to better address the complexity of the material and accommodate students who need more practice or time to digest the material. Currently, we are looking at ways to increase the visibility of the Program as noted below.

What (if any) factors within control of the college may be influencing enrollments in your courses?

Limited classroom space further limits enrollment in the MLT Program. Due to the highly specific nature of training, proper assessment of psychomotor skills, use of equipment, and unique safety considerations, class size for MLT labs must be limited to 10-12 students. It should be noted that students are working with real patient specimens that pose a biohazard threat under crowded conditions. A second lab space that meets biosafety level 2 specifications would help in this endeavor.

The field of laboratory science is a hidden one. Unlike other healthcare professions, laboratory professionals work behind closed doors away from the public eye. As such, students do not often know this field exists. Current efforts to advertise our Program through the college's Advertising and Marketing division are sorely inadequate. MLT

staff is working to improve visibility through outreach into area high schools, job fairs, etc. A realignment of duties among staff has been made to make this outreach possible.

B. Please review the grades awarded for the courses in your program. What patterns or trends do you see?

The Program requires that students maintain a GPA of 2.00. In addition, students must earn a minimum grade of 'C' for all MLT courses. Once enrolled, students are successful, as demonstrated by an average 82% completion rate and 100% pass rate on the national board certification exam. Only two students in the past three cohorts have been unsuccessful due to academic performance.

Are there any courses with consistently lower pass rates than others?

For the last 3 years, MLT 110 grades have been consistently lower than that of other MLT courses, with an average passing rate of 75%. This is expected for an open-enrollment exploratory course.

Why do you think this is the case, and how is your SAC addressing this?

Faculty has sought to determine what are the commonalities between students who are less successful in their academic performance. These students have identified to faculty a number of reasons for their poor performance. Some of the reasons they state include:

- Inadequate study skills necessary to be successful
- Unrealistic expectations around employment and study hours
- Family obligations and other outside commitments

Once accepted into the Program, students are assigned to an academic advisor in the department. They are required to meet on a regular basis to develop a plan for success and to ensure they are meeting Program goals and objectives. When academic performance falls below minimum standards, faculty work closely with students to develop remediation activities. For example, in the 2017-18 cohort, 5 out of 20 students required remediation through the SimLab, where they received additional practice to meet competencies. As a result, all 5 students graduated on time, passed their board certification exams and found jobs.

C. Which of your courses are offered online and what is the proportion of on-campus and online?

Currently, no MLT courses are offered completely online. The medical laboratory profession requires development of specific and numerous psychomotor skills that are not conducive to online learning. The proportion of on campus classes to online classes is therefore, 100% and 0%, respectively. Two courses are currently offered in a hybrid format, with online lectures and campus-based laboratory activities.

MLT SAC is exploring the addition of an online option, as a way to expand our Program while addressing MLT shortages in rural areas across the region. This would necessitate a deep commitment from distance partners to deliver effective laboratory instruction.

For courses offered both via online and on campus, are there differences in student success?

Not applicable.

If yes, describe the differences and how your SAC is addressing them. When referencing classes taught online, it is acceptable to refer to those offerings as 'OL.' In the PCC vernacular, 'Online Learning' has replaced 'Distance Learning (DL)' in the PCC vernacular due to the recent name change of the Online Learning Division.

Not applicable.

D. Has the SAC made any curricular changes as a result of exploring/adopting educational initiatives (e.g., Community-Based Learning, Internationalization of the Curriculum, Inquiry-Based Learning, etc.)? If so, please describe.

The department has implemented the use of Open Educational Resources, providing students with free and low-cost access to digital versions of textbooks and other resources. We have also decreased the number of textbooks students are required to purchase and/or allow students to utilize previous, less-expensive editions, as appropriate. The Program is working to create a free version of the Cell Atlas that students currently use by taking high quality photos of cells and compiling it into a free resource.

E. Are there any courses in the program that are offered as Dual Credit at area high schools? If so, describe how the SAC develops and maintains relationships with the HS faculty in support of quality instruction.

SAC is currently looking into the feasibility of offering MLT 110 as a dual credit course, specifically by targeting area high schools that are known for preparing students to enter careers in healthcare, such as Benson and Beaverton. The Dean of Allied Health, Emergency, and Legal Services, the Director of Allied Health Programs, and the MLT Program Director are members of the Benson High School Advisory Committee and are working to forge stronger connections.

F. Please describe the use of Course Evaluations by your SAC. Have you created SAC-specific questions?

Each instructor reviews their course evaluations and uses feedback to improve classroom instruction. In lieu of SAC-specific questions, a post-graduate survey is sent to students 6 months after they graduate from the Program. Rather than focusing on individual courses, the survey asks graduates to provide detailed feedback on overall Program satisfaction and to identify areas needing improvement.

Do you have a mechanism for sharing results of the SAC-specific questions among the members of your SAC?

Yes, the results of the survey are compiled and shared at the spring SAC meeting.

Has the information you have received been of use at the course/program/discipline level?

Yes, it has. Feedback from the post-graduate survey is used to make changes to coursework and curriculum. For example, a greater focus on molecular techniques has recently been implemented and lab exercises for body fluids have been developed, as students felt underprepared in these areas.

4. Needs of Students and the Community

A. Have there been any changes in the demographics of the student populations you serve? If there have been changes, how have they impacted curriculum, instruction, or professional development, and, if so, in what way?

With respect to gender, no real shifts have been seen and the breakdown has remained rather steady at 70% female and 30% male/other gender (see table below). This data reflects a historically typical gender distribution of workers in the profession across the entire US.

Program Review Data Profiles
Collegewide and Campus Demographics by Subject
Institutional Effectiveness Office, 2018-19 Program Profiles 5 Year Trend.

Subject: Medical Laboratory Technology-MLT

Campus: Cascade

Demographics by Subject; Gender

	2013-14		2014-15		2015-16		2016-17		2017-18	
Gender	Headcounts	% of Total Headcounts	Headcounts	% of Total Headcounts	Headcounts	% of Total Headcounts	Headcounts	% of Total Headcounts	Headcounts	% of Total Headcounts
Female	111.0	75.5%	118.0	79.7%	114.0	83.2%	99.0	75.6%	86.0	70.5%
Male	35.0	23.8%	27.0	18.2%	21.0	15.3%	25.0	19.1%	27.0	22.1%
Unreported	1.0	0.7%	3.0	2.0%	2.0	1.5%	7.0	5.3%	9.0	7.4%
Grand Total	147.0	100.0%	148.0	100.0%	137.0	100.0%	131.0	100.0%	122.0	100.0%

Note:
Source reports; SWRPRGE.
Source name; Gender by Subject
Author; nbr.

With response fields for gender limited to female, male, or other, this may not be truly reflective of the MLT student population. When the PCC recording systems are updated to recognize gender fluidity, then these statistics may change.

Since 2013, the student age demographic in the MLT program has shifted towards enrollment of younger ages (see chart below). The MLT program has seen the most increase in the number of students from the age group 20-24 years, increasing from 19% to 29%. MLT students in the age range of 25-49 years have decreased from 70% down to 64%, and a decrease has also been seen in the 50+ age group, moving from 8% down to 5% of the total population. The group less than 20 years of age has held rather steadily at approximately 3% for the seven-year time span since 2013. This younger age group represents the lower limit of age that a person could enter into this field.

Generally there is limited access to the hospital environment for this age group, even to volunteer. Clinical laboratories have somewhat tighter restrictions due to the BSL-2 environment. Typically persons under the age of 18 years are not allowed to work in the clinical laboratory environment due to the blood borne pathogen risk and vaccine requirements.

Program Review Data Profiles
Collegewide and Campus Demographics by Subject
Institutional Effectiveness Office, 2018-19 Program Profiles 5 Year Trend.

Subject
Medical Laboratory Technology-MLT

Campus
Collegewide

Demographics by Subject; Age

	2013-14		2014-15		2015-16		2016-17		2017-18	
Age Group	Headcount	% of Total Headcount	Headcount	% of Total Headcount	Headcount	% of Total Headcount	Headcount	% of Total Headcount	Headcount	% of Total Headcount
Under 20	4	2.7%	3	2.0%	1	0.7%	6	4.6%	2	1.6%
20-24	29	19.7%	36	24.3%	34	24.8%	38	29.0%	36	29.5%
25-49	103	70.1%	102	68.9%	92	67.2%	85	64.9%	78	63.9%
50+	11	7.5%	7	4.7%	10	7.3%	2	1.5%	6	4.9%
Grand Total	147	100.0%	148	100.0%	137	100.0%	131	100.0%	122	100.0%

Note:
Source reports; SWRPRAG.
Source name: Age by Subject.
Author; nbr.

Lastly, the MLT department has also seen shifts in race/ethnicities of its students (see chart below). The population demographics for students declaring themselves to be of white race/ethnicity have decreased from 67% down to 53%. Students who did not report race/ethnicity declined from 8% down to 3%. Of students declaring themselves as Asian race/ethnicity, an increase from 16% up to 23% was seen. The population of students declaring Hispanic race/ethnicity also increased from 7% up to 11%. Students declaring Multi race/ethnicity increase from <1% up to 7%. Students reporting Native/Pacific ethnicity held steady at approximately 1%.

Program Review Data Profiles
Collegewide and Campus Demographics by Subject
Institutional Effectiveness 2018-19 Program Profiles 5 Year Trend

Subject
Medical Laboratory Technology-MLT

Campus
Cascade

	Year									
	2013-14		2014-15		2015-16		2016-17		2017-18	
Race/Ethnicity	Headcounts	% of Total	Headcounts	% of Total	Headcounts	% of Total	Headcounts	% of Total	Headcounts	% of Total
Asian	23.0	15.6%	27.0	18.2%	33.0	24.1%	30.0	22.9%	28.0	23.0%
Black	3.0	2.0%	1.0	0.7%	3.0	2.2%	4.0	3.1%	3.0	2.5%
Hispanic	10.0	6.8%	8.0	5.4%	11.0	8.0%	16.0	12.2%	13.0	10.7%
Multi	1.0	0.7%	3.0	2.0%	3.0	2.2%	7.0	5.3%	9.0	7.4%
Native	1.0	0.7%					1.0	0.8%	1.0	0.8%
Pacific					1.0	0.7%				
Unreported	11.0	7.5%	12.0	8.1%	2.0	1.5%	5.0	3.8%	4.0	3.3%
White	98.0	66.7%	97.0	65.5%	84.0	61.3%	68.0	51.9%	64.0	52.5%
Grand Total	147.0	100.0%	148.0	100.0%	137.0	100.0%	131.0	100.0%	122.0	100.0%

Notes:
Source reports; SWRPRRE. Source name; Race Ethnicity by Subject. Author; nbr.

Other population demographics that have not been surveyed and are more anecdotal are that students in the MLT program appear to have a higher level of financial need than in the past. More students have to work part or full time to be able to attend school. This may be a factor of increased tuition costs, less availability for financial assistant (Pell Grants, scholarships, etc.), and the rising costs of living in the Portland-Metro area.

The MLT Program is exploring methods to increase diversity in the Program, especially in regards to under-represented and minority populations. One population of interest is American Indians and Alaskan Natives, as this represents less than 1% of the total enrollment for the last 5-10 years. The MLT Program Director (Teresa Wolfe) is collaborating with the OHSU Tribal Scholar's program to discuss routes for inclusion of their students into PCC's MLT Program. Discussions are planned for later this year to explore an inclusive pathway for these students. Efforts such as this will contribute to the strength and health of the MLT Program, increase the diversity of professionals entering the field, and support state and national workforce needs.

B. What strategies are used within the program/discipline to facilitate success for students with disabilities?

Student accessibility has been a focal point of discussion at the MLT Advisory Committee meetings. Historically, certain physical disabilities have limited student access to the Program. Working together, department staff, affiliates, and PCC's Disability Services have been able to implement appropriate accommodations and redefine essential functions necessary for employment. As a result, fewer barriers now exist.

For example, a recent graduate with a significant hearing and speech impairment was able to, not only successfully complete the Program, but has gone on to find gainful employment in the area.

The MLT Department coordinates academic accommodations through the Office of Students with Disabilities. Examples of accommodations that have been implemented in the past are:

- Allowing students to audio record lecture sessions
- Providing access to instructional materials through MyPCC & Desire2Learn (i.e. PowerPoint slides, lecture notes, handouts, videos, etc.)
- Extending time available to complete lecture examinations
- Providing a distraction-free environment during examinations, either in the Cascade testing center or in the MLT department
- Providing sign language interpreters for all classes, labs, and clinical rotation

The MLT department works closely with DS to ensure that the department provides resources that accommodate all students, with and without disabilities. We regularly seek DS guidance on a variety of issues that can assist all students. Some examples of processes that we have implemented in the department include:

- Combining all cohort courses into one D2L shell for ease of access to course materials, and providing resource notifications (job postings, healthcare access, housing assistance, and scholarship announcements).
- Using alternative methods of instruction (lecture activities, assignments, videos, field trips)
- Posting all course materials (lecture handouts, lab reports, and readings to D2L ahead of time
- Getting DS to provide tape recorder for lab, so students can record & post to D2L in the laboratory (outside electronics and personal items are not allowed in the laboratory due to the biohazard environment).
- Finding alternative equipment and resources to accommodate student needs or learning styles so that they can succeed (chairs for lecture, tables, lab equipment, etc.)
- Implementation of a student success plan that flags students who score lower than 70% on an exam at any time during the program. The system implements a safety net that involves the course instructor, the department chair, and the student to discuss study habits, accommodations, and needed resources for success.

If known, to what extent are your students utilizing the resources offered by Disability Services?

The MLT department coordinates with Disability Services to give a presentation to students during their MLT program orientation (Fall Term of the first year). The use of DS resources appears to have increased slightly, as we receive 1 – 2 DS requests per student cohort. Students must self-initiate a DS request to receive accommodations. They are not required to disclose disabilities nor use DS services.

The MLT department works closely with DS to provide needed DS accommodations to students. Beyond that, the MLT department works very closely with each new student cohort to make sure individual students are getting the resources they need, regardless of DS requests. Thus, MLT student utilization of DS resources may be less than other departments because the department and instructors maintain a close advising relationship with students in the program and adapt or make changes as situations arise to promote student success.

What does the SAC see as particularly challenging in serving these students?

Many of the challenges come from getting students to initially file a request with DS services and subsequently for the student to follow up with each instructor. This follow up process is particularly difficult, despite communicating the importance of working with the instructors to assure students get what they need to succeed. Many students view disability accommodations as a weakness instead of a resource to help them succeed. Students have anonymously commented that they were afraid or embarrassed to seek DS or to do a follow-up with instructors for fear of bias or grade discrimination by the department. The MLT Department Chair and MLT Faculty discuss the importance of DS resources during the MLT new student orientation and we emphasize to students that this service is designed to help them succeed.

The MLT Department has had past challenges with students being able to schedule exams in the testing center because our exams exist solely within D2L and they must be taken at the same time as the rest of the class. There are no paper exams and all MLT students take their exams on department-supplied laptops. After students have finished the exam, all students are convened back to discuss the exam content. Instructors review each question with the class to reconcile errors or misunderstandings and to review theory or content. This is done with every exam in every course within the Program. This method assists students in both learning the material and in preparing for the board of certification examination after graduation. Faculty makes a good-faith effort to make accommodations with regards to laboratory practicum exams. However, this is often very difficult due to the biohazardous nature of the required materials and limited suitable space.

C. What strategies are used within the program/discipline to facilitate success for online students?

The MLT department currently does not have online students. The department does combine all courses into one D2L shell and posts all materials to it for each course. While MLT students are not online students, MLT faculty uses the discussion board and online resources. Instructors also make use of PCC email to communicate with students, and can schedule Zoom conferencing as needed. The Department posts extensive lists of PCC and community resources on D2L for students. Additionally, many students record the lectures and the Department provides a place for them to post these within the D2L course shell using the Discussion Board. During times of campus closure due to weather, select lectures are audio recorded and made available for students.

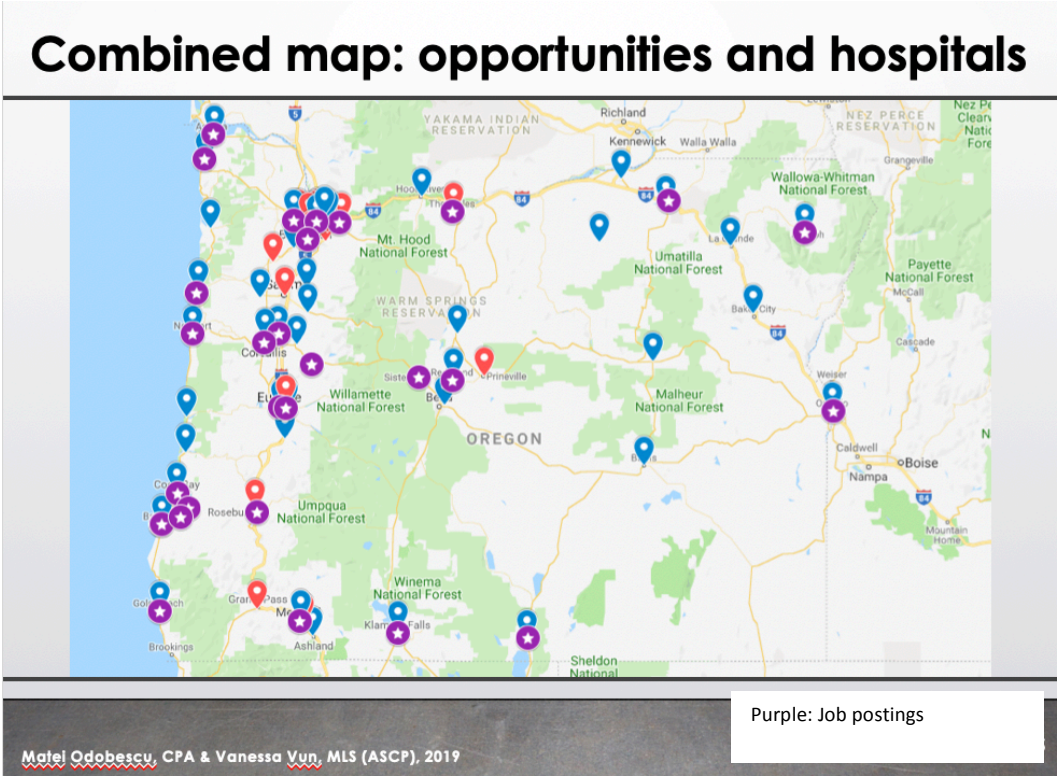
What does the SAC see as particularly challenging in serving online students?

The medical laboratory field is a very hands-on, technically oriented profession that requires practice of many psychomotor skills with a high level of hand-eye coordination. These skills cannot be practiced on a computer screen. The laboratory activities taught in the MLT program use blood and body fluids and students learn to appropriately handle, manipulate, and test these samples under the supervision of certified medical laboratory technologists. Students are learning skills and behaviors that they will be required to perform in the workforce. Students become proficient in these techniques through repeated practice, supervision by instructors, and receiving continual feedback on their performance. Instructors provide feedback for each student on their cognitive, psychomotor, and affective skills while performing each laboratory lesson. These three constructs are outlined by our accrediting agency, the National Accrediting Agency for Clinical Laboratory Science (NAACLS).

Several MLT advisory board members have explicitly expressed that they are not willing to hire graduates from an online program without a prior degree in the field of laboratory medicine. Their rationale is that students who attend online programs lack technical knowledge and possess low-level technical skills. There are several online clinical laboratory-training programs around the United States that consistently produce graduates that are inadequately trained and lack the necessary skills to function at an entry-level. Unfortunately, these programs are a primary reason for this perception.

One option under consideration is to offer the program in a hybrid format. The didactic portions of the program would be offered online, but students would be required to attend laboratory activities on campus. The logistics for this option require further exploration on part of the department.

The MLT department worked with a group of Oregon Health and Sciences Graduate students to create a feasibility study for developing an online MLT program at PCC. Data that emerged from this study includes: 29% of PCC credit students take both online and campus based courses, while only 14% participate solely in online courses (PCC Institutional Effectiveness, 2019). In Oregon, 53 out of the 62 (86%) major hospitals in the state are outside of the Portland area, and these statewide hospitals constitute 83% of the total job postings for laboratory professionals. The high number of positions outside the Portland area constitutes an unfilled workforce need in the State of Oregon (see figure below). This need supports the work being done to explore the possibility of offering a hybrid-format program.



D. Has feedback from students, community groups, transfer institutions, business, industry or government been used to make curriculum or instructional changes (if this has not been addressed elsewhere in this document)? If so, describe.

Feedback from current students, prior graduates, and the larger laboratory community is a critical element for maintaining a dynamic and relevant curriculum, and a strong driving force for change. The MLT department actively seeks feedback from advisory partners at each quarterly board meeting. Advice is discussed among faculty in the department and is used to make changes to the program.

Each MLT instructor reviews student course evaluations to make instructional changes. Reoccurring themes or items that would impact student development of professional skills are discussed at each SAC meeting. Additionally, the American Society for Clinical Pathology (ASCP) updates the MLT exam content guide almost annually and the National Accrediting Agency for Clinical Laboratory Science (NAACLS) posts annual updates to program standards. The MLT Program Director (Teresa Wolfe) presents these updates to MLT faculty at the annual pre-SAC fall meeting or when notifications of updates are received, and affected courses are discussed accordingly. Additionally, MLT faculty who attend the national American Society for Clinical Laboratory Sciences (ASCLS) Educators Conference learn of changes in industry practices and to governmental regulations and these are shared within the department. The MLT Program Director (Teresa Wolfe) also receives email and electronic newsletters from

state and federal government agencies (CDC, CLIA, HHS, OHA), and national organizations (ASCP, ASCLS, APHL, ASM), which are monitored for recommendations and mandates to industry practices that would elicit changes and improvements to the MLT curriculum.

CDC: The Centers for Disease Control and Prevention

CLIA: Clinical Laboratory Improvement Amendment

HHS: Department of Health and Human Services

OHA: Oregon Health Authority

APHL: Association for Public Health Laboratories

ASM: American Society for Microbiology

5. Faculty: reflect on the composition, qualifications, and development of the faculty

A. Provide information on how the faculty instructional practices reflect the strategic intentions for diversity, equity and inclusion in PCC's Strategic Plan, Theme 5. What has the SAC done to further your faculty's inter-cultural competence and creation of a shared understanding about diversity, equity, and inclusion?

The MLT department is committed to ensuring that all Program applicants are fairly admitted into the MLT Program. One way we currently use is to remove personal identifying information of the applicants and assess their admissibility by virtue of the information they provide on their application. Plans to continue to reduce implicit bias for students that are seeking entry into the Program are being investigated throughout all of the Allied Health programs at Cascade Campus. The MLT Program will adapt these changes in our ongoing effort to improve student diversity in our Program.

The MLT department continues to practice equity and inclusion by ensuring that students who need accommodations are supported. Faculty and staff participate in trainings offered through the college, as they are made available. The faculty are likewise interested in maintaining equity in the classroom. As a first-step in this direction, we have begun researching the book, Grading for Equity, by Joe Feldman. Our intention is to help identify and address bias that may exist in the way we design and administer learning assessments.

B. **Report any changes the SAC has made to instructor qualifications since the last review and the reason for the changes. Current Instructor Qualifications are available at:** http://www.pcc.edu/resources/academic/instructor-qualifications/index.html

Instructor qualifications were updated in January of 2016. The updates primarily addressed changes made to the Program structure rather than new curriculum. Two exceptions to this were new courses that were developed, MLT 105 and MLT 110. The SAC felt that the curriculum for these two courses did not require the same level of education that was being required for other courses in the Program. Current and prior instructor qualifications can be found in the Appendix G.

C. How have professional development activities of the faculty contributed to the strength of the program/discipline? If such activities have resulted in instructional or curricular changes, please describe.

Faculty and staff are encouraged to attend fall in services, and fall and spring SAC meetings. In addition, staff meets periodically to discuss department issues and student progress.

Maintenance of a relevant curriculum in this field requires more than just feedback and suggestions from industry partners, it requires an engaged faculty that are able to

participate in a variety of educational activities. For example, staff has attended/participated in the following:

- **NAACLS Workshop –** Provides valuable insights on the newly developed Standards for Accreditation of MLT programs.
- **Clinical Laboratory Educator's Conference (CLEC) –** This is the only conference anywhere that focuses on clinical laboratory education. The conference presents current trends in clinical laboratory education, which emphasizes the development of critical thinking and problem solving skills, online learning tools, flipped classrooms, and inter-professional learning activities. Attendees learn how their peer educators from other programs are addressing challenges such as limited externship sites and enrollment issues. Work done on the MLT Program re-structuring project was based, in part, on the knowledge and information gained from the Educator's Conference.

All staff members are required to maintain their certification, which requires participation in continuing education activities. The staff has traditionally participated in the Oregon Spring Seminar and/or the Northwest Medical Laboratory Symposium, both of which occur on alternating years in Oregon or Washington. These professional events are a primary means of staying abreast of the latest trends and innovations in the clinical laboratory sciences including cutting-edge research into new tests and methodologies, and state-of-the-art instrumentation. In addition, these types of events also offer unparalleled opportunities to connect with peers and colleagues, Program graduates, and other practicing laboratory professionals. The MLT Department sincerely hopes that the college will continue to support our efforts to maintain the relevancy of our Program and the curriculum through these and other professional activities.

6. Facilities, Instructional, and Student Support

A. Describe how classroom space, classroom technology, laboratory space, and equipment impact student success.

The lecture rooms in Jackson Hall at Cascade Campus offer computer and media equipment and connections, along with built-in projectors, white boards, acoustics/audio capabilities, and lighting. The lecture rooms have provisions for individuals with disabilities, and the College Office of Disability Services determines specific student accommodations. Many of the Jackson Hall lecture rooms are adequate for teaching laboratory medicine, but teaching the required high resolution microscopy (e.g. hematology blood cell identification and microbiology) would be significantly improved through the use of high definition monitors as opposed to the use of standard cloth projector screens.

The MLT laboratory (JH-213) in Jackson Hall has a built-in projector, white boards, and a computer connected to the projector. The MLT department has purchased water baths, centrifuges, differential counters, spectrophotometers and basic laboratory equipment such as various sized pipets and glassware; all housed within the cabinets in the laboratory. Several pieces of laboratory equipment (hematocrit centrifuges and spectrophotometers) are over 25 years old. They still work well and are functional, but can be costly to maintain or repair when malfunctions occur.

While working in JH-213, all students and PCC personnel are required to wear the appropriate personal protective equipment (PPE), which at a minimum includes gloves, lab coats, long pants, and closed toed shoes. Students are required to purchase disposable lab coats once per term or more frequently as needed. The MLT Department provides eye protection and gloves. The MLT department also provides writing utensils, paper, and any necessary other equipment like calculators and rules for use in the laboratory. These items do not leave the laboratory as they are considered biohazards once used in this space.

While the JH-213 laboratory was originally designed for both lecture and laboratory instruction, this is an outdated design that is no longer in compliant with current biosafety regulations. The JH-213 laboratory cannot be used for a typical lecture instruction where students bring in their own electronic equipment, writing utensils, paper, etc. Due to the human blood, body fluids, and microbial pathogens used in that room, the laboratory is classified at a biosafety level 2 (BSL-2). This is the minimum level at which all clinical diagnostic laboratories operate and is a function of working with human specimens. A BSL-2 designation restricts items that can be brought into the laboratory. For example: consumption of food and drink in the lab are never allowed; papers/note pads, pens/writing instruments, or personal electronic equipment cannot be brought into this laboratory. This is standard biosafety protocol for all BSL-2 facilities and is in accordance with BSL-2 guidelines from the Centers for Disease Control and

Prevention (CDC) and the American Society for Microbiology (ASM) guidelines for biosafety practices in teaching BSL-2 laboratories. These biosafety practices protect workers and students from laboratory acquired infections.

The JH-213 laboratory was remodeled over 20 years ago and is no longer sufficient to meet current student enrollment and disability needs. The workstations heights require the use of barstool style lab chairs, which are uncomfortable, often difficult to adjust, and do not accommodate persons of shorter stature. The barstool chairs have wheels similar to office chairs.

The workstation benches are fixed to the floor and that fact both reduces the overall floor space in the laboratory and the occupant load of the room. There is one workstation at the front of the room that can accommodate a wheelchair. The fixed design of the workstations and the support posts in the room prevent wheelchair access to other areas in the laboratory. Hence a student in a wheelchair would only be able to enter the lab through the main door and not the required support lab where coats and personal items are stored. This person would only have access to the front part of the room, would not be able to access the chemical shower in an emergency, would not be able to use the chemical fume hood, and would be able to access any of the countertops or work surfaces.

The JH-213 laboratory is 1181 square feet total, but with the fixed counters and workbenches, the overall space is reduced to 883 square feet of usable space (*see diagram in the Appendix H*). This is based on Oregon Fire code (1004.4 Fixed Seating). The laboratory was originally designed to accommodate 24 students, but according to current Oregon Fire code for occupant load in a shop/educational vocational space, the actual occupant load is much lower. There are "net" calculations that must be subtracted from the gross square footage. The "fixed items" include the permanently affixed tables, cabinets, and desks. The occupant load is determined by the "net" square footage and divided by a factor (20 for classrooms or 50 for vocational rooms) and this gives the final occupant load. Because the JH-213 laboratory is a vocational/shop area where students work with biohazardous samples and not just a lecture classroom, the net factor used is 50. So the occupant load is calculated at 883 square feet divided by 50 = 17.6 occupants. The Portland Fire Inspector provided these calculations when they toured the facility in January, 2020.

JH-212 is a multi-purpose instructional room used primarily as a "Student Support Laboratory" where students can study independently. JH-212 is 450 square feet and has individual workstations, enough to accommodate 6 – 8 students. This room houses cabinets containing 30 microscopes, a large movable electronic-bay cart containing 25 laptop computers, and an microbiology incubator that houses the current organisms being propagated. The front part of this room is also used to store student's personal belongings that are not allowed in JH-213 as that room is designated an area where biohazardous material is present.

While the JH-212 space is intended to be used by students to complete make- up labs, small group independent lab exercises, team learning experiences and independent study using the MedTraining online tutorials from University of Washington, the room is a mixture of clean area and biohazard area space. Yellow tape on the floor marks the clean from the biohazard space. This is a difficult space to monitor, as students walk in and place their personal items on the opposite countertops. These countertops are considered biohazard spaces, as they are next to the microbiology incubator and where the students often perform makeup labs using human specimens. A remodel or reorganization of this space is needed to both comply with biosafety regulations and to prevent the spread of laboratory acquired infections.

Room JH-222 is a central storage area that is shared with the science programs and is approximately 1000 square feet. The room has a shared autoclave and glassware washer. This area houses the MLT designated refrigerator and freezer. Areas specifically designated for the MLT department in this space include the MLT Prep area (190 sq. ft.), where the AP instructional support technician prepares chemical reagents, propagates microbiological organisms, and designs laboratory exercises and practicum exams. A shared media prep area (room JH 222B - 140 sq. ft.) contains a laminar flow hood and is used to make bacteriological media for the microbiology courses. A shared, locked -80C freezer contains the frozen prepared microbiological cultures used in the MLT microbiology courses.

The PCC MLT Program Simulation Laboratory (SimLab) is located at Legacy Good Samaritan Hospital (550 sq. feet) in NW Portland. This laboratory space is generously donated by Legacy Health Systems and is not owned by PCC. The lab is equipped with a hematology analyzer, a chemistry analyzer, a coagulation analyzer, a blood bank gel system, a MicroScan bacterial identification system, 2 microbiological incubators, centrifuges, a Class II biosafety cabinet, laboratory refrigerator, freezer and safety devices. Many of the instruments in this laboratory have been donations received from the MLT clinical affiliates or have been purchased directly by the PCC MLT department. Maintenance and repair of these instruments are the responsibility of the PCC MLT department. The SimLab provides five individual student workstations and one trainer's workstation.

As the medical laboratory industry has become more automated it is very important to provide our students with experience in automated instrumentation before they attend clinical rotations at area hospitals and clinics. The PCC campus laboratory activities provide the theory and methodology of the diagnostic tests students are learning to perform and also provides them with the opportunity to learn basic lab skills and biosafety techniques. The SimLab removes the academic atmosphere of the classroom laboratory and immerses students into a real world setting of the clinical laboratory. This transition is very necessary to help students develop affective and psychomotor skills and multitasking dexterity needed for this type of environment. Development of

these traits better prepares students for their clinical rotations by removing some of the anxiety related to working in this high stress environment.

Each year the department submits a capital budget request, which is considered with other campus needs. The administrative responses to department needs have been driven by statewide and College fiscal realities.

The following items are currently on the MLT 2019 – 2020 equipment needs list:

Multi-Headed Microscope .....1 at $30,000
Laptop computers (replacement) .....25 at $800 each
Microhematocrit Centrifuges.....2 at $2,300 each
Molecular testing equipment.....4 at $900 each

B. Describe how students are using the library or other outside-the-classroom information resources (e.g., computer labs, tutoring, Student Learning Center). If courses are offered online, do students have online access to the same resources?

The Support Lab (JH212) has a small library of books used by students for additional study resources. The SimLab has a collection of atlases and other reference books used by students and the trainer to complement SimLab activities. Students have access to numerous online learning resources posted to the Desire2Learn (D2L) course shell to enhance and complete their academic, SimLab and Clinical Laboratory Practice experiences. These resources include various tutorials related to WBC differentials, RBC morphology with Self-Test, and Urinary Sediment with Self-test. Various videos such as blood banking techniques, pipetting techniques, hematological techniques are available. In addition, there are picture galleries covering colonial morphology, Gram stain morphology, RBC morphology, WBC morphology, urinary sediment, body fluids differentials, parasitology and mycology. Students can access the University of Washington Med Training web site (http://www.medtraining.org/) for numerous tutorials (with quizzes) and webinars. Most of these provide continuing education (CEU) credits. In addition to PCC's extensive library facilities, each clinical affiliate also has atlases, other specialty book resources, and Internet access for students.

C. Does the SAC have any insights on how students are using Academic Advising, Counseling, Student Leadership, and Student Resource Centers (e.g., the Veterans, Women's, Multicultural, and Queer Centers)? What opportunities do you see to promote student success by collaborating with these services?

Students meet the admissions specialist prior to admission to the MLT Program. The admissions specialist helps students assess prerequisites, apply for admission, and enroll in classes upon admission. Each student also meets with the dedicated Perkins advisor each term during the first year of the Program. Starting the third term of the Program, first year students are assigned to a designated program instructor (one of

the 3 MLT instructors) for advising. Students are required to meet each term with their designated instructor thereafter to review their academic progress and performance, to ensure they are on track to graduate. Students are advised of scholarship opportunities from Academic Advising, the Student Resource Center, and from other sources as they become available. Scholarship opportunities are posted to the D2L Brightspace MLT course shell and sent out via email to students.

The MLT Program encourages students to utilize the PCC counseling services. Every fall during the MLT Program student orientation, representatives from the PCC counseling center are invited to give a presentation to the incoming cohort. Students are made aware of the counseling services available, why they might chose to use the counseling center, and are guided toward appropriate support services. During this same orientation session, representatives from Disability Services (DS) and the Library are invited to give presentations on their respective resources. DS provides information on the accommodations available for students with disabilities, such as interpreters for hearing-impaired students or students requiring special conditions for taking exams. The Library representative discusses the extensive materials, resources, and electronic equipment available for use at the PCC library, including electronic items that can be checked out and taken home.

During the second year of the Program, Career Services representatives give a presentation to students on resumes, cover letters, and developing good interviewing skills. Students are encouraged to seek out additional help from Career Services during the last six months of the program. These efforts improve students' ability to successfully apply for jobs, enter the workforce and pursue career goals.

Lastly, students are made aware of the vast array of resources such as the Student Leadership, Student Resources Center, the Food Pantry, Women's Center, ASPCC emergency grants and loans, etc. at both the MLT Program student orientation and through the D2L Brightspace MLT course shell. A link to the "Student Life" page is discussed and posted to D2L. Within D2L, the MLT department posts an extensive list of resources for food, housing, transportation, and finances that are available both within PCC and in the surrounding communities.

Note to LDC-DE SACs: In your report, put N/A for Section 7 and continue with Sections 8 and 9.

7. <u>Career and Technical Education (CTE) Programs only:</u> To ensure that the curriculum keeps pace with changing employer needs and continues to successfully prepare students to enter a career field…

A. Evaluate the impact of your program's advisory committee on curriculum and instructional content methods, and/or outcomes. Please include the minutes from the last three advisory committee meetings in the appendix.

Throughout the history of the MLT Program, the MLT department has sought input from the laboratory community for curriculum recommendations and program planning. The design of the MLT Program advisory committee is based on PCC advisory committee guidelines and on the MLT department goal to seek a broad representative voice from our laboratory community. The MLT advisory committee provides a valuable perspective for long-range planning and curriculum change.

Based on past recommendations and assistance from our advisory committee, the MLT department has:

- Enhanced the MLT Program curriculum by adding discussion topics and lessons to courses such as Point-of Care testing and work ethics.
- Modified Program structure, sequence, curriculum and assessment. This occurred in 2015-2016 and resulted in some existing courses being broken apart and others recombined to create new courses. The assessment rubric for CLP evaluations was modified to make it more user-friendly for clinical preceptors.
- Modified admission criteria and pre-requisites. Changes to the admissions criteria have included a new scoring rubric for application essays and more directed topics for applicants to write about. For example, question number one, regarding program success attributes states: "Adaptability, Task Management and Troubleshooting/Problem Solving are important attributes for success in the MLT program. Choose ONE of these attributes you consider a strength and explain why you consider it a strength and how you believe this will help you to be successful in the program. Provide at least one example to support your response."
- Received numerous donations of used equipment and supplies such as protein electrophoresis equipment.
- Formed a PCC Foundation endowed scholarship (Gwendolyn Brewer) for MLT students.
- Revised the Essential Functions for MLT's document. Outdated language in the document that was biased and/or exclusionary with regards to disabilities and functionality was removed in an effort to increase inclusivity.

B. Describe current and projected demand and enrollment patterns for your program. Include discussion of any impact this will have.

Enrollment in the Program is limited by the availability of clinical sites and campus laboratory space. Staff is looking at expansion through distance sites, but the DL program would have to be structured differently (traditional hospital-based structure with online lessons).

PCC's MLT Program is the only one in the state of Oregon. There is one MLS program offered through Oregon Institute of Technology (located in Wilsonville), and one Clinical Laboratory Assistant program offered through Clackamas Community College. These three programs provide the bulk of the staff for laboratories throughout the state.

C. How are students selected and/or prepared (e.g., prerequisites) for program entry?

Admissions process:
Allied Health has an Admissions Coordinator who aids the MLT department with marketing and student admission. Prior to applying to the MLT Program, prospective students must complete the prerequisite coursework as outlined in the MLT Advising Guide (see below).

Students are selected based on a competitive point system as outlined in the MLT Advising Guide. Approximately 20 – 24 students are admitted annually.

Institutional effectiveness data shows a disproportionate number of Caucasian students admitted versus non-Caucasian students based on the number of applications received. In response, the admissions process is currently under review with revisions intended to remove unintentional bias from the selection process and better align with other allied health admissions policies. For example, this year we have included a volunteer external to the MLT department and PCC to read and score applicant essays.

Program prerequisites:

- WR 121
- MTH 95
- BI 121, 122 (or higher)
- CH 105, 105, 106 (or high)
- MLT 110 Intro to MLT
- Recommended: MP 111

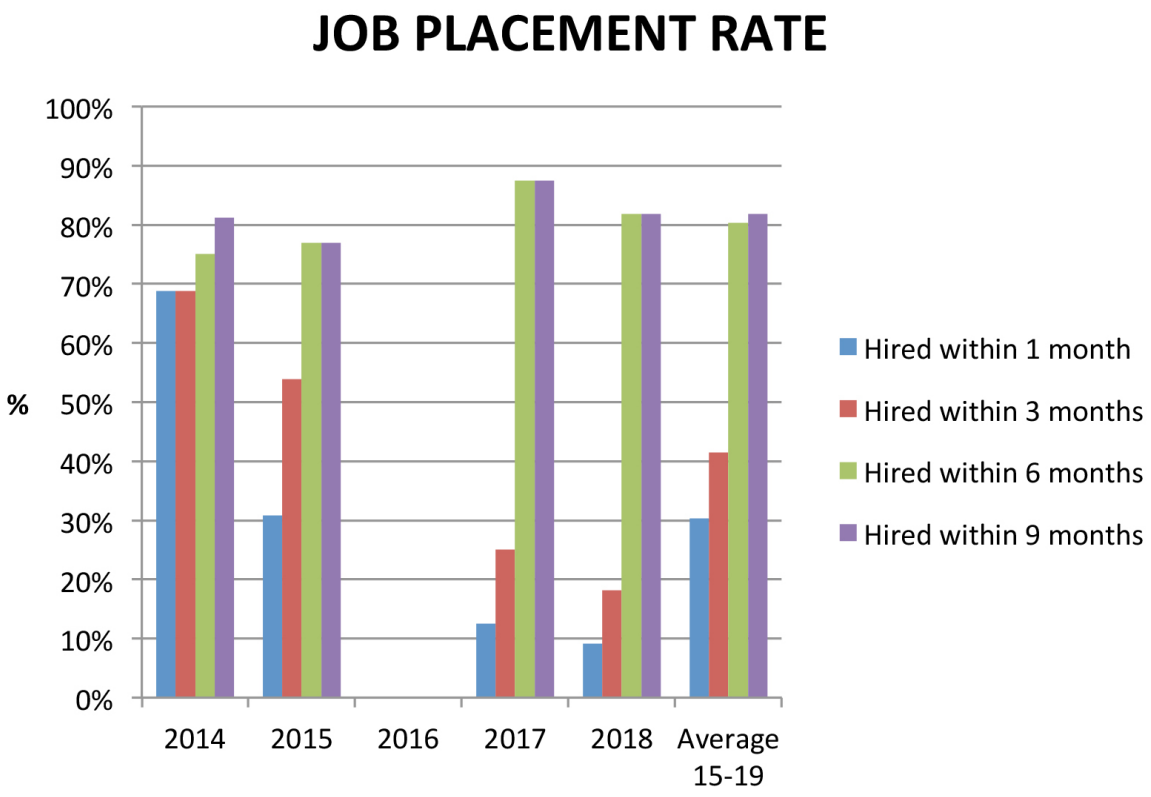
The medical lab profession tends to be a "hidden field" in that professionals work outside of the public eye. In addition, there are really no opportunities for students interested in the profession to spend time in a lab due to restrictive policies to protect

patient information. As such, students often apply to the Program without any substantive knowledge about the laboratory profession. MLT 110 is a course that provides some real insight as to what to expect in both the program and the field. MLT 110 helps improve visibility and allows students to "try on" the profession before committing to two years of rigorous academia and the associated costs.

D. Review job placement data for students over the last five years, including salary information where available. Forecast future employment opportunities for students, including national or state forecasts if appropriate.

Employment rates for MLT graduates are very satisfactory. The following data collected from post-graduation surveys conducted from 2015 – 2019 show the percentage of respondents receiving a job offer within nine months of graduation (see *Figure 7.1*):

Within 1 month 17%
Within three months..... 32%
Within six months 82%
Within nine months 82%

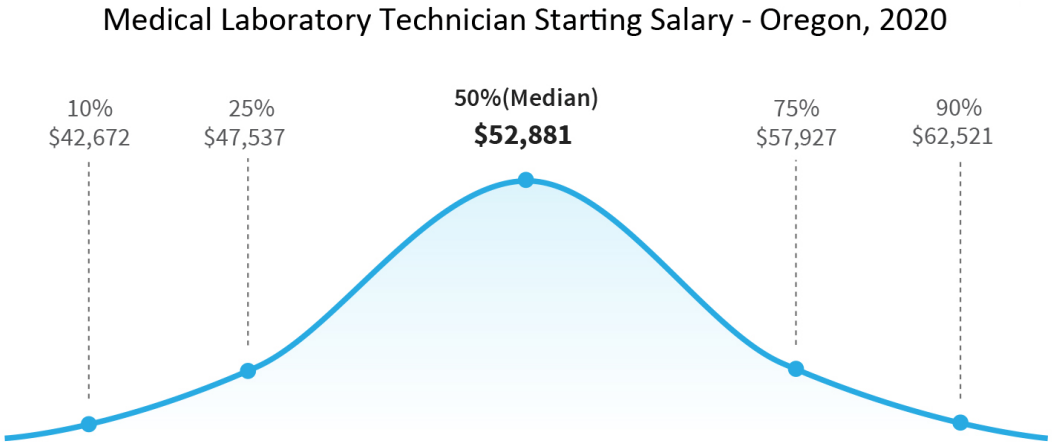


Oregon Wage Range – 2019
For Medical Laboratory Technicians

10th Percentile	25th Percentile	50th Percentile (median)	75th Percentile	90th Percentile	Average Hourly	Average Annual
$17.86	$23.76	$30.58	$38.72	$46.22	$31.14	$64,767

Source: State of Oregon Employment Department

Oregon Starting Wage Range – 2020
For Medical Laboratory Technicians



Source: Salary.com

The projected growth rate for Medical Laboratory Technicians in Oregon is 13% through 2027, similar to other industries statewide, and consistent with the Portland metro area for MLT's. Some areas, like Rogue valley, are as high as 25%.

Fig. 7.2
Oregon Employment Projections
For Medical Laboratory Technicians

2017 Employment	2027 Employment	% Change	Annual Change Openings	Annual Replacement Openings	Total Annual Openings
1,555	1,757	13.0%	20	100	120

Source: State of Oregon Employment Department

Future employment for MLTs is very promising both nationwide and statewide. Feedback from both the MLT Advisory Committee as well as national and state employment data indicate a growing need for trained medical laboratory technicians. The number of projected annual job openings over the next ten years far exceeds the expected number of graduates from our Program. As the only MLT program in the state of Oregon, continued demand is expected.

The following statistics and analysis come from the Occupational Information Center of the Oregon Employment Department for 2017 – 2027 (see Figure 7.2):

- The projected growth in employment for MLT's from 2017 – 2027 is 13%
- Projected annual openings (new positions and annual replacements): 120
- Statewide employment analysis:
    - *"Employment in this occupation in 2017 was similar to most occupations across the state. The total number of job openings is projected to be similar to job openings for most occupations in Oregon through 2027. This occupation is expected to grow at about the statewide average rate for all occupations through 2027."*

A couple of recent developments help to highlight the employment opportunities that continue to emerge for our graduates. For example, the Oregon State Public Health Laboratory (OSPHL) has hired four MLT graduates from the last 2 years graduating cohorts. The MLT Department Chair has received anecdotal comments that OSPHL appreciates the quality of students coming out of this Program. This is significant in that many of the state job descriptions posted for laboratory positions at OSPHL have limited applications to candidates that possess a bachelor's degree and clinical laboratory experience. The MLT Department Chair has had conversations with the Oregon Department of Employment (responsible for posting State workforce information), the State of Oregon CLIA Inspector (responsible for laboratory compliance of personnel certifications), and staff at OSPHL regarding CMS/CLIA regulations that state AAS degreed, NAACLS accredited MLT personnel are qualified to perform moderate and high complexity testing. These efforts have apparently shifted the culture at OSPHL as evidence by the recent number of graduate that they have hired from the PCC MLT Program.

A similar situation has occurred with the Oregon State Police Forensic Laboratory units. Historically, laboratory positions were limited to applications from candidates who possess a bachelor's degree in science. Recent positions posted for forensic laboratory positions in Oregon have specifically been titled; "Medical Laboratory Technician" and the qualifications have specified that the applicant must have an "Associate of Applied Science Degree from an accredited Medical Laboratory Technician training program." The most recent positing from the OSP Forensic unit highlighted that they would even be willing to under fill the position at a level 1 so long as the candidate had an AAS

degree in Medical Laboratory Technology. Considering the PCC MLT Program is the only MLT program in the state and within a 300-500 mile radius, this appears to be significant evidence that employers are noticing the quality of graduates coming out of our Program.

E. Present data on the number of students completing degree(s) and/or certificate(s) in your program.

The MLT Program is a 2-year Associate of Applied Science degree program and graduates approximately 20 students per year (*see Graduation Numbers and Graduation Rates in Appendix J*). The Program continues to experience high student retention rates and actively supports students struggling academically by providing remediation opportunities whenever possible.

Analyze any barriers to degree or certificate completion that your students face, and identify common reasons why students may leave before completion.

Attrition rates have decreased significantly since re-structuring the Program in 2016. The development of MLT 110, an open enrollment survey course, gives prospective students the opportunity to explore clinical laboratory science before deciding if it is something they are interested in pursuing. That said, attrition is, on average, higher in the first term of the first year of the Program.

The MLT Program Director meets with students prior to departing the Program to discuss what barriers they are experiencing that is affecting their ability to be successful. Through these interviews, the department has identified the most common factors that contribute to attrition:

- Financial difficulties (including work schedule conflicts)
- Academic performance (including poor laboratory skills)
- Personal issues (marriage, divorce, children, family, health, etc.)
- Change in personal interest and career pursuit

If the program is available 100% online, please include relevant completion data and analysis.

Not applicable.

F. Is the program Perkins-eligible? If so, answer the questions below. If not put N/A for F

i. With which secondary school(s) does the program have aligned Programs of Study? Do PCC faculty meet with these HS program faculty on a regular basis?

The Dean of Allied Health, Emergency, and Legal Services, the Director of Allied Health Programs, and the MLT Program Director are members of the Benson High School Advisory Committee. The MLT SAC is looking into the feasibility of

offering MLT 110 as a dual credit course, specifically by targeting area high schools that are known for preparing students to enter careers in healthcare, such as Benson and Beaverton.

ii. Please describe the Technical Skill Assessments (TSAs) that are reported annually. Include information about the nature of the assessment, content covered, alignment of degree and certificate outcomes, when the assessment is taken by students, the number of completers, and the percentage of students meeting the identified benchmark(s) for the last 5 years.

TSA reports for the MLT program are submitted annually. The test name (2AREG001) refers to: A+ Certification Master Exam. The test type (PALOC) is a performance assessment developed and scored locally. The test description is prescribed to be: "one or more tasks or work samples are evaluated using a standard rubric. Development and scoring is controlled by a regional or local agency or organization." The MLT department has chosen the work samples to be the Clinical Laboratory Practicum evaluations done while students are on clinical rotations. The MLT Program developed these rubrics with assistance from MLT advisory board members. The rubrics are comprehensive and the clinical preceptors evaluate the students while training them at the clinical affiliate sites. The MLT faculty assigned to clinical laboratory practicums is responsible for assessing these evaluations, working with the students and clinical preceptors when students do not meet a minimum level of competence. These evaluations are done for each subject matter rotation while students are on clinical practicums from January to June of the 2nd year of the Program.

MLT TSA Reports

Year	Test Name	Test Type	CIP Code	Number of Graduates	Percentage of Students Meeting Benchmarks
2015	2AREG001	PALOC	511004	25	100%
2016	2AREG001	PALOC	511004	*None	100%
2017	2AREG001	PALOC	511004	18	100%
2018	2AREG001	PALOC	511004	20	100%
2019	2AREG001	PALOC	511004	18	100%

*No graduates in 2016 due to Program redesign

iii. What does the SAC consider to be the most impactful use of Perkins funding for your program?

The most impactful use of Perkins funding has been for our continued support of a dedicated program advisor. MLT students are required to meet with a Perkins advisor at least once during each of the first two terms of the Program to assist with both academic and financial aid issues. Perkins advisors have received more training and are more knowledgeable in these areas than department faculty. Student access to a dedicated advisor is vital to ensuring that our students are maintaining their academic plan for completion of the MLT Program and achieving an AAS in MLT.

Perkins funding has also provided opportunities for staff to attend important conferences such as the Clinical Laboratory Educators Conference (CLEC) and NAACLS workshops. The information learned from attending these activities has been instrumental on staying up to date with current changes to the NAACLS standards and guidelines for accreditation and our continued accreditation status.

G. Describe opportunities that exist or are in development for graduates of this program to continue their education in this career area or profession.

The MLT department and the CLS department at the Oregon Institute of Technology (OIT) have maintained an informal agreement for transfers of course work from PCC to OIT. Every year, on average, 1 or 2 MLT graduates transfer to OIT to complete their baccalaureate degree in Clinical Laboratory Science (CLS).

Other opportunities exist for graduates who wish to continue their education and earn a baccalaureate in Clinical Laboratory Science but who cannot commit to a traditional classroom-based program. Online MLT-to-MLS programs offered through well-respected universities such as Weber State University in Utah provide another avenue for MLT graduates to continue their education and advance their professional development. Additionally, students entering the MLT Program who have previously earned a Bachelor of Science degree in a related field such as biology or chemistry can earn eligibility for the MLS board of certification exam by working as an MLT for two years.

The MLT department also has an articulation agreement with the Clinical Laboratory Assistant Program at Clackamas Community College for transfers of coursework from CCC to PCC.

The SAC has also discussed the possibility for offering some MLT courses individually to practicing laboratory professionals for continuing education and for re-training. This would add additional relevance for the Program and potentially fill a niche in the field.

8. Recommendations

A. What is the SAC planning to do to improve teaching and learning, student success, and degree or certificate completion, for on-campus and online students as appropriate?

The MLT department frequently discusses ways to improve teaching and learning, student success, and degree completion. These are not constructs that are only planned for the future, but are consistent in everyday conversations among the MLT faculty and are a staple of current planning. Attendance at the annual ASCLS Clinical Laboratory Educator's conference is one major way we improve our teaching, learning, and student success. This conference is attended by laboratory educators from around the US and many of the sessions discuss ways to improve teaching the specific laboratory material within the program.

We have made many changes in the past 3 years to the curriculum, and all faculty monitor each student cohort for academic success. Some of these recent changes include implementing a student success plan, restructuring some laboratory activities and lecture materials, and incorporating varied materials into the courses. Additionally, plans are being made to develop an equity plan and improve course materials for diverse learners. Our medical accreditation agency requires annual reports of student success, including degree completion and exam pass rates. The MLT department has achieved 97-100% degree completion rates for students who progress to the 2nd year of the program and 100% pass on the board exam for all students who take the exam. These have been consistent stats for the last 12 years or more. These statistics are becoming widely known around the country, to the effect that the MLT Program Director (Teresa Wolfe) receives inquiries from other programs regarding methods.

Continued and future plans include faculty attending available teaching and learning workshops, keeping abreast of changing trends in the industry and implementing them into the MLT curriculum. Student success in MLT includes admissions and equity, coursework, time to completion for graduation, passing national board exams, and employment after graduation.

B. What support do you need from administration in order to carry out your planned improvements? (For recommendations asking for financial resources, <u>please present them in priority order</u>. Understand that resources are limited and asking is not an assurance of immediate forthcoming support. Making the administration aware of your needs may help them look for outside resources or alternative strategies for support.)

BSL-2 Laboratory Space Support

The MLT Department's biggest priority is in BSL-2 laboratory space. (Refer to section 6.0 on Facilities). The laboratory in JH-213 has not been remodeled in at least 25 years, when the program was moved from the Sylvania campus to the Cascade Campus. The

space is quite outdated, does not accommodate disability needs, and cannot safely seat the number of students designated by the room schematics. The occupant capacity is listed as 40 students can occupy the one laboratory space, but in fact we can only safely place 12-15 students in there at one time. The laboratory is a BSL-2 facility and students are learning to work with biohazardous materials and equipment. This requires space for both the students to safely work, but also for the instructors to safely move about in that space and assist students. Due to the biohazard nature of the work, one instructor can at most assist 10-12 students at one time. This room is also not designed for lecture and due to biohazard restrictions should not be used for lecture. Students cannot bring in notebooks, personal pens, pencils, but in the past the MLT department has had to use this space for lecture when no classroom space is available, either because the JH207 lecture room is already scheduled for some other class or when only smaller classrooms are available.

We would like to admit more students into the program, but cannot due to the lack of clinical sites and the constraints of having one laboratory space. The department is limited to scheduling one lab per day as two sections. Each student cohort is divided into 2 groups, and each group attends one section of the lab. Having two lab spaces would allow the MLT department to operate two separate laboratory courses at the same time, with opposing student groups attending each lab section. That would maximize both student and instructor time, while freeing up the department course scheduling to allow for more flexibility. In prior discussions, a suggestion was made to remodel the current JH-213 laboratory into two separate laboratory spaces. The JH-213 laboratory is only 1131 square feet, with 900 square feet of usable space. Dividing that space into 2 sections would create two 500 square feet laboratories. That is about the size of the simulation laboratory that we use at Legacy Good Samaritan. That space can only hold 5 students and 1 instructor at a time. Assuming that we could utilize the entire 1131 square feet of space, we would end up sacrificing the safety shower, the chemical fume hood, and possibly many other features that make that space a functional laboratory. We plan to continue discussions for either creating new space or finding ways to change the use of the current space.

Another constraint of the teaching laboratory is that the microbiology lab activities have to be scheduled on consecutive days and during certain times of the week (like Wed/Thurs, Thurs/Fri). This is due to the fact that there has to be adequate time for the bacterial organisms to grow before being handled by the students. Because the campus is closed on Sundays, growing bacterial organisms over the weekend is not feasible, since they have to be monitored and maintained every 24hours. Allowing them to propagate unattended over a 48 – 72hr time period would result in overgrowth or dead cultures. As a result, we are only able to schedule the microbiology laboratory sections on certain days of the week. This has a trickle-down effect, which impacts the days that other MLT courses can be scheduled in that same space. Having two laboratory spaces that can be used for two separate courses simultaneously would alleviate some of this burden.

The other support item that has been requested in the last several MLT program reviews (dating back to 2013 or earlier) has been a remodel of the support laboratory space in JH212. Currently this space has limited room for students to place backpacks, coats, and personal items. This is supposed to be a designated clean area, but due to space constraints, the clean area is shared with the microbiological incubator. Tape on the floor marks the division between the clean and dirty areas. Additionally, this incubator is growing organisms and is fairly close to the exit door, which poses its own security and biohazard risks. Due to the BSL2 level environment of the JH213 laboratory next to the JH212 support lab, students are not allowed to bring any personal items into that space, including cell phones, electronic items, pens/pencils, etc. All of these items can be potential containers for transmitting organisms to the outside environment. Laboratory acquired infections from teaching laboratories is one reason for the restriction on bringing in any personal items. These are standard industry practices and part of the appropriate laboratory behaviors that students learn while in the program.

Several equipment needs are also of a priority for the MLT Department. These include:

1. Multi-Headed Teaching Microscope

   The MLT Department submitted a proposal for Perkins Funding in 2019, but the proposal was not accepted. Many of our MLT courses (at least 8 of the courses) use microscopy and students must learn to identify elements in blood and body fluids. Most of the microscopes are not of a high enough quality and do not contain electronic pointers. It is difficult to try to assist students when they have questions about morphology, when instructors cannot simultaneously see what the student is seeing. We play a game of trying to decide which element the student is describing and pointing out the correct items. Having a multi-headed teaching microscope allows the student (or students) and the instructor to be able to view the same microscope fields at the same time. This setup also allows the students to watch the methods that the instructor uses, which is impossible to do with single use microscopes.

2. MLT Department Student Laptops

   The MLT Department would very much like to update the student laptops currently used by the department. The MLT Program received 24 laptops in 2014-2015 for students to take online MLT exams. These computers have been a big asset to students in the Program, as this method replicates the situation that they will experience when taking the ASCP board exam. This may be one reason that students perform well on this exam. Prior research shows that students who consistently take exams via computer scored significantly higher on medical board exams than their peers. We have also used these computers to teach microscopy and certain cellular differentiation and enumeration procedures during lecture. Because not all

students have access to personal laptops or tablets, being able to provide them with the opportunity to view the images up close on a high definition screen while the instructor is discussing the material provides a more enhanced learning opportunity within the program. Unfortunately, these computers are nearing the end of their lifespan and replacement will allow this unique teaching method to continue.

3. MLT Laboratory iPads/Pens

   One solution to recording laboratory data during the lab activities in JH-213 is the use of iPads and pens. This would alleviate the issue of students and instructors taking lab reports out of the laboratory and the issue with laboratory acquired infections. These iPads would remain in the laboratory for use in the BSL-2 environment. A survey of the biomedical literature on the prevention of laboratory acquired infections and recommendations from the American Society of Microbiology in teaching laboratories is to prohibit students from taking any personal items into the labs. This includes paper lab reports and writing instruments. Many teaching laboratories have moved to installing iPads and electronic pens in the laboratory. Students record the data and write up their labs on the iPads and the reports are sent electronically to the LMS. The MLT SAC has discussed this configuration, along with many others such as waterproof paper that can be disinfected. There are not many good options out there at this point in time and the MLT SAC continues to explore options.

The MLT Program is poised for growth over the next several years with the COVID19 pandemic. The outbreak highlights the importance of laboratory testing and we expect to see an increase in the number of students expressing interest in the profession. In MLT Advisory meetings and laboratory related content, we consistently hear the message that more graduates are needed. In the clinical and public health laboratory (PHL) fields recruitment and retention of skilled personnel has become increasingly difficult due to retirements, attrition to other fields, and lack of new people entering the field. The American Society for Clinical Pathology (ASCP) workforce survey reported a 10.5% vacancy rate for positions in the core lab, with respondents expecting ~17% of their current staff to retire in the next 5 years. The Association for Public Health Laboratories (APHL) published a similar report in 2018 stating public health laboratories expected a 16-25% decrease of their staff due to retirements alone.

To support the MLT Program and its future growth, we request that the administration consider:

1. Support to fund a dedicated or shared clinical coordinator. Due to the large clinical competency requirements of the program's accrediting body, the coordination, placement, evaluation, and oversight of students at clinical sites is a very time-consuming endeavor. The expansion to a larger cohort cannot be

achieved without a dedicated or shared clinical coordinator. The MLT clinical rotations are a valuable part of the program that prepares students for entry into the laboratory workforce. The MLT Advisory committee continually expresses the need for well-trained graduates and the PCC MLT Program's clinical rotation hours (640 hours) are in the average to low range of what many programs around the country require. Our accreditation body, NAACLS, consistently sends the message that MLT trained graduates should have similar or more rotation hours than the 4-year MLS trained graduates, because MLTs do the bulk of the hands-on testing. The MLS trained graduates have both testing and supervisory/management responsibilities.

2. Support for additional part-faculty for future expansion of the MLT Program. The MLT Program envisions expansion of student cohorts and the ability to offer continuing education to trained professionals. Expansion could include offering evening or weekend program cohorts, or possibly an online hybrid model. Continuing education could easily be offered in the evenings and this would both increase visibility of the Program and create new networks for affiliations.

9. Assurances

Please put X's next to all three boxes to verify that…

☑ faculty and FDCs at all of the campuses offering courses in this discipline/program have received a late-stage draft of the Program Review document.

☑ all of the division deans offering courses in this discipline/program have been sent the late-stage draft.

☑ the SAC administrative liaison has reviewed and had the opportunity to provide feedback on the final report.

Appendix

MLT CURRICULUM

First Term: Fall	COURSE	Credits
	MLT 105 - PHLEBOTOMY FOR MLTs	1
	MLT 114 – LABORATORY OPERATIONS & TECHNIQUES	4
	MLT 120 - URINALYSIS	2
	MLT 113 - INTRODUCTION TO MEDICAL MICROBIOLOGY	3
	MLT 115 - LABORATORY MATHEMATICS	1
	MLT 110 – INTRO TO MLT (*)	4
	General Education (*)	4
	TOTAL	19

Second Term: Winter	COURSE	Credits
	MLT 224 - CLINICAL CHEMISTRY I	4
	MLT 241 - IMMUNOHEMATOLOGY I	3
	MLT 261 – CLINICAL BACTERIOLOGY I	3
	MLT 251 - HEMATOLOGY I	4
	TOTAL	14

Third Term: Spring	COURSE	Credits
	MLT 242 - IMMUNOHEMATOLOGY II	4
	MLT 225 - CLINICAL CHEMISTRY II	4
	MLT 262 – CLINICAL BACTERIOLOGY II	4
	MLT 252 - HEMATOLOGY II	4
	TOTAL	16

Fourth Term: Summer	COURSE	Credits
	MLT 271 – CLINICAL LABORATORY PRACTICE I	2
	MP 113 – FIRST AID & CPR PROFESSIONAL	1
	TOTAL	3

Fifth Term: Fall	COURSE	Credits
	MLT 253 - HEMOSTASIS	2
	MLT 266 – IMMUNOLOGY & INFECTIOUS SEROLOGY	2
	MLT 265 - CLINICAL MYCOLOGY & PARASITOLOGY	3
	MLT 230 - BODY FLUIDS	2
	MLT 272- CLINICAL LABORATORY PRACTICE II	2
	General Education (*)	4
	TOTAL	15

Sixth Term: Winter	COURSE	Credits
	MLT 273 - CLINICAL LABORATORY PRACTICE III	9
	MLT 282 - CLINICAL SEMINAR I	2
	General Education	4
	TOTAL	15

Seventh Term: Spring	COURSE	Credits
	MLT 274 - CLINICAL LABORATORY PRACTICE IV	9
	MLT 283 - CLINICAL SEMINAR II	2
	General Education	4
	TOTAL	15

MLT PROGRAM	MLT PROGRAM COURSES	80
	Other	17
	TOTAL	**97**

(*) from Prerequisites

CORE OUTCOMES MAPPING SAC MLT

Mapping Level Indicators:	Core Outcomes:
0- Not Applicable 1- Limited demonstration or application of knowledge and skills. 2- Basic demonstration and application of knowledge and skills. 3- Demonstrated comprehension and is able to apply essential knowledge and skills 4- Demonstrates thorough, effective and/or sophisticated application of knowledge and skills.	1- Communication 2- Community and Environmental Responsibility 3- Critical Thinking and Problem Solving 4- Cultural Awareness 5- Professional Competence 6- Self-Reflection

Course #	Course Name	CO1	CO2	CO3	CO4	CO5	CO6
MLT 105	Phlebotomy for Medical Laboratory Technicians	3	2	3	3	3	3
MLT 110	Introduction to Medical Laboratory Technology	2	2	2	0	2	3
MLT 113	Introduction to Medical Microbiology	2	2	3	3	3	3
MLT 114	Laboratory Operations and Techniques	3	2	4	1	4	4
MLT 115	Clinical Laboratory Mathematics	3	0	3	0	3	1
MLT 120	Urinalysis	3	0	3	1	4	2
MLT 224	Clinical Chemistry I	3	2	4	3	4	3
MLT 225	Clinical Chemistry II	3	2	4	3	4	4
MLT 230	Body Fluids	3	2	3	2	3	3
MLT 241	Immunohematology I	4	2	4	3	3	3
MLT 242	Immunohematology II	4	2	4	3	4	3
MLT 251	Hematology I	3	2	4	1	4	4
MLT 252	Hematology II	3	2	4	1	4	4

CORE OUTCOMES MAPPING SAC MLT

Mapping Level Indicators:	Core Outcomes:
0- Not Applicable 1- Limited demonstration or application of knowledge and skills. 2- Basic demonstration and application of knowledge and skills. 3- Demonstrated comprehension and is able to apply essential knowledge and skills 4- Demonstrates thorough, effective and/or sophisticated application of knowledge and skills.	1- Communication 2- Community and Environmental Responsibility 3- Critical Thinking and Problem Solving 4- Cultural Awareness 5- Professional Competence 6- Self-Reflection

Course #	Course Name	CO1	CO2	CO3	CO4	CO5	CO6
MLT 253	Hemostasis	3	2	4	1	4	4
MLT 261	Clinical Bacteriology I	3	2	4	3	4	3
MLT 261	Clinical Bacteriology II	4	2	4	3	4	3
MLT 265	Clinical Mycology & Parasitology	4	3	4	3	4	3
MLT 266	Immunology and Infectious Serology	3	2	4	1	4	4
MLT 271	Clinical Laboratory Practice I	3	0	3	3	3	2
MLT 272	Clinical Laboratory Practice II	3	2	4	3	4	3
MLT 273	Clinical Laboratory Practice III	3	3	4	3	4	4
MLT 274	Clinical Laboratory Practice IV	3	4	4	4	4	4
MLT 282	Clinical Seminar I	3	2	4	1	4	4
MLT 283	Clinical Seminar II	3	2	4	1	4	4

Core Outcomes

Graduates of Portland Community College should be able to…

Communication: …communicate effectively by determining the purpose of communication, analyzing audience and context to use appropriate language and modality; and by responding to feedback to achieve clarity, coherence, and effectiveness.

Community and Environmental Responsibility:…apply scientific, cultural and political perspectives in understanding the natural and social world and in addressing the consequences of human activity both globally and locally by demonstrating an understanding of social change and social action.

Critical Thinking and Problem Solving:…think critically and creatively solve problems by understanding and
using various methods of reasoning and evaluating information.

Cultural Awareness:… demonstrate an understanding of the varieties of human cultures, perspectives, and forms of expression as well as their own culture's complexities.

Professional Competence:… demonstrate mastery in a discipline or profession at a level appropriate to program
and transfer requirements through the application of concepts, skills, processes and technology in the performance of authentic tasks that enhance community involvement and employability.

Self-Reflection:… be self-appraising in applying the knowledge and skills that have been learned, examining and
evaluating personal beliefs, and comparing them with the beliefs of others.

Guidelines for Evaluation

Knowledge and Application (Cognitive Skills)

Communication				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Does not speak clearly, difficult to understand; cannot follow verbal instructions	Speech is understood with difficulty and concentration; follows verbal instructions with frequent questions to explain meaning	Speech is understood with little effort; follows verbal instructions, occasionally questions to explain meaning	Speech may not be fluent but understood without difficulty; follows verbal instructions, rarely questions to explain meaning	Writing is clear, concise; follows verbal instructions; speaks clearly, easy to understand

Explains Facts & Principles				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Little or no understanding of subject	Limited understanding of subject	Adequate understanding of subject	Usually able to explain facts and principles	Excellent grasp of theory

Applies Knowledge				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Lack of understanding; very little, if any, ability to apply	Limited understanding of theory affects ability to apply	Adequate ability to apply knowledge to work	Above average ability to apply knowledge	Easily applies theory to testing

Problem Recognition				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Never or rarely recognizes problems	Occasionally recognizes problems	Often recognizes problems	Usually recognizes problems	Always recognizes problems

Critical Thinking				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Little or no critical thinking; does not know how to proceed	Requires significant guidance to formulate plan of action, or formulates incorrect plan of action	Requires some guidance to formulate plan of action and act	Formulates plan of action and takes action with minimal guidance	Formulates plan of action and promptly takes action

Interpretation & Correlation				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Incorrect or incomplete interpretation of lab results	Often incorrect interpretation of lab results; requires significant assistance	Often interprets lab results correctly; require some assistance	Usually interprets lab results correctly; may require minimal assistance	Correctly interprets and correlates lab results No significant assistance required

Performance (Psychomotor Skills)

Safety				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Rarely, if ever, wears proper PPE; conducts self in an unsafe manner	Occasionally shows lack of concern for lab safety and/or PPE	Often shows acceptable use of PPE, with only few reminders; rarely handles equipment/materials improperly	Usually wears proper PPE; generally exhibits safe lab practices	Always wears proper PPE; always exhibits safe lab practices

Organization & Prioritization				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Very poor organization; consequently does not finish work	Often unorganized; rarely recognizes priorities & frequently spends time on low priority tasks	Acceptable level of organization and generally prioritizes tasks well	Usually well- organized; often recognizes important tasks and puts them first	Organized; effectively multi-tasks; recognizes priorities and always puts important tasks first

Productivity and Timeliness				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Rarely, if ever, finishes work in allotted time; needs constant prodding to start/complete work	Work pace is slower than expected; limited improvement in work pace over time	Often completes tasks in allotted time; work pace increases with repetition	Usually finishes work in allotted time	Completes tasks faster than expected; excellent time management

Guidelines for Evaluation

Manual Dexterity				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Very awkward with equipment and/or specimens; poor dexterity and/or coordination	Has more than expected number of accidents/errors with equipment and/or specimens	Has the expected number of accidents/errors with equipment and/or specimens	Rarely has accidents/ errors with equipment and/or specimens	Demonstrates excellent dexterity and coordination when manipulating equipment

Accuracy				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Rarely accurate or precise; results are often unreliable	Demonstrates limited ability to achieve accuracy; needs improvement	Often achieves satisfactory results within the expected values	Usually achieves accurate results and makes only occasional errors	Consistently achieves accurate results

Technique				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Requires significant assistance to perform techniques; needs details pointed out	Will need more than usual amount of practice to perform technique skillfully; makes more mistakes than expected; often misses important details	Needs a reasonable length of time to learn proper techniques; good attention to detail	Needs very little practice to learn proper techniques; only occasionally misses minor details	Learns and performs procedures quickly, correctly, and independently; excellent attention to detail

Record Keeping				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Paperwork is illegible, incomplete, and/or not according to protocol; does not respond to requests to correct errors	Record keeping often contains errors and/or lacks neatness; needs prompting to correct errors	Paperwork is usually neat, legible, and complete; makes some errors, corrects according to protocol when prompted	Makes only occasional errors; corrects errors independently according to protocol	Paperwork is always neat, legible, and complete; results always reported according to protocol

Professionalism (Affective Skills)

Interest & Enthusiasm				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
No preparation; looks bored or absent; does not participate	Minimum preparation; does not show intellectual curiosity; indifferent to improving performance	Usually prepared; shows a moderate degree of intellectual curiosity and enthusiasm	Almost always prepared; shows notable interest and intellectual curiosity	Always prepared; demonstrates enthusiasm for learning by showing efforts beyond what is required

Initiative & Motivation				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Requires step-by-step instruction; demonstrates no initiative	Leans on supervisor for guidance; requires "push" to start and/or finish work	Occasionally requires supervisor's guidance to accomplish assigned tasks	Proceeds on own after instructions are given; occasionally seeks additional work as time permits	Promptly initiates work; asks for additional tasks as time permits

Stress				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Easily upset by stressful situations; exhibits difficulty maintaining composure	Can become distracted or upset if stress is prolonged; lacks flexibility with changes	Displays adequate concentration; makes an effort to work out the difficulty	Possesses good concentration; able to remain calm while working through difficulties	Excellent composure during stressful situations; always shows flexibility when change is required

Guidelines for Evaluation

Teamwork				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Lacks respect for others; uncooperative	Exhibits minimal cooperation and respect for the rights of others	Often cooperative and shows respect for the rights of others	Usually cooperative and shows respect for the rights of others	Always courteous, respectful, sensitive, and cooperative with others; excellent team skills

Attitude				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Exhibits a negative attitude; lacks confidence or is overly confident	Often lacks a positive attitude; demonstrates limited confidence	Usually positive; demonstrates adequate confidence	Generally positive; aware of own limitations, asks for help if needed	Models behavior that has a positive influence; aware of own limitations, asks for help if needed

Cleanliness & Hygiene				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Frequently has poor hygiene habits; lack of orderliness leads to errors	Acceptable hygiene habits; work area seldom organized or clean	Acceptable hygiene; work area is usually orderly and clean	Good hygiene; work area always maintained	Presents an appropriate level of personal hygiene; maintains a clean and clutter-free workspace, in addition to common areas

Integrity				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Knowingly releases questionable results; careless regarding confidentiality; Does not admit mistakes	Maintains confidentiality; may or may not admit and/or resolve errors properly	Maintains confidentiality; attempts to resolve errors fully and properly	Maintains confidentiality; usually resolves errors fully and properly	Maintains confidentiality; checks for mistakes; repeats questionable results; admits mistakes

Responsibility & Reliability				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Lacks punctuality and/or is excessively absent; schedule changes not communicated; fails to accept responsibility for own work	Often late or absent, and/or fails to notify when absence is anticipated; occasionally irresponsible/unreliable	Fewer than 3 properly reported late arrivals; accepts responsibility for own work	No more than 1 properly reported late arrival; accepts responsibility for own work	Always punctual and present; accepts responsibility for own work; strives for high quality work

Supervision & Feedback				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Does not follow instructions; is not receptive to constructive criticism; does not take any corrective action; requires excessive supervision	Not hostile but accepts criticism with indifference and without making improvement; sometimes takes corrective action; requires frequent supervision	Receptive to criticism; attempts to make improvements; requires some supervision with tasks	Accepts criticism and suggestions with positive attitude; makes obvious improvement; completes tasks with minimal supervision	Responds promptly to instructions; seeks constructive criticism to improve performance; completes tasks with minimal supervision

Perseverance				
1 – Poor	**2 – Needs Improvement**	**3 – Satisfactory**	**4 – Above Average**	**5 – Outstanding**
Gives up easily and quickly when faced with difficult tasks; does not attempt to use available resources	Occasionally perseveres until a solution is reached; does not use all available resources	Perseveres until a proper solution is reached; usually uses available resources with direction	Perseveres until a solution is reached; occasionally uses available resources independently	Stays on task when trying to find answers or solutions to problems; draws on available resources

PCC MLT PROGRAM
Clinical Laboratory Practice
Final Evaluation

Directions for using this form:

Rating Scale:
5 = Outstanding achievement
4 = Exceeds expectations
3 = Satisfactory progress
2 = Needs improvement
1 = Critical deficiency
na = not applicable, unable to evaluate

Name: _____

Trainer(s): _____

Department: _____

Affiliate/Location: _____

Dates of Rotation: _____

Knowledge and Application of Knowledge	na	1	2	3	4	5	Comments
Communicates effectively (writing, reading, listening, verbal skills)							
Explains facts and principles as needed for this level of education							
Applies knowledge to working situations							
Recognizes problems, errors in performance & discrepancies in results							
Solves problems as required and/or analyze course of action							

Performance	na	1	2	3	4	5	Comments
Accuracy & precision							
Efficiency & organization (logical work flow, productive & timely output)							
Technique (safe, skillful, orderly, attention to detail)							
Manual dexterity (coordination, ease of handling equipment)							
Record keeping (thorough, legible, accurate, good attention to detail)							

Interpersonal Skills & Professionalism	na	1	2	3	4	5	Comments
Interest (enthusiasm, willingness to learn)							
Initiative (independence in performing routine tasks)							
Adaptability (degree of composure during stressful and/or new situations)							
Personal relations (demonstrates cooperation and sensitivity toward others, both in the laboratory and throughout the healthcare facility; teamwork)							
Attitude (outlook toward work and other people, level of confidence)							
Cleanliness & Orderliness (personal hygiene, maintenance of work environment)							
Integrity (admission of errors, patient & co-worker confidentiality)							
Responsibility (dependability, punctuality, attendance, reliability)							
Supervision (response to supervision & instruction)							
Perseverance (completion of tasks)							

Please list suggestions to improve performance (especially important for "1" or "2" ratings):

Please list student's strengths:

_____ _____ _____ _____

Signature of Student Date Signature of Evaluator Date

Mail completed form to:

Erin Krauter, MLT Clinical Practice Coordinator
Portland Community College
Cascade Campus, JH 201
P.O. Box 19000
Portland, OR 97280-0990

OR

FAX with cover "Attention To:"
PCC MLT Clinical Coordinator
971-722-5257

ASCP BOC ASCP BOARD OF CERTIFICATION

MEDICAL LABORATORY TECHNICIAN, MLT(ASCP)
INTERNATIONAL MEDICAL LABORATORY TECHNICIAN, MLT(ASCP^{i})

EXAMINATION CONTENT GUIDELINE

EXAMINATION MODEL

The MLT(ASCP) and MLT(ASCP^{i}) certification examination is composed of 100 questions given in a 2 hour 30 minute time frame. All exam questions are multiple-choice with one best answer. The certification exam is administered using the format of computer adaptive testing (CAT).

With CAT, when a person answers a question correctly, the next test question has a slightly higher level of difficulty. The difficulty level of the questions presented to the examinee continues to increase until a question is answered incorrectly. Then a slightly easier question is presented. In this way, the test is tailored to the individual's ability level.

Each question in the test bank is calibrated for level of difficulty and is classified by content area. The content area aligns with the examination specific content outline. The examinee must answer enough questions correctly to achieve a measure above the pass point in order to successfully pass the certification examination. There is no set number of questions one must answer to pass, nor is there a set percentage one must achieve to pass. If at the end of the exam the examinee's score is above the pass point, then he or she passes the exam.

EXAMINATION CONTENT AREAS

The MLT exam questions encompass different content areas within Medical Laboratory Science: Blood Banking, Urinalysis and Other Body Fluids, Chemistry, Hematology, Immunology, Microbiology, and Laboratory Operations. Each of these content areas comprise a specific percentage of the overall 100-question exam. The content areas and percentages are described below:

CONTENT AREA	DESCRIPTION	EXAM PERCENTAGE
BLOOD BANKING	Blood Products, Blood Group Systems, Blood Group Immunology, Physiology and Pathophysiology, Serology and Molecular Testing, Transfusion Practice	**15 – 20%**
URINALYSIS AND OTHER BODY FLUIDS	Physical and Chemical Testing, Microscopic Analysis, Physiology, Disease States	**5 – 10%**
CHEMISTRY	Carbohydrates, Lipids, Heme Derivatives, Enzymes, Proteins & Other Nitrogen-Containing Compounds, Acid-Base Determinations (Including Blood Gases), Electrolytes, Endocrinology, Vitamins and Nutrition, Therapeutic Drug Monitoring, Toxicology	**20 – 25%**
HEMATOLOGY	Physiology, Disease States, Hematology Laboratory Testing, Hemostasis	**20 – 25%**
IMMUNOLOGY	Principles of Immunology, Diseases of the Immune System, Transplantation, Infectious Disease Serology, Serologic and Molecular Procedures, Test Results	**5 – 10%**
MICROBIOLOGY	Preanalytic Procedures; Analytic Procedures for Bacteriology; Analytic Procedures for Mycology, Mycobacteriology, Virology, Parasitology, and Virology; Post-Analytic Procedures	**15 – 20%**
LABORATORY OPERATIONS	Quality Assessment/Troubleshooting, Safety, Laboratory Mathematics, Manual/Automated Methodology and Instrumentation	**5 – 10%**

For a more specific overview of the MLT exam, please refer to the **CONTENT OUTLINE** starting on page 2.

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MEDICAL LABORATORY TECHNICIAN, MLT(ASCP)
INTERNATIONAL MEDICAL LABORATORY TECHNICIAN, MLT(ASCP^{i})

EXAMINATION CONTENT OUTLINE

Examination questions, which are related to the subtest areas outlined below, may be both theoretical and/or procedural. Theoretical questions measure skills necessary to apply knowledge, calculate results, and correlate patient results to disease states. Procedural questions measure skills necessary to perform laboratory techniques and follow quality assurance protocols. Additionally, regulatory questions are based on U.S. sources (e.g., AABB, FDA, CLIA, etc.).

BLOOD BANKING

(15 – 20% of total exam)

I. BLOOD PRODUCTS

A. Donors
1. Qualification
2. Collection methods
3. Adverse reactions
4. Special donations (e.g., autologous)

B. Processing
1. Testing
2. Labeling

C. Storage
1. Anticoagulants/additives
2. Temperature requirements
3. Transportation
4. Properties of stored products
5. Expiration

D. Blood Components
1. Red blood cells
2. Cryoprecipitated AHF
3. Platelets
4. Plasma
5. Leukocyte-reduced components
6. Frozen/deglycerolized red blood cells
7. Apheresis products
8. Fractionation products
9. Whole blood
10. Washed red blood cells
11. Rejuvenated red blood cells
12. Irradiated components

E. Blood Component Quality Control

II. BLOOD GROUP SYSTEMS

A. Genetics
1. Basic
2. Molecular
3. Inheritance of blood groups

B. Chemistry, Antigens
1. ABO
2. Lewis
3. Rh
4. MNS
5. P1PK/Globoside(P)
6. Ii
7. Kell
8. Kidd
9. Duffy
10. Lutheran
11. Other
12. Antigens of high prevalence
13. Antigens of low prevalence
14. Platelet-specific
15. Granulocyte-specific

C. Role of Blood Groups in Transfusion
1. Immunogenicity
2. Antigen frequency

III. BLOOD GROUP IMMUNOLOGY

A. Immune Response
1. Primary and secondary response
2. B and T cells, macrophages
3. Genetics

B. Immunoglobulins
1. Classes and subclasses
2. Structure
3. Biologic and physical properties

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C. Antigen-Antibody Interactions
1. Principles
2. Testing
   a. Principles
   b. Methods

D. Complement
1. Classical and alternative pathway mechanisms
2. Biologic properties

IV. PHYSIOLOGY AND PATHOPHYSIOLOGY

A. Physiology of Blood
1. Circulation and blood volume
2. Composition and function of blood
   a. Normal function
   b. Abnormal physiology
3. Cell survival
4. Cell metabolism

B. Hemostasis and Coagulation
1. Coagulation factors and disorders
2. Platelet functions and disorders

C. Hemolytic Disease of the Fetus and Newborn
1. Pathophysiology
2. Detection
3. Treatment
4. Prevention

D. Anemias
1. Congenital and acquired
   a. Pathophysiology
   b. Detection
   c. Treatment
2. Immune hemolytic anemias: warm, cold, drug-induced
   a. Pathophysiology
   b. Detection
   c. Treatment

E. Transplantation
1. Solid organ
2. Hematopoietic progenitor cells (HPC)

V. SEROLOGIC AND MOLECULAR TESTING

A. Routine Tests
1. Blood grouping tests
2. Compatibility tests
   a. Antibody detection
   b. Crossmatch
3. Antibody identification/clinical significance
4. Direct antiglobulin testing

B. Reagents
1. Antiglobulin sera
2. Blood grouping sera
3. Reagent red cells

C. Application of Special Tests and Reagents
1. Enzymes
2. Enhancement media
3. Lectins
4. Adsorptions
5. Elutions
6. Titrations
7. Cell separations
8. ELISA
9. Molecular techniques
10. Use of thiol reagents
11. Immunofluorescence
12. Solid phase
13. Column agglutination test
14. Chloroquine diphosphate
15. EDTA glycine acid

D. Leukocyte/Platelet Testing
1. Cytotoxicity
2. Platelet testing
3. Granulocyte testing

E. Quality Assurance
1. Blood samples
2. Reagents
3. Test procedures

VI. TRANSFUSION PRACTICE

A. Indications for Transfusion
B. Component Therapy
C. Adverse Effects of Transfusion
1. Immunologic reactions
2. Nonimmunologic reactions
3. Transfusion-transmitted diseases

D. Apheresis and Extracorporeal Circulation
E. Blood Administration and Patient Blood Management

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URINALYSIS AND BODY FLUIDS

(5 – 10% of total exam)

I. URINALYSIS

A. Physical
1. Color and clarity
2. Specific gravity/osmolality

B. Chemical
1. Reagent strip
2. Confirmatory tests

C. Microscopic
1. Cells
2. Casts
3. Crystals
4. Microorganisms
5. Contaminants
6. Artifacts

D. Renal Physiology

E. Disease States

II. BODY FLUIDS (e.g., CSF, Amniotic, Synovial, Serous, Semen, and Feces)

A. Physical
B. Chemical
C. Microscopic
D. Physiology
E. Disease States

CHEMISTRY

(20 – 25% of total exam)

I. GENERAL CHEMISTRY

A. Carbohydrates
1. Biochemical theory and physiology
   a. Metabolic pathways
   b. Normal and abnormal states
   c. Physical and chemical properties
2. Test procedures
   a. Principles
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
   c. Tolerance testing
   d. Glycated proteins
3. Test result interpretation
4. Disease state correlation

B. Lipids
1. Biochemical theory and physiology
   a. Metabolic pathways
   b. Normal and abnormal states
   c. Physical and chemical properties
      1) Lipoproteins
      2) Phospholipids
      3) Triglycerides
      4) Cholesterol
      5) Apolipoproteins
2. Test procedures
   a. Principles
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
3. Test result interpretation
4. Disease state correlation

C. Heme Derivatives
1. Biochemical theory and physiology
   a. Metabolic pathways
   b. Normal and abnormal states
   c. Physical and chemical properties
      1) Hemoglobin
      2) Bilirubin
      3) Urobilinogen
      4) Myoglobin
2. Test procedures
   a. Principles
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
3. Test result interpretation
4. Disease state correlation

II. PROTEINS AND ENZYMES

A. Enzymes
1. Biochemical theory and physiology
   a. Metabolic pathways
   b. Normal and abnormal states
   c. Physical and chemical properties
      1) LD
      2) CK
      3) AST/ALT
      4) GGT
      5) Lipase

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6) Amylase
7) Alkaline phosphatase
8) Other enzymes

2. Test procedures
   a. Principles
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
3. Test result interpretation
4. Disease state correlation

B. Proteins and Other Nitrogen-Containing Compounds

1. Biochemical theory and physiology
   a. Metabolic pathways
   b. Normal and abnormal states
   c. Physical and chemical properties
      1) Proteins
      2) Amino acids
      3) Urea
      4) Uric acid
      5) Creatinine
      6) Ammonia
      7) Tumor markers
      8) Viral proteins
      9) Cardiac markers
      10) Other compounds
2. Test procedures
   a. Principles
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
   c. Clearances
3. Test result interpretation
4. Disease state correlation

III. ACID-BASE, BLOOD GASES AND ELECTROLYTES

A. Acid-Base Determinations (Including Blood Gases)

1. Biochemical theory and physiology
   a. Henderson-Hasselbach equation
   b. pH and H+ ion concentration
   c. CO2 and O2 transport
   d. Normal and abnormal states
2. Test procedures
   a. Analytical principles
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
3. Test result interpretation
4. Disease state correlation

B. Electrolytes

1. Biochemical theory and physiology
   a. Sodium, potassium, chloride, CO_2, bicarbonate
   b. Calcium, magnesium, phosphorus, iron, TIBC
   c. Trace elements
   d. Normal and abnormal states
2. Test procedures
   a. Principles
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
3. Calculations (osmolality, anion gap)
4. Test result interpretation
5. Disease state correlation

IV. SPECIAL CHEMISTRY

A. Endocrinology

1. Biochemical theory and physiology
   a. Metabolic pathways
   b. Normal and abnormal states
   c. Mechanism of action
   d. Physical and chemical properties
      1) Steroid hormones (e.g., cortisol, estrogen, hCG)
      2) Peptide hormones (e.g., insulin, prolactin)
      3) Thyroid hormones
      4) Other hormones
2. Test procedures
   a. Principles
      1) Fluorescence
      2) Immunoassay
      3) Other methods
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
   c. Stimulation/suppression tests

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3. Test result interpretation
4. Disease state correlation

B. Vitamins and Nutrition

1. Biochemical theory and physiology
   a. Metabolism and action
   b. Normal and abnormal states
   c. Properties
      1) Vitamin D
      2) Vitamin B12/folate
      3) Other vitamins
2. Test procedures
   a. Principles
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
3. Test result interpretation
4. Disease state correlation

C. Therapeutic Drug Monitoring

1. Pharmacokinetics
   a. Therapeutic states
   b. Toxic states
   c. Metabolism and excretion
2. Chemical and physical properties
   a. Aminoglycosides (e.g., gentamicin)
   b. Cardioactive (e.g., digoxin)
   c. Anti-convulsants (e.g., phenobarbital)
   d. Anti-depressants (e.g., lithium)
   e. Immunosuppressants (e.g., tacrolimus)
   f. Other drugs
3. Test procedures
   a. Principles
      1) Immunoassay
      2) Other methods
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
4. Test result interpretation
5. Disease state correlation

D. Toxicology

1. Toxicokinetics
   a. Toxic effects, signs and symptoms
   b. Metabolism and excretion
2. Chemical and physical properties
   a. Alcohols
   b. Heavy metals (e.g., lead)
   c. Analgesics (e.g., acetaminophen)
   d. Drugs of abuse
   e. Other toxins
3. Test procedures
   a. Principles
      1) Immunoassay
      2) Other methods
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
4. Test result interpretation
5. Disease state correlation

HEMATOLOGY

(20 – 25% of total exam)

I. PHYSIOLOGY (to include blood, body fluids, and bone marrow)

A. Production
B. Destruction
C. Function

II. DISEASE STATES

A. Erythrocytes

1. Anemia
   a. Microcytic
      1) Iron deficiency
      2) Thalassemia
      3) Sideroblastic
      4) Chronic inflammation
   b. Normocytic
      1) Hereditary hemolytic
      2) Acquired hemolytic
      3) Hypoproliferative
      4) Acute hemorrhage
   c. Macrocytic
      1) Megaloblastic
      2) Non-megaloblastic
   d. Hemoglobinopathies
2. Erythrocytosis
   a. Relative
   b. Absolute

B. Leukocytes (WHO classification)

1. Benign leukocyte disorders
   a. Myeloid
   b. Lymphoid

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2. Myeloid neoplasia
   a. Acute leukemia
   b. Myelodysplastic syndromes
   c. Myeloproliferative neoplasms
3. Lymphoid neoplasia
   a. Acute leukemia
   b. Chronic leukemia/lymphoma
   c. Plasma cell dyscrasias
4. Hereditary anomalies

C. Platelets

1. Quantitative abnormalities
   a. Thrombocytopenia
      1) Increased destruction (e.g., ITP, TTP, HIT)
      2) Decreased production
      3) Pseudothrombocytopenia
   b. Thrombocytosis
2. Qualitative defects
   a. von Willebrand disease
   b. Bernard-Soulier syndrome
   c. Glanzmann thrombasthenia

III. HEMATOLOGY LABORATORY TESTING

A. Cell Counts (to include blood and body fluids)

1. Manual
2. Automated
3. Reticulocytes
4. Spurious results

B. Differentials and Morphology Evaluation (to include blood and body fluids)

C. Hemoglobin

1. Quantitative
2. Qualitative
   a. Electrophoresis
   b. Sickle solubility

D. Hematocrit

E. Indices

F. Hemolytic Indicators (e.g., haptoglobin, LD)

G. Special Stains

1. Esterase
2. Myeloperoxidase
3. Prussian blue
4. Kleihauer Betke

H. Other Studies

1. ESR
2. G6PD
3. Heinz body

I. Flow Cytometry Immunophenotyping

1. Leukemia
2. Lymphoma
3. Lymphocyte subsets
4. PNH

J. Molecular and Cytogenetic Testing

1. Recurring cytogenetic abnormalities (WHO classification)
2. *BCR-ABL*
3. *JAK2*

IV. HEMOSTASIS

A. Physiology

1. Coagulation pathways
2. Fibrinolytic pathway
3. Vascular system

B. Disease States

1. Coagulation factor deficiencies
   a. Acquired
   b. Hereditary
2. Fibrinolytic system
3. Hypercoagulable states
4. DIC

C. Laboratory Determinations

1. PT/INR
2. APTT
3. Fibrinogen
4. D-dimer
5. Thrombin time
6. Mixing studies
7. Platelet function (e.g., PFA)
8. Hypercoagulability assessment
   a. Assays (e.g., protein S, protein C)
   b. Molecular (e.g., factor V Leiden, prothrombin 20210)
9. Anti-Xa

IMMUNOLOGY

(5 – 10% of total exam)

I. PRINCIPLES OF IMMUNOLOGY

A. Immune System Physiology

1. Primary and secondary response
2. B and T cells, macrophages
3. Genetics

B. Immunoglobulins

1. Classes and subclasses

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2. Structure
3. Biologic and physical properties

C. Antigen-Antibody Interactions
1. Principles
2. Testing
   a. Principles
   b. Methods

D. Complement
1. Classical and alternative pathway mechanisms
2. Biologic properties

II. DISEASES OF THE IMMUNE SYSTEM

A. Autoimmunity
1. Systemic (e.g., SLE)
2. Organ-specific (e.g., Graves disease)

B. Hypersensitivity
1. I, II, III, IV

C. Immunoproliferative Diseases
1. Monoclonal gammopathies (e.g., multiple myeloma, Waldenström macroglobulinemia)

D. Immunodeficiency
1. Hereditary (e.g., SCID)
2. Acquired (e.g., HIV)

III. TRANSPLANTATION

A. Graft-versus-host Disease
B. HLA Typing
C. Tumor Immunology

IV. INFECTIOUS DISEASE SEROLOGY

A. Clinical Significance and Epidemiology of Viral Pathogens (e.g., hepatitis (A, B, C), EBV, HIV, CMV, rubella, measles)

V. SEROLOGIC AND MOLECULAR PROCEDURES

A. ANA
B. Thyroid Antibodies
C. Rheumatoid Factor
D. Direct Detection Methods for Pathogens
E. Labeled Immunoassays (e.g., ELISA)
F. Nontreponemal Syphilis Testing (e.g., RPR)
G. Treponemal Syphilis Testing (e.g., MHATP)
H. Hybridization Techniques
I. Other

VI. TEST RESULTS

A. Interpretation
B. Confirmatory Testing
C. Disease State Correlation

MICROBIOLOGY

(15 – 20% of total exam)

I. PREANALYTIC PROCEDURES

A. Specimen Collection and Transport
1. Patient identification and specimen labeling
2. Specimen collection
3. Specimen transport systems and conditions for all organisms

B. Specimen Processing
1. Specimen prioritization and rejection criteria
2. Biosafety cabinet and personal protective equipment
3. Specimen preparation methods and applications
4. Media
5. Inoculation of media
6. Incubation conditions (e.g., temperature, atmosphere, duration)
7. Preparation methods for slides used for stains

C. Stains: Procedure, Principle, and Interpretation
1. Gram
2. Acid-fast
3. Modified acid-fast

D. Stains: Procedure and Principle
1. KOH and calcofluor-white
2. Trichrome
3. Giemsa

II. ANALYTIC PROCEDURES FOR BACTERIOLOGY

A. Blood and Bone Marrow
1. Specimen sources (e.g., peripheral, intravenous catheters)
2. Continuous monitoring systems
3. Rapid identification/resistance detection methods
4. Species comprising skin flora and clinical significance

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5. Colony morphology and identification of major pathogens (e.g., *Staphylococcus aureus*, coagulase-negative staphylococci, beta-hemolytic streptococci, *Enterococcus* spp., *Candida* spp.*, Streptococcus pneumoniae, Acinetobacter baumannii, Enterobacteriaceae, Pseudomonas* spp.)
6. Common agents of endocarditis
7. Organism pathogenicity (e.g., etiology, transmission)

B. Cerebrospinal Fluid

1. Specimen sources (e.g., lumbar puncture, shunt, reservoir)
2. Colony morphology and identification of major pathogens associated with acute meningitis (e.g., *Streptococcus pneumoniae, Haemophilus influenzae*, *Neisseria meningitidis*, *Escherichia coli*, *Listeria monocytogenes*, *Enterobacteriaceae*, *Staphylococcus aureus*, beta-hemolytic streptococci)
3. Common agents of shunt infections (e.g., coagulase-negative staphylococci, *Corynebacterium* spp., *Propionibacterium* spp.)
4. Correlation with other lab results (e.g., glucose, protein, cell count)
5. Direct detection and molecular methods
6. Organism pathogenicity (e.g., etiology, transmission)

C. Body Fluids from Normally Sterile Sites

1. Specimen sources (e.g., pleural, peritoneal, pericardial, vitreous and aqueous humor, synovial, amniotic)
2. Indigenous organisms associated with mucosal surfaces and skin
3. Colony morphology and identification of major pathogens (e.g., *S. pneumoniae*, *H. influenzae, Neisseria* spp.*, E. coli, Listeria monocytogenes, Enterobacteriaceae, S. aureus,* beta-hemolytic streptococci, *Enterococcus* spp., *Pseudomonas aeruginosa*, *Acinetobacter, Clostridium perfringens, Bacteroides fragilis* group)
4. Molecular methods
5. Organism pathogenicity (e.g., etiology, transmission)

D. Lower Respiratory

1. Specimen sources (e.g., sputum, endotracheal aspirate, bronchoalveolar lavage, bronchial wash, bronchial brush)
2. Significance of quantitative and semi-quantitative reporting of results
3. Species comprising oral flora colony and Gram stain morphology
4. Colony morphology and identification of major pathogens
5. Direct detection and molecular methods (e.g., *Streptococcus pyogenes*, *Bordetella pertussis*)
6. Organism pathogenicity (e.g., etiology, transmission)

E. Upper Respiratory

1. Specimen sources (e.g., throat, nasopharynx, middle ear, sinus)
2. Indigenous flora colony and Gram stain morphology
3. Colony morphology and identification of major pathogens
4. Direct detection and molecular methods (e.g., *Streptococcus pyogenes*, *Bordetella pertussis*)
5. Organism pathogenicity (e.g., etiology, transmission)

F. Gastrointestinal

1. Colony morphology and identification of major pathogens (e.g., *Salmonella* spp., *Shigella* spp., toxigenic *E. coli, Campylobacter* spp., *Vibrio* spp., *Yersinia enterocolitica, Aeromonas* spp., *Plesiomonas shigelloides*)
2. Direct detection and molecular methods (e.g., *Clostridium difficile,* Shiga toxin)
3. Serotyping of *E. coli, Salmonella, Shigella*
4. Organism pathogenicity (e.g., etiology, transmission, virulence mechanisms)

G. Skin, Soft Tissue, and Bone

1. Specimen sources (e.g., wound, abscess, biopsy)
2. Indigenous flora colony and Gram stain morphology
3. Colony morphology and identification of major pathogens
4. Organism pathogenicity (e.g., etiology, transmission)

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H. Genital Tract
1. Specimen sources (e.g., vaginal, cervical, urethral, endocervical)
2. Indigenous organisms colony and Gram stain morphology
3. Methods for detection of pathogens associated with vaginitis (e.g., *Trichomonas, Candida*, bacterial vaginosis)
4. Culture and/or molecular detection (e.g., *N. gonorrhoeae*, *C. trachomatis*, and *Streptococcus agalactiae*)
5. Organism pathogenicity (e.g., etiology, transmission)

I. Urine
1. Specimen source (e.g., mid-stream clean catch, catheterized, suprapubic, nephrostomy)
2. Colony morphology and identification of major urinary pathogens (e.g., *Enterobacteriaceae, Enterococcus*, *Streptococcus agalactiae*, *Candida* spp., *Staphylococcus saprophyticus*)
3. Correlation of colony counts with clinical significance
4. Correlation of culture with urinalysis results

J. Identification Methods (Theory, Interpretation, and Application)
1. Colony morphology
2. Rapid tests used for presumptive identification (e.g., coagulase, catalase, oxidase, indole, PYR)
3. Conventional biochemical identification (e.g., TSI, decarboxylases, carbohydrate utilization, motility, urease, XV factors)
4. Commercial kits
5. Automated methods
6. MALDI-TOF MS
7. Multiplex molecular methods

K. Antimicrobial Susceptibility Testing and Antibiotic Resistance
1. Method, theory, interpretation, and application
2. Phenotypic detection of resistance (e.g., beta-lactamase, ESBL, inducible clindamycin resistance, carbapenamases)
3. Detection of genetic determinants of resistance (e.g., *mecA*, *vanA*, bla_{KPC})
4. Intrinsic resistance patterns for common species

L. MRSA/MSSA, VRE, ESBL/CRE Screening
1. Specimen sources
2. Culture methods

M. BSL-3 Pathogens and Select Agents (Bioterrorism)
1. Specimen source (e.g., blood, sputum, tissue, lymph node)
2. Colony morphology and rapid tests used for presumptive identification (e.g., *Bacillus anthracis, Yersinia pestis, Brucella* spp., *Francisella tularensis)*
3. Role of regional laboratory and Laboratory Response Network
4. Organism pathogenicity (e.g., etiology, transmission)

III. ANALYTIC PROCEDURES FOR MYCOLOGY, MYCOBACTERIOLOGY, PARASITOLOGY, AND VIROLOGY

A. Mycobacteriology and Nocardia spp.
1. Specimen source (e.g., lower respiratory, blood, soft tissue)
2. Acid-fast reaction, colony morphology and growth characteristics

B. Virology
1. Specimen sources
2. Major pathogens and disease states (e.g., etiology, epidemiology, transmission)
3. Direct detection of pathogens

C. Parasitology
1. Specimen source (e.g., stool, respiratory, blood, tissue)
2. Major pathogens and disease states (e.g., etiology, epidemiology, transmission)
3. Microscopic identification
4. Direct and molecular detection

D. Mycology
1. Specimen sources
2. Major pathogens and disease states (e.g., etiology, epidemiology, transmission)
3. Yeast identification (e.g., biochemical, automated methods, MALDI-TOF MS)
4. Microscopic identification of major pathogens
5. Other identification methods

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IV. POST-ANALYTIC PROCEDURES
- **A.** Documentation Practices
- **B.** Urgent and Critical Value Reporting
- **C.** Result Review and Autoverification
- **D.** Issuing Corrected Reports
- **E.** Reporting to Infection Control/Prevention and Public Health

LABORATORY OPERATIONS
(5 – 10% of total exam)

I. QUALITY ASSESSMENT/TROUBLESHOOTING
- **A.** Pre-analytical, Analytical, Post-analytical
- **B.** Quality Control
- **C.** Point-of-care Testing (POCT)
- **D.** Compliance
- **E.** Regulation (e.g., proficiency testing, competency assessment, accreditation standards)

II. SAFETY
- **A.** Safety Programs and Practices
  1. Prevention of infection with bloodborne pathogens
  2. Use of personal protective equipment (PPE)
  3. Safe work practices
  4. Safety data sheets (SDS) for chemicals and reagents
- **B.** Emergency Procedures (e.g., needlesticks, splashes to mucous membranes, fire)
- **C.** Packaging and Transportation of Specimens and Microorganisms

III. LABORATORY MATHEMATICS
- **A.** Concentration, Volume, and Dilutions
- **B.** Molarity, Normality
- **C.** Standard Curves
- **D.** Mean, Median, Mode, and Confidence Intervals
- **E.** Sensitivity, Specificity, and Predictive Value

IV. MANUAL/AUTOMATED METHODOLOGY AND INSTRUMENTATION
- **A.** Microscopy
- **B.** Centrifugation
- **C.** Spectrophotometry and Photometry
- **D.** Osmometry
- **E.** Electrophoresis
- **F.** Electrochemistry
- **G.** Molecular Methods
- **H.** Other Methods

Examples provided (as indicated by e.g.) are not limited to those listed.

All Board of Certification examinations use conventional and SI units for results and reference ranges.

You will need to bring a non-programmable calculator with log function to the examination.

END OF CONTENT GUIDELINE