

**Professional Practice in Clinical Chemistry: Supporting Patient Care from Cradle to Grave  
Answers to Self-Assessment Questions**

**Sunday, April 26 presentations:**

**The Virtues and Pitfalls of Implementing a New Test**

What is the CV or Coefficient of Variation?

- A – SD/Mean x 100**
- B – Mean/SD
- C –  $\sigma^2 = \sum (X_i - X)^2 / N$
- D –  $\sum (X) / N$

What is the definition of verification?

- A – Establishing the performance specifications of a new diagnostic tool such as a new test created by a laboratory
- B – Identifying the factors that will affect the performance of a laboratory test, such as hemolysis.
- C – A one-time process to determine performance characteristics of a test before use in patient testing**
- D – Identifying the accuracy and precision of a new methodology or test

Who regulates laboratory quality in the United States?

- A – CDC
- B – CMS**
- C – FDA
- D – OSHA

What is the analytical reference range?

- A – The range of test results obtained from 100 healthy individuals.
- B – A target or threshold concentration defined by an expert panel consensus
- C – The spread of results from at least 40 inpatients without disease.
- D – All of the above**

**So You Want to Develop a Test? Navigating the Regulatory Waters of Laboratory Developed Testing**

What is an LDT?

- A – New method or test
- B – Modified FDA approved test
- C – Laboratory developed test
- D – All of the above**

What agency currently oversees the quality of LDTs?

- A – CDC
- B – CMS through CLIA**
- C – NIDA
- D – IATA

What agency could levy a fine against you (personally) and your institution for improperly mailing a specimen?

- A – FDA
- B – CMS through CLIA

- C – FAA and IATA
- D – OSHA

What change is proposed by the FDA that will most impact clinical labs performing LDTs?

- A – Inspect for quality control of LDTs
- B – Require analytical validation of test performance
- C – Audit billing of LDTs
- D – No longer offer enforcement discretion for LDTs**

### Endocrinology of the Female Reproductive Axis

Which hormone is capable of negative and positive feedback effects on the pituitary gland during the normal menstrual cycle?

- A) estradiol**
- B) progesterone
- C) inhibin A
- D) Inhibin B

Which hormone is NOT secreted by the corpus luteum.

- A) estradiol
- B) progesterone
- C) inhibin A
- D) Inhibin B**

Human chorionic gonadotropin levels should increase by about \_\_\_\_\_ every 24-48 hours in a healthy, first-trimester pregnancy.

- A) 25%
- B) 50%**
- C) 75%
- D) 100%

### Prenatal Screening: Serum or DNA?

A common cut-off used to determine women at high risk for a fetal open neural tube defect is an AFP MoM greater than\_\_\_\_\_.

- A) 0.5
- B) 1.0
- C) 1.5
- D) 2.0**

The serum test with the best performance for Down syndrome screening is\_\_\_\_\_.

- A) Integrated**
- B) First trimester
- C) Quad
- D) AFP

Which of the following is NOT an appropriate next step to follow a screen positive cfDNA test?

- A) Termination**
- B) Amniocentesis
- C) CVS
- D) Genetic counseling

In which ethnic group is prenatal screening for cystic fibrosis LEAST effective?

- A) Caucasian
- B) Hispanic
- C) African American
- D) Asian**

### Complications of Pregnancy

When hCG exceeds the discriminatory zone and no IUP is visualized by TVUS

- A. An ectopic pregnancy is present
- B. A molar pregnancy is present
- C. hCG testing should be repeated in 48 hours**
- D. Urine hCG testing should be performed to confirm pregnancy

Use of the 75g-2h OGTT increases the prevalence of GDM because

- A. It requires a single glucose result above a cutoff for the test to be considered an abnormal**
- B. The oral carbohydrate is maltose which was 2x the glucose content of the 100g-3h OGTT
- C. More women undergo testing by that protocol
- D. The glucose cutoffs for identifying GDM are low

Which lab result would not support the diagnostic criteria for preeclampsia?

- A. Protein/creatinine ratio of 0.40
- B. Platelet count of 90,000/ $\mu$ L
- C. Serum creatinine of 1.0 mg/dL**
- D. Blood pressure of 150/95 mmHg

### Complications of Childbirth

Preterm premature rupture of membranes is defined as a rupture of membranes:

- A. Prior to 24 weeks of gestation
- B. Between 24 and 37 weeks of gestation**
- C. Beyond 37 weeks of gestation
- D. At the onset of labor

Fetal fibronectin testing is potentially useful to identify women:

- A. With symptoms of preterm labor who are likely to deliver preterm infants
- B. Without symptoms of preterm labor who are likely to deliver preterm infants
- C. With symptoms of preterm labor who are unlikely to deliver preterm infants**
- D. Without symptoms of preterm labor who are unlikely to deliver preterm infants

The clinical benefit of fetal lung maturity tests is:

- A. Their ability to predict which infants will develop RDS
- B. Their high positive predictive value
- C. They are easy to perform and readily available
- D. Minimal**

Which laboratory test should be used to identify HIV infection in infants born to HIV+ mothers?

- A. 3<sup>rd</sup> generation HIV-1/2 antibody test
- B. 4<sup>th</sup> generation HIV-1/2 combination test
- C. HIV DNA test**
- D. HIV Western blot

### Newborn Screening and Methods for Diagnosing Inborn Errors of Metabolism

Which of the following is a reason to include an IEM in NBS programs?

- A. Disorder has no effective treatment
- B. Disorder can be detected a week after birth
- C. Cost of testing and treatment is more than the cost of the untreated disorder
- D. Disorder has an appropriately sensitive and specific screening test**

The first newborn screening test:

- a) Was instituted in Maine and was for tyrosinemia
- b) Was a bacterial growth inhibition assay**
- c) Was developed on the tandem mass spectrometer
- d) Screened for 5 disorders

Common laboratory findings in IEM presentations do NOT include:

- a) Hyperammonemia
- b) Low concentrations of transaminases**
- c) Metabolic acidosis with elevated anion gap
- d) Hypoglycemia

Propionic and methylmalonic acidemias are commonly differentiated by which of the following tests:

- a) Organic acids by GC/MS**
- b) Acylcarnitines by tandem mass spectrometry
- c) Amino acids by MS/MS

- d) PCR for specific genetic defects

### **Neonatal Hyperbilirubinemia: The Basics, Testing, and Interpretation of Results**

Which of the following chemistry results would you be likely to see in hemolytic anemia?

- A. Normal lactate dehydrogenase
- B. Elevated total serum bilirubin with increased conjugated (direct) bilirubin
- C. Elevated total serum bilirubin with normal conjugated bilirubin**
- D. Normal total and conjugated serum bilirubins

What is the most likely cause of an unconjugated bilirubin of 11 mg/dL (188  $\mu$ mol/L) on day of life 2 in a newborn?

- A. bacteria have not yet colonized the intestines
- B. hepatic enzymes are not fully functional**
- C. mother's bilirubin is increased
- D. hemolytic disease of the newborn

A baby with biliary atresia is most likely to have markedly elevated serum level of:

- A. conjugated bilirubin**
- B. unconjugated bilirubin
- C. delta bilirubin
- D. urine urobilinogen

Unconjugated bilirubin is directly measured by which of the following methods?

- A. methods using diazotized sulfanilic acids
- B. Jendrassik-Grof method
- C. HPLC methods**
- D. Ortho dry-slides with reflectance spectrometry**

Of the following bilirubin species, which one would be most likely to give you close to the same results no matter which method you used to measure it?

- A. Conjugated bilirubin
- B. Unconjugated bilirubin
- C. Albumin bound bilirubin
- D. Total bilirubin**

### **Who Drugged the Baby? Managing Neonatal Abstinence Syndrome**

What is NAS?

- A. Network Attached Storage
- B. National Achievement Strategies
- C. Nashville Academy of Songwriters
- D. Neonatal Abstinence Syndrome**

What laws regulate neonatal abstinence syndrome?

- A. Federal CLIA law
- B. Local State regulations**
- C. College of American Pathologists
- D. FDA Federal Food, Drug and Cosmetic Act

Why is umbilical cord becoming a preferred sample for neonatal drug testing?

- A. Homogeneous
- B. Can be collected over several days
- C. Available in sufficient quantities to prevent QNS errors**
- D. Can be rapidly analyzed in most hospital laboratories

Why might a baby's cord drug testing results disagree with meconium or urine collected at the same time?

- A. Different sample types**
- B. Analyzed by different laboratories
- C. Tested by different methodologies
- D. Urine presents with more labeling errors than umbilical cord samples

**Monday, April 27 presentations:**

**Urgent, STAT, Super STAT, ASAP! Achieving your Timely Lab Testing for the Emergency Department**

Comprehensive Stroke Center certification requires documentation indicating the ability to achieve order to report lab test turnaround time within what timeframe?

- A. < 30 minutes
- B. < 45 minutes**
- C. < 60 minutes
- D. < 90 minutes

Lab test turnaround time is best defined as:

- A. Order to report
- B. Collect to report
- C. Receive to report
- D. Definition is institution-dependent**

Which strategy may be used for achieving timely testing for the Emergency Department?

- A. STAT testing performed in the central lab
- B. STAT testing performed in a satellite lab in the ED
- C. Point of Care Testing
- D. All of the above**

Which of the following specimen types may cause prolonged delay in preanalytical specimen processing?

- A. Whole blood
- B. Plasma
- C. Serum with silica activator**
- D. Serum with thrombin activator

**Acute Coronary Syndrome: Key Test for Diagnosis**

Which disease is NOT considered part of the acute coronary syndrome continuum?

- A. Stable angina**
- B. Unstable angina
- C. NSTEMI
- D. STEMI

What is the 2014 AHA/ACC recommended troponin cutoff for considering myocardial necrosis?

- A. Value at assay's 10% CV
- B. Value at assay's 20% CV
- C. 99<sup>th</sup> percentile URL with CV  $\leq$  10%**
- D. 99<sup>th</sup> percentile URL with CV  $\leq$  20%

Which of the following statements best describes high-sensitivity cTn assay performance?

- A. Improved clinical sensitivity for unstable angina

- B. Improved clinical sensitivity for myocardial ischemia
- C. Improved analytical sensitivity with equimolar detection of both cTnT and cTnI
- D. Improved analytical sensitivity with detection of cTn in  $\geq$  50% healthy patient population**

### Two Great Tests for Shortness of Breath

Why should higher thresholds be used for BNP (and NTproBNP) in ER patients with shortness of breath than for diagnosing CHF?

- A. COPD causes shortness of breath
- B. ER patients are older
- C. CHF can exist without shortness of breath**
- D. Anxiety can raise BNP (and NTproBNP) levels

Which of the following patients can be screened with D-Dimer levels as a means of ruling out DVT or PE?

- A. A hospitalized patient
- B. A patient with history of DVT and heart rate  $>$  100
- C. A patient with a swollen, tender leg
- D. A patient on chemotherapy for breast cancer**

Which of the following is an advantage of offering D-Dimer testing in the Emergency Room?

- A. Increased numbers of patients admitted to hospitals for thorough examinations
- B. Decreased numbers of patients exposed to radiation**
- C. Increased revenue to radiologists for performing CTAs
- D. No need for physicians to carefully evaluate patients

### Is My Patient Drugged? Identifying Drugs of Abuse in the Emergency Room

What is the difference between heterogeneous and homogeneous immunoassays?

- A. Heterogeneous requires extended incubation steps
- B. With heterogeneous IA there is no mixing of reagents
- C. Heterogeneous requires separation of bound and free antibody before detection**
- D. Heterogeneous runs on the same analyzer as chemistry tests

What is the advantage of confirmation testing?

- A. Lower cost
- B. Specificity**
- C. Using high tech equipment
- D. Greater efficiency

A patient is positive for 6-monoacetyl morphine. This indicates ingestion of which drug?

- A. Heroin**
- B. Methamphetamine
- C. Cocaine
- D. Marijuana

How would the laboratory director find the potential for a drug to cross-react in an immunoassay?

- A. Defer to the clinician
- B. Run an interference study on their assay
- C. Ask the patient what medications they ingested
- D. Look in the package insert**

### "All Things Are Poison": So What Should We Test For?

Which toxidrome is characterized by Salivation, Lacrimation, Urination, Diarrhea, GI upset, Emesis –

- A. "SLUDGE"?
- B. Anticholinergic**
- C. Cholinergic
- D. Sympatomemetic
- E. Sedative-hypnotic

A blood ethanol concentration of 130 mg/dL will contribute how much to a serum osmolality?

- A. 2.8 mOsm/kg
- B. 3.5 mOsm/kg
- C. 28 mOsm/kg**
- D. 35 mOsm/kg
- E. 280 mOsm/kg

By what mechanism does N-acetylcystine help prevent hepatic damage in acetaminophen overdose?

- A. Blocks absorption of acetaminophen
- B. Provides a source of glutathione**
- C. Prevents hepatic conjugation of acetaminophen
- D. Blocks acetaminophen receptors on hepatocytes
- E. Forms an in active complex with acetaminophen

### **Drug Testing: The Moving Target**

Which of the following is not a class of amphetamine/cathinone like novel psychoactive substances?

- A. Piperazines
- B. Phenethylamines
- C. Naphthoylindoles**
- D. Typtamines

Which of the following is not a characteristic of a high resolution mass spectrometry method?

- A. Provides accurate mass, retention time, isotope pattern and fragmentation information for drugs and metabolites in a biological sample
- B. Acquires data in an untargeted manner
- C. Method develop is complex due to the need to establish multiple method parameters**
- D. Data can be analyzed using targeted, suspect or untargeted data analysis

Which of the following compounds is not detected by most opiate immunoassays?

- A. Morphine
- B. Codeine
- C. hydrocodone
- D. Oxycodone
- E. Fentanyl
- F. Both d and e**

### **Stop Sepsis: Challenges and Approaches to the Laboratory Diagnosis of Sepsis**

Which of the following test is recommended for severe sepsis evaluation in the 2012 SSC guidelines?

- A. Blood Cultures**
- B. Procalcitonin
- C. CRP
- D. *C. difficile* PCR

Procalcitonin levels in serum may increase for all of the following conditions except?

- A. Surgery
- B. Bacterial pneumonia
- C. Sepsis

#### D. Viral pneumonia

Broadly multiplexed molecular assays are currently available for detection of pathogens from positive blood culture?

- A. True
- B. False

Which of the following statement about sepsis is correct?

- A. Caused by infection only
- B. **Caused by infection and inflammation**
- C. Caused by inflammation only
- D. None of the above

#### Rapid Diagnosis of Infectious Diseases: Impact on the Delivery of Clinical Care

Advantages of RIDT include all of the following except?

- A. Rapid TAT
- B. High PPV
- C. Low complexity
- D. **High NPV**

Which of the following influenza type (s) is not usually included in routine diagnostic assays?

- A. Influenza A
- B. Influenza B
- C. **Influenza C**
- D. Influenza B and C

Diagnosis of *C. difficile* can be made based on symptoms only with high accuracy?

- A. True
- B. **False**

Which of the following is a limitation of molecular assays for diagnosis of *C. difficile* disease?

- A. High complexity
- B. Detection of Infection
- C. **Detection of colonization**
- D. High negative predictive value

#### Blood Gases 1: Why Oxygen Concentration can be Confusing

Which is the best indicator of oxygen concentration in blood?

- A. PO<sub>2</sub>
- B. Hematocrit
- C. **O<sub>2</sub> content**
- D. O<sub>2</sub> saturation

Which of the following is true?

- A. A normal alveolar PO<sub>2</sub> is higher in Denver than in Boston because the air is cleaner
- B. **A normal fractional oxyhemoglobin is higher in Denver than Boston because it has less air pollution**
- C. Typical pulse oximeters provide reliable measurements of "oxygen saturation" for use in patients with smoke inhalation
- D. One must use arterial blood to get an accurate assessment of methemoglobin concentrations

What method principle is involved in measuring oxyhemoglobin percentages?



- A. Gas chromatography
- B. Ion selective electrodes
- C. Beer's Law**
- D. O<sub>2</sub> electrode, followed by interpolation from oxyhemoglobin dissociation curve

### **Blood Gases 2: Acid-Base and Electrolytes Made Simple**

Which of the following represents the typical findings in a respiratory alkalosis?

- A. increased PCO<sub>2</sub>, decreased HCO<sub>3</sub>
- B. increased PCO<sub>2</sub>, increased HCO<sub>3</sub>
- C. decreased PCO<sub>2</sub>, decreased HCO<sub>3</sub>**
- D. decreases PCO<sub>2</sub>, increased HCO<sub>3</sub>

Which of the following is a cause for a normal anion gap metabolic acidosis?

- A. diarrhea**
- B. diabetic ketoacidosis
- C. vomiting
- D. lactic acidosis

Pseudohyponatremia can be caused by which of the following:

- A. high glucose concentrations
- B. low platelet counts
- C. high concentrations of serum proteins (e.g. multiple myeloma)**
- D. high concentrations of ADH

### **Tuesday, April 28 presentations:**

#### **The Operating Room**

#### **Where Clinical Chemistry & Transfusion Medicine Collaborate**

Which of the following factors increase the risk of hemorrhage following cardiopulmonary bypass?

- A. Patient age greater than 60 years
- B. Revision surgery for complex congenital heart disease
- C. Need for substantial body temperature decrease during surgery
- D. History of bleeding after prior knee surgery
- E. All of the above**

Which of the following coagulation defects requires the use of viscoelastic tests of coagulation for rapid detection?

- A. Thrombocytopenia
- B. Coagulation factor deficiency
- C. Persistent heparinization
- D. Fibrinolysis**
- E. Platelet dysfunction

Transfusion algorithm studies demonstrate success in decreasing transfusions, but not always decreasing postoperative blood loss as measured by chest tube drainage.

- A. True
- B. False**

## Transplant Applications of Solid-phase Immunoassays

Which of the following is a risk factor for HLA alloimmunization? (choose all that apply)

- A) **Blood transfusion**
- B) **Pregnancy**
- C) **Transplantation**
- D) Trauma

Which is NOT needed to establish compatibility between potential recipient and donor pair?

- A) Recipient HLA typing
- B) Donor HLA typing
- C) Recipient anti-HLA antibody testing
- D) **Donor anti-HLA antibody testing**

The 2 main types of antibody assays are cellular and SPI. It is recommended that both an SPI and cellular assay be performed. Which 2 methods meet this recommendation? (choose all that apply)

- A) AHG-CDC and Flow cytometry
- B) Luminex and ELISA
- C) **AHG-CDC and Luminex**
- D) **Flow cytometry and ELISA**

Which of the following can cause false-negative interference in SPI which can impact interpretation of results and result in transplantation of an incompatible organ? (choose all that apply)

- A) Rituximab
- B) **IgM**
- C) **ATG**
- D) **Complement**

## The "Neck-xt" Exploration: Intraoperative Parathyroid Hormone (IOPTH) Testing During Surgical Parathyroidectomy

Which process is not directly mediated by PTH?

- A. Increased Ca<sup>2+</sup> reabsorption in distal convoluted tubules
- B. Increased Ca<sup>2+</sup> mobilization from bones
- C. **Increased Ca<sup>2+</sup> absorption from gastrointestinal tract**
- D. Increased expression of 1-alpha hydroxylase in renal cells

Which best describes 3<sup>rd</sup> generation PTH immunometric assays?

- A. Pan-anti-PTH antibodies detect all PTH fragments
- B. **Analytical specificity for 1-84 PTH**
- C. Analytical specificity for 7-84 PTH
- D. Equimolar detection of both 1-84 and 7-84 PTH

## New HIV Test and Algorithm: A Change we can believe in

The new CDC/APHL recommends that a reactive 4<sup>th</sup> generation immunoassay be followed by testing with which of the following tests?

- A. **HIV-1/HIV-2 ab**
- B. HIV-1 RNA
- C. Western Blot
- D. HIV-2 RNA

Which of the following HIV antigens is detected by antibody/antigen combo assays?

- A. p24**
- B. p55
- C. gp120
- D. gp160

Use of the new CDC/APHL HIV testing algorithm improves detection of acute HIV?

- A. True**
- B. False

Which of the following test is reactive during the eclipse period of HIV infection?

- A. Qualitative HIV-1 RNA
- B. 4<sup>th</sup> generation IA
- C. Both of the above
- D. None of the above**

### **Diagnostic, Screening and Monitoring Approaches for HBV infection**

All HBsAg positive samples should be confirmed using an antibody neutralization assay:

- A. True
- B. False**

Which of the following HBV serological markers reflects immunity through vaccination?

- A. Positive anti-HBc only
- B. Positive anti HBc IgM only
- C. Positive anti-HBs only**
- D. Positive anti-HBe only

The following groups should be screened for HBV except:

- A. IV drug users
- B. Pregnant women
- C. MSM
- D. All newborn infants**

False negative HBsAg test may result from all of the following conditions except

- A. Escape HBsAg mutants
- B. Occult HBV infection
- C. Testing during window period
- D. Chronic HBV**

### **Advances in HCV Infection: The End of a Silent Killer?**

Positive HCV antibody test results should be confirmed using which of the following tests?

- A. RIBA
- B. Qualitative HCV RNA**
- C. Western Blot
- D. Quantitative HCV RNA

Which of the following HCV genotypes is most common in North America?

- A. Genotype 1**
- B. Genotype 2
- C. Genotype 3
- D. Genotype 6

Which of the following demographic group should be tested regardless of risk?

- A. 1935-1955
- B. 1945-1965**
- C. 1987-1992
- D. 1998-2012

Addition of DAA to HCV treatment results in higher SVR

- A. True**
- B. False

### Principles and Practices of Therapeutic Drug Monitoring

Ethanol distributes in total body water (approx 40 L), if the legal limit for intoxication is 1 mg/mL in plasma, how much pure ethanol must be consumed to reach intoxication levels?

- A. 400 mg
- B. 40 g**
- C. 4g
- D. 40 ml

Warfarin (anticoagulant) is about 98% protein bound. For a 5 mg dose, only 0.1 mg of warfarin is free. If a patient takes a normal dose of aspirin at the same time as warfarin (occupies 50% of binding sites), what is the new level of free warfarin in the body?

- A. 0.1 mg
- B. 0.2 mg**
- C. 0.4 mg
- D. 2.5 mg

A 55 kg woman has a plasma theophylline ( $V_d = 0.5 \text{ L/Kg}$ ) concentration of  $15 \mu\text{g/L}$ . How much theophylline does she have in her body?

- A. 200  $\mu\text{g}$
- B. 300  $\mu\text{g}$
- C. 400  $\mu\text{g}$**
- D. 500  $\mu\text{g}$

A patient has a potentially toxic digoxin level of  $4.5 \mu\text{g/L}$ . Given that the half-life of digoxin in this patient is 60 hr, and assuming that renal function is stable, how long should the drug be stopped to allow the level to fall to  $1.5 \mu\text{g/L}$ ?

- A. 1 day
- B. 2 days
- C. 3 days
- D. 4 days**

A doctor orders 200 mg of Rocephin to be taken by a 7 Kg infant every 8 hrs. The medication label shows that 75 – 150 mg/Kg per day is the appropriate dosage range. What is the most appropriate answer?

- A. The dose is lower than the minimum desired dosage
- B. The dose is within the appropriate dosage range**
- C. The dose is higher than the minimum desired dosage
- D. The range cannot be calculated from the supplied information

Phenobarbital  $180 \text{ mg/m}^2/24 \text{ hrs}$  is ordered to be given every 8 hours for a child whose BSA (body surface area) is  $0.29 \text{ m}^2$ . If this formulation of phenobarbital is only 50% bioavailable, how much should be given at each dose?

- A. 15 mg
- B. 17 mg

- C. 35 mg
- D. 50 mg

### Chemotherapy and the Infusion Clinic

A heparinized-syringe whole blood sample is received in the laboratory for blood-gas and electrolyte testing. Upon careful examination, the medical technologist notices frothy air bubbles in the sample. What impact, if any, may air bubbles have on pH and free  $iCa^{2+}$  results using ISE methodology?

- A. No effect
- B. Falsely  $\downarrow$  pH and  $\uparrow$   $iCa^{2+}$
- C. Falsely  $\downarrow$  pH and  $\downarrow$   $iCa^{2+}$
- D. Falsely  $\uparrow$  pH and  $\uparrow$   $iCa^{2+}$
- E. Falsely  $\uparrow$  pH and  $\downarrow$   $iCa^{2+}$**

Patients exhibiting tumor lysis syndrome have electrolyte imbalances characterized by:

- A.  $\uparrow$   $K^+$ ,  $\uparrow$   $Ca^{2+}$ ,  $\uparrow$   $PO_4^{3-}$ ,  $\uparrow$  uric acid
- B.  $\downarrow$   $K^+$ ,  $\uparrow$   $Ca^{2+}$ ,  $\uparrow$   $PO_4^{3-}$ ,  $\uparrow$  uric acid
- C.  $\uparrow$   $K^+$ ,  $\downarrow$   $Ca^{2+}$ ,  $\uparrow$   $PO_4^{3-}$ ,  $\uparrow$  uric acid**
- D.  $\uparrow$   $K^+$ ,  $\uparrow$   $Ca^{2+}$ ,  $\downarrow$   $PO_4^{3-}$ ,  $\uparrow$  uric acid

$\uparrow$  = above reference range  
 $\downarrow$  = below reference range

Reverse pseudohyperkalemia is characterized by:

- A. Elevated serum  $K^+$  artifact
- B. Elevated plasma  $K^+$  artifact**
- C. Elevated  $K^+$  artifact in both serum and plasma
- D. Physiologically elevated  $K^+$  concentration

### What Clinical Chemist Should Know about M-Proteins

The best combination of tests to screen for monoclonal proteins is:

- A. Serum immunoglobulin concentrations (IgG, IgA, IgM)
- B. Serum protein electrophoresis and immunofixation electrophoresis
- C. Serum and urine protein electrophoresis**
- D. Urine protein electrophoresis and immunofixation electrophoresis

Typical findings in Light Chain Myeloma include all of the following EXCEPT:

- A. A discrete band in the serum protein electrophoresis**
- B. (Serum) hypogammaglobulinemia
- C. A discrete band in the urine protein electrophoresis
- D. A negative urine dipstick for protein

What is the most common diagnosis associated with monoclonal proteins?

- A. Amyloidosis
- B. Multiple Myeloma
- C. Monoclonal Gammopathy of Undetermined Significance**
- D. Waldenstrom's Macroglobulinemia

### Wednesday, April 29 presentations:

#### Cooking Meth and Doctor Shopping: The Challenges of Managing Prescription Therapeutics

A patient with Hx of illicit drug use on adderall for ADHD is positive for methamp (3500 ng/mL) and amphetamine (5500 ng/mL), what is the most appropriate interpretation of these results?

- A. Adderall can cause both methamphetamine and amphetamine to be positive
- B. Adderall will cause positive methamphetamine but not amphetamine
- C. Adderall will cause positive amphetamine but not methamphetamine**
- D. Adderall will not cause either methamphetamine or amphetamine to be positive

A patient is being prescribed morphine and OxyIR with a positive drug test for morphine (48,000 ng/mL), hydrocodone (5,000 ng/mL), hydromorphone (6,500 ng/mL), oxycodone (6,900 ng/mL), and oxymorphone (6,400 ng/mL). What is the most appropriate interpretation of these results?

- A. Consistent with ingestion of morphine and OxyIR.
- B. Consistent with ingestion of morphine and Oxy IR, but also shows presence of hydrocodone**
- C. Consistent with ingestion of OxyIR, but also indicates heroin use
- D. Consistent with ingestion of morphine, but not OxyIR

A patient is being prescribed morphine and OxyIR with a positive drug test for morphine (127,000 ng/mL), oxycodone (760 ng/mL) and oxymorphone (1,170 ng/mL). What is the most appropriate interpretation of these results?

- A. Consistent with ingestion of morphine and OxyIR**
- B. Consistent with ingestion of morphine, but not OxyIR
- C. Consistent with ingestion of OxyIR, but not morphine
- D. Consistent with ingestion of morphine and OxyIR, but also numorphan (oxymorphone)

### **It's Not Your Father's Music: Toxicology of Heavy Metals**

A 3 year-old child is brought to the Emergency department because of a week-long history of abdominal discomfort, irritability, and weakness. A complete blood count and blood smear demonstrate microcytic, hypochromic anemia with basophilic stippling of the red blood cells. Further history reveals that the family lives in a very old apartment complex with peeling paint. The most likely cause of the hematologic findings is:

- A. Binding of carbon monoxide to hemoglobin
- B. Inhibition of cytochrome oxidase
- C. Inhibition of hemoglobin production caused by lead**
- D. Zinc deficiency
- E. Iron intoxication

A 48 year-old woman with a diet rich in fish/shellfish was admitted to the hospital. Her clinical history in the previous 5 days included progressive deterioration in balance, gait, and speech. She had lost 15 pounds during the prior 2 months and had periods of nausea, diarrhea, and abdominal discomfort. She complained of a metallic taste and had a blue line along her gums.

These findings/history are most consistent with exposure to what heavy metal?

- A. Chromium
- B. Lead
- C. Mercury**
- D. Copper
- E. Cadmium

To screen for lead toxicity in a child, what is the preferred sample type?

- A. Hair
- B. Capillary EDTA whole blood
- C. Venous EDTA whole blood**
- D. Sodium citrate plasma
- E. Random urine

## Is My Patient Vitamin D Deficient? The Rise and Pitfalls of "Sunshine Vitamin" Testing

Production of biologically active 1,25(OH)Vitamin D is mediated by 1 $\alpha$ -hydroxylase in which organ(s)?

- A. Skin
- B. Liver
- C. Kidney**
- D. Skin and liver
- E. Liver and Kidney

Which best describes the purpose of solvent extraction in 25(OH)Vitamin D test methodologies?

- A. Remove C3 epimer 25(OH)Vit D interference
- B. Separate 25(OH)VitD2 from 25(OH)VitD3
- C. Separate 25(OH)VitD from 1,25(OH)VitD
- D. Dissociate 25(OH)VitD from VDBP**

Separation of 25(OH)Vitamin D from C3 epimer 25(OH)Vitamin D can be accomplished using:

- A. Solvent extraction
- B. Liquid chromatography with C18 column
- C. Liquid chromatography with Pentafluorophenylpropyl column**
- D. Selective m/z filtering using mass spectrometry

## Chronic Kidney Disease: The Role of the Clinical Chemist

Which of the following lab tests is used in making a diagnosis of CKD?

- A. Serum cystatin C
- B. FE(Na)
- C. Urine glucose
- D. Urine albumin/creatinine**

Which of the following variables is not part of the MDRD equation for estimated GFR?

- A. serum creatinine
- B. age
- C. gender
- D. serum cystatin C**

Which statement about urine dipstick protein is **true**?

- A. It will reliably detect Bence-Jones protein
- B. It can be used to screen for antigen excess for immunoassays for urine albumin.**
- C. By itself, it can be used to give a good estimate of the severity of proteinuria
- D. It is adequately sensitive to detect microalbuminuria

## Autoimmune Disease: So Many Tests, but Not So Complicated

Which of the following combinations of autoantibody and disease is **incorrect**?

- A. ANA: Systemic Lupus Erythematosus
- B. ANCA: Wegner's Granulomatosis
- C. ANA: Primary Biliary Cirrhosis**
- D. anti-TTG: Celiac Disease

Which of the following methods is **not** typically used for autoantibody measurement?

- A. Indirect Immunofluorescence
- B. ELISA

- C. Multiplex ELISA
- D. Mass Spectrometry**

All of the following are "weird but true" *except*:

- A. You shouldn't measure Tg unless you've proved that anti-Tg is not present
- B. Rheumatoid Factor is an autoantibody directed against normal IgM molecules**
- C. IgA deficiency complicates screening for celiac disease
- D. A large minority of healthy people positive ANAs

#### Thursday, April 30 presentation:

##### Point-of-Care Testing: Is Faster Really Better?

- 1) What is an advantage of POCT?
  - A. Expense
  - B. Speed**
  - C. Lack of limitations
  - D. Ease of training
  
- 2) How do we integrate tests into patient care?
  - A. Demand staff document results
  - B. Purchase POCT equipment
  - C. Recommend tests be performed in a core lab
  - D. Match test method to clinical need**
  
- 3) What is a limitation of POCT?
  - A. Small number of staff involved
  - B. Multiple tests available
  - C. Variety of locations where testing is performed**
  - D. Speed of testing

##### Quality Control of the Future: Risk Management and Individualized Quality Control Plans (IQCPs)

Which device would best benefit from an individualized quality control plan?

- A. A glucose meter where manufacturer recommends daily QC
- B. A high volume chemistry analyzer requiring QC 3 times daily
- C. A molecular test with 500 reactions occurring on a single use cartridge**
- D. A batch analyzer for infrequent therapeutic drug testing

Which errors would most likely be detected by traditional liquid QC?

- A. A mistake where the assay pipette is set to the incorrect volume**
- B. Drug interference in a patient's sample
- C. Hemolysis in a neonatal specimen
- D. A clot in a dialysis patient sample

Staff approach the medical laboratory director with a problem. During maintenance on Monday morning, a brown precipitate was found in the acid wash buffer which cleans all the cuvettes. It appears sometime over the weekend, staff poured an assay reagent into the wash buffer. What is the best course of action?

- A. Fire the weekend staff
- B. Call the manufacturer to determine how to flush the analyzer**



- C. **Verify the validity of the weekend quality controls and reanalyze all the samples, correcting results as necessary**
- D. **Contact risk management** (if results corrected)

**CMS and CLIA Regulations: What to Know Now and Looking Ahead**

What is the major CLIA regulatory change as a result of the Patient Access regulation?

- A. **Allows providers to send test results to patients**
- B. Allows patients to request test results directly from laboratory
- C. Clarifies the HIPAA requirements for data security

The TEST Act allows the Secretary discretion for ?

- A. Revocation of the CLIA certificate for PT Referral
- B. Imposition of the 2 year owner/operator ban when sanctioned for PT referral
- C. **Both a and b**

What are the definitions included under Burden II that clarify intentional PT referral?

- A. Reflex Testing
- B. Confirmatory Testing
- C. Distributive Testing
- D. **All of the above**