CLS 424 - Phlebotomy
BASIC PRINCIPLES of PHLEBOTOMY: Lecture Handout

I. Introduction (text, page 4-7)
   A. Historical procedure practiced as far back as the Stone Age to present day
      1. Greek root words: phlebos = veins, tome = incision
      2. Blood-letting procedures, leeches
   B. Phlebotomy today
      1. Diagnosis and monitor treatment
      2. Remove blood for transfusions
      3. Therapeutic purpose: polycythemia and hemochromatosis

II. Blood Function and Composition
   A. Function
      1. Supplies nutrients to tissues: Oxygen, hormones, etc
      2. Removes end-products of metabolism: CO2, urea, etc
      3. Provides defense mechanism: WBC, antibodies
      4. Prevents blood loss: coagulation (platelets and coagulation proteins)
   B. Composition
      1. Whole blood contains formed elements or cells ~45%
         a. Erythrocytes (RBC) most numerous; carry hemoglobin (O2,CO2)
         b. Leukocytes (WBC) 5 types; defend against infection
         c. Platelets (PLT) important component of blood coagulation
      2. Fluid component of whole blood in-vivo is called plasma ~ 55%
         a. Composed primarily of water (~92%) 
         b. ~ 7% protein
         c. ~ 1% minerals, vitamins, carbohydrates, hormones, enzymes, electrolytes

III. Coagulation
   A. In vivo = in the body
      1. In an UNINJURED vessel normal blood remains fluid and does not clot
      2. UPON INJURY, a series of reactions involving platelets and plasma coagulation factors transform fluid blood into a gel/clot at the site of injury
   B. In vitro = outside the body
      1. Freshly drawn blood is fluid, but within minutes will spontaneously clot
      2. Coagulation reactions are triggered by
         a. Contact with the glass tube
         b. POOR blood drawing technique
C. Basic coagulation reaction:

\[
\text{Clotting factors} + \text{calcium} \rightarrow \text{thrombin}
\]

\[
\text{Fibrinogen} + \text{thrombin} \rightarrow \text{fibrin strands}
\]

1. Fibrin strands trap RBC’s, WBC’s and PLT’s forming a ‘fibrin clot’
2. Fibrinogen and other clotting factors are ‘used up’ in the formation of the fibrin clot
3. To prevent activation of the coagulation process, anticoagulants are used

IV. Anticoagulants

A. What are they?

1. Chemical substances which prevent the coagulation reaction by:
   a. Removing/binding calcium
   b. Neutralizing thrombin

2. The use or non-use of an anticoagulant, determines what type of blood sample is obtained:
   a. Whole blood
   b. Plasma
   c. Serum

B. When an anticoagulant is used: (text, page 519)

1. Clotting is prevented: irreversible
2. Mixing blood with anticoagulant is CRITICAL: Completely invert tube 8-10 times!
3. If sample is not centrifuged, can analyze whole blood
4. Must centrifuge sample to separate cells from plasma
5. Plasma contains fibrinogen (a clotting protein)

C. When an anticoagulant is NOT USED:

1. Spontaneous clotting occurs: irreversible
2. Mixing is not required: fibrinogen is used during the clotting process to form fibrin strands which entrap the cellular elements in the formed clot
3. The clotted sample must be centrifuged to separate the clot from the liquid portion called serum
4. Serum lacks fibrinogen and several other clotting proteins; calcium is not depleted from the serum
D. Descriptions of the appearance of serum and plasma
1. Normal: clear and pale yellow
2. Abnormal:
   a. Hemolyzed: pink to red, indicates red cell destruction
   b. Icteric: dark orange-yellow; indicates presence of bilirubin
   c. Lipemic: milky; indicates presence of fat

V. Types of blood collection tubes
A. All blood collection tubes are ‘evacuated tubes’
1. Automatically fill with blood because of the vacuum inside the tube
2. The amount of vacuum is pre-measured so that the tube will draw a certain amount of blood
3. The tube that has lost its vacuum, will not fill
   a. Opening the tube
   b. Dropping the tube
   c. Pulling needle bevel partway out of the skin when drawing blood
4. Used with both ‘systems’ of drawing blood
   a. **Vacutainer system**: a closed system in which the patient’s blood goes directly from the vein into stoppered tube without being exposed to air
   b. **Syringe method**: blood is drawn into the syringe and then transferred into evacuated tubes after collection
5. Different tube sizes available: from 2-15 ml. Size selected is dependent on
   a. Amount of blood needed for the test
   b. Size and condition of the patient’s vein
   c. Patient’s age
6. **Tube stoppers are color coded** to indicate the presence and type of additive or the absence of an additive. The color scheme is universal
7. Always check tubes for expiration date. **Never** use expired tubes

B. Non-anticoagulated tubes (non-additive)
1. Red-top tube:
   a. Glass red-top tubes (these are rarely used because of safety reasons)
      1) No additive \(\rightarrow\) glass test tube activates clotting sequence
      2) Most often used for serology (antibody detection), chemistry (therapeutic drug monitoring) and blood bank testing
      3) Do not need to invert to mix
   b. Plastic red-top tubes (text, page 513)
      1) Contains additive (silica particles) to activate clotting sequence
      2) **DO INVERT** 8-10 times to ensure mixing of blood with clot activator
2. Gold top tube ~or~ Mottled red and grey-top tube:
   a. Contains clot activator, and gel for serum separation (SST)
   b. Contains inert gel that physically separates serum from clot
      when sample is centrifuged. Because they contain an inert separator
      gel and the liquid is called serum, they are called serum separator
      tubes (SST).
   c. Invert 8-10 times: ensure thorough mixing of activator with blood
   d. Do NOT use for blood bank specimens (gel may interfere)

C. Anticoagulated tubes (additive tubes):
   Must be **completely inverted 8-10 times immediately** after blood draw to
   thoroughly mix blood with anticoagulant to prevent clotting

1. Blue-top tube (baby blue top)
   a. Contains sodium citrate: prevents coagulation by binding calcium
   b. Anticoagulant of choice for coagulation studies (hematology dept)
   c. Must be full to maintain proper blood to anticoagulant ratio
   d. Must be on ice if not analyzed immediately (within 30 minutes)

2. Green-top tube
   a. There are three heparin formulations: lithium-heparin, ammonium-
      heparin, sodium-heparin
   b. Prevents coagulation by inhibiting thrombin formation
   c. Anticoagulant of choice for plasma chemistry determinations.
   d. Often used for chemistry testing (saves time by eliminating the time
      required for complete clot formation ~ 30-60 minutes)
   e. Must be full and on ice if used for ionized calcium and/or pH
   f. PST = plasma separator tube; contains inert gel that will physically
      separate the blood (RBC, WBC) from plasma when centrifuged

3. Lavender-top tube
   a. Contains EDTA = ethylenediamine tetraacetic acid
   b. Prevents coagulation by binding calcium
   c. Anticoagulant of choice for whole blood hematology studies
      (complete blood count = CBC); preserves cell morphology

4. Grey-top tube
   a. Contains potassium oxalate and sodium fluoride
   b. Oxalate prevents coagulation by binding calcium
   c. Sodium fluoride is an antiglycolytic agent that inhibits metabolism
      of glucose by the blood cells (preserves plasma glucose)
   d. Often used to collect plasma specimens for glucose and lactic acid
D. Special tube types

1. Royal blue-top tube:
   a. **All are trace metal-free tube**
   b. Most often used in the chemistry dept for iron, and heavy metal (copper and zinc) analysis
   c. NOTE: If label is red, tube contains no additive (liquid = serum)
      If label is lavender, tube contains EDTA (liquid = plasma)
      If label is green, tube contains sodium heparin (liquid = plasma)

2. Fibrin-split products tube (FSP or FDP)
   a. Light blue top tube with two yellow bands on the label.
   b. Contains thrombin/soybean trypsin which causes blood to clot immediately.
   c. Keep refrigerated before use and on ice after blood is collected.
   d. Rarely done test. Most laboratories do the D-Dimer test which uses a standard light blue tube.

6. Yellow-top tube
   a. Contains acid citrate dextrose (ACD)
      1) Available as 2 different formulations: Solution A or Solution B
      2) Specialized tube used in DNA testing, paternity evaluations
      3) Acid citrate prevents coagulation by binding calcium
      4) Dextrose acts as a nutrient (and preservative)
   b. Contains sodium polyanethol sulfonate (SPS)
      1) Specialized tube used for blood culture collection
         (inhibits activity of certain antibiotics)
      2) Prevents coagulation by binding calcium

D. Laboratory requirements

1. Each laboratory department has **specific specimen requirements**. The type and amount of specimen to be collected is dependent on:
   a. Test that is ordered
      1) Whole blood: EDTA or heparin?
      2) Plasma: EDTA or heparin? Will a separator gel interfere with analysis?
      3) Serum: no additive or trace-metal free? Will a separator gel interfere with analysis?
   b. Amount of sample required to perform the test
   c. Sometimes two tubes of the same type may be needed because two different laboratory departments need to analyze the specimen

2. Trained personnel and quality control are essential to provide valid laboratory results and recognize specimens inadequate for testing

3. The first step in obtaining accurate test results and providing quality patient care is the proper collection of the blood specimen
VI. Safety Practices Used in Phlebotomy

A. Infection Control: used to stop the spread of infectious microorganisms by breaking the ‘infection chain’

1. Source: Bloodborne Pathogens, Biologic Hazards
   a. HBV
   b. HCV
   c. HIV

2. Mode of transmission
   a. Parenteral: (anything that is not through GI tract)
      1) Non-intact skin (chapped hands, cuts)
      2) Percutaneous (needle, sharps)
      3) Permucosal (mouth, nose, eyes)
   b. Ingestion

3. Susceptible Host

B. Infection Control Methods:

1. Hand washing
   a. Most important means of preventing spread of infection
   b. Requires proper technique: minimum 15 seconds, soap, friction
   c. When should hands be washed?
      1) Before and after each patient contact
      2) Between different procedures on the same patient
      3) Before putting on gloves and after taking them off
      4) Before leaving the laboratory
      5) Whenever hands become visibly soiled

2. Personal Protective Equipment (PPE)
   a. Protective clothing and other attire used to provide a barrier against infection
   b. Gowns, lab coats
   c. Gloves
   d. Masks, face shields (N95 respirator)

3. Standard Precautions: treat all patient samples as potentially infectious
   a. Transmission-Based Precautions: used for patients known or suspected to be infected with highly infective pathogen (airborne, droplet, contact)
   b. Protective or reverse isolation: used to protect highly susceptible patients
C. Engineering controls
1. PPE
2. Sharps containers
3. Safer medical devices (safe needles)

VII. Specimen Collection: Venipuncture
A. Equipment used for venipuncture
   1. PPE (Standard Precautions!)
      a. Gloves: wash your hands before and after obtaining blood.
      b. Lab coat, gown
      c. Mask (if type of isolation requires its use)

   2. Cleaning agent
      a. 70% isopropyl alcohol: most common; individually wrapped prep pads
      b. Povidone iodine: swab stick and sponge pads for blood culture collection; prep pads for blood gas collection
      c. Soap and water: used if patient allergic to routine cleaning agents or if blood alcohol sample is to be collected

   3. Cotton balls or sterile gauze pads: used to hold pressure over site following blood draw

   4. Bandage/Tape: used to cover site once the BLEEDING HAS STOPPED. Paper or cloth tape: for patients allergic to the bandage, who have a latex allergy or whose skin is sensitive. Bandages should not be used on children <2 years old because of the danger of aspiration or suffocation

   5. Sharps Container
      a. Used only to discard needles, biohazard sharps, lancets. No regular trash should go into these containers!
      b. Usually bright red or orange color with ‘biohazard’ markings
      c. Rigid, puncture resistant, leakproof; easily sealed and disposable.
      d. NOTE: Needles are never recapped, cut, bent or broken prior to disposal

   6. Tourniquets (do not use if visibly soiled)
      a. Used for venipuncture only (not used for arterial draws or skin punctures)
      b. Causes the venous blood flow to slow down, allowing more blood to flow into the area than out. This causes the veins to enlarge, making them easier to find and penetrate with a needle.
      c. Never leave on more than 1 minute: hemoconcentration
      d. Avoid having the patient clench their fist or vigorously pump their hands: causes increased potassium, lactic acid, LD, etc
      e. Special tourniquets available for latex allergy
7. Needles: (textbook, page 227)
   a. NEVER recap, cut, bend or break needles
      NEVER use a needle if the protective shield is broken.
      NEVER use a needle twice
      NEVER use a needle with a nick in the bevel
   b. The gauge of the needle indicates the size of the needle and refers to the diameter of the needle’s lumen or bore.
      1) The larger the gauge number, the smaller the diameter of the needle.
      2) For phlebotomy, 21-23 gauge recommended: 21 for routine use, 23 for smaller veins
      3) Gauge selection depends on the size and condition of vein
   c. Needle lengths most often used: 1 inch and 1.5 inch
   d. ‘Safer needles’ must be used as mandated by OSHA
   e. Multiple-sample needle used with vacutainer: (text, page 230)
      1) Threaded in middle with beveled point at each end
      2) The beveled end is used to enter the vein, the other end (covered with rubber retractable sleeve) penetrates the stopper of the collection tube
      3) The rubber sleeve prevents blood leakage when changing tubes during multiple-tube draws, and also when the tube is removed prior to withdrawing the needle from the vein
      4) Threaded portion allows easy, secure attachment to tube holder
   f. Single-use needle used with syringe: (text, page 237)
      1) Some needles can be screwed onto the syringe, others are ‘pushed’ onto the syringe.
      2) Used on small, fragile veins, veins that tend to roll, veins of the elderly patient
   g. Butterfly (winged infusion) needle (text, page 239-241)
      1) Most often used with a syringe
      2) Very expensive
      3) Increased incidence of accidental needle sticks
      4) Used on very small, fragile veins

8. Tube holder (also called vacutainer adapter) (text, page 231-232)
   a. One end is threaded to receive the multiple-sample needle
   b. Flanges or extensions on the sides of the holder aid in tube placement and removal
9. Syringe (text, page 237)
   a. Various sizes: 2 - 10 ml most common
   b. Consists of a barrel with graduated markings (mls) and plunger
   c. The plunger is slowly retracted by the phlebotomist, allowing the barrel to fill with blood.
   d. Blood collected with a syringe must be transferred to evacuated tubes using a ‘syringe transfer device’ (OSHA)
   e. NEVER force blood from a syringe into evacuated tube!

10. Syringe transfer device: used to safely transfer blood from the syringe to the evacuated collection tube (text, page 238)

11. Black indelible (water proof) marker/pen (NO PENCIL, legal document)
   a. Information must be legible → PRINT
   b. **Required information:**
      1) EXACTLY as hospital identification band (if inpatient) or acceptable legal document (if outpatient):
         Patient last name, patient first name, middle initial
      2) Hospital identification number
      3) Date of draw: month, day, year (mm,dd,yyyy)
      4) Time of draw: use military time
         (see text, appendix D, pg A-26)
      5) Signed by phlebotomist: initial of first name, full last name
      6) Optional: location of patient

B. Vacutainer or syringe draw?? Which should I do?
1. Vacutainer: most often used when vein is prominent
   a. **Advantages**
      1) Can obtain large amounts of specimen
      2) Most economical
      3) Quickest and safest method to obtain specimen
      4) Least risk for accidental needle stick
   b. **Disadvantages**
      1) May cause small, fragile veins to collapse
      2) Not repositioned easily if vein not entered immediately
      3) Cannot see ‘flash’ of blood when vein entered

2. Syringe: most often used when vein is ‘hard to find’
   a. **Advantages**
      1) More control when drawing ‘hard to get’, small veins
      2) Can reposition the needle easily
      3) Will see a ‘flash’ of blood when vein is entered
   b. **Disadvantages**
      1) More expensive
      2) Increased risk of accidental needle stick
VIII. The Patient

A. Approaching the Patient
1. Communication Skills
   a. Verbal (cultural differences, vocabulary, tone of voice, clichés)
   b. Non-verbal (facial expressions, gestures, eye contact, appearance)
2. Develop trust (listen, show empathy, properly communicate)
3. Your appearance and attitude are extremely important
   a. Display a professional, courteous manner and attitude at all times
   b. Be assertive and confident (but don’t over do it!)

B. Entering the patient’s room
1. Knock gently before entering, even when the door is open, to make occupants aware of your presence.
2. Show tact before opening a closed curtain to avoid embarrassing situations.
3. Identify yourself: state your name, where you are from, why you are there

C. Handling special situations:
1. Patient is asleep: wake them gently, try not to startle the patient. Do not turn the overhead lights on until the patient’s eyes have adjusted to being open. NEVER draw blood from a sleeping patient
2. Patient is unconscious or combative: identify yourself as you would for an alert patient. Have someone assist you in holding the arm.
3. Doctor or clergyman is present: don’t interrupt, proceed to next patient and come back. If the request is a STAT order or a timed specimen, excuse yourself and explain why you are there and ask to proceed
4. Patient not in room: Every attempt should be made to locate the patient. Notify the patient’s nurse and see if the patient can be located for you to draw. If the patient is not available, document on the order sheet you were unable to obtain the specimen because patient not in room and that the nurse was notified.
5. Family or visitors are present: you may ask them to step outside the room; if a family member wishes to remain present, then that is acceptable

D. Patient identification: avoid asking ‘Mr. Smith?’ (text, page 265)
1. Importance of proper identification: obtaining a specimen from the wrong patient can have serious, even fatal, consequences. Misidentification of a patient can be grounds for dismissal of the person responsible, and could lead to a malpractice lawsuit
2. Inpatient:
   a. **Indentified** using patient’s hospital identification armband:
      Name and hospital number on the armband must **match exactly**
      the information on the order slip. All hospital patients are required
      to wear a hospital ID band (wrist, ankle)
   b. **Verified** by asking the patient to spell his/her full name
   c. If patient information does not match, the discrepancy should be
      addressed and corrected before the specimen is obtained
   d. It is **NOT** acceptable if the armband is taped to the bed railing,
      night stand or wall
   e. If no armband, best to have armband put on patient; then proceed
      to draw
   f. If armband cannot be attached to patient, nurse or MD in charge of
      the patient must identify the patient, watch you draw the blood and
      then sign the tubes with their name and credentials

3. Outpatient:
   a. **Indentified** using legal document such as driver’s license, SS card
   b. **Verified** by asking the patient to spell his/her full name and stating
      their date of birth
   c. If patient information does not match, the discrepancy should be
      addressed and corrected **before** the specimen is obtained

E. Preparing the patient for the blood draw
1. Ask the patient if they have a latex allergy
2. Bedside manner: gain the patient’s trust and confidence, and put the
   patient at ease. Always display a professional manner and appearance
3. Handling difficult patients: hospitalization is usually a stressful time for a
   patient. A patient may be lonely, scared, fearful or disagreeable and may
   react in a negative manner toward the phlebotomist. You should remain
   calm and professional and treat the patient in a caring manner under all
   circumstances.
4. Handling inquiries about testing: some hospitals will allow the phlebotomist
   to tell the patient the name of the test to be performed; others prefer all
   inquiries be directed to the physician. You can handle the situation by stating
   that the doctor has ordered the tests as part of the patient’s care and that the
   doctor will be happy to explain the test to him/her if asked.
5. If the patient refuses the blood draw: all patients have the right to refuse.
   Reminding the patient that the test was ordered by the doctor as part of their
   care will sometimes convince them to cooperate. If not, notify the nurse and
   he/she may be able to convince the patient to cooperate. You should not
   badger the patient, but you should also not take the easy way out! If the
   patient truly refuses, notify the nurse and document on the order slip the
   refusal.
6. Verifying diet restrictions: most often, you will need to verify the patient has
   been in a fasting state overnight, or nothing past midnight
IX. Selecting the Site (text, page 195)

A. Locating the vein
   1. Position the arm (2) and apply the tourniquet
   2. Antecubital area most often accessed
      a. Basilic vein
      b. Median cubital vein
      c. Cephalic vein
   3. Wrist or hand veins also acceptable
   4. Use the tip of your index finger on your non-dominant hand to palpate the vein
      a. Helps you determine the size, depth and direction of the vein
      b. Develop your sense of touch: veins have bounce or resiliency; arteries pulsate
      c. Choose a vein that is large and well-anchored
      d. Once you have chosen a vein, mentally visualize the location and direction of the vein

B. Collection site problems to avoid (text, page 332-339)
   1. Sclerosed and thrombosed veins feel hard and cordlike, and lack resiliency
      These veins are hard to penetrate, roll easily, and may not have adequate blood flow to obtain an adequate blood sample.
   2. Sites with extensive scarring
   3. Hematomas (indicates blood leakage into the tissue area) caused by
      a. Poor venipuncture technique
      b. Bending the arm after venipuncture
      c. Decreased platelets, bleeding disorder
      d. Fragile veins
   4. Edematous areas
   5. The side of a mastectomy: lymphostasis occurs on the side of the mastectomy, results in poor drainage of fluids; may be painful for patient
   6. Intravenous (IV) lines
      a. DO NOT draw above IV site; blood will be diluted with IV fluid
      b. Draw blood from the other arm (best solution)
      c. Draw blood from a hand vein below the IV site if necessary
      d. Perform a fingerstick instead, if possible
      e. May ask the nurse to turn off the IV for 20 minutes, if patient care is not compromised, and then draw the specimen. Document on the order slip the type of fluid being infused (dextrose, saline, etc) and the time the IV was turned off and on.
   7. Indwelling lines
      a. Types include hickman catheters and heparin locks
      b. Used to administer medications and fluids
      c. Nurse may draw blood from these lines; the sample is called a “line draw”; the line must be cleared of heparin before the sample is collected for analysis by first discarding 5-10 cc of blood in a separate syringe
X. Inserting the needle and collecting blood (text, page 285-286)
A. Properly anchor the vein: most common cause of not obtaining blood
   1. Grasp the patient’s arm with your nondominant hand, placing your fingers under the elbow area; this helps keep the patient from pulling away as the needle enters the vein
   2. Use your thumb to pull the skin taut about 1-2 inches below the intended venipuncture site; this anchors the vein and helps keep it from moving/rolling to the side upon needle entry
B. Smoothly and confidently insert needle with the bevel up

Bevel should appear smooth and free of nicks

   1. Line the needle up with the vein with the bevel of the needle facing up and pointing in the same direction as the venous flow
   2. Warn the patient by saying something like ‘there’s going to be a poke now
   3. Insert the needle into the skin at a 15-30° angle
   4. Sometimes when you enter the vein, you can feel a slight ‘give’ or decrease in resistance
C. Steady (anchor) the blood-drawing apparatus on the patient’s arm so there is no (minimal) needle movement
D. Fill the evacuated tubes using the correct order of draw.
   Always follow the SOP of your laboratory and recommendations of CLSI
   Avoid cross-contamination of additives; avoid bacterial contamination
   Always MIX tubes containing additive

   1. Blood cultures (tubes or bottles): sterile specimen
   2. Light-Blue-top tube: contain sodium citrate
   3. Red-top or gold-top tube: no additive
   4. Green-top tube: contain heparin
   5. Purple-top tube: contain EDTA
   6. Grey-top tube: contain oxalate/fluoride
E. Be careful!
   1. Do NOT push the needle into the vein further when you are engaging the evacuated tube into the vacutainer holder
   2. Do NOT pull the needle out of the vein as you pull the evacuated tube out of the vacutainer holder
   3. Do NOT pull the needle out of the vein as you pull on the plunger of the syringe to obtain blood
   4. Do NOT pull up or press down on the needle while it is in the vein
5. Do NOT forget to mix tubes containing an additive/anticoagulant
   a. If the tubes contain an additive, gently invert the tubes several times before putting it down and drawing the next tube. After completion of blood draw, mix all tubes containing an anticoagulant or additive the recommended number of times
   b. Vigorous mixing or shaking the tube can cause hemolysis
   c. Lack of adequate mixing can lead to clot formation in the blood tube (called microclots)

F. Withdraw the needle
   1. First release the tourniquet
   2. Disengage evacuated tubes from the needle
   3. Place a strip of gauze or cotton ball directly over the needle without pressing down onto the needle and venipuncture site
   4. Withdraw the needle in one smooth motion and immediately apply pressure to the wound for 3-5 minutes or until bleeding has stopped. It is acceptable to have the patient apply this pressure if they are able.
   5. Do not bend the arm; keep it extended or raised
   6. Immediately put the needle and “hub” in to the sharps container.

G. Label tubes immediately after blood collection, at bedside, within patient’s view
   1. Patient name: all capital letters, printed: last name, first name, initial
   2. Identification number
   3. Date of draw: month, day, year (mm,dd,yyyy)
   4. Time of draw: use military time (text, appendix D, page A-26)
   5. Sign tube: first initial, complete last name

H. Before leaving the patient: check draw site and verify bleeding has stopped. Can apply small amount of clean cotton and bandage (or gauze, tape) to site

XI Failure to Obtain Blood
This can be caused by many factors. Being aware of these factors and how to correct for them may determine whether you obtain blood on the first try or have to repeat the procedure

A. Remain calm: you need to clearly analyze the situation. Check the following:
   1. Tube position and vacuum: make sure the tube is properly seated and the needle has penetrated the stopper; reseat the tube to make certain the needle sleeve is not pushing the tube off the needle. If the tube has lost its vacuum, try another tube: always have backup tubes near by
   2. Needle position: (text, page 353-355)
      a. Needle too deep: the needle has gone too deep and penetrated all the way through the vein. This can happen when the needle is first inserted into the vein, or as the tube is pushed onto the vacutainer needle. Withdraw the needle slightly to establish blood flow. If not corrected quickly, the blood will leak into the tissues and form a hematoma.
b. **Needle not deep enough**: if the needle is not completely inserted into the vein, blood may fill the tube very slowly. Push the needle gently into the vein and correct blood flow should be established. Partial needle insertion can cause blood to leak into the tissue and form a hematoma. If this occurs, immediately remove the tourniquet and withdraw the needle.

c. **Needle bevel against the vein wall**: blood flow will be impaired if the bevel of the needle is against the upper or lower wall of the vein. This is hard to tell. Try rotating the bevel slightly. If blood begins to flow, this was probably the cause.

d. **Needle has slipped beside the vein**: veins are fairly tough and if not anchored well, the vein may move slightly and the needle may slip to the side of the vein instead of penetrating it. Sometimes the needle ends up to the side and slightly under the vein. In this situation, slip the tube off of the needle so that you do not risk losing the vacuum, and withdraw the needle slightly until just the bevel is under the skin. Anchor the vein securely and redirect the needle into the vein.

e. If you cannot find the vein, release the tourniquet and withdraw the needle following the proper protocol.

3. **Collapsed vein** (text, page 355-356)
   
a. **Vacuum draw of the tube or the pressure created when pulling on the plunger can be too much for some veins**
   
b. **If a vein collapses, it will disappear as soon as the needle penetrates it and no blood will flow**
   
c. **Withdraw the needle.**
   
d. **You will need to redraw, so use a different vein, most likely on the other arm. This time don’t use a vacutainer and pull slowly on the plunger of the syringe.**

B. **If you are unable to obtain blood on the first try, you should try again (within reason)**
   
1. **Look at an alternate site: the other arm or a hand vein**
2. **Use a clean needle**
3. **Use a clean syringe if interior contaminated**
4. **If the second attempt is not successful, you should NOT try a third time. Someone else should take over. Unsuccessful attempts are frustrating to the patient as well as to the person drawing the blood.**
XII. Collection Techniques that Affect Specimen Integrity

A. **A poor quality specimen will yield a poor quality test result** affecting patient care

B. **Hemoconcentration or venous stasis**
   1. Prolonged application of the tourniquet (>1 minute)
   2. Vigorous hand pumping (will also falsely increase LD and potassium)
   3. Tourniquet applied way too tight

C. **Hemodilution**
   1. This may occur when sample is obtained from above an IV site: all parameters will be decreased except for the type of fluid being infused (if physiologic saline is being infused, the sodium and chloride results will be elevated and the other blood parameters will be decreased)
   2. Not enough blood placed into anticoagulated tube

D. **Hemolysis:** destruction of RBC’s will affect many test results such as hemoglobin, hematocrit, RBC count, LD, AST, iron, magnesium, potassium, lactic acid, etc.
   1. Traumatic stick
   2. Mixing tubes too vigorously
   3. Not allowing the alcohol cleanser to dry completely
   4. Drawing blood from a hematoma
   5. Pulling back on the plunger too quickly
   6. Using a needle with too small of a bore
   7. Frothing of the blood caused by improper fit of needle on syringe
   8. Forcing blood from a syringe into the tube
   9. Failing to wipe off the first drop of blood (might contain alcohol) from a skin puncture
   10. Excessive squeezing of the site when performing a skin puncture

E. **Clotted anticoagulated sample:** will result in low RBC count
   1. Inadequate mixing after obtaining blood sample
   2. Traumatic stick

F. **Partially filled tubes**
   1. Anticoagulated tubes should be filled according to the vacuum to obtain the proper ratio of blood to anticoagulant
   2. Especially critical for the sodium citrate tubes used for coagulation studies
   3. NEVER pour two partially filled tubes together in order to fill one tube

G. **Using the wrong anticoagulant**
H. **Specimen contamination**
   1. Using the wrong cleanser can affect test results
      a. Alcohol wipe: contaminates an ethanol (alcohol) specimen
      b. Povidone-iodine: falsely elevates uric acid, phosphate, potassium
   2. Not allowing cleanser to dry
   3. Powder from gloves can contaminate skin puncture specimens, especially neonatal screening specimens
   4. Drawing above an IV site

I. **Specimen handling errors**
   1. Sample not protected from light
   2. Sample not drawn into a pre-chilled tube
   3. Sample not put on ice

XIII. Routine Venipuncture Procedure
   A. Remain cool, calm and collected 😌

   B. What if the patient is in ISOLATION?
      1. Different types of isolation are used depending upon patient circumstances
         Always follow facility protocol
      2. What goes into the isolation room, must remain in the isolation room

   C. Organize yourself
      1. Always make sure you know what and how much you are going to draw
      2. Always make sure you have back up tubes near by in case a tube fails

   D. ALWAYS follow established protocol:
      1. Organize your equipment:
         a. Gloves (PPE) h. Bandage/tape
         b. Lab coat (PPE) i. Sharps container
         c. Alcohol wipe j. Tourniquet
         d. Cotton ball k. Needle
         e. Indelible marker
         f. Syringe/transfer device -or- vacutainer tube holder/adapter
         g. Collection tubes (including back up tubes)

            **Stick to Eleven**

      2. Wash hands and put on gloves
      3. Identify the patient
      4. Inquire about latex allergy and any required patient preparation (fasting?)
      5. Reassure the patient with your bedside manner 😊
6. Position the arm and apply the tourniquet
7. Locate the vein
8. Release the tourniquet
9. Cleanse the site and allow to air dry (~ 30 sec) (while waiting to air dry, get your equipment ready)
10. Reapply the tourniquet without touching the venipuncture site
11. Anchor the vein
12. Insert the needle into the vein
13. Fill tubes, giving the anticoagulated tubes a ‘quick mix’
14. Release the tourniquet …then… withdraw needle engaging safety shield
15. Dispose of the needle immediately into sharps container
16. Apply pressure to puncture site
17. Thoroughly mix anticoagulated tubes by inversion 8-10 times
18. Label the tubes in patient’s sight
19. Observe any special handling instructions
20. Check the patient’s arm (verify bleeding has stopped) and apply bandage
21. Dispose of contaminated and non-contaminated materials
22. Thank the patient
23. Remove gloves and wash hands
24. Wipe the perspiration from your forehead ☺

E. Accidental Needle Stick ☹
1. Remain calm, complete the task at hand
2. Cleanse the wound immediately
3. Always follow site protocol
   a. UNMC site students:
      1) Notify your instructor/supervisor
      2) Page the hot line: 1-402-888-OUCH (1-402-888-6824)
      3) Do what the OUCH service says
   b. UNMC affiliate site students:
      1) Notify your instructor/supervisor
      2) Follow site protocol
      3) Do what your site protocol outlines
      4) Notify UNMC OUCH service: 1-402-888-OUCH (6824)
         for documentation and follow-up purposes
   d. Affiliated University students:
      1) Notify your instructor/supervisor
      2) Document your laboratory protocol here:
         Who do you call? ______________________
         Phone number: ______________________
         Special instructions: __________________
      4. Complete an incident report form: your supervisor will assist you