COURSE DESCRIPTIONS

CLSC 134: Advanced Hematology and Hemostasis

Hematologic and cytochemical findings in anemias, leukemias and selected diseases; instrumentation; calculations; abnormal histogram and scattergram interpretation; basic theory in hemostasis and coagulation test procedures. College laboratory required with competency in hematology and coagulation procedures. (A special fee will be assessed.)
Prerequisites: CLSC 132, 133; Corequisite: CLSC 136

CLSC 135: Immunohematology Concepts and Procedures

Humoral immune response; basic blood groups and types; direct and indirect antiglobulin tests; crossmatching; donor testing and selection; hemolytic disease of the newborn; Rh immune globulin candidacy testing; advanced coagulation tests; quality control. College laboratory required with competency in immunohematology procedures. (A special fee will be assessed.)
Prerequisite: CLSC 134; Corequisite: CLSC 136

CLSC 136: Hematology II / Immunohematology Clinical Practicum

Clinical practicum in Advanced Hematology methods and instrumentation, abnormal WBC differentials, and Immunohematology methods at an affiliated clinical agency. Clinical competency hematology, coagulation, and immunohematology methods required.
Prerequisite: CLSC 132, CLSC 133; Corequisites: CLSC 134, CLSC 135.

COURSE PLACEMENT: Second (Spring) Semester, First Year

FACULTY:

Instructor: Mr. James E. Daly, MT(ASCP), M.Ed., B.S.
440-366-7194
HS210A
jdaly@lorainccc.edu

Clinicals: Mr. James E. Daly, MT (ASCP), M.Ed., B.S.
Mr. Eric Slavik, MLT(ASCP), A.A.S.
Ms. Ginger Weaver, MT(ASCP), B.S.

College Laboratory: Mrs. Melanie Forren, MT (ASCP), B.S.

PROGRAM POLICIES

Students are responsible for conforming to the policies contained in the CLS Program Student Handbook. Students are urged to review these policies again, since they will be followed on campus and at the clinical site.
COURSE ACADEMIC POLICIES

1. Students failing to score at least 77% in either the lecture or college laboratory portions of CLSC 134 or 135 will not be admitted to CLSC 123.

2. Five quizzes are given during the lecture sessions for each lecture course.

Students absent on a quiz day (for any reason) may have the opportunity to make up the quiz at the discretion of the instructor, and at the first mutually agreeable available time. **One point will be deducted from the score of a make-up quiz for each day that has passed since the date the quiz was originally given. In addition, the student will not be permitted to complete any “extra credit” questions that were part of the original version of the quiz.**

3. A Final Exam will be given in each lecture course. Examination make-ups will be made at the discretion of the instructor and may require a physician's statement documenting student illness. If an Exam is taken late, **FIVE POINTS will be deducted from the score of the Exam for EACH DAY that has passed since the date the Exam was originally given. In addition, the student will not be permitted to complete any “extra credit” questions that were part of the original version of the Exam.** Students who cannot take exams as scheduled in any event are expected to **schedule the test ahead of schedule** with the instructor if at all possible.

4. **COLLEGE LABORATORY POLICIES:** The purpose of College Laboratory sessions is to provide students the maximum opportunity to learn and master clinical testing principles and procedures free of the pressures of the actual clinical setting.

Completion of assigned College Laboratory activities is evaluated on a Satisfactory/Unsatisfactory basis. **All College Laboratory reports are due no later than one week from the session during which the work was completed.** Worksheets and/or assigned objectives must be thoroughly completed to the satisfaction of the instructor for a student to be considered satisfactory in College Laboratory performance. Repeated failure to submit all assigned College Laboratory work on time may result in a Deficiency Notice, followed by an **Unsatisfactory College Laboratory grade,** and the letter grade for the course will be **lowered by one grade** (i.e., and ‘A’ becomes a ‘B’, a ‘B’ becomes a ‘C’, etc.).

Students may be required to repeat College Laboratory procedures if the test performance or results obtained are considered unsatisfactory by the instructor. Incorrect or incomplete worksheets will be returned to the student for satisfactory completion of the assigned work.

**ALL STUDENT TEST RESULTS ON WORKSHEETS MUST BE INITIALED BY AN INSTRUCTOR BEFORE BEING SUBMITTED TO BE GRADED. DO NOT DISCARD ANY SAMPLES, SLIDES, BLOOD BANK REACTION TUBES, etc., BEFORE HAVING YOUR RESULTS CHECKED AND INITIALED. ANY RESULTS SUBMITTED FOR GRADING THAT ARE NOT INITIALED BY AN INSTRUCTOR WILL NOT BE ACCEPTED AND THE LAB ASSIGNMENT WILL HAVE TO BE REPEATED.**
Failure to complete all assigned CLSC 134 College Laboratory work by the Friday of the last week of the course will result in an Unsatisfactory College Laboratory grade and the letter grade for CLSC 134 will be lowered by one grade. Failure to complete all assigned CLSC 135 College Laboratory work by the second Reading Day (Wednesday May 7th) will result in an Unsatisfactory College Laboratory grade and the letter grade for CLSC 135 will be lowered by one grade. If all College Laboratory work is not completed by the last Final Exam day (Wednesday May 14th) a course grade of Incomplete will be assigned for CLSC 135. A student cannot enter CLSC 123 with a grade of Incomplete in CLSC 135.

5. CLSC 136 is the 16-week clinical portion of CLSC 134 and CLSC 135 that runs concurrently with these two 8-week courses. The grade assigned in CLSC 136 will be Satisfactory (S) or Unsatisfactory (U). A grade of “C” must be obtained in both CLSC 134 and 135 to continue in the CLSC program and earn a “S” in CLSC 136. If a student does not earn a minimum grade of “C” in CLSC 134, they will not be allowed to continue onto CLSC 135, and will immediately be withdrawn from CLSC 136 with a grade of “W”. If a student does not earn a minimum grade of “C” in CLSC 135, they will be given a grade of “U” in CLSC 136 and will not be permitted to continue in the program. A grade of “Unsatisfactory” in CLSC 136 will result in a letter grade of “F” in CLSC 134 and/or CLSC 135, regardless of the student’s grade percentage in that course.

6. The WBC Differential Practicum Exam is given on campus as part of the College Laboratory rotations, but is considered a part of clinical competency. The exam is given at LCCC for purposes of standardization, fairness, and conservation of clinical time, but counts toward the clinical grade of Pass (Satisfactory) or Fail (Unsatisfactory). The minimum passing grade on this exam is 80% on Part 1 (cell identification on 35mm Kodachrome slides) and 77% on Part 2 (WBC differentials on select blood smears). Failure to meet these criteria will result in an UNSATISFACTORY CLINICAL GRADE and a CLSC course grade of “F”.

PROGRAM ATTENDANCE AND TARDINESS POLICIES

Absence from Lecture: When a student misses a lecture session for any reason, they are putting themselves at a great disadvantage. Classroom discussion is an important part of the learning process and copying a classmate’s notes is not an adequate substitute for attending class! There is no specific attendance policy regarding lecture, but students are advised that lending class notes to their classmates who miss class for no legitimate reason encourages them to not attend and is unfair to the students who do attend. Students are not obligated to lend notes and may do so at their own discretion. UNDER NO CIRCUMSTANCES WILL THE INSTRUCTOR LEND HIS/HER NOTES TO A STUDENT. Students are, however, expected to assist their classmates by lending notes under legitimate circumstances.

Tardiness to Lecture: If a student arrives after a lecture class has already begun, the student will not be admitted to the classroom until the instructor releases the class for a break. Students are NOT to enter the classroom once a class has begun! It is disruptive to the learning and concentration of their classmates and disrespectful to the instructor! If a student is late for class on the day of a quiz and the quiz has already begun, the student will not be allowed to take the quiz during class time. The quiz will be considered a “missed” quiz and course policies for missed quizzes will be followed in these instances.
PROGRAM ATTENDANCE AND TARDINESS POLICIES (continued)

Absence from College Laboratory: College Laboratory sessions involve extensive preparation and setup by the LIA and therefore, an absence creates a great inconvenience for program faculty. In addition, some College Laboratory sessions may be impossible to duplicate. For this reason, a student is only allowed ONE UNEXCUSED ABSENCE from College Laboratory. The total allowable absences from College Laboratory cannot exceed TWO DAYS in a given course or THREE DAYS in a given semester. If a student exceeds these limits, their final course grade will be LOWERED BY ONE LETTER GRADE.

If a student is absent from College Laboratory for any reason, they must schedule a makeup session with the LIA or course instructor. A written form will be used for this purpose, so that both the student and the instructor are aware of how and when the missed activities will be rescheduled. IT IS THE RESPONSIBILITY OF THE STUDENT to see the LIA or course instructor immediately following an absence to schedule the makeup activities.

Absence from Clinicals: A student is only allowed ONE UNEXCUSED ABSENCE from Clinicals. The total allowable absences from Clinicals cannot exceed FOUR DAYS in a given semester. If a student exceeds these limits, they will be given an Unsatisfactory Clinical grade.

Tardiness to Clinicals: Unexcused tardiness in the clinical setting (greater than 5 minutes late) will be dealt with in the following manner:

First Time: verbal warning and makeup work as determined by the instructor.

Second Time: the student will receive a written Deficiency Notice and may be told to leave the clinical site for the duration of that session. Makeup work will be added to the remaining rotation.

Third Time: the student will receive an Unsatisfactory (U) clinical grade and be dismissed from all remaining CLSC Technology sections.

ANGEL COURSE MANAGEMENT SYSTEM

Throughout the program, the CLSC faculty may use the online ANGEL course management system to enhance the content and the activities of a course. In addition, faculty make use of the system’s gradebook program, so that students can access their current quiz, exam, and overall course grades at any time. Be aware that, while this feature of ANGEL is convenient, the gradebook does not represent a student's official course grade at any time. Grades in ANGEL may be revised at any time at the discretion of the instructor. The only official grade awarded to a student is the final course grade entered by faculty into the LCCC WebReg system. Instructions for accessing course grades through the ANGEL system are on the following page.
ACCESSING YOUR GRADES THROUGH ANGEL

- ANGEL works best with Internet Explorer (may not always work with Netscape)
- From the LCCC home page (www.lorainccc.edu) click on Angel Login
- When the Angel page comes up, bookmark it as one of your Favorites
  (The Angel website does not reside on the LCCC server and does not have to be accessed through the LCCC website. If you have it bookmarked you can access it even when the LCCC server is down.)
- Before attempting to log onto Angel, be sure to read Required Angel Technical Settings on the web page. You may need to change some settings in your browser in order for Angel to work (unblock cookies, etc.).
- Log onto Angel with your Student Number and password.
  When logging onto Angel for the first time, your LCCC ID Number and Password are both your LCCC student number. You will then be prompted to change your password after login.
- From your personal Homepage, click on the appropriate course.
- On the Course page, click on Report (the last tab on the top right of the page).
- On the Reports Console page, choose Grades in the Category drop-down window.
- Click Run in the lower right corner of the displayed page.
- Your grades for the entire course will now be displayed, including your overall average course grade with your lowest quiz score dropped. You will need to scroll down through the grade page to see everything.

NOTE: Because the grade book is set up to drop your lowest quiz score, when you have only taken Quiz #1, your overall average score will display as 0% (F). The grade book is dropping your Quiz #1 score. DON’T PANIC! Your overall grade will be correct after Quiz #2 is entered!
ACADEMIC INTEGRITY POLICY

Students caught cheating on any examination or laboratory assignment will be subject to disciplinary action. “Cheating” is defined by irregular behaviors as observed by Program faculty that include but are not limited to: copying a classmate’s answers to test questions or laboratory worksheet questions, allowing a classmate to copy one’s answers to test questions or laboratory worksheet questions, looking at a classmate’s paper during a quiz or exam or giving the appearance of looking around the room during a quiz or exam, falsifying laboratory results, and plagiarism of writing from another source.

Quizzes and Exams: Anyone caught cheating on a quiz or exam will be given a score of “zero” for that quiz or exam, and be issued a written Deficiency Notice documenting the incident. If a student is caught cheating on a quiz or exam a second time, they will be immediately dismissed from the Program and receive a grade of “F” for the course.

College Laboratory: Anyone caught not doing their own work in the college laboratory (bench testing or written assignments) will be given a written Deficiency Notice documenting the incident and be expected to repeat that laboratory assignment. If a student is caught cheating in the college laboratory a second time, they will be immediately dismissed from the Program and receive a grade of “F” for the course. If written answers to worksheet questions are too similar from two different students, both students will be disciplined for cheating according to this policy. Students are to answer college laboratory worksheet questions independently and in their own words!

Clinical Assignments: Anyone caught lying or cheating in any way at their clinical site will be given an Unsatisfactory (U) clinical grade and immediately dismissed from the clinical site.

ACCOMMODATION STATEMENT

A student with a disability who desires special accommodation must inform the Office of Special Needs of their disability and need for accommodation. The reason for this is to provide support services to enable a qualified student to be successful. If you are a person with a disability who needs accommodations or assistance, contact the O.S.N.S. located in Room 115 in the Learning Resource Center (Theo Scott, Coordinator, ext. 4058).

FINAL GRADE EVALUATION

The CLSC 134 and CLSC 135 course grade will be calculated based on the total points scored by the student in the course (assuming a clinical grade of Satisfactory). The grading scale used in all CLS courses appears in the Student Handbook.
### CLSC 134 / 2008-2009

**STUDENT GRADING FORM**

<table>
<thead>
<tr>
<th>QUIZZES</th>
<th>STUDENT SCORE</th>
<th>POSSIBLE SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td></td>
<td>20</td>
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<td>#4</td>
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<tr>
<td>#5</td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

Total Quiz Points: ___________ 100

Final Exam: __________ 150

**Final Point Total**: __________ __________% 250

### CLSC 135 / 2008-2009

<table>
<thead>
<tr>
<th>QUIZZES</th>
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<tbody>
<tr>
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<td>#5</td>
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<td>20</td>
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</tbody>
</table>

Total Quiz Points: __________ 100

Poster Project: __________ 50

Final Exam: __________ 150

**Final Point Total**: __________ __________% 300

**Grading Scale:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>CLSC 134 Points</th>
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</tr>
</thead>
<tbody>
<tr>
<td>93 - 100% = A</td>
<td>232 to 250 points</td>
<td>279 to 300 points</td>
</tr>
<tr>
<td>85 - 92% = B</td>
<td>213 to 231 points</td>
<td>255 to 278 points</td>
</tr>
<tr>
<td>77 - 84% = C</td>
<td>193 to 212 points</td>
<td>231 to 254 points</td>
</tr>
<tr>
<td>69 - 76% = D</td>
<td>173 to 192 points</td>
<td>207 to 230 points</td>
</tr>
<tr>
<td>00 - 68% = F</td>
<td>0 to 172 points</td>
<td>0 to 206 points</td>
</tr>
</tbody>
</table>
ELECTRONIC DEVICE POLICY

If electronic devices such as pagers and cellular telephones go off during class, it is disruptive to the educational process, as well as disrespectful to the instructor and fellow classmates. For this reason, use of these devices during class time is PROHIBITED. Students are to TURN OFF their cellular phones and pagers when entering class and store them away. **There are to be no phones, pagers, PDAs, or any other electronic devices on the desktop during lectures, quizzes, or exams.** **THE USE OF CELL PHONES AND PAGERS IS ALSO PROHIBITED DURING ASSIGNED CLINICAL HOURS.** If a student's cell phone or pager goes off during class, the student will be expected to **leave class immediately and will not be permitted to return that day.** If a quiz or exam is being taken, the student will be required to turn in the quiz / exam immediately and leave class, accepting the grade based on the points scored on the portion of the quiz / exam completed.

**Calculator Policy:** During the first semester of the Program, students will be instructed in CLSC 111 the approved type of calculator to be used for all quizzes and exams in the Program. Students are required to purchase the assigned calculator and keep it the entire two years in the Program. It will be the only calculator permitted to be used during quizzes and exams in any CLSC course. Each student must have their own calculator. **There will be no sharing of calculators allowed during testing periods.**

AUTHORIZATION FOR RELEASE OF INFORMATION

On many occasions, Program faculty are requested by students to provide reference information for the purposes of obtaining employment, scholarships, and other reasons. In these instances, complete information cannot be provided unless the student has signed a Program “Authorization for Release of Information” form. These forms are distributed at the beginning of each semester and all students have the option of signing or not signing a form. This form is also used as an authorization for electronic transmission of information such as grades from the faculty to the student. A copy of this form can be found in the Program Student Handbook.

TEXTBOOKS REQUIRED FOR CLS 134 / 135 / 136


REFERENCE TEXTS:


POSTER PROJECT
(50 points)

Fifty points of the student’s grade for CLSC 135 is comprised of preparing and presenting a poster on a topic in Clinical Hematology, Coagulation, or Immunohematology (Blood Banking). This poster is a requirement of the course and failure to complete a poster will result in a letter grade of “F” for CLSC 135.

The following is the process to be followed for preparation and presentation of your poster:

1. Do a topic search and select a suitable topic for presentation. (Get instructor’s help if needed.)

2. Submit topic and general outline for approval by instructor by the deadline date. See deadline dates below. One point will be deducted from the student’s final grade for every day the topic and outline is late.

3. A narrative description of the poster must be submitted along with the poster. This narrative must be a minimum of two FULL pages, PLUS a cover page and reference page. The student must submit a Draft Copy of the poster narrative by the deadline date indicated. One point will be deducted from the student’s final grade for every day the draft narrative is late.

4. Submit the Poster and revised narrative (if revision is necessary) by the final deadline date.

5. During the last two weeks of the Semester, a portion of the scheduled class time will be used for students to present their posters to the class.

Required Elements of the Poster Project:

1. The topic chosen must relate to Clinical Hematology, Coagulation, or Immunohematology (Blood Banking). If the topic is covered in the regular lecture content of CLSC 134 or 135, then the student’s presentation must present information or aspects of the topic that ARE NOT COVERED AS PART OF THE REGULAR COURSE CONTENT. The topic can be presented in the form of a research project or a case study (fictional or actual).

2. Poster may be any size but large enough for an organized, detailed presentation of the topic.

3. Must cite (refer to) at least 4 sources as described below other than the course texts.

4. Minimum references that are required:
   a. One reference book (other than a course textbook). (Copyright 2003 or later unless prior approval is obtained from instructor.)
   b. Three scientific journals. (2003 or later unless prior approval is obtained)
5. In addition to the poster, the student must submit a written narrative summary of the poster content that includes the following:
   a. a cover page
   b. a narrative description of the poster and summary of the topic (minimum 2 FULL pages)
   c. reference page

6. **Copies of all journal articles** used must be submitted along with the written narrative.

7. The narrative must be double-spaced and **typed in a standard font (Times New Roman or similar) and size (10 – 12) with 1” margins on all sides.**

8. Students must present their poster orally to the class, giving an in depth explanation of its content and answering questions posed by classmates and the instructor. This oral presentation must be a minimum of 10 minutes in length.

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**GRADING SCALE AND DEADLINE DATES FOR POSTER PROJECT (100 points possible)**

<table>
<thead>
<tr>
<th>Grading of Poster Project:</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Poster Written Content</td>
<td>10 points</td>
</tr>
<tr>
<td>Poster Graphic Content</td>
<td>10 points</td>
</tr>
<tr>
<td>Poster Organization and Neatness</td>
<td>5 points</td>
</tr>
<tr>
<td>Narrative Description and Summary Content</td>
<td>10 points</td>
</tr>
<tr>
<td>Narrative Length, Grammar, and Spelling</td>
<td>5 points</td>
</tr>
<tr>
<td>References</td>
<td>10 points</td>
</tr>
<tr>
<td><strong>Total Possible Points</strong></td>
<td><strong>50 points</strong></td>
</tr>
</tbody>
</table>

**Deadlines:**

- Topic and Outline deadline: March 17, 2008 (minus 1 point / day late)*
- Draft Narrative deadline: April 7, 2008 (minus 1 point / day late)*
- Final Poster and Narrative deadline: April 21, 2008 (minus 1 point / day late)*

*Points deducted for late outlines/drafts will remain deducted from the final score.*
## GENERAL COURSE OUTCOMES

At the end of CLSC 134, the student will be able to:

<table>
<thead>
<tr>
<th>Cognitive / Knowledge: What should the students know from studying this discipline?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Describe principles and procedures of tests performed in a clinical laboratory in the areas of Hematology and Coagulation.</td>
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<th>Behavior / Skills: What should a student be able to do as a result of studying this discipline? (Psychomotor)</th>
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<tr>
<td>3. Operate and maintain laboratory instruments used in the performance of tests in the areas of Hematology and Coagulation, with entry-level skill at the Medical Laboratory Technician / Clinical Laboratory Technician level.</td>
</tr>
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<td>4. Demonstrate satisfactory entry-level skill at the Medical Laboratory Technician / Clinical Laboratory Technician level in the performance of laboratory tests in the areas of Hematology and Coagulation.</td>
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<td>5. Demonstrate decision-making problem-solving skills in the performance of laboratory tests in the areas of Hematology and Coagulation.</td>
</tr>
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<td>6. Demonstrate an ethical and professional attitude in all aspects of their course performance, adhering to all program policies and procedures as delineated in the Program Student Handbook.</td>
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</table>

At the end of CLSC 135, the student will be able to:

<table>
<thead>
<tr>
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</thead>
<tbody>
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<td>1. Describe principles and procedures of tests performed in a clinical laboratory in the area of Immunohematology.</td>
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**LCCC GENERAL EDUCATION OUTCOMES:** Recognizing the responsibility of the Clinical Laboratory Science Technology Program to address the General Education outcomes established by the College, the content of these courses have been developed to address these Outcomes:

- **In1 Critical Thinking:** Employ critical thinking skills in addressing issues and problems.
- **In2 Communication:** Demonstrate competence in verbal and nonverbal communication.
- **In4 Ethics:** Apply personal, professional, social and civic values.

*See the complete LCCC General Education Policy in the current College Catalog.*
<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>M W</td>
<td>CLSC 134 Advanced Hematology and Hemostasis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Martin Luther King Day – NO CLASSES RBC Counting and Instrumentation</td>
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<td></td>
<td></td>
<td>RBC Indices</td>
</tr>
<tr>
<td>2</td>
<td>M W</td>
<td>WBC Instrumentation Methods Waterman/Aden Anemias</td>
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<tr>
<td></td>
<td></td>
<td>Microcytic/Hypochromic Anemias</td>
</tr>
<tr>
<td>3</td>
<td>M W</td>
<td>QUIZ #1, Macrocytic/Normochromic Anemias</td>
</tr>
<tr>
<td></td>
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<td>Normocytic/Normochromic Anemias</td>
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CLSC 134: OUTLINE FOR LECTURE #1

I. Red Blood Cell Counting
   A. Main Uses of RBC Counts
   B. Normal Ranges
   C. Methods of Counting
      1. Manual Hemocytometer
      2. Electronic Impedence
         - Coulter Principle
         - Coincidence of Passage
         - Correction for Coincidence of Passage
      3. Modern Cell Counters
         - Features
         - Sample Sequence
         - Modern Cell Counter Problems
      4. Bull’s Algorithm for QC of Automated Cell-Counters
         - Also known as…
         - Bull’s moving average procedure
         - corrective action when the moving average is abnormal
         - perceived advantage of Bull’s averaging

II. RBC Parameters
    A. RBC Indices
       1. Mean Corpuscular Volume (MCV)
       2. Mean Corpuscular Hemoglobin (MCH)
       3. Mean Corpuscular Hemoglobin Concentration (MCHC)
    B. Red Cell Distribution Width (RDW)
    C. Platelet Counts (PLT)
    D. Mean Platelet Volume (MPV)

III. WBC Counting
    A. Peripheral Blood Leukocytes
       1. Normal Ranges
       2. Circulating Versus Marginated
       3. Terms for Elevated and Depressed WBC Counts
       4. Counting Methods
       5. Absolute Versus Relative Counts
       6. Relative Percentages in a Normal WBC Diff
       7. Wrights Staining
       8. Automated counting and classification methods for WBCs
       9. WBC Cytochemistries
CLSC 134: OBJECTIVES FOR LECTURE #1

At the end of this period of instruction, the student should be able to:

1. List the three uses of the RBC count.

2. state the normal ranges for an adult male and female RBC count.

3. name the two sex hormones which affect RBC production and describe the effect of each on erythropoietic activity.

4. explain how the general principle of cell counting by the principles of electronic impedance.

5. identify a parameter that is generated by averaging all pulse heights on the Oscilloscope during the count cycle.

6. identify a parameter that is generated by totaling all particles that generate pulses during the count cycle.

7. define the term "Coincidence of Passage" and predict its effect on cell count data.

8. state when CBC results must be corrected for Coincidence of Passage, and predict the effect of this correction on the reported values.

9. compare and contrast older and more modern hematology counting instruments, listing features of each.

10. list several common problems when performing cell counts using the Coulter Fn.

11. explain the function(s) of each of the following in automated cell counting instruments:
    a. Blood Sample Valve (sandwich)
    b. Baths
    c. Bath Bubbles
    d. Lyse Reagent
    e. Vote-outs (...)
    f. Sweep-flow lines
    g. Linearity flags (+++)


12. predict the effect that each of the following might have on the CBC data generated by automated cell counters and describe how the problem might be resolved:
   a. no lyse reagent
   b. gross sample lipemia
   c. gross sample icterism
   d. gross sample hemolysis
   e. very elevated WBC counts (leukemic blood samples)
   f. many nucleated RBCs present
   g. sample contains strong Cold Auto-agglutinin antibody
   h. sample contains platelet clumps
   i. a slow protein build-up on the apertures
   j. a slow protein build-up on the electrodes
   k. results outside linearity limits - high
   l. isotonic diluent is contaminated with bacteria

13. Examine CBC results for the possible problems listed in #12 and describe how the problem would be resolved.

14. give two synonyms for Bull's algorithm for QC of automated cell-counters and describe the procedure by which this is performed.

15. describe when corrective action must be taken when evaluating the results of Bull’s averaging.

16. list four steps to be taken as corrective action when the moving average is abnormal.

17. describe the perceived advantage of using the Bull’s averaging procedure.

18. identify the parameters that are directly measure by automated cell counters, and those that are derived from measure values by histogram evaluation or calculation.

19. State the “times three rule” that relates Hgb and HCT values, and use this calculation to assess the validity of patient CBC results, suggesting possible reasons when the calculation fails to meet the criteria.

20. define the abbreviation, state the formulas, adult normal ranges, and units of measure for each of the following indices:
   a. MCV
   b. MCH
   c. MCHC

21. identify the indices that are used to classify anemias on the basis of RBC size (cytic) and color (chromic), and classify RBCs by size and color when given indice data.

22. recognize MCV values that imply microcytic and macrocytic RBC averages.

23. rearrange the indices formulas and solve for RBC, HGB, HCT, MCV, MCH, or MCHC when given the essential data.
24. explain how an RBC histogram is generated by a hematology instrument like the Coulter and diagram histograms when provided appropriate data.

25. define the term "RDW."

26. recall the normal range and units for reporting RDW.

27. explain the relationship between RDW, RBC size variation, and microscopic anisocytosis in a given sample.

28. state the adult normal range for PLT counts.

29. describe the normal relationship between PLT count and PLT size.

30. define the parameter, MPV.

31. list two causes of elevated MPV values.

32. state the adult normal range for peripheral blood WBC counts.

33. explain how automated hematology instruments such as the Coulter counter count WBCs by electronic impedance.

34. state the normal range of relative WBC percentages and the function for the following:
   a. bands
   b. segs
   c. eosinophils
   d. basophils
   e. lymphocytes
   f. monocytes

35. describe the essential difference between the normal differential of an adult, versus that of a young child.

36. calculate an absolute cell count for any type of WBC when given the total WBC count/mm$^3$ and the relative percentages from the differential exam.

37. explain how cell-counting instruments derive a WBC histogram using the principles of electronic impedance.

38. draw a normal WBC histogram, labeling each of the following:
   a. femtoliter numbers
   b. lymphocyte population (AL)
   c. mononuclear population (AM)
   d. granulocyte population (AG)
   e. Region 1
   f. Region 2
   g. Region 3
   h. Region 4
39. Recognize Region Code Errors as reported by Coulter instruments, and identify the most common causes of each error.

40. Describe the basic principle of laser scatter flow cytometry as used to perform automated WBC differentials, including definitions of:
   a. Hydrodynamic focusing
   b. Right angle scatter
   c. Forward scatter
   d. Blocker bar

41. Describe the conductivity principle by which instruments assess internal contents of WBCs.

42. Describe how a WBC scatter plot (scattergram) is derived on cell-counting instruments and contrast this with derivation of WBC histograms.

43. Explain why scatter plots are generally considered to be better than histograms in representing WBC populations.

44. Identify the location of the different normal WBCs as they appear on a sample scatter plot.

45. Describe and contrast how abnormal WBC populations can be recognized on histograms and scatter plots.
CLSC 134: OUTLINE FOR LECTURE #2

I. Anemia
   A. Definition
   B. Symptoms
   C. Classification of Anemias
   D. Three Morphologic Classes of Anemias

II. Hypochromic/Microcytic Anemias
   A. Definition
   B. Iron Deficiency Anemia
      1. Iron Physiology, Transport, and Storage
      2. Siderocytes and Iron Staining Methods
      3. Incidence
      4. Three Main Causes
         a. Low Dietary Intake of Iron
         b. Chronic Blood Loss
         c. Malabsorption of Iron
      5. Diagnosis
         a. Bone Marrow Findings
         b. Peripheral Blood Findings
            (1) Hematology
            (2) Chemistry
      6. Treatment
   C. Thalassemias
      1. Incidence and Underlying Defect
      2. Severity
      3. Beta Thalassemia
         a. Major
         b. Minor
      4. Alpha Thalassemia
         a. Heterozygous
         b. Homozygous
   D. Sideroblastic Anemias
      1. Hereditary
      2. Acquired
         a. Idiopathic
         b. Secondary
   E. Lead Poisoning
CLSC 134: OBJECTIVES FOR LECTURE #2

At the end of this period of instruction, the student should be able to:

1. define the term "anemia."
2. list several physical symptoms commonly experienced by anemic patients.
3. name three classes of anemias as defined by MCV (cytic) and MCHC (chromic) appearance of RBCs.
4. explain why MCHC is a better predictor of RBC "chromicity" than is MCH.
5. describe the process of iron absorption identifying the site of absorption and the functions of:
   a. apoferritin
   b. ferritin
   c. apotransferrin
   d. transferrin
   e. hemosiderin
6. name a stain that is used to estimate the amount of iron stored in developing blood cells in the bone marrow.
7. state the normal percentage of ringed sideroblasts seen in bone marrow.
8. explain what is meant by each term below:
   a. ringed sideroblast
   b. siderocyte
   c. Pappenheimer bodies
9. state one reason for the appearance of siderocytes in the peripheral blood.
10. differentiate between Siderocytes, Howell-Jolly Bodies, Basophilic stippling, and Heinz Bodies with respect to their reaction and appearance with Wright's and Prussian Stain, and state the contents of each.
11. name at least four "hypo/micro" anemias.
12. list the three main causes of Iron Deficiency Anemia, and indicate the most common in the U.S.
13. predict whether each of the following are normal, increased, or decreased in Iron Deficiency Anemia (IDA):
   a. stored iron (ferritin)
   b. ringed sideroblasts in b.m. (hemosiderin)
   c. serum iron
   d. TIBC
   e. % saturation
   f. hemoglobin
   g. MCV and MCHC
   h. RDW

14. describe the general therapy for IDA

15. recall the genetic basis of Thalassemias, and describe the malfunction in hemoglobin synthesis that results from this condition.

16. define “major” and “minor” beta-Thalassemia, and explain the basis of the separation of Thalassemias into alpha and beta types.

17. contrast untreated Thalassemia and IDA with respect to:
   a. the amount of stainable bone marrow iron seen in each condition
   b. serum iron levels seen in each condition
   c. the appropriateness of iron therapy vs. chelation therapy

18. recall the geographic areas of the world having the most Thalassemics.

19. recall two alternate names for Beta Thalassemia Major.

20. describe the RBC population defects present in Beta Thalassemia Major, and name the Hemoglobin fraction that is elevated in Hgb electrophoresis.

21. define the following terms:
   a. hypertrophy
   b. hepatomegaly
   c. splenomegaly
   d. hyperplasia
   e. hypoplasia
   f. erythroid hyperplasia
   g. erythroid hypoplasia
   h. myeloid hyperplasia
   i. myeloid hypoplasia
   j. hemochromatosis

22. Explain why hemochromatosis (iron toxicity) is a major symptom of beta Thalassemia Major, and describe the use of chelating agents in the treatment of this symptom.

23. explain what is meant by the M:E ratio, state the normal value of an M:E ratio, and describe the effect of beta Thalassemia on this value.

24. recall two names used to describe Thalassemia minor.
25. identify the RBC shape abnormality and abnormal hemoglobins present in Thalassemia minor.

26. list the hemoglobins produced in Heterozygous and Homozygous Alpha Thalassemia.

27. describe the oxygen-carrying capabilities of Bart’s Hemoglobin and name the globin chains it contains.

28. explain why Homozygous Alpha Thalassemics do not survive, and state the name for the fetal death that occurs.

29. list several causes of Sideroblastic anemia, stating the most common cause, and predict what the bone marrow iron stain would reveal.

30. name several toxic substances that result in Sideroblastic anemia.

31. state the biochemical effect of lead poisoning on the synthesis of hemoglobin.

32. list at least two substances that are elevated in the serum and urine, and can be used to diagnose lead poisoning.

33. name the RBC inclusion which is present in lead poisoning.
CLSC 134: OUTLINE FOR LECTURE #3

I. Macrocytic Normochromic Anemias
   A. Definition
   B. Typical Causes
   C. Review of Normal Vitamin B12 Absorption and Transport
   D. Pernicious Anemia
      1. Incidence
      2. Theoretical Cause
      3. Effects on RBCs and WBCs
      4. Clinical Symptoms
      5. Diagnosis
         a. Patient History
         b. Bone Marrow
         c. Peripheral Blood Hematology
         d. Peripheral Blood Chemistry
         e. Gastric Acidity Tests
         f. RBC Survival Tests
         g. Schilling's Test
            - Presumptive
            - Confirmatory
      6. Treatment
   E. Dietary B12 Deficiency
   F. Small Intestinal Disorders
   G. Gastrectomy
   H. Folic Acid Deficiency
      - Characteristic Causes and Findings
CLSC 134: OBJECTIVES FOR LECTURE #3

At the end of this period of instruction, the student will be able to:

1. define the term "Megaloblastic Anemia."

2. list the two most common causes of Macrocytic Anemia.

3. describe the process of Vitamin B12 absorption, transport, and storage, including:
   a. site of absorption
   b. name of the protein which is essential for B12 absorption
   c. name of the serum protein which transports B12
   d. normal adult range of Serum B12

4. define the term "pernicious."

5. explain why Pernicious Anemia (PA) is thought to be an autoimmune disease.

6. define "asynchronism."

7. explain why patients with PA have:
   a. megaloblastic cells in the bone marrow
   b. macrocytic RBCs in the peripheral blood
   c. hypersegmented PMNs in the peripheral blood
   d. little or no response to oral B12 therapy

8. explain why neurologic malfunctions often accompany untreated PA cases and list two of them.

9. describe at least two bone marrow abnormalities present in untreated PA.

10. explain why the MCV and MCH are elevated but the MCHC remains normal in PA.

11. list at least two hematologic abnormalities present in the peripheral blood and marrow of PA patients.

12. list at least two serum chemistry abnormalities in PA.

13. explain the basis of the gastric acidity test, and describe the procedure.

14. explain the basis of the presumptive Schillings Test, and describe the steps of the procedure.

15. explain the basis of the confirmatory Schillings Test, and describe the procedure, noting the difference between the presumptive and confirmatory tests.

16. given a set of patient results, interpret the meaning of a:
   a. Gastric Acidity Test
   b. Schillings Test
17. discuss how each of the following would affect the Schillings Test:
   a. the presence of renal disease
   b. incomplete urine collection
   c. intestinal malabsorption
   d. failure to give B12 injection prior to the test
   e. total gastrectomy
   f. fish tapeworm

18. explain the principle of the RBC survival test.

19. recall the name of a radioactive element that is used to tag RBCs for the RBC survival test.

20. recall the treatment for PA.

21. state the normal range for Serum Folic Acid.

22. state the most common cause of folic acid deficiency.

23. list at least two causes of Folic Acid Deficiency other than dietary insufficiency.
CLSC 134: OUTLINE FOR LECTURE #4

I. Normocytic Normochromic Anemias
   A. Primary Hypoproliferation Anemias
      1. Aplastic anemia
         a. Idiopathic Aplastic Anemias
            - Fanconi's
            - Diamond Blackfan
         b. Known Cause Aplastic Anemia
            - Bacterial Toxins
            - Radiation Exposure
            - Chemical Exposure
   B. Secondary Hypoproliferation Anemias
      1. Leukemias
      2. Multiple Myeloma
      3. Metastic Carcinoma
      4. Myelofibrosis
      5. Severe Inflammation
      6. Kidney Disease
      7. Congestive Heart Failure
      8. Toxic Exposures
   C. Intrinsic Hemolytic Anemias
      1. Thalassemias
      2. Hereditary Spherocytosis
         a. Osmotic Fragility Testing
      3. Hereditary Ovalocytosis
      4. Hereditary Elliptocytosis
      5. Paroxysmal Nocturnal Hemoglobinuria
      6. G6PD Deficiency
      7. Sickle Cell Anemia
         a. Solubility Tests
      8. Sickle Cell Trait
      9. Hemoglobin C Disease
   D. Extrinsic Hemolytic Anemias
      1. Hemolytic Disease of the Newborn
         a. ABO HDN
         b. Rh HDN
      2. Incompatible Transfusions
      3. Autoimmune Hemolytic Anemias
      4. Drug Induced Hemolytic Anemias
      5. Malaria
      6. Others
   E. Blood Loss Anemias
      1. Acute Blood Loss
      2. Chronic Blood Loss
CLSC 134: OBJECTIVES FOR LECTURE #4

At the end of this period of instruction, the student will be able to:

1. name two types of Aplastic Anemias that are both idiopathic and congenital.
2. identify the marrow cell lines affected in each anemia listed in objective #1 and predict the ME ratio of each.
3. list at least four causes of Secondary Hypoproliferation Anemias.
4. explain the basis for classifying hemolytic anemias as either "intrinsic" or "extrinsic."
5. explain why the RBCs of Hereditary Spherocytosis have:
   a. a shortened invivo lifespan
   b. an increased osmotic fragility
6. describe the principle, procedure, and expected results of the Autohemolysis Test in the diagnosis of Hereditary Spherocytosis.
7. state the principles and procedural steps for the performance of an Osmotic Fragility Test.
8. recall the saline concentrations at which normal RBCs begin to lyse and are completely lysed in the Osmotic Fragility Test.
9. interpret the results of graphed osmotic fragility curves identifying the curves which correspond to:
   a. Spherocytes
   b. Normal Erythrocytes
   c. Sickle Cells and Target Cells
10. explain the cause of invivo hemolysis in Paroxysmal Nocturnal Hemoglobinuria.
11. name a laboratory test performed in Blood Bank that will be positive in cases of PNH, and predict results using three different types of reagent.
12. name two serum tests that are used as diagnostic tools in cases of suspect PNH and state a general description of the principle of these two tests.
13. explain how the deficiency of G 6 P D enzyme results in the formation of Heinz Bodies.
14. describe the effect of Heinz Bodies on the RBC.
15. review the substances of which each of the following RBC inclusions are composed:
   a. Heinz Bodies
d. Pappenheimer bodies
   b. Howell-Jolley Bodies
e. reticulocytes
   c. Siderotic granules
   f. Basophilic stippling
16. differentiate between reticulocytes, Heinz Bodies, Howell-Jolly Bodies, and Siderotic granules when given a description of inclusion containing RBCs stained with:
   a. New Methylene Blue
   b. Wright-Giemsa
   c. Prussian Blue

17. explain why New Methylene Blue and Brilliant Cresyl are called "Supravital" stains.

18. describe the hemoglobin defect which results when two Hemoglobin S genes are inherited, stating the amino acid substitution that results in the abnormal hemoglobin.

19. list the two hemoglobins produced by those persons having two Hemoglobin S genes (SS).

20. define the term "sickle crisis."

21. list two physiologic side effects of sickle crises.

22. name at least two peripheral blood hematology findings that are elevated in Sickle Cell Anemia.

23. name at least two peripheral blood hematology parameters that are depressed in Sickle Cell Anemia.

24. explain the principle and describe positive results of Solubility Sickle Screening tests.

25. recall the formula and calculate the corrected WBC count when given the number of nRBCs seen per number of WBCs viewed.

26. name the genotype which causes Sickle Cell Trait, and list the two hemoglobins normally produced by those persons having Sickle Cell Trait.

27. calculate the percentage of offspring which have a particular hemoglobin genotype using a Punnett Square.

28. contrast the terms: phenotype and genotype.

29. name the genotype which causes Hemoglobin C Disease.

30. identify the key morphologic abnormality present in the RBC population of persons having:
   a. Hemoglobin SS
   b. Hemoglobin AS
   c. Hemoglobin CC
   d. Hemoglobin AC

31. describe the hemoglobin defect which results when two Hemoglobin C genes are inherited, and state the amino acid substitution that results in the abnormal hemoglobin.

32. describe the underlying defect present in porphyrias.
33. name at least one lab test that is used to diagnose porphyria.

34. identify the external mechanism of RBC destruction for each of the following extrinsic hemolytic anemias:
   a. HDN
   b. Incompatible transfusions
   c. AIHA
   d. Drug induced
   e. Malaria

35. for HDN, incompatible transfusions, drug-induced RBC destruction, and the different types of AIHA, predict the DAT results in polyspecific, anti-IgG, and anti-C₃ AHG reagents.

36. list the names of the four main species of Plasmodium that causes Malaria in humans.

37. identify the type of mosquito that carries malarial parasites.

38. explain why a drop in the RBC, HGB, and HCT is seen in Acute Blood Loss only after IV fluids are given.

39. explain why chronic blood loss reveals a decrease in the RBC, HGB, and HCT without IV treatment.

40. contrast acute and chronic blood loss with respect to the expected peripheral blood retic percentage and presence or absence of polychromasia.
CLSC 134: OUTLINE FOR LECTURE #5

I. Polycythemia
   A. Definition
   B. Two Main Types of Polycythemia
      1. Relative
      2. Absolute
   C. Relative Polycythemia
      1. Alternate Name
      2. Laboratory Findings
         a. Bone Marrow
         b. Peripheral Blood/Plasma Volume
         c. Leukocyte Alkaline Phosphatase
      3. Common Causes of
   D. Absolute Polycythemia
      1. Laboratory Findings
         a. Bone Marrow
         b. Peripheral Blood/Plasma Volume
         c. Two Main Groups Versus Erythropoietin
            (1) Primary
            (2) Secondary
   E. Polycythemia Vera (Primary)
      1. Definition
      2. Bone Marrow Findings
      3. Peripheral Blood/Plasma Volume
      4. Physical Symptoms
      5. Treatment
         a. Whole Blood Phlebotomy
         b. Radiotherapy
         c. Chemotherapy
      6. Usual Progression of P. Vera
   F. Secondary Absolute Polycythemia
      1. Typical Findings
      2. Causes without Hypoxia
      3. Causes with Hypoxia
   G. Diagram of Polycythemias Overall

II. Erythroleukemia
   A. Definition
   B. Alternate Names for
   C. Typical Onset
   D. Stage 1 Findings
   E. Stage 2 Findings
   F. Stage 3 Findings
OBJECTIVES FOR LECTURE #5

At the end of this period of instruction, the student will be able to:

1. define the term "polycythemia."

2. contrast relative versus absolute polycythemia with respect to the:
   a. overall plasma volume
   b. overall RBC mass
   c. hematocrit
   d. erythropoietic rate
   e. reticulocyte percentage
   f. erythropoietin activity
   g. LAP activity of neutrophils

3. describe the procedure for LAP staining, calculate a final patient result given the raw data, and state the normal range for the procedure.

4. list at least one cause of Relative Polycythemia.

5. list at least two physical symptoms associated with Polycythemia Vera.

6. describe the bone marrow and peripheral blood findings in P. vera.

7. identify the usual treatment for the symptoms of hypertension due to P. vera.

8. explain why P. vera is often classified as a myeloproliferative disease.

9. list at least two causes of Secondary Absolute Polycythemia with and without hypoxia.

10. recall at least one alternate name for the disease called Erythroleukemia.

11. describe the first, second and third stages of Erythroleukemia, and state the condition that the final stage of erythroleukemia resembles.

12. describe the effect of each stage of Erythroleukemia on the ME ratio.

13. state the formula for correcting WBC counts for high numbers of nRBCs often seen in erythroleukemia, and use the formula to solve problems.
CLSC 134: OUTLINE FOR LECTURE #6

I. Leukemias in General
   A. Definition
   B. Etiology
   C. Incidence in the USA
   D. High Risk Groups
   E. Prevalence of Various Types of Leukemia
   F. Symptoms
      1. Acute
      2. Subacute
      3. Chronic
   G. Treatment
      1. Chemotherapy
      2. Radiation Therapy
      3. Corticosteroids
      4. Antibiotics
      5. Analgesics
      6. Transfusions
   H. Usual Causes of Death

II. Classification of Leukemias
   A. Factors on Which Classification Is Based
   B. Findings in the Acute, Subacute, Chronic Scheme
   C. French American British (FAB) Classification

III. The Acute Leukemias
   A. Stem Cell Leukemia
   B. Acute Lymphocytic Leukemia
   C. Acute Granulocytic Leukemia
   D. Acute Myelomonocytic Leukemia
   E. Acute Monocytic Leukemia
   F. Acute Erythroleukemia

IV. The Chronic Leukemias
   A. Chronic Granulocytic Leukemia
   B. Chronic Lymphocytic Leukemia
   C. Hairy Cell Leukemia
CLSC 134: OBJECTIVES FOR LECTURE #6

At the end of this period of instruction, the student should be able to:

1. define the term "leukemia."
2. define the term "malignancy."
3. list five factors that may stimulate or collectively stimulate malignancies such as leukemia.
4. describe how a leukemic line of WBCs might first develop, define what is meant by a "triggering event", and give examples.
5. identify the two age groups within the U.S. population which have the highest incidence of leukemia.
6. recall at least five symptoms of leukemia.
7. describe the general laboratory diagnosis of leukemia by examination of peripheral blood and bone marrow.
8. contrast the essential hematologic differences in both bone marrow and peripheral blood for:
   a. acute leukemias
   b. chronic leukemias
9. list the six main types of treatment which are used to combat the symptoms of leukemia.
10. list the five main classes of chemotherapeutic agents, and name one drug in each class.
11. explain how radiation therapy kills leukemic cells, and state the chemical reaction involved in this process.
12. explain the purpose of giving each blood component to leukemic patients:
   a. packed red blood cells
   b. platelets
   c. leukocyte concentrates
   d. plasma components
13. describe the process of bone marrow transplant, citing the risks of the procedure.
14. recall the two main causes of death among leukemic patients.
15. list at least five factors upon which the classification of leukemias are based.
16. contrast acute and chronic leukemias with respect to:
   a. rate of onset
   b. typical age of patient
   c. peripheral blood WBC counts
   d. degree of WBC maturation in peripheral blood and bone marrow
   e. severity of anemia
   f. severity of thrombocytopenia
   g. life expectancy
   h. causes of death

17. define the term "blastic crisis."

18. list the symbols and names for the acute lymphoblastic and myeloblastic leukemias as
    they are classified in the French American British (FAB) scheme.

19. describe the predominant WBC morphology for the L1, L2, and L3 lymphoblastic
    leukemias.

20. name and describe the type of blood cell that predominates in the peripheral blood for
    each Myeloblastic Leukemia below:
    a. M1
    b. M2
    c. M3
    d. M4
    e. M5
    f. M6

21. predict the cytochemical stain reactions seen for Acute Myeloblastic and Lymphoblastic
    Leukemias, citing Peroxidase, Esterase, Sudan Black, and TdT results.

22. state the FAB class of leukemia frequently demonstrating DIC symptoms.

23. describe the hematologic (CBC and diff) findings which are expected in:
   a. Acute Lymphocytic Leukemia (ALL)
   b. Acute Granulocytic Leukemia (AGL)
   c. Acute Myelomonocytic Leukemia (AMMoL)
   d. Acute Monocytic Leukemia (AMoL)

24. recall the expected Periodic Acid Schiff (PAS) cytochemical reaction for ALL and AGL.

25. contrast the following acute leukemias with respect to their usual Peroxidase
    cytochemical reaction:
   a. AMMoL
   b. AMoL

26. recall the usual Non-Specific Esterase (NSE) findings in both the Naegli and Schillings
    types of acute monocytic leukemia.

27. state the key difference between M5a and M5b AMoL.

28. recall two alternate names for M6 Leukemia.
29. explain the chromosomal abnormality known as Ph1 (Philadelphia Chromosome).

30. name the type of chronic leukemia that is most often associated with the Philadelphia Chromosome.

31. identify the cytochemical test which is used to differentiate Chronic Granulocytic Leukemia (CGL) from leukemoid reaction, and the expected result for each condition.

32. list at least three peripheral blood abnormalities associated with CGL.

33. contrast the expected peripheral blood smear appearance of the following:
   a. ALL vs. Chronic Lymphocytic Leukemia (CLL)
   b. AGL vs. CGL

34. explain why AIHA is occasionally seen in cases of CLL.

35. recall the key cytochemical test for Hairy Cell Leukemia.
CLSC 134: OUTLINE FOR LECTURE #7

Other WBC Disorders

I. Multiple Myeloma
   A. Definition
   B. Characteristics
      1. Demographics
      2. Bone Marrow Findings
      3. Peripheral Blood
         a. Hematology/Coagulation
         b. Chemistry/Electrophoresis/Urinalysis

II. Lymphomas
   A. Definition
   B. Characteristics
   C. Hodgkins Lymphoma
   D. Non-Hodgkins Lymphomas
      1. Burkitts Lymphoma
CLSC 134: OBJECTIVES FOR LECTURE #7

At the end of this period of instruction, the student should be able to:

1. describe the peripheral blood (CBC + diff) findings in Multiple Myeloma.
2. describe the appearance of "Flame Cells" and "Mott Cells."
3. name and state the composition of the inclusions within the cells listed in the previous objective.
4. explain the frequent occurrence of osteoporosis in patients with Multiple Myeloma.
5. define the term "hypergammaglobulinemia."
6. draw a normal protein electrophoresis pattern, as would be generated by a scanning densitometer, labeling the following:
   a. point of sample application  
   b. anode  
   c. cathode  
   d. albumin  
   e. alpha one  
   f. alpha two  
   g. beta  
   h. gamma
7. diagram the appearance of a protein electrophoretic pattern which indicates monoclonal gammopathy, and explain the meaning of this terminology.
8. list the five main classes of immunoglobulins.
9. name the immunoglobulin that most often is increased in Multiple Myeloma (MM).
10. define the term "rouleaux."
11. explain why rouleaux is often present on blood films prepared from the blood of patients with MM.
12. recall at least two hematologic abnormalities associated with MM other than rouleaux.
13. name the light chain protein that is often present in the urine of patients with MM.
14. define the term "lymphoma."
15. state the difference between Hodgkins and Non-Hodgkins lymphomas.
16. name the large cell which must be seen (microscopically) in lymph node biopsy slides before a diagnosis of Hodgkins Lymphoma is made.
17. name the most common type of Non-Hodgkins Lymphoma.
CLSC 134: OUTLINE FOR LECTURE #8

Hemostatis

I. Blood Vessel Integrity
   A. Vasoconstriction
   B. Endothelial Maintenance
   C. Limiting Factors

II. Platelet Functions
   A. Serotonin Absorption
   B. Release of:
      1. Thrombasthenin
      2. Platelet factors
   C. Plug Formation
   D. Viscous Metamorphosis
   E. Clot Retraction

III. Plasma Coagulation Factors
   A. Discovery
   B. Naming of PCFs
   C. Activation of Factors
      1. Extrinsic pathway
      2. Intrinsic pathway
   D. Pathway Diagrams Handouts
   E. Factor Facts Handout
   F. Factors Discussed by Pathway
      1. Extrinsic Pathway
         a. Factor III
         b. Factor VII
         c. Factor X
         d. Factor V
         e. Factor II
         f. Factor I
         g. Factor XIII
         h. Factor IV
      2. Intrinsic Pathway
         a. Factor XII
         b. Factor XI
         c. Factor IX
         d. Factor VIII

IV. Hemostatic-Fibrinolytic Balance
   A. Clot Enhancers
   B. Clot Suppressors and Fibrinolysins
      1. Anti-thrombins
      2. Heparin
      3. Fibrinogen fragments
      4. Oral anticoagulants
      5. Plasmin
      6. FDPs (FSPs)
CLSC 134: OBJECTIVES FOR LECTURE #8

By the end of this period of instruction, the student should be able to:

1. define the term "hemostasis."

2. list four general items on which normal hemostasis is dependent.

3. list two substances released by platelets associated with normal blood vessel integrity, and describe their functions.

4. describe the function of each of the following:
   a. Platelet Factor 2
   b. Platelet Factor 3
   c. Platelet Factor 4

5. list the three main steps in the formation of a Primary Hemostatic "Plug."

6. define the term "viscous metamorphosis."

7. identify a substance that is necessary for normal clot retraction.

8. name the three main activators of the intrinsic pathway and the coagulation lab test which is routinely used to monitor this pathway.

9. name the main activator of the extrinsic pathway and the coagulation test used routinely to monitor this pathway.

10. list the factors in the intrinsic and extrinsic pathways in their proper order of activation using Roman numerals.

11. list the names for the following Plasma Coagulation Factors (PCFs):
    a. II
    b. IIa
    c. I
    d. Ia

12. list one alternate name for PCF III and identify three tissues which are rich in this factor.

13. recall the name of a reagent containing PCF III which is used in the PT test.

14. list one alternate name for PCF VII.

15. give an example of an "alkaline earth" and list those factors which are present in normal plasma that has been absorbed with alkaline earths.

16. list one alternate name for PCF X.

17. list the four PCFs whose synthesis is dependent upon adequate levels of Vitamin K.
18. recall one alternate names for PCF V and identify the reaction which this factor catalyzes.

19. recall the name for PCF II and one substance which regulates the conversion of PCF II to PCF IIa.

20. name one other activity of factor IIa besides activation of I and XIII.

21. recall the name for PCF I and its normal range in human plasma.

22. describe and diagram the process of fibrinogen polymerization forming fibrin strands and name the PCF that catalyzes this reaction.

23. identify the function of and two names for PCF XIII.

24. explain the principle of the "urea solubility test."

25. explain why PCF III and PCF IV are unique among PCFs.

26. recognize the adult normal range for ionized serum calcium.

27. list one step in the coagulation cascade which is not calcium dependent.

28. list two alternate names for PCF XII, and name three substances that can activate it.

29. recall the name for PCF XI, and describe how it is activated.

30. list one name for PCF IX and two names used to describe deficiency of this factor.

31. give the name for PCF VIII, list two names which describe deficiency of this factor, and state where it is synthesized.

32. list five substances or other factors which enhance clot formation.

33. explain how each of the following suppresses clotting:
   a. anti-thrombin I
   b. anti-thrombin II
   c. anti-thrombin III
   d. heparin
   e. oral anticoagulants
   f. proteins C and S

34. describe the role of Proteins C and S in normal hemostasis, and the clinical implications of abnormal levels of these proteins.

35. name a coagulation test which is routinely used to monitor IV heparin therapy.

36. give two alternate names for Coumadin, describe a common household use for this chemical, and explain how an overdose is treated.
37. define the term “fibrinolysis”.

38. describe the action of plasmin, and list four activators which convert plasminogen to plasmin, indicating which are most important in vivo.

39. recall two names used to describe fibrinolytic products.

40. explain the process by which FDPs are formed, and state the sequence of formation of FDPs X, Y, A, B, C, D, and E.

41. describe the clot suppression activity of FDPs.

42. explain the involvement of plasminogen/plasmin in treatment of Myocardial Infarct.

43. define d-Dimers, describe how they are formed, and explain why they are a better indicator of in vivo fibrin formation, as compared to FDPs.
CLSC 134: OUTLINE FOR LECTURE #9

I. Tests of Vascular Integrity
   A. Bleeding Time
      1. Methods, sites, and normal ranges
   B. Rumple-Leeds Test
      1. Alternate names
      2. Principle
      3. Normal range
      4. Definitions of related terms

II. Platelet Tests
   A. Platelet Counts
   B. Platelet Function Tests
      1. Bleeding Times
      2. Rumple-Leeds Test
      3. Clot Retraction Test

III. Plasma Coagulation Factor Tests
   A. Extrinsic Pathway Tests
      1. Prothrombin Test (PT)
         a. principle
         b. optical methods
            - principle (MLA)
            - disadvantages
            - advantages
         c. mechanical methods
            - principle (Fibrometer)
         d. normal range
         e. therapeutic range (oral anticoagulants)
         f. percentage expression of results
   B. Intrinsic Pathway Tests
      1. Partial Thromboplastin Time (PTT)
      2. Activated Partial Thromboplastin Time (APTT)
         a. principle
         b. normal values
         c. therapeutic values with heparin
         d. reporting
         e. critical steps
3. Substitution Testing (Thromboplastin Generation Time)
   a. heat aged serum
   b. absorbed plasma
   c. TGT test performance
   d. usefulness
   e. confirmation
   f. normal times

4. Factor assay tests

IV. Tests of Fibrinolysis

A. Clot Retraction Test
   1. Principle
   2. Normal values
   3. Abnormal results

B. Latex FDP Tests
   1. Specimen collection
   2. Principle
   3. Interpretation
   4. Drawbacks
   5. Advantages
   6. Modifications

C. Latex d-Dimer Test
   1. definition
   2. advantages over FDP

D. Quantitative Immunoassays for d-dimer
   1. basic principle of quantitative immunoassays
   2. clinical use of quantitative d-dimer measurements
   3. normal reference ranges for quantitative d-dimer
CLSC 134: OBJECTIVES FOR LECTURE #9

By the end of this period of instruction, the student should be able to:

1. recall the site and normal ranges for the Duke, Ivy and Simplate Bleeding Time Tests.

2. state the following relative to the Rumple-Leeds Test:
   a. two alternate names for the test
   b. principle
   c. normal findings

3. recall the normal range for platelet counts on adults.

4. explain the principle of the clot retraction test.

5. discuss the significance of excessive RBC fallout in the clot retraction test.

6. state the expected values for a clot retraction test performed on a normal individual.

7. explain the optical principle that is used in fibrin detection instruments such as the MLA 700 and 750.

8. explain the principle by which the electromechanical instruments detect the formation of fibrin strands.

9. list two advantages and two disadvantages of optical coagulation instruments.

10. describe the two types of reagent that can be used in the Prothrombin Time (PT) Test, describe the components of the reagents, explain the difference between the two reagents, and state which one is better for Prothrombin Time testing.

11. recall the following relative to the PT Test:
    a. normal range
    b. the principle of the test
    c. PCFs involved in the PT Test
    d. effect of oral anticoagulants on the result
    e. therapeutic range for oral anticoagulants

12. define the abbreviation “INR”, describe how it is derived, and explain the purpose of performing this calculation related to PT results.

13. name the PCF that is most affected by oral anticoagulants.

14. recall the following relative to the APTT Test:
    a. normal range
    b. the principle of the test
    c. PCFs involved in the APTT Test
    d. effect of heparin on the result
    e. therapeutic range for heparin
15. list the procedural steps and reagents used in the Activated Partial Thromboplastin Time (APTT) Test.

16. describe the specific components of APTT reagent and their functions.

17. note the critical steps in the APTT procedure.

18. name the coagulation test which uses mixtures of patient plasma and aged serum or absorbed plasma.

19. explain how normal aged serum and absorbed plasmas are made and list the PCFs contained in each.

20. describe the principle of substitution testing and how results are used to determine possible coagulation factor deficiencies.

21. determine which factor may be deficient when given the PT, APTT, and substitution test data.

22. explain two reasons for performing Factor Assay tests.

23. describe the step-by-step procedure for performing a Factor VIII assay.

24. state the reporting format for Factor Assay tests, and describe the expected result of a factor-deficient patient.

25. identify the factor assay test which is most frequently performed in coagulation.

26. recall an alternate name for fibrin degradation products.

26. explain the principle of latex FDP and D-dimer testing methods, and differentiate between qualitative and semi-quantitative methods.

27. describe the appearance of a (+) and (-) latex FDP or D-dimer test.

28. state two key ingredients in the special collection tube used for later FDP testing, and describe their functions.

29. explain why the d-dimer test may be better than the FDP for monitoring fibrinolysis.

30. explain the basic principle of quantitative immunoassays for D-dimer.

31. describe the clinical use of quantitative d-dimer measurements in the diagnosis and treatment of patient conditions.

32. state the normal reference ranges for quantitative d-dimer.

33. name several disease states that would result in an elevation in levels of FDPs and/or d-dimers in the plasma.
I. Vascular Defects
   A. Symptoms
   B. Lab Results
   C. Causes
      1. Scurvy
      2. Von Willebrand's Disease

II. Platelet Defects
   A. Thrombocytopenia
      1. Definition
      2. Causes
      3. ITP
         a. acute
         b. chronic
         c. theory of
   B. Thrombocytosis
      1. Definition
      2. Effects
      3. Diseases associated with
   C. Thrombocytopathy
      1. Definition
      2. Three defects
         a. decreased adhesion
         b. decreased aggregation
         c. failure to release

III. Extrinsic Pathway Defects
   A. Factors Affected
   B. Exclusions of Factors
   C. Factor VII Deficiency
      1. Anticoagulant therapy
      2. Liver disease
      3. Vitamin K deficiency
   D. Factor X Deficiency
   E. Factor V Deficiency
   F. Factor II Deficiency
      1. Hereditary
      2. Acquired
   G. Factor I Deficiency
      1. Results of
      2. Main causes for
   H. Factor XIII Deficiency
IV. Intrinsic Pathway Defects

A. Factors Involved
B. Factor XII Deficiency
C. Factor XI Deficiency
D. Factor IX Deficiency
E. Factor VIII Deficiency
   1. Characteristics
   2. Therapy
   3. Post-therapy findings
F. Von Willebrand's Disease

V. Disseminated Intravascular Coagulation

A. Triggering Events
B. Incidence of DIC
C. Results of Syndrome When Triggered
   1. Invivo
   2. Invitro
      a. Hematology changes
      b. Coagulation/chemistry changes (table)
D. Prolonged DIC Changes Invivo
E. Prophylaxis of DIC
F. Treatment of DIC

VI. Thrombotic Diseases

A. Risk factors for thrombotic disease
B. Factor V Leiden genetic mutation
C. Lupus Anticoagulant
D. Anti-Thrombin III deficiencies
E. Protein C or S deficiencies
F. HomocYTEine levels
G. Genetic elevations of prothrombin
H. Thrombotic disease “double hits”
CLSC 134: OBJECTIVES FOR LECTURE #10

By the end of this period of instruction, the student should be able to:

1. describe the involvement of Vitamin C in normal vascular integrity, and name the dietary deficiency of Vitamin C that causes bleeding disorders.

2. define the term "thrombocytopenia" and list at least five causes for this condition, stating which is the most common.

3. define the term acute "ITP," state the age group it is most commonly associated with, and conditions it is related to.

4. define the term "thrombocytosis" and list two causes of this condition.

5. name one disease state in which the platelets display abnormal adhesion.

6. list three causes for decreased platelet aggregation.

7. name one condition involving lack of platelet granular contents.

8. list two PCF's of the extrinsic pathway of which there has not been documentation of any known deficiencies.

9. name the PCF most affected by oral anticoagulant therapy, and state the coagulation test that will reflect this condition.

10. recall the absorption and synthesis of Vitamin K within the G.I. tract, and describe the effects of the following on Vitamin K metabolism:
    a. gallstones
    b. diarrhea
    c. age (i.e. newborns)

11. name at least one item which would cause an acquired PCF II deficiency.

12. define and state at least one cause of:
    a. Hypofibrinogenemia
    b. Afibrinogenemia
    c. Dysfibrinogenemia

13. state one condition that would cause an acquired PCF XIII deficiency

14. describe coagulation test results seen in a PCF XII deficiency, and explain why this condition is asymptomatic.

15. give another name for hereditary PCF XI deficiency and state which sexes are affected by this condition.

16. give two other names for PCF IX deficiency and state which sexes are affected by this condition.
17. differentiate between Hemophilia B+ and B-.

18. give two other names for PCF VIII deficiency and state which sexes are affected by this condition.

19. describe the symptoms of Hemophilia A.

20. define hemarthrosis.

21. name three preparations that can be used to treat Hemophilia A, and state which is the best.

22. name the two fractions of the factor VIII molecule, list their functions, and state which is deficient in Hemophilia A, and in Von Willebrand's disease.

23. describe the clotting defects in Von Willebrand's disease, and state their effect on:
   a. bleeding time
   b. PTT results
   c. platelet aggregation studies
   d. Rumple-leeds test

24. contrast Hemophilia A with Von Willebrand's disease with respect to:
   a. platelet function
   b. Sexes affected
   c. hemarthrosis

25. name two preparations used to treat Von Willebrand's.

26. contrast the response to therapy seen in Hemophilia A with that seen in Von Willebrand's disease.

27. list four events which are documented to have triggered Disseminated Intravascular Coagulation (D.I.C.)

28. predict the changes in early, mid, and late DIC:
   a. platelet counts
   b. fibrinogen levels
   c. PT results
   d. APTT results
   e. FDP levels
   f. Anti-Thrombin III levels

29. explain how the following therapies affect DIC:
   a. IV heparin
   b. subcutaneous heparin injections
   c. IV EACA
   d. FFP

30. identify five factors that put a person at high risk for thrombotic disease.
31. explain the genetic abnormality known as the Factor V Leiden mutation and state the frequency that this condition causes thrombotic disease.

32. define “Lupus Anticoagulant”.

33. describe the in vitro effect of Lupus Anticoagulant on laboratory tests.

34. describe the in vivo effect of Lupus Anticoagulant.

35. explain how these factors can contribute to increased risk of thrombotic disease:
   a. anti-thrombin III deficiencies
   b. Protein C or S deficiencies
   c. Homocysteine levels
   d. Genetic elevations of prothrombin

36. explain the term “double hit” in terms of risk of thrombotic disease.
CLSC 135: OUTLINE FOR LECTURE #1

**Immunology**

I. Introductory Article: *Technological Advances Put an “Immediate Spin” on Transfusion Services*

II. Review of Basic Immunology
   A. Self-Recognition
   B. Tolerance
   C. Non-Self Recognition
   D. Antibody Production
   E. Primary vs. Secondary Immune Response
   F. Antigens
   G. Antibody
      1. Two regions of antibody molecule
         a. FAB
         b. FC
   H. Adsorption
   I. Elution
   J. Agglutination
   K. Zeta potential
   L. Alloantibody
   M. Autoantibody

**The Complement System**

I. Three Main Functions of the Complement System
   A. Inflammatory Responses
   B. Opsonization
   C. Cytolysis

II. Composition and Activation of Complement
   A. Composition
   B. Designation
   C. Activation
   D. Analogy
III. Two Pathways of Complement Activation

A. The Classical Pathway
   1. Prerequisites
   2. Four phases
      a. attachment
      b. activation
      c. amplification
      d. attack

B. The Alternate (Properdin) Pathway
   1. Triggering events
   2. Properdin factors
   3. End result

C. End Result of C3 and C4
   1. Inactivators
   2. Importance in Blood Banking
CLSC 135: OBJECTIVES FOR LECTURE #1

By the end of this period of instruction, the student should be able to:

1. describe the transfusion practices attempted prior to the discovery of blood groups and comment on the success of these procedures.

2. name the discoverer of ABO blood groups and the year in which this discovery occurred.

3. state the year that crossmatching of donor and recipient blood was first suggested and the researcher who developed this practice.

4. describe the discovery in the production of blood bank reagents that enabled reagents to be made more specific and of a better grade than previously.

5. describe the development of various anticoagulants used for blood collection stating the years in which significant advances were made, and name the anticoagulant that is considered to be the standard today.

6. throughout the 1970s and 1980s, describe the use of more specific blood components to treat specific conditions, including the uses for:
   a. packed red blood cells
   b. fresh frozen plasma
   c. random donor platelets
   d. cryoprecipitate

7. name the newer components that are gradually replacing the use of random donor platelets and cryoprecipitate.

8. explain the abilities of self-recognition, tolerance, and non-self-recognition and how these drive the activities of the immune system.

9. state the cells which produce antibodies in an immune response.

10. describe six differences between a primary and a secondary immune response

11. define “antigen” and “antibody”.

12. define the abbreviation “FAB” and explain the features of this portion of an antibody molecule.

13. define the abbreviation “FC” and state two important functions of this portion of an antibody molecule.
14. define each of the following immunology terms:
   a. adsorption
   b. elution
   c. agglutination
   d. zeta potential
   e. alloantibody
   f. autoantibody

15. list the three main functions of the complement system.

16. explain why the words "waterfall, cascade and domino effect" are used to describe complement activation.

17. recall what must occur prior to the attachment of complement.

18. describe, in general terms, the activities which occur during complement activation from initial attachment phase to membrane attack.

19. list the complement proteins of the classical pathway in their correct order of activation, indicating cleavages where they occur.

20. define the terms:
   a. C3 convertase
   b. C5 convertase
   c. membrane attack complex

21. explain how the activation of the classical and alternate pathway differs, and list four "triggering events" of the alternate pathway.

22. name the three "Properdin Factors."

23. explain the importance of the Properdin pathway to the immune system, and why it is more efficient at removing some infectious agents.

24. state the end products of the C4b/C3b fragments, and describe the negative feedback mechanism associated with these fragments.

25. explain why C3 and C4 are the two complement proteins most important to blood bankers.
CLSC 135: OUTLINE FOR LECTURE #2

The ABO System

I. Discovery
   A. Researcher and Year
   B. Accidental Method of Discovery

II. Genetics and Frequencies
   A. Genotypes Versus Phenotypes
   B. Frequencies
   C. Development of ABO Antigens

III. Antigenic Determinants and Terminal Sugars
   A. Nature of ABO Antigens
   B. H Substance and H Genes
   C. Terminal Sugars Versus ABO

IV. Detection of H Substance on RBCs
   A. Conversion of H Substance
   B. Detection of H Substance with Anti-H Lectin

V. Detection of H Substance in Body Secretions
   A. Method for Detection
   B. Determination of Secretor Status

VI. The Bombay Phenotype
   A. Naming/Discovery
   B. Genotypic Abnormality
   C. Phenotypic Abnormality
   D. Problems in Blood Banking
      1. Incompatibility

VII. Detection of ABO Antigens
   A. Forward Grouping Test
   B. Reagents
VIII. Subgroups of the A Antigen
   A. What are subgroups?
   B. How do they react to in ABO testing?
   C. Resolving the Discrepancies
      1. Anti-A1 lectin
      2. A2 reagent cells

IX. Naturally Occurring Antibodies
   A. Natural Stimulation and Titers
   B. Immune Forms
   C. Hemolytic Transfusion Reactions

X. The Reverse Grouping Test
   A. Tube Contents
   B. Expected Reactions
   C. Basis for Discrepancies in the Reverse

XI. Causes and resolutions of ABO Discrepancies
   A. Missing or Weak Antigens
   B. Extra Antigens
   C. Missing or Weak Antibodies
   D. Extra Antibodies
   E. Mixed Field Agglutination
   F. Technical Errors
CLSC 135: OBJECTIVES FOR LECTURE #2

By the end of this period of instruction, the student should be able to:

1. name the discoverer of the ABO system and briefly explain the method used.
2. predict the ABO phenotype when given the ABO genotype.
3. list the possible ABO genotype when given the phenotype.
4. recall the frequencies of the ABO phenotypes among U.S. blacks and caucasians.
5. define the terms and phrases, and explain how ABO antigens develop on RBCs using these terms:
   a. H gene
   b. H substance
   c. terminal sugars
   d. conversion of H substance
6. name the 2 terminal sugars and state which ABO antigen they form.
7. state which ABO phenotypes have the most to the least H substance on them.
8. define the term "lectin".
9. name the plant (scientific name) from which reagent for detection of H antigens is extracted.
10. explain how Anti-H lectin and body fluids may be used to determine an individual's "secretor status."
11. explain what is meant by the "Bombay" phenotype.
12. recall the expected reaction of:
    a. Bombay cells plus anti-H lectin
    b. Bombay serum plus A cells
    c. Bombay serum plus B cells
    d. Bombay serum plus O cells
    e. Bombay serum plus Oh cells
13. list the test tube contents in a forward grouping test.
14. define "hybridoma" and explain how blood bank reagents are made using hybridomas.
15. explain why monoclonal reagents are generally preferred over polyclonal.
16. define "subgroups of A" and explain how they can cause discrepancies in forward and reverse typing.
17. name the plant (scientific name) from which reagent for detection of A₁ antigens is extracted.

18. name the 2 reagents used to resolve suspect A subgroups, and interpret results from use of these reagents.

19. define the following:
   a. naturally occurring antibody
   b. immune form antibody

20. state the test tube contents in the reverse grouping test.

21. determine which antibodies are present when given the results of a reverse grouping test using A₁, A₂, and B reagent cells.

22. list the one most common reason for ABO discrepancies, which is detected in reverse groupings.

23. list three causes and resolutions for ABO discrepancies which are seen as:
   a. missing or weak antigens
   b. extra antigens
   c. missing or weak antibodies
   d. extra antibodies
   e. mixed field agglutination

24. define "acquired B-like antigen" and name two conditions in which this may occur.

25. describe the most common method used to differentiate from the acquired B antigens.

26. name a lectin that can be used to differentiate true from acquired B antigens, and interpret results from this testing.

27. list several technical errors that may cause ABO grouping errors.
CLSC 135: OUTLINE FOR LECTURE #3

The Rh System

I. Discovery
   A. Researchers and Dates
      1. Landsteiner/Weiner
      2. Fisher/Race
   B. Method of Discovery (Landsteiner)
   C. Importance

II. Antigens and the RBC Membrane
   A. Production/Regulation
   B. Antigenicity
   C. Antigens

III. Naming the Rh Antigens
   A. Nomenclatures
      1. Basis
      2. Differences
      3. Similarities

IV. Landsteiner/Weiner Nomenclature
   A. Genetic Model
   B. Notation Scheme
   C. Examples

V. Fisher/Race Nomenclature
   A. Genetic Model
   B. Notation Scheme
   C. Examples

VI. Rosenthal Nomenclature
   A. Genetic Theory
   B. Notation Scheme
   C. Examples

VII. Conversions Between L/W and F/R Nomenclatures
   A. Chart
VIII. Rh Frequencies in the U.S. Population

A. Most common Rh genes
B. Most common Rh+ genotypes
C. Most common Rh- genotypes

IX. Rh Antigen Detection

A. The D Typing Test
B. Anti-D Antiseras
   1. Protein-based
   2. Saline-based
   3. Chemically modified
C. Other Rh Antigen Typings
D. Slide Typing Tests
   1. Method description
E. The Weak D Test
   1. Indications
   2. Recording results
   3. Reagents used
   4. Weak D and transfusions
   5. False positives in Du testing

X. Rh System Antibodies

A. Characteristics
B. Examples
C. "Dosage" Effect
CLSC 135: OBJECTIVES FOR LECTURE #3

By the end of this period of instruction, the student should be able to:

1. recall the names and dates several key researchers that are credited with discovery of the Rh System.
2. explain how Landsteiner was able to differentiate Rh+ and Rh negative human RBCs.
3. identify two groups of people in which the Rh System becomes an important blood banking concern.
4. identify the gene which controls Rh expression.
5. explain how Rh antigens differ from ABO antigens with respect to the RBC membrane.
6. explain what is meant by the term "Rh null" and describe several phenotypic findings associated with this anomaly.
7. name the three most common Rh system nomenclatures in their order of discovery.
8. identify the key differences between the genetic models used by L/W and F/R.
10. define "amorph" and give two examples which demonstrate this phenomenon.
11. explain the basis for the Rosenfield nomenclature and recall the symbols for each of the following antigens:
    a. D
    b. C
    c. E
    d. c
    e. e
12. recall the three most common Rh+ genotypes and their frequencies among the U.S. population (L/W).
13. recall the most common Rh- genotype and its frequency among the U.S. population.
14. list the advantages and disadvantages of using protein, saline-based, and chemically-modified Anti-D typing sera
15. identify a source of cells which would be appropriate to use when performing + and - QC checks on Rh typing seras.
16. list the procedural steps in the performance of the Rh slide typing test.
17. recall the proper temperature for view boxes being used for Rh "slide typing" tests and the amount of incubation time required for slides to reach 37°C.

18. explain the three mechanisms by which a person might be positive for the “weak D” antigen.

19. recall the indications for, reagents for, procedure for, and recording of weak D tests.

20. explain why weak D tests yield false positive results when performed on cells that are DAT positive.

21. explain how the Rh negative control tube may be used to prevent false positive weak D results.

22. explain why Anti-C, Anti-D, and Anti-E antibodies do not usually interfere with ABO reversing grouping tests.

23. identify the antigens against which the following antibodies are directed:
   a. Anti-f
   b. Anti-G

24. explain what is meant by "dosage effect" and give an example of this reactivity.
CLSC 135: OUTLINE FOR LECTURE #4

Antiglobulin Testing

I. Historical Production of AHG
   A. Production
   B. First Application of AHG

II. Modern Production of AHG Reagent
   A. Hybridomas and Gene Splicing
   B. Monospecific Reagents
   C. Polyspecific Reagents

III. Direct Antiglobulin Testing
   A. Principle
   B. Procedure
   C. Specimen Requirements
   D. Threshold
   E. DAT Positives
      1. With positive screens
      2. With negative screens
      3. With antigen typings
   F. Chloriquine Diphosphate (CDP) Reagent

IV. The Indirect Antiglobulin Test
   A. Principle
   B. Procedure
   C. Specimen Requirements
   D. Threshold
   E. Applications for IDAT
      1. Antibody screens
      2. Antibody ID panels
      3. Antigen typings
         a. the Weak D test
         b. others
      4. Compatibility testing
   F. LISS reagent and PEG reagent
   G. Enzyme Treated Panel Cells
   H. Check Cells
      1. Preparation of
      2. Use of

V. Sources of Error in Antiglobulin Testing
   A. False Negatives
   B. False Positives
CLSC 135: OBJECTIVES FOR LECTURE #14

By the end of this period of instruction, the student should be able to:

1. describe the historical process of anti-human globulin production.
2. describe the first application for coombs serum in blood bank testing.
3. list three monoclonal (monospecific) AHG reagents that are currently available.
4. list the three specificities of polyspecific AHG reagent.
5. state the principle of the DAT and IDAT procedures.
6. state the specimens requirements for the DAT and IDAT tests.
7. explain why EDTA cells are the specimen of choice for DAT testing.
8. identify the usual cause of a positive DAT when the antibody screen is positive.
9. identify the most common cause of a positive DAT when the antibody screen and eluates show no reactivity.
10. list the four mechanisms by which drugs induce positive DAT results, name at least one drug in each group, and state the expected DAT result with different AHG reagents.
11. explain how DAT positive cells yield false positive AHG antigen typings.
12. name a chemical that may be used to remove IgG molecules from RBCs thereby allowing the cells to be antigen typed.
13. list four applications of the IDAT principle.
14. explain how LISS and PEG reagents enhance the strength of weak antibodies.
15. list one disadvantage of using LISS reagent in IAS tests.
16. identify several antigens that are destroyed on RBCs that have been pre-treated with proteolytic enzymes.
17. recall the names of at least three enzymes which are used to treat reagent cells.
18. offer an example of how enzyme treated panel cells may be helpful when performing ID panels on serums containing multiple antibodies.
19. explain how check cells may be prepared and QC'd.
20. list at least ten sources of false negatives that may be encountered in Coombs Testing.
21. list at least six sources of false negatives that may be encountered in "Coombs Testing."
CLSC 135: OUTLINE FOR LECTURE #5

Pretransfusion Testing

I. Organizations Which Govern Blood Banks
   A. JCAHO
   B. CAP
   C. AABB
   D. FDA

II. Definitions
   A. Pretransfusion Tests
   B. Compatibility Tests

III. Purposes
   A. Decrease ABO Errors
   B. Detect Antibodies Missed in IAS Testing
   C. Increase Donor Cell Survival Time

IV. Pretransfusion Testing
   A. Listed
   B. Compatibility Testing (Crossmatching)
      1. Specimen requirements
      2. Major crossmatches
         a. test tube contents
         b. why is it called "major"
         c. indications and contraindications
         d. FDA requirements
         e. specimen requirements
         f. shortcomings

V. Incompatible Crossmatches - Causes and Resolutions
   A. Antibody Screen Negative
      1. RT Phase
         a. ABO mismatches
      2. Thermal and/or AHG Phase
         a. ABO
         b. high-titered cold agglutinin
         c. warm alloantibody
B. Antibody Screen Positive/Autocontrol Negative
   1. RT Phase
      a. ABO mismatches
      b. cold agglutinin
   2. Thermal and/or AHG phase
      a. ABO
      b. warm alloantibody
      c. antibiotic preservative interference
C. Antibody Screen Positive/Autocontrol Positive
   1. RT phase
      a. cold autoantibody
      b. Rouleaux
   2. Thermal phase
      a. high-titered cold agglutinins
      b. warm autoantibodies
      c. Rouleaux
   3. AHG phase
      a. high-titered cold agglutinins
      b. warm autoantibodies
D. Antibody Screen Negative/Autocontrol Positive
   1. Any phase
      a. rare autoantibodies
      b. other RBC coatings
         (1) complement
         (2) drugs
         (3) abnormal proteins
CLSC 135: OBJECTIVES FOR LECTURE #5

By the end of this period of instruction, the student should be able to:

1. list the names and functions for each of the four main organizations governing a “typical” hospital blood bank.
2. list at least ten laboratory functions that are a part of pretransfusion testing.
3. recall an alternate term for the "compatibility test."
4. list the three main purposes for performing pretransfusion tests.
5. given a patient's ABO and Rh type, state the 1st, 2nd, and 3rd choice of donor type that would be selected for transfusion.
6. state the test tube contents in a major crossmatch tube at any "phase" of testing.
7. given a patient and donor ABO and Rh type, predict the compatibility/incompatibility of the major crossmatch.
8. list at least one blood component for which performance of a major crossmatch is and is not appropriate.
9. state the current AABB specimen and procedural requirements for the major crossmatch test.
10. list at least three "shortcomings" of the major crossmatch.
11. state the most likely cause for the following results in the RT, thermal, and AHG phases:
   a. IAS negative/auto negative/crossmatch positive
   b. IAS positive/auto negative/crossmatch positive
   c. IAS positive/auto positive/crossmatch positive
   d. IAS negative/auto positive/crossmatch positive
12. explain how each of the following affect the major crossmatch and how the blood banker may resolve them:
   a. cold agglutinins (such as anti-I)
   b. ABO mismatches
   c. Rouleaux
d. cold autoagglutinins
e. warm agglutinins
f. warm autoagglutinins
g. recipient cells coated with:
   (1) complement proteins
   (2) drugs
   (3) antibodies
CLSC 135: OUTLINE FOR LECTURE #6

Transfusion Reactions

I. Definition

II. Incidence

III. Types of Transfusion Reactions
   A. Main Types Listed
      1. Febrile
      2. Allergic
      3. Alloimmunization
      4. Delayed hemolytic
      5. Hemolytic
      6. Bacterial
      7. Circulatory overload
      8. Blood borne diseases
      9. Graft versus host disease
     10. Citrate toxicity
     11. Others
   B. Frequencies by Type

IV. Reaction Characteristics by Type
   A. Febrile
      1. Main causes
      2. Basic pathology
      3. Symptoms
      4. Lab findings
      5. First aid and treatment
      6. Prevention
   B. Allergic
      1. Main causes
      2. Basic pathology
         a. urticarial
         b. anaphylactic
   C. Alloimmunization
      1. Main causes
      2. Basic pathology
   D. Delayed Hemolytic Transfusion Reactions
      1. Main causes
      2. High risk groups
      3. Antibodies implicated
      4. Basic pathology
      5. Symptoms
      6. Lab findings
      7. First aid and treatment
      8. Prevention
E. Hemolytic Transfusion Reactions
1. Definition
2. Site of hemolysis
   a. intravascular
   b. extravascular
3. Incidence
4. Characteristics
5. Causes
6. Intravascular hemolytic transfusion reactions
   a. main cause
   b. basic pathology
   c. symptoms
   d. lab findings
   e. first aid and treatment
   f. prevention
7. Extravascular hemolytic transfusion reactions
   a. main cause
   b. basic pathology
   c. symptoms
   d. lab findings
   e. first aid and treatment
   f. prevention

F. Bacterial Transfusion Reactions
1. Main causes
2. Sources of contamination
3. Basic pathology
4. Symptoms
5. Lab findings
6. First aid and treatment
7. Prevention

G. Circulatory Overload Transfusion Reactions
1. Main causes
2. Basic pathology
3. Symptoms
4. Lab findings
5. First aid and treatment
6. Prevention

H. Transfusion Reactions Due to Blood Borne Diseases
1. Main causes
2. Important agents
3. Basic pathology
4. Hepatitis
5. Hepatitis A
6. Hepatitis B
7. Hepatitis C
8. Syphilis
9. Malaria
10. AIDS
11. Cytomegalovirus
I. Graft Versus Host Disease
J. Citrate Toxicity
K. Others
   1. shock
   2. DIC
CLSC 135: OBJECTIVES FOR LECTURE #6

By the end of this period of instruction, the student should be able to:

1. define the term "transfusion reaction."

2. identify two groups of recipients in which transfusion reactions occur with greater frequency.

3. identify three specimens which should be collected when a transfusion reaction workup is ordered.

4. explain why transfusion reaction specimens should always be collected ASAP (as soon as possible) when the reaction is reported to the laboratory.

5. describe the minimum AABB requirements for workups of transfusion reactions.

6. describe various tests that may be performed on the pre- and post-transfusion samples during a transfusion reaction workup, explain the purpose of each, and significance of positive results in each.

7. determine the most probable type of transfusion reaction when given the patient transfusion history and complete transfusion reaction workup data.

8. name nine types of transfusion reactions, and list them in the order of their frequency.

9. name the following:
   a. two types of allergic transfusion reactions
   b. two types of hemolytic transfusion reactions
   c. five blood borne diseases that may cause transfusion reactions

10. identify the frequencies of the three most common types of transfusion reactions.

11. recall the following with respect to febrile transfusion reactions:
    a. two causes
    b. pathology
    c. symptoms
    d. lab findings
    e. treatment
    f. prevention

12. differentiate between urticarial and anaphylactic transfusion reactions with respect to:
    a. usual cause
    b. severity
    c. treatment
    d. prevention

13. discuss the expected changes in lab findings following alloimmunization.
14. recall the following with respect to delayed transfusion reactions:
   a. cause
   b. two high risk groups
   c. antibodies most often implicated
   d. serum chemistry test most affected (elevated)
   e. other lab findings in blood bank

15. identify the two main sites of RBC destruction in hemolytic transfusion reactions, and describe in detail the breakdown of hemoglobin in each pathway.

16. list several clinical situations where errors resulting in hemolytic transfusion reactions are likely to occur.

17. list two errors which may lead to hemolytic transfusion reactions.

18. identify the most frequent "serologic" cause of hemolytic transfusion reactions.

19. list the five antibodies most often associated with intravascular hemolytic transfusion reactions.

20. discuss the basic pathology involved in intravascular hemolytic transfusion reactions.

21. explain what is meant by the term "free hemoglobin."

22. name a plasma protein that binds to hemoglobin.

23. list at least six symptoms of intravascular hemolytic transfusion reactions.

24. contrast intravascular and extravascular hemolytic transfusion reactions with respect to:
   a. plasma hemoglobin levels
   b. urine hemoglobin and hemosiderin levels
   c. plasma haptoglobin levels
   d. DAT test results post transfusion

25. identify three antibody systems most often implicated in delayed hemolytic transfusion reactions.

26. discuss the basic pathology involved in delayed extravascular hemolytic transfusion reactions.

27. identify the blood component which is most likely to cause a "bacterial" transfusion reaction.

28. describe characteristics of blood components that would indicate possible bacterial contamination.

29. list five symptoms and two forms of treatment for circulatory overload transfusion reactions.
30. name the component of choice when correcting for anemia in a recipient with hypertension.

31. describe the preventative measures that can be taken for circulatory overload transfusion reactions.

32. identify the organism which causes the following and describe their basic pathology:
   a. "infectious" Hepatitis
   b. "serum sickness" Hepatitis
   c. 90% of all transfusion-related Hepatitis

33. identify that which is tested for in the following:
   a. HBsAG
   b. HbcAg
   c. Anti-HBc
   d. RPR and VDRL
   e. Anti-HIV-I and Anti-HIV-II
   f. HAVAB

34. Name the organism which causes syphilis.

35. list the three names used for the virus which causes AIDS, and state which is currently accepted.

36. identify two recipient types that should receive only CMV antibody negative donor blood.

37. explain what is meant by GVHD and recall one way this type of transfusion reaction may be prevented.

38. describe how transfusions can result in citrate toxicity and name one way to prevent this condition.
CLSC 135: OUTLINE FOR LECTURE #7

Hemolytic Disease of the Newborn and Rh Immune Globulin

I. Hemolytic Disease of the Newborn
   A. HDN Workups
      1. Pathology
      2. Antibodies
      3. Cord blood
      4. ABO HDN
      5. Rh HDN
      6. Other HDN
      7. Detection of HDN
      8. Treatment of HDN

II. Rh Immune Globulin Studies
   A. Candidacy Testing
      1. Purpose of RhIG
      2. Post-partum candidacy requirements
      3. Post-partum efficiency
      4. Antenatal theory and efficiency
      5. Antenatal complications
   B. Kleihauer-Betke Stains
      1. Principle
      2. Indications
         a. MFA
         b. MFMH
   C. Dosage Calculations
      1. Vial contents and dosages
      2. Mini-dose vials
      3. Formula
      4. Examples
      5. Other RhIG uses
CLSC 135: OBJECTIVES FOR LECTURE #7

By the end of this period of instruction, the student should be able to:

1. describe the pathology that results in Hemolytic Disease of the Newborn
2. identify the five most common antibodies causing HDN.
3. give one reason why cord cells (in HDN) may give false negative antigen typings.
4. explain why donor cells should be tested against maternal serum and baby's eluate when transfusing HDN infants.
5. given the ABO of the mother and infant, select the correct donor ABO(s) to be transfused.
6. identify the:
   a. most frequent type of HDN
   b. substance used to prevent Anti-D HDN
7. explain how ABO differences between the mother and fetus affects the incidence of Rh HDN (sensitization).
8. list two changes in prenatal blood bank results that are supportive of an HDN diagnosis.
9. explain what is meant by and the importance of an amniotic L/S ratio.
10. discuss the following relative to HDN:
    a. intrauterine transfusion
    b. C-section
    c. exchange transfusion
    d. glucoronyl transferase
    e. hyperbilirubinemia
    f. phototherapy
11. list three purposes of an exchange transfusion.
12. explain the theory of Rh immune suppression by RhIG.
13. differentiate between the abbreviations RhIG and Rh_o GAM
14. list four candidacy requirements for postnatal RhIG use.
15. state the time limit for administration of postnatal RhIG.
16. explain what is meant by "antenatal RhIG" therapy and why such therapy is currently being used in addition to postnatal injections.
17. describe one complication of antenatal RhIG therapy relative to blood bank tests done during pregnancy.
18. identify the specimen of choice for a Kleihauer-Betke stain and explain the principle of this procedure, describing the appearance of adult and fetal cells with this stain.

19. recall the formula for using Kleihauer-Betke (KHB) stain results to determine RhIG dosage calculations.

20. perform the RhIG dosage calculations when given the KHB stain results and determine the number of vials of RhIG that should be used to prevent alloimmunization when given the whole blood "bleed" volume.
CLSC 135: OUTLINE FOR LECTURE #8

Blood Donors and Component Preparation, Storage, and Transfusion Procedures

I. Screening Prospective Blood Donors
   A. Registration
   B. Verbal Examination of Medical History
      1. Deferrals and rejections
   C. Physical Exam
      1. Limits for Acceptability

II. Collection of Donor Blood
    A. Whole Blood Phlebotomy
    B. Component Pheresis
    C. Adverse Donor Reactions
    D. Observation and Fluid Replacement

III. Processing Donor Whole Blood

IV. Preparation of Components from Whole Blood Units
    A. By Refrigerated Sedimentation
    B. By Refrigerated Centrifugation

V. Natural Changes in Refrigerated Blood
    A. Plasma Dextrose Levels
    B. Plasma Hemoglobin Levels
    C. Plasma Potassium (K+) Levels
    D. Plasma pH
       1. 2, 3-DPG levels

VI. Temperature Requirements
    A. Refrigeration
    B. Freezers

VII. Blood Bag Anticoagulants and Additives
    A. Anticoagulants
       1. ACD
       2. CPD
       3. Advantages of CPD versus ACD
    B. Nutritional Additives and Preservatives
       1. Adsol
       2. Nutricell
       3. Functions and ingredients
VIII. Component Therapy

A. Three Goals of Component Therapy
B. Whole Blood
C. Red Blood Cells
   1. Sedimented or packed
   2. Washed
   3. Frozen/deglycerolized
D. Fresh Frozen Plasma
E. Platelets
   1. Plastic storage bag composition vs time limits
F. Cryoprecipitate
G. Others

IX. Transfusion Process

A. Pre-transfusion duties of technician
B. Transfusion of Blood
C. Criteria for return of blood
CLSC 135: OBJECTIVES FOR LECTURE #8

By the end of this period of instruction, the student should be able to:

1. explain why each item below is a part of the blood donor screening prior to donation:
   a. registration
   b. verbal examination
   c. physical examination

2. describe the various situations which result in rejection or deferral of prospective donors, state whether a given donor’s medical history warrants acceptance, deferral, or permanent rejection.

3. state the physical examination limits for donor acceptance when given the sex of the donor.

4. describe the process of donor whole blood phlebotomy.

5. describe the principle and process of component pheresis, and state the components commonly collected this way.

6. list six adverse physical reactions to blood donation.

7. recall the amount of time it takes the donor’s body to replace the formed elements and plasma lost to a single unit donation.

8. state the minimum amount of time between (allologous) whole blood donations.

9. list the names (and abbreviations if applicable) of twelve donor unit processing tests.

10. list two ways of separating the donor blood cells from plasma and other whole blood components.

11. explain how platelet rich plasma and fresh frozen plasma are prepared from whole blood.

12. state whether the following constituents will increase or decrease during refrigerated storage of whole blood:
   a. dextrose in plasma
   b. hemoglobin in plasma
   c. potassium in plasma
   d. pH of plasma
   e. 2, 3-DPG Enzyme in RBCs

13. explain the relationship between refrigeration, plasma dextrose levels, the ”sodium pump” and RBC osmotic lysis.

14. explain why plasma K⁺ and hemoglobin increase in stored whole blood.
15. explain how plasma pH changes effect the ability of stored RBCs to perform normal oxygen exchange functions.

16. recall the acceptable temperature ranges for storage of refrigerated and frozen blood components.

17. recall the ingredients in CPD AND CPDA anticoagulants.

18. list three reasons why CPD is considered superior to ACD.

19. list the names of two additives which improve the viability of RBCs in refrigerated packed cell units, and list their contents.

20. list the conditions and maximum storage time limits for the following blood components:
   a. packed RBCs in CPDA2 with additives
   b. washed RBCs
   c. glycerolized frozen RBCs
   d. thawed deglycerolized RBCs
   e. frozen FFP
   f. thawed FFP
   g. platelets
   h. cryoprecipitate

21. list the three main reasons why patients receive transfusions of whole blood or its components.

22. For each of the following components, list the indications for transfusion, describe the procedure for preparation of the component, and state any special transfusion procedures that are performed:
   a. Whole Blood
   b. Packed RBCs
   c. Washed PRBCs
   d. Frozen RBCs
   e. FFP/SDFP
   f. platelet concentrates
   g. cryoprecipitate

23. explain why "packed RBCs" are preferred to whole blood when correcting for anemia.

24. identify the best component to administer for each clotting disorder:
   a. Von Willebrand's disease
   b. classical Hemophilia
   c. fibrinogen deficiency
   d. thrombocytopenia

25. explain why pooled components have an elevated potential for causing blood borne disease in the recipient.

26. name at least two "pooled products" and identify the pooled product which has the greatest infective potential.
27. list the names of two (non-blood) "plasma expanders."

28. state the current limits regarding temporary storage of components that were prepared by a method involving entry of the sterile (integral) blood bag system.

29. list four very important CLS duties that must be performed when releasing blood components to the transfusionist.

30. list the six basic steps in the blood transfusion sequence.

31. recall the purpose of blood filters and the "pore sizes" for standard and microaggregate blood filters.

32. explain how microaggregate filters help to prevent febrile transfusion reactions.

33. list the three criteria which must be met before an unused blood bag may be returned to inventory.
CLSC 135: OUTLINE FOR LECTURE #9

Other Antigen Systems

I. The MNS System
   A. Discovery
   B. Main Antigens
   C. Frequencies
   D. Antibodies and Reactivity

II. The P System
    A. Main Antigen
    B. Frequencies
    C. Antibodies and Reactivity

III. The I System
     A. Adult Versus Cord Cells
     B. Antibodies and Reactivity
     C. Prewarming Technique

IV. The Kell System
    A. Main Antigens
    B. Frequencies
    C. Antibodies and Reactivity

V. The Duffy System
   A. Naming
   B. Main Antigens
   C. Malarial Resistance
   D. Frequencies
   E. Antibodies and Reactivity

VI. The Kidd System
    A. Main Antigens
    B. Frequencies
    C. Antibodies and Reactivity

VII. The Lewis System
     A. Main Antigens
     B. Frequencies
     C. Antigens and Pregnancy
     D. Antibodies and Reactivity
     E. Genetics and Secretor Status
VIII. the Lutheran System

A. Main Antigens
B. Frequencies
C. Antibodies and Reactivity

IX. The Sid System

A. Main Antigen
B. Antibodies and Reactivity
CLSC 135: OBJECTIVES FOR LECTURE #9

By the end of this period of instruction, the student should be able to:

1. name and recognize abbreviations for the main antigens in each system below:
   a. MNS
   b. P
   c. I
   d. Kell
   e. Duffy
   f. Kidd
   g. Lewis
   h. Lutheran
   i. Sid
   j. Rh

2. name the most frequent phenotype in each antigen system listed in objective #1.

3. state whether the antibodies of each system listed in #1 are implicated in HTR or HDN.

4. recall the optimal phase(s) of reactivity for antibodies of the systems listed in objective #1.

5. identify an antibody that commonly causes immediate-spin positivity of the crossmatch and antibody screen, and explain how this incompatibility is resolved using cord cells.

6. recall the antigenic phenotype in the Duffy system which is associated with malarial resistance in Africans and the Plasmodium species involve.

7. name two antibodies that are:
   a. commonly found in seras with >1 unexpected antibody
   b. enhanced by proteolytic enzymes
   c. destroyed by proteolytic enzymes
   d. implicated in delayed transfusion reactions

8. name an antibody that reacts with all panel cells except fetal cord cells.

9. explain how Lewis antigens become attached to the RBC membrane.

10. list the Lewis, ABO, and H antigens that will be found on the RBCs and in the saliva when given the Lewis, ABO, H, and Secretor Genotype.

11. name an antibody displaying weak, refractile, mixed-field agglutination which may be dispersed by the addition of fresh urine to the reaction mixture.