

**Pharmacology Update:
Breaking News for
Prescribers**

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**Speaker has no
relationship to disclose.**

Objectives

- Describe changes in patient management related to use of new medications, dosage changes, or changes in medication use. (30 mins)
- Describe updated guidelines that are useful for treatment and prevention of common diseases seen in primary care. (30 mins)
- Develop prescribing strategies for avoidance of drug interactions and adverse events. (30 mins)

Pneumonia

- Updated treatment guidelines
- New Antibiotics/Indications
- New safety warnings
- Update on pneumonia vaccine

A generally healthy 55-year old adult has developed community acquired pneumonia (CAP). What evidence-based antibiotic should be a first consideration for this patient?

1. Azithromycin
2. Amoxicillin
3. Levofloxacin
4. Lefamulin (Xenleta)

NO!
Azithromycin

Azithromycin

- *Streptococcus pneumoniae* resistance rates exceed 30% in most US locales
- OK to use if resistance rate is <25%

Metlay JP, Waterer GW, Long AC, et al. Diagnosis and treatment of adults with community-acquired pneumonia: an official clinical practice guideline of the American Thoracic Society and Infectious Diseases Society of America. *Am J Respir Crit Care Med* 2019;200:e45-67

Amoxicillin

- Amoxicillin 1 g TID
- The high dose overcomes resistant *S. pneumoniae*...and efficacy similar to quinolone for CAP

Metlay JP, Waterer GW, Long AC, et al. Diagnosis and treatment of adults with community-acquired pneumonia: an official clinical practice guideline of the American Thoracic Society and Infectious Diseases Society of America. *Am J Respir Crit Care Med* 2019;200:e45-67

Is amoxicillin-clavulanate a better choice?

- Amoxicillin responsible for eradication of *S. pneumoniae*
- *S. pneumoniae* is not a beta lactamase producer

Levofloxacin

- Used in patients with co-morbidities (*“a generally healthy 55-year old”*)
- And.....there are probably safer choices

When do you consider a respiratory quinolone?

First Issue:

- Used in patients with co-morbidities (heart, lung, liver, kidney disease, asplenia, malignancy)
- Suspected *S. pneumo*, atypical pathogens, beta lactamase producing *H influenzae*, others

The Second Issue....

- “there are safer choices”

Quinolones

- **2008:** FDA added a boxed warning for the increased risk for *tendinitis and tendon rupture*
- **2011:** FDA added to the boxed warning the risk for *worsening symptoms* in patients with *myasthenia gravis*
- **2013:** FDA required updated labels to reflect potential for *irreversible peripheral neuropathy*

Quinolones

- **2016:** FDA issued *enhanced warnings* about link between fluoroquinolones and disabling and potentially permanent side effects involving tendons, muscles, joints, nerves, and the central nervous system
- **July, 2018 BLACK BOX WARNING:** potential psyc side effects, risk for coma with hypoglycemia

Quinolones: Feb, 2019

- Risk of aortic dissection, rupture, or aneurysm
- Includes oral and injectable quinolones
- Risk may increase with duration of treatment

FDA. FDA warns about increased risk of ruptures or tears in the aorta blood vessel with fluoroquinolone antibiotics in certain patients. December 20, 2018. <https://www.fda.gov/Drugs/DrugSafety/ucm628753.htm>. (Accessed February 9, 2020)

Why AAA?

- **Quinolones may disrupt collagen in the aorta...possibly leading to vessel wall damage and aortic rupture**

FDA. FDA warns about increased risk of ruptures or tears in the aorta blood vessel with fluoroquinolone antibiotics in certain patients. December 20, 2018. <https://www.fda.gov/Drugs/DrugSafety/ucm628753.htm>. (Accessed February 9, 2020).

WHO is at high risk?

- **Older adults**
- **Patients with history of aneurysm**
- **Patients with hypertension, vascular disease**
- **Smokers!!!!**

FDA. FDA warns about increased risk of ruptures or tears in the aorta blood vessel with fluoroquinolone antibiotics in certain patients. December 20, 2018. <https://www.fda.gov/Drugs/DrugSafety/ucm628753.htm>. (Accessed February 9, 2020).

Quinolones still an option for CAP

- **Assess patient's risk of dissection, rupture, or aneurysm BEFORE prescribing a quinolone...**
- **Weigh risks and benefits....**
- *Use alternatives when possible*

Quinolone Alternatives?

Beta-lactam PLUS Macrolide or Doxy

- **Beta lactam:** Amoxicillin/clavulanate OR cephalosporin [cefpodoxime (Vantin) or cefuroxime (Ceftin)]
- **Macrolide:** Azithromycin or clarithromycin
- **Doxycycline** (consider loading dose 200 mg)

Metlay JP, Waterer GW, Long AC, et al. Diagnosis and treatment of adults with community-acquired pneumonia: an official clinical practice guideline of the American Thoracic Society and Infectious Diseases Society of America. *Am J Respir Crit Care Med* 2019;200:e45-67.

Lefamulin

- **New class of "pleuromutilin" antibiotics**
- **Indicated for the treatment of CABP caused by *Strep pneumo*, *MSSA*, *H flu*, *Mycoplasma*, *Legionella***
- **Lefamulin inhibits bacterial protein synthesis by binding to the 50S ribosomal subunit**

Product information for *Xenleta*. Nabriva Therapeutics U.S. King of Prussia, PA 19406. August 2019.

Retapamulin (Altabax)

- **Topical agent (approved in 2007)**
- **Belongs to pleuromutilin class of antibiotics**
- **Indications: Impetigo, infected small lacerations caused by Staph and Strep**

Cold Spring Harb Perspect Med. 2017 Jan; 7(1): a027110.
doi: 10.1101/cshperspect.a027110

Lefamulin

- **Pleuromutilins have extremely low resistance rates despite the use in veterinary medicine for >30 years**

Cold Spring Harb Perspect Med. 2017 Jan; 7(1): a027110.
doi: 10.1101/cshperspect.a027110

Lefamulin: QT Interval Prolongation

- **Avoid with other QT-prolonging meds (amiodarone, antipsychotics, macrolides, others)**
- **Avoid in patients with existing or history of prolonged QT interval, ventricular arrhythmias, torsade de pointes**
- **Avoid if taking Class IA (e.g., quinidine, procainamide) or Class III antiarrhythmics (e.g., amiodarone, sotalol)**

Product information for *Xenleta*. Nabriva Therapeutics U.S. King of Prussia, PA 19406. August 2019.

Lefamulin: 3A4 Drug Interactions

- **Avoid in combo with strong and moderate CYP3A4 inhibitors**
- **Avoid in combo with P-glycoprotein inducers (phenytoin, others)**
- **Avoid in strong inhibitors (itraconazole, others)**

<https://www.medsafe.govt.nz/profs/PUArticles/March2014DrugMetabolismCytochromeP4503A4.htm>

Product information for *Xenleta*. Nabriva Therapeutics U.S. King of Prussia, PA 19406. August 2019.

A “New” Tetracycline

- Omadacycline (Nuzyra)
- An aminomethylcycline
- Once-daily tetracycline
- Indications: community-acquired pneumonia or skin infections
- Usual tetracycline warnings: tooth discoloration, reversible inhibition of bone growth if used during the second or third trimesters of pregnancy

Product information for *Nuzyra*. Paratek Pharmaceuticals. Boston, MA 02116. October 2018.

Why a New Tetracycline?

- Effective against some doxycycline resistant bacteria
- Can be given IV
- Transition to oral tabs (\$400/oral dose)

A New Indication for a (sort of) new Antibiotic

Delafloxacin (Baxdela)

- **Approved November, 2017 for skin and skin structure infections**
- **Approved in Oct, 2019 for CAP**
- **4th generation Quinolone**
- **Indication: CAP 450 mg PO q12h for 5-14 days**
- **Effective against Gram-positive bacteria**

Summary: CAP

- **If No Co-Morbidities: Amoxicillin, Doxycycline; or Macrolide (if resistance rate <25%)**
- **If Co-Morbidities Present: Amox/clav or Cephalosporin plus macrolide or doxy (more data supports macrolide use)**

Metlay JP, Waterer GW, Long AC, et al. Diagnosis and treatment of adults with community-acquired pneumonia: an official clinical practice guideline of the American Thoracic Society and Infectious Diseases Society of America. *Am J Respir Crit Care Med* 2019;200:e45-67.

*While we are
talking about
Pneumonia*

Pevnar 13 in Older Adults?

- **Pevnar 13 no longer routine for adults ≥ 65 y/o (herd immunity in place)**
- **Continue to give Pneumovax 23 if ≥ 65 years! (protects against 11 serotypes)**
- **“Shared decision making”**

Matanock A, Lee G, Gierke R, Kobayashi M, Leidner A, Piliushvili T. Use of 13-Valent Pneumococcal Conjugate Vaccine and 23-Valent Pneumococcal Polysaccharide Vaccine Among Adults Aged ≥ 65 Years: Updated Recommendations of the Advisory Committee on Immunization Practices. *MMWR Morb Mortal Wkly Rep* 2019;68:1069–1075. DOI: <http://dx.doi.org/10.15585/mmwr.mm6846a5> external icon.

Pevnar 13 in Older Adults?

- **Immunocompromised adults of any age get BOTH vaccines (Pneumovax 23 and Pevnar 13)!**

Matanock A, Lee G, Gierke R, Kobayashi M, Leidner A, Piliushvili T. Use of 13-Valent Pneumococcal Conjugate Vaccine and 23-Valent Pneumococcal Polysaccharide Vaccine Among Adults Aged ≥ 65 Years: Updated Recommendations of the Advisory Committee on Immunization Practices. *MMWR Morb Mortal Wkly Rep* 2019;68:1069–1075. DOI: <http://dx.doi.org/10.15585/mmwr.mm6846a5> external icon.

Cannabinoids, Benefits? and Drug Interactions

Cannabinoids

2 active components of cannabis:

- Delta-9-tetrahydrocannabinol (THC)
- Cannabidiol (CBD)

The National Academies of Sciences, Engineering, and Medicine. The health effects of cannabis and cannabinoids: current state of evidence and recommendations for research (2017). <https://www.nap.edu/catalog/24625/the-health-effects-of-cannabis-and-cannabinoids-the-current-state>. (Accessed January 8, 2020).

Cannabinoids

Two active components of cannabis:

- **THC** activates cannabinoid receptors in the brain (creates a “high”)
- **CBD** appears to work on other receptor sites (CBD does not produce a “high”)

The National Academies of Sciences, Engineering, and Medicine. The health effects of cannabis and cannabinoids: current state of evidence and recommendations for research (2017). <https://www.nap.edu/catalog/24625/the-health-effects-of-cannabis-and-cannabinoids-the-current-state>. (Accessed January 8, 2020).

CBD: Potential Benefits

- Analgesia
- Anxiolytic
- Muscle relaxant
- Insomnia

Clinical Resource, *Comparison of Cannabinoids. Pharmacist's Letter/Prescriber's Letter*. September 2018.

**FDA Approved
Purified CBD & Synthetic THC**

- Epidiolex oral solution is **purified CBD**
- Rx dronabinol (Marinol, Syndros, and nabilone (Cesamet) are **synthetic THC**
- Rx Epidiolex is about \$32,500/year
- Rx Epidiolex is tested for safety, efficacy, and quality by FDA

Non-Purified CBD

Non-FDA-approved CBD is:

- Online
- Dispensaries
- Smoke shops (oral or topical oils, caps, tabs, SL sprays, edibles, inhalants, creams, etc.)
- May have inconsistent CBD amounts, THC or other contaminants

**The Buzz about CBD
and Arthritis**

- Widespread use by arthritis patients
- Anecdotal evidence: helps with pain, insomnia, anxiety
- ? Anti-inflammatory effects (animal data)

• J Rheumatol 2019;46(5):532-8
• Expert Rev Clin Immunol 2019;15(10):1019-32
• Curr Opin Rheumatol 2019;31(3):271-8

The Buzz about CBD and Arthritis

- Topical CBD: usually contains topical analgesic (camphor, menthol)
- Need to look for “certificate of analysis”
- Stop if no relief in a few weeks

Prescribers Letter, December 2019, No. 351204.

CBD Metabolism

- CBD (and THC) both primarily metabolized by CYP P450 enzymes: 1A2, 2C9, 2D6, 2C19, and 3A4
- Medications that cause *inhibition* of these enzymes can increase CBD and THC levels

Continuing Education, Medical Marijuana. Pharmacist's Letter/Prescriber's Letter. Course no. 17-231. 2017.

Inhibition
slowsssss
down drug
metabolism.....

Consequence of an “Inhibitor”?

- Slows down metabolism of the drug
- Increases affect of drugs (usually)

CBD Metabolism

- CBD (and THC) both primarily metabolized by CYP P450 enzymes: 1A2, 2C9, 2D6, 2C19, and 3A4

On the other hand....

- Medications that cause *induction* of these enzymes could decrease CBD and THC levels

Continuing Education, Medical Marijuana. Pharmacist's Letter/Prescriber's Letter. Course no. 17-231. 2017.

When a substance is an “Inducer”

- Speeds up metabolism of the drug
- Decreases affect of drugs (usually)

3A4 Enzymes

- CYP3A4 is responsible for the metabolism of more than 50% of meds
- Small intestine has the highest CYP3A4 activity
- Some important CYP3A4 interactions are due to intestinal rather than hepatic enzyme inhibition

<https://www.medsafe.govt.nz/profs/PUArticles/March2014DrugMetabolismCytoc hromeP4503A4.htm>

3A4 Inhibitors + CBD

- **Potent inhibitors** of CYP3A4: clarithromycin, erythromycin, diltiazem, itraconazole, ketoconazole, ritonavir, verapamil, goldenseal and grapefruit
- Consider **reducing** CBD doses when used with moderate to strong inhibitors

Continuing Education, *Medical Marijuana. Pharmacist's Letter/Prescriber's Letter.* Course no. 17-231. 2017.
<https://www.medsafe.govt.nz/profs/PUArticles/March2014DrugMetabolismCytoc hromeP4503A4.htm>

3A4 Inducers+ CBD

- **Potent inducers** of CYP3A4: phenobarbital, phenytoin, rifampicin, St. John's Wort, carbamazepine and glucocorticoids
- Monitor for a need to **increase** CBD doses when used with inducers

Continuing Education, *Medical Marijuana. Pharmacist's Letter/Prescriber's Letter.* Course no. 17-231. 2017.
<https://www.medsafe.govt.nz/profs/PUArticles/March2014DrugMetabolismCytoc hromeP4503A4.htm>

Drugs that Increase CBD Levels

- Clarithromycin, Erythromycin
- Omeprazole
- Diltiazem, verapamil, amiodarone, fenofibrate
- Itraconazole, fluconazole
- Warfarin, clopidogrel,
- Amitriptyline, morphine, carbamazepine, phenytoin, valproic acid, cyclobenzaprine
- Citalopram, bupropion

Continuing Education, Medical Marijuana. Pharmacist's Letter/Prescriber's Letter. Course no. 17-231. 2017.
<https://www.medsafe.govt.nz/profs/PUArticles/March2014DrugMetabolismCytochromeP4503A4.htm>

Foods that Increase CBD Levels

- Grapefruit
- High fat, high calorie foods
- Goldenseal

Continuing Education, Medical Marijuana. Pharmacist's Letter/Prescriber's Letter. Course no. 17-231. 2017.
<https://www.medsafe.govt.nz/profs/PUArticles/March2014DrugMetabolismCytochromeP4503A4.htm>

Drugs that May Decrease CBD Levels

- Phenobarbital, phenytoin, carbamazepine
- Rifampin
- Glucocorticoids
- St. John's wort

Continuing Education, Medical Marijuana. Pharmacist's Letter/Prescriber's Letter. Course no. 17-231. 2017.
<https://www.medsafe.govt.nz/profs/PUArticles/March2014DrugMetabolismCytochromeP4503A4.htm>

Drugs that May Increase CBD Side Effects

- Alcohol
- Benzodiazepines
- Opioids

Continuing Education, *Medical Marijuana. Pharmacist's Letter/Prescriber's Letter.*
Course no. 17-231. 2017.

<https://www.medsafe.govt.nz/profs/PUArticles/March2014DrugMetabolismCytoc hromeP4503A4.htm>

Biotin

- Water soluble B vitamin, B7, Co-Enzyme R
- RDA for biotin is approximately 30 mcg/day
- Multivitamins contain 30-300 mcg biotin
- Hair and nail supplements usually range from 5,000 to 10,000 mcg
- Very few patients report taking it!

Katzman BM et al 2018 Prevalence of biotin supplement usage in outpatients and plasma biotin concentrations in patients presenting to the emergency department. *Clin Biochem.* Epub 2018 Jul 20. PMID: 30036510.

Does biotin effect the thyroid gland?

1. True
2. False

Biotin Interference with Lab Testing

- Falsely high levels of T₄ and T₃
- Falsely low levels of TSH
- Falsely low troponin levels
- Falsely low PTH, LH, FSH
- Vitamin D 1,25 dihydroxy vitamin D

Katzman BM et al 2018 Prevalence of biotin supplement usage in outpatients and plasma biotin concentrations in patients presenting to the emergency department. Clin Biochem. Epub 2018 Jul 20. PMID: 30036510.

Consequences of Biotin Interference

- Many adverse events!
- Wrong diagnosis of hyperthyroidism
- Thyroid hormone dose is too high
- Troponin level too low.....missed MI!

Katzman BM et al 2018 Prevalence of biotin supplement usage in outpatients and plasma biotin concentrations in patients presenting to the emergency department. Clin Biochem. Epub 2018 Jul 20. PMID: 30036510.

Why does this happen?

- Some immunoassays use biotin as part of the reagent mixture
- Excess biotin may falsely increase or falsely decrease the substance depending on the test

(28 November 2017) Food and Drug Administration. Biotin (Vitamin B7): Safety Communication – May Interfere with Lab Tests. Available online at www.fda.gov/Safety/MedWatch/SafetyInformation/SafetyAlertsforHumanMedicalProducts/ucm586641.htm. Accessed on December 17, 2019.

How to handle?

- Doses up to 1,000 mcg have not been reported to cause interference
- American Thyroid Association: stop biotin for at least 2 days before thyroid testing

Danni Li et al. AACC Guidance Document on Biotin Interference in Laboratory Tests. *The Journal of Applied Laboratory Medicine*. Available online at <https://academic.oup.com/jalm/advance-article/doi/10.1093/jalm/fz010/5700349?searchresult=1>. Published January 13, 2020.

2020 Guidance from AACC

- AACC (Am Assoc Clinical Chemistry)
- Doses up to 1,000 mcg have not been reported to cause interference
- 5000-10,000 mcg biotin: wait \geq 8 hours after the last dose before lab tests
- Wait 72 hours for others

Danni Li et al. AACC Guidance Document on Biotin Interference in Laboratory Tests. *The Journal of Applied Laboratory Medicine*. Available online at <https://academic.oup.com/jalm/advance-article/doi/10.1093/jalm/fz010/5700349?searchresult=1>. Published January 13, 2020.

Something else....

- Biotin cleared through kidneys
- Diminished renal function patients...???

Danni Li et al. AACC Guidance Document on Biotin Interference in Laboratory Tests. *The Journal of Applied Laboratory Medicine*. Available online at <https://academic.oup.com/jalm/advance-article/doi/10.1093/jalm/fz010/5700349?searchresult=1>. Published January 13, 2020.

**Before we leave
vitamins....**

Vitamin D

Vitamin D

- **Doesn't reduce risk of CV events or cancer**
- **VITAL (n = 25,871): 2,000 IU (50 mcg)/day (mean follow-up 5.3 yr)**

Manson JE, Cook NR, Lee IM, et al. Vitamin D supplements and prevention of cancer and cardiovascular disease. *N Engl J Med* 2019;380:33-44.
JAMA Cardiol 2019;4(8):765-76

Vitamin D

- **Doesn't reduce falls in seniors...**
- **Vitamin D receptors are found in muscle**
- **Symptoms of vitamin D deficiency include bone pain and muscle weakness**

Latham NK, Anderson CS, Reid IR. Effects of vitamin D supplementation on strength, physical performance, and falls in older persons: a systematic review. *J Am Geriatr Soc* 2003;51:1219-26.
U.S. Preventive Services Task Force. Final recommendation statement. Falls prevention in community-dwelling older adults: interventions. April 2018. <https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/falls-prevention-in-older-adults-interventions1>. (Accessed January 29, 2020).

Vitamin D

USPSTF: “doesn’t reduce risk of falls”

- A meta-analysis of 20 trials (about 30,000 patients) found that taking vitamin D, with or without calcium, “does not significantly reduce the risk of falling in elderly patients, regardless of baseline 25-hydroxyvitamin D levels, level of 25-hydroxyvitamin D achieved with treatment, duration of treatment, or patient residential status”

Latham NK, Anderson CS, Reid IR. Effects of vitamin D supplementation on strength, physical performance, and falls in older persons: a systematic review. *J Am Geriatr Soc* 2009;51:1219-26.
U.S. Preventive Services Task Force. Final recommendation statement. Falls prevention in community-dwelling older adults: interventions. April 2018. <https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/falls-prevention-in-older-adults-interventions1>. (Accessed January 29, 2020).

Vitamin D

- 4,000 IU (100 mcg)/day for 48 weeks (n = 127) did not improve diabetic control in patients with A1C ≤7.5% controlled with lifestyle and metformin

Angellotti E, D'Alessio D, Dawson-Hughes B, et al. Vitamin D supplementation in patients with type 2 diabetes: the vitamin D for established type 2 diabetes (DDM2) study. *J Endocr Soc* 2018;2:310-21.

What’s New with Asthma?

What rescue medication is commonly used for treatment of an asthma exacerbation?

Mild Asthma Tx in 2020

Mild Intermittent:

- Symptoms \leq 2x times/week
- PRN albuterol

Mild Persistent:

- Symptoms > 2x/week but not daily
- Daily inhaled steroid, albuterol PRN

<https://ginasthma.org/pocket-guide-for-asthma-management-and-prevention/>

Asthma

NEJM May, 2019

- Double blind placebo-controlled trial
- Budesonide–formoterol (Symbicort) PRN was superior to albuterol used PRN for the prevention of asthma exacerbations
- No more exacerbations with this **combo PRN** than a daily low-dose inhaled steroid...at half the steroid exposure
- Study did NOT include children
- Study only included patients who used albuterol PRN and who used budesonide daily

N Engl J Med 2019; 380:2020-2030 DOI: 10.1056/NEJMoa1901963

Why Budesonide/Formoterol?

- **Budesonide: inhaled steroid (gives relief later)**
- **Formoterol: LABA, 5-10 minute onset of action (gives relief quickly)**
- **FDA approved this as a every 12-hour inhalation, NOT PRN!**

Symbicort, Dailymed.gov. Accessed January 20, 2020.

What about other Combos?

Median Time to Onset of Clinically Significant Bronchodilation	LABA	Steroid
15 minutes (≥15% improvement in FEV1)	Formoterol	Budesonide
30 to 48 minutes (≥15% improvement in FEV1)	Salmeterol	Fluticasone propionate
15 minutes (≥15% improvement in FEV1)	Formoterol	Mometasone furoate
16 minutes (100-mL increase from baseline in FEV1)	Vilanterol	Fluticasone furoate

What about Cost?

- **Formoterol/ICS combo costs about \$300**
- **Fluticasone/salmeterol is generic**
- **Generic albuterol costs about \$35**
- **Inhaled steroids cost about ≥ \$175**
- **Consider (switch from a daily low-dose inhaled steroid to) PRN formoterol/ICS if patients aren't compliant with daily steroid**

N Engl J Med 2019; 380:2020-2030 DOI: 10.1056/NEJMoa1901963

**adalimumab
crizanolizumab
eptinezumab
infliximab**

What do these words all have in common?

“mab”

- Monoclonal antibodies
- FDA: “not drugs”, not generics
- Biologics
- Exact copies of each other
- Revolutionizing treatment of diseases

What Diseases?

Asthma. Rheumatoid arthritis. Migraine headaches. Osteoporosis. HER 2 positive breast cancer. Inflammatory bowel disease. Multiple myeloma. Non-Hodgkin's lymphoma. Macular degeneration. Psoriasis. Sickle cell anemia. Lung cancer. Colorectal cancer. Hyperlipidemia. Advanced sarcoma. Thyroid eye disease. Osteoarthritis. Thrombocytopenia. Multiple sclerosis. Others.

What are Monoclonal Antibodies?

- Antibody = immunoglobulin
- Mono = one
- Clone = exact copy

Antibodies

- We make billions of antibodies
- Almost always beneficial
- Sometimes cause disease by disrupting the normal function of a cell

Monoclonal Antibody

- Developed in a lab (EXACT COPIES)
- Injected into a patient

Monoclonal Antibody

- MAB travels and attaches to the exact matching target on that specific cell (puzzle piece)

Monoclonal Antibody

- The “mab” targets a single and specific protein on a cell
- Each MAB has a specific target protein

Infliximab

- MAB that targets TNF alpha
- MAB attaches to the cytokine that generates inflammation and disrupts the ability to produce inflammation
- IBD, RA, psoriasis

Denosumab

- MAB that targets RANKL
- MAB attaches to the protein that inhibits osteoclast survival so bone resorption is decreased
- Osteoporosis

Trastuzumab

- MAB targets the cells that overexpress HER2; so inhibits proliferation of human tumor cells that overexpress HER2
- HER2 positive breast cancer

Monoclonal Antibody

- There are 100s of monoclonal antibodies that have been developed
- More being made
- Keep your eyes open!

Changes that Change Practice

5 Take Home Points

Pneumonia

Think amoxicillin first!

CBD

Watch out for drug interactions!

Biotin

Ask before hormone tests!

Asthma

Consider PRN combo inhaler for mild asthma

MABs
Revolutionizing treatment
of disease!

Questions???

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