Learning Needs Construction

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How was your first PBL session?

PBL Session

Verna takes Tylenol for headaches

Pharmacology textbooks
Lexicomp

What is Tylenol?

"Tylenol is an analgesic that relieves pain because it inhibits the synthesis of prostaglandins".

Tylenol

- What is Tylenol (Names)
- Mechanism of action
- pharmacodynamics
- pharmacokinetics
- Indications/contraindications
- Doses
- Side effects
- Drug interactions

What is a Learning Need Packet?

- Derived from the need to learn a topic to understand the patient problem(s) and address the hypotheses/ideas created in the session
- Assigned to each student in the group during the PBL session
- Constructed independently by each student! However, you can ask for help finding resources
- It has several components (described later)
- Produced in form of a digital PDF, word or google document

Header

- Case number 2701
- Case title Verna Williams
- Part of case Part 1
- Title (of your LN) "Tylenol"
- Name of student Maggie Z David
- Group number Z3

File name

- Save all the learning needs files in the following format:

"PBL.case#.Part#.Group#.Initials.Title (topic of your LN)"

Example:

PBL.2701.Part1.Z3.MZD.Tylenol

Learning needs components

Summary – A brief statement or restatement of main points of your content, encompassing all aspects of the content. In other words, taking a lot of information and creating a condensed version that covers the main points.

Patient Analysis – Application of the information learned to understand what is happening with the patient.

Idea Validation - Assigned ideas are determined to be valid or invalid based on your LN pack. Provide sufficient explanation that supports your conclusion.

New or revised ideas – New or revised ideas are based on what you learned and should advance the group efforts to further understand the topic and case.

Content/Body – This part should contain all the pertinent information related to the topic, including information that will address the assigned ideas, to allow all students to learn the subject described.

References/Sources - Sources must be reliable, up-to-date, and taken from doctoral levels resources. Only peer reviewed scientific research journals are used when needed. State which source(s) you found most useful so that others can learn from your experience).

LN Components

Final document

1. Summary
2. Patient analysis
3. Hypothesis/Idea validation
4. New Ideas
5. Content
6. References/Sources

How to proceed

1. References
2. Content
3. Hypothesis/Idea validation
4. New ideas
5. Summary
6. Patient analysis

How to proceed step by step

1. References – sources
2. Content
3. Hypothesis/Idea validation
4. New Ideas
5. Summary
6. Patient analysis

References / Sources

- Search for sources that will provide the information needed according to the assigned learning need. Check the library website for PBL students
- Studentshttps://libraries.usc.edu/locations/wilson-dental-library/problem-based-learning-students

Electronic or physical Books (reliable and must recent)

Textbooks (doctoral level) When possible, always start with a textbook!

Scientific research journals (reviews, articles; most updated)

Evidence-based sources (Evidence based dentistry)

Reliable websites (government, universities, associations, foundations)

Google Images (Pictures, diagrams, tables, if verified reliable source of origin)

List all resources used in the learning need (proper and complete citations including URL if digital source)

- Add a note as to what information you got from what source.
- Separate references for images, if obtained from google images.

Sources to avoid for content

- Wikipedia
- Individual Blogs
- Practices Blogs
- WebMD
- Mayo Clinic
- Everyday health
- Merck Manual of Diagnosis – consumer edition (use the professional edition)

All directed to the patient, you are the Doctor!

Suggested sources

Useful Textbooks Available at the Wilson Dental Library compiled by the librarians:

Research Guides

Research Guides for individual cases and subjects have been developed for you by the librarians at the Wilson Dental Library.

Research Guides for individual PBL cases focus on the first cases for DDS and ASPID students. There are not Research Guides for every PBL case, but other resources listed below contain helpful information for all PBL cases.

- PBL: Verna Williams Research Guide
- PBL: Bob Lewin Research Guide
- PBL: Jane Burke Research Guide
- PBL: Jacqueline Doe Returns Research Guide
- PBL: The Programmer Who Couldn't Eat Research Guide

Research Guides

Ask Us / FAQS

USC Libraries / Research Guides / Health Sciences / PBL: Verna Williams / Home

PBL: Verna Williams

Search this Guide | Search

This guide is for DDS and ASPID students participating in the PBL curriculum. Resources related to the case "Verna Williams" are suggested.

- Home
  - Using library resources to resolve learning needs
  - E-Book Collections
  - Search the USC Libraries Catalog for Textbooks
  - Tutorials
  - Dictionaries
  - Dental Librarian
- Keywords
- Textbooks
- Databases
- Articles & Websites
- Evaluating PBL Sources
- Citation Help

Using library resources to resolve learning needs

About this guide:

- For all PBL cases, you will be using scholarly resources, in most cases, textbooks, to address your learning needs.
- You can use the resources listed in this guide to search for textbooks, look up information in clinical databases, or find scholarly articles.

Good places to start:

1. Search within the specific textbooks listed on the **Textbooks** page of this guide using keywords (search terms) related to your learning need. Case relevant keywords are listed on the **Keywords** page of this guide.
2. Search within books on the "**Recommended Textbook List for PBL**," linked at the top of the Textbooks page.
3. Search for textbooks in **ebook collections** (Access Medicine, Clinical Key, Stat!Ref, R2 Library) using keywords related to your learning need.
4. Search the library catalog for additional textbooks, using keywords related to your learning need.
5. For some cases, you may have to search for additional articles using the databases listed on the Databases page of this guide.
6. For some cases, you may need to consult the resources listed on the Articl… this guide. Evaluate any sources you find from an internet search.

Need Help? Chat/Email Us

the Herman Ostrow School of Dentistry of USC

https://libguides.usc.edu/vernaw/home

USC

Research Guides

Ask Us / FAQS

USC Libraries / Research Guides / Health Sciences / PBL: Verna Williams / Textbooks

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- Home
- Keywords
- Textbooks
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- Databases
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- Citation Help

PBL Textbooks

- Many of your learning needs for this case are covered in the ebooks below.
- Search the library catalog for additional textbooks/ebooks.
- Search within Access Medicine, Clinical Key, Stat!Ref, and R2 Library for additional textbooks/ebooks.
- Additional resources, such as useful databases and websites, can be found using the navigation menu on the left.

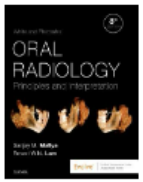
- **List of Recommended Textbooks for PBL**

  Consult this list if you are not finding information in the books below.

Textbooks

Textbooks

Radiology

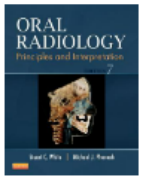


White and Pharoah's Oral Radiology : Principles and Interpretation, 8th Ed.

ISBN: 0323543839

Print only

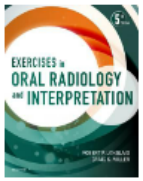
Previous Edition Available Online



Oral Radiology: Principles and Interpretation, 7th Ed.

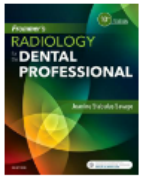
ISBN: 0323096336

Has information on: radiation safety



Exercises in Oral Radiology and Interpretation, 5th Ed.

ISBN: 0323400639

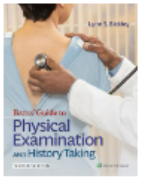


Frommer's Radiology for the Dental Professional, 10th ed.

ISBN: 9780323479332

Has information on: all aspects of dental radiology

Physical Exams



Bates' Guide to Physical Examination and History Taking, 13th Ed.

ISBN: 1975109953

Has information on: patient interviewing, history taking, vital signs

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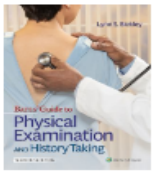

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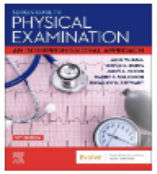
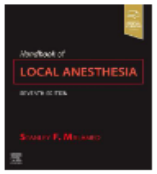


Seidel's Guide to Physical Examination, 10th Ed.

ISBN: 9780323761833

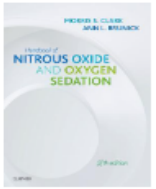
Anesthesia and Sedation



Handbook of Local Anesthesia, 7th Ed.

ISBN: 9780323582070

Has information on: local anesthesia, pharmacology, mechanism of action, tools & materials used

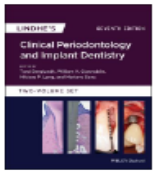


Handbook of nitrous Oxide and Oxygen Sedation, 5th ed.

ISBN: 9780323567428

Has information on: Nitrous oxide

Periodontology



Lindhe's Clinical Periodontology and Implant Dentistry, 7th Ed.

ISBN: 9781119438953

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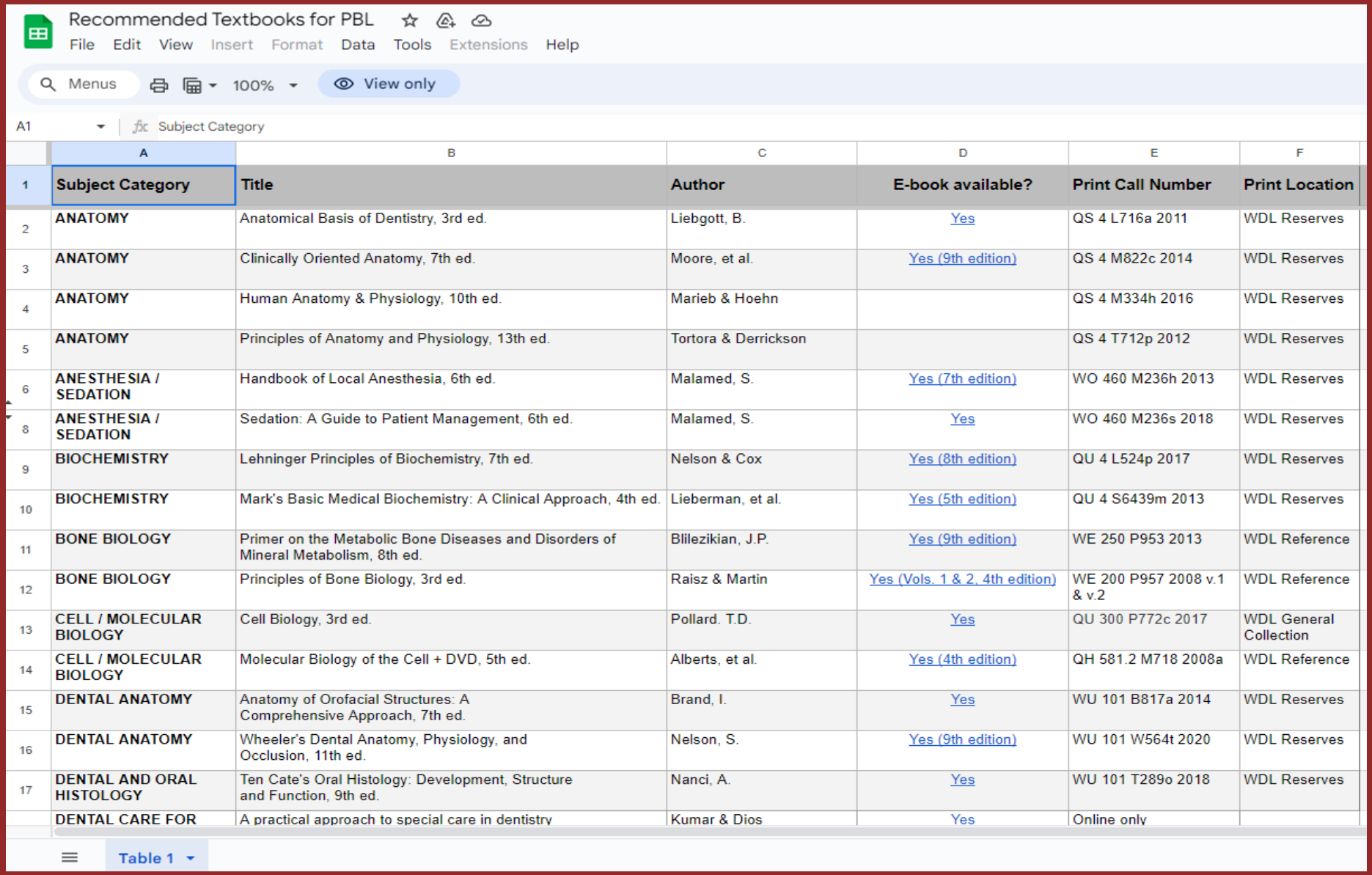

Recommended Textbooks for PBL

File Edit View Insert Format Data Tools Extensions Help

Menus 100% View only

A1 Subject Category

	A	B	C	D	E	F
1	**Subject Category**	**Title**	**Author**	**E-book available?**	**Print Call Number**	**Print Location**
2	ANATOMY	Anatomical Basis of Dentistry, 3rd ed.	Liebgott, B.	Yes	QS 4 L716a 2011	WDL Reserves
3	ANATOMY	Clinically Oriented Anatomy, 7th ed.	Moore, et al.	Yes (9th edition)	QS 4 M822c 2014	WDL Reserves
4	ANATOMY	Human Anatomy & Physiology, 10th ed.	Marieb & Hoehn		QS 4 M334h 2016	WDL Reserves
5	ANATOMY	Principles of Anatomy and Physiology, 13th ed.	Tortora & Derrickson		QS 4 T712p 2012	WDL Reserves
6	ANESTHESIA / SEDATION	Handbook of Local Anesthesia, 6th ed.	Malamed, S.	Yes (7th edition)	WO 460 M236h 2013	WDL Reserves
8	ANESTHESIA / SEDATION	Sedation: A Guide to Patient Management, 6th ed.	Malamed, S.	Yes	WO 460 M236s 2018	WDL Reserves
9	BIOCHEMISTRY	Lehninger Principles of Biochemistry, 7th ed.	Nelson & Cox	Yes (8th edition)	QU 4 L524p 2017	WDL Reserves
10	BIOCHEMISTRY	Mark's Basic Medical Biochemistry: A Clinical Approach, 4th ed.	Lieberman, et al.	Yes (5th edition)	QU 4 S6439m 2013	WDL Reserves
11	BONE BIOLOGY	Primer on the Metabolic Bone Diseases and Disorders of Mineral Metabolism, 8th ed.	Blilezikian, J.P.	Yes (9th edition)	WE 250 P953 2013	WDL Reference
12	BONE BIOLOGY	Principles of Bone Biology, 3rd ed.	Raisz & Martin	Yes (Vols. 1 & 2, 4th edition)	WE 200 P957 2008 v.1 & v.2	WDL Reference
13	CELL / MOLECULAR BIOLOGY	Cell Biology, 3rd ed.	Pollard. T.D.	Yes	QU 300 P772c 2017	WDL General Collection
14	CELL / MOLECULAR BIOLOGY	Molecular Biology of the Cell + DVD, 5th ed.	Alberts, et al.	Yes (4th edition)	QH 581.2 M718 2008a	WDL Reference
15	DENTAL ANATOMY	Anatomy of Orofacial Structures: A Comprehensive Approach, 7th ed.	Brand, I.	Yes	WU 101 B817a 2014	WDL Reserves
16	DENTAL ANATOMY	Wheeler's Dental Anatomy, Physiology, and Occlusion, 11th ed.	Nelson, S.	Yes (9th edition)	WU 101 W564t 2020	WDL Reserves
17	DENTAL AND ORAL HISTOLOGY	Ten Cate's Oral Histology: Development, Structure and Function, 9th ed.	Nanci, A.	Yes	WU 101 T289o 2018	WDL Reserves
	DENTAL CARE FOR	A practical approach to special care in dentistry	Kumar & Dios	Yes	Online only	

Table 1

and more.....

the Herman Ostrow School of Dentistry of USC

USC

References / Sources

- If you have trouble finding the information you need……

ASK FOR HELP!

- Librarians
- Facilitator
- Group members
- Faculty

How to cite your references

Books:

Ost L-G, Skaret E, "Chapter 1, Symptoms, Clinical Characteristics and Consequences" In: Cognitive Behavioral Therapy for Dental Phobia and Anxiety. John Wiley & Sons Inc.; 2013. Print

e-Books:

Ost L-G, Skaret E, "Chapter 1, Symptoms, Clinical Characteristics and Consequences" In: Cognitive Behavioral Therapy for Dental Phobia and Anxiety. John Wiley & Sons Inc.; 2013. https://onlinelibrary-wileycom.libproxy2.usc.edu/doi/pdf/10.1002/9781118499825.ch1

Journal Articles:

Norman L. Corah, Elliot N. Gale, Stephen J. Illig, Assessment of a dental anxiety scale, The Journal of the American Dental Association, Volume 97, Issue 5, 1978, Pages 816-819, IS 0002-8177. https://doi.org/10.14219/jada.archive.1978.0394

Websites:

https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/x-rays-radiographs

Images:

https://www.researchgate.net/publication/228477434_The_Intraoral_and_Extraoral_Exam-

How to proceed

1. References
2. Content
3. Hypothesis/Idea validation
4. New ideas
5. Summary
6. Patient analysis

Content

- Serves as main source of information to acquire and advance knowledge on your topic
- Information pertinent to learning the area where the topic belongs, not only the specific topic. For example, if the patient has a lung problem, the LN should be: "the anatomy of the respiratory system" not only "the anatomy of the lungs". Lungs are part of the respiratory system!
- Information pertinent to testing the validity of the hypothesis/ideas assigned to the student
- Start always with a general overview and then focus on the particular

Content

Example:

- Learning need : **Anatomy and histology of the respiratory system**
- Content:
  - What constitutes the respiratory system - diagrams, tables
    Gross anatomy – Diagrams/Pictures
  - Upper respiratory system
    - Macro anatomy – diagrams/pictures
    - Histology –diagrams/pictures
  - Lower respiratory system
    - Macro anatomy – diagrams/pictures
    - Histology – diagrams/pictures

Where am I going to get this information:

Anatomy textbooks, Respiratory system textbooks.

Content

- Information extracted from dependable sources. If possible, always start with a textbook and update/complement from other sources. However, if they have the same information, don't repeat the information from the other sources, but do add this source to the references because it is a confirmatory reference. Edit to avoid repetition.
- You should cut and paste the information into a working file (WORD™ or Google drive file)
- Your source should be from an appropriate level of knowledge for a health care provider. Do not use books, magazines or websites designed to patients. You are the doctor not the patient.
- Include as many pictures as possible, diagrams, flow charts, tables, etc. If you are thinking about it, illustrate! You can use Google images to illustrate if they come from a valid source and cite on References using a separate subheading; Images
- Use several different sources for your content (confirm/complement/update).
- Well organized, the information should flow and not be disjointed.
- Make it easy to read: create paragraphs, use the same font (not too small not to big), embed the pictures or tables in the text, highlight, etc. It makes a big difference!

Content

The tight junctions between capillary endothelial cells in the brain and between the epithelial cells in the choroid plexus (a highly vascular portion of the pia mater that projects into the ventricles of the brain and is thought to secrete the cerebrospinal fluid) effectively prevent proteins from entering the brain in adults and slow the penetration of smaller molecules. An example is the slow penetration of urea (Figure 32–5). This uniquely limited exchange of substances into the brain is referred to as the blood–brain barrier. Some physiologists use this term to refer to the barrier in the capillary walls and the term blood–CSF barrier to refer to the barrier in the choroid epithelium. However, the barriers are similar, and it seems more appropriate to use the term blood–brain barrier to refer to exchange across both barriers.

Passive diffusion across the tight cerebral capillaries is very limited, and little vesicular transport takes place. However, there are numerous carrier-mediated and active transport systems in the cerebral capillaries. These move substances out of as well as into the brain, though movement out of the brain is generally freer than movement into it because of bulk flow of CSF into venous blood via the arachnoid villi.

II. Penetration of Substances into the Brain:

Water, CO2, and O2 penetrate the brain with ease. So do the lipid-soluble free forms of steroid hormones, whereas their protein-bound forms and, in general, all proteins and polypeptides do not. The easy penetration of CO2 contrasts with the slow penetration of H+ and HCO3– and has physiologic significance in the regulation of respiration.

Glucose is the major ultimate source of energy for nerve cells. Its passive penetration of the blood–brain barrier is slow, but it is transported across the walls of brain capillaries by the glucose transporter GLUT 1. The brain contains two forms of GLUT 1: GLUT 1 55K and GLUT 1 45K. Both are encoded by the same gene, but they differ in the extent to which they are glycosylated. GLUT 1 55K is present in high concentration in brain capillaries (Figure 32–6). Infants with congenital GLUT 1 deficiency develop low CSF glucose concentrations in the presence of normal plasma glucose, and they have seizures and delayed development.

Another transporter in the cerebral capillaries is a unique Na+–K+–2Cl– cotransporter that is stimulated by ET-1 and ET-3 and apparently induced by a humoral factor from astrocytes. It may help keep the brain K+ concentration low. In addition, transporters for thyroid hormones, several organic acids, choline, nucleic acid precursors, and neutral, basic, and acidic amino acids are present.

A variety of drugs and peptides actually cross the cerebral capillaries but are promptly transported back into the blood by a multidrug nonspecific transporter in the apical membranes of the endothelial cells. This P-glycoprotein is a member of the family of ATP-binding cassettes that transport various proteins and lipids across cell membranes. In mice in which the function of this cassette has been disrupted by gene inactivation, much larger proportions of systemically administered doses of various chemotherapeutic drugs, analgesics, and opioid peptides are found in the brain than in controls. If pharmacologic agents that inhibit this transporter can be developed, they could be of value in the treatment of brain tumors and other CNS diseases in which it is difficult to introduce adequate amounts of therapeutic agents into the brain.

III. Function of the Blood–Brain Barrier:

The blood–brain barrier probably maintains the constancy of the environment of the neurons in the central nervous system. These neurons are so dependent on the concentrations of K+, Ca2+, Mg2+, H+, and other ions in the fluid bathing them that even minor variations have far-reaching consequences. The constancy of the composition of the ECF in all parts of the body is maintained by multiple homeostatic mechanisms, but because of the sensitivity of the cortical neurons to ionic change, it is not surprising that an additional defense has evolved to protect them.

Other suggested functions for the blood–brain barrier is protection of the brain from endogenous and exogenous toxins in the blood and prevention of the escape of neurotransmitters into the general circulation.

IV. Development of the Blood–Brain Barrier:

In experimental animals, many small molecules penetrate the brain more readily during the fetal and neonatal period than they do in the adult. On this basis, it is often stated that the blood–brain barrier is immature at birth. Humans are more mature at birth than rats and various other experimental animals, and detailed data on passive permeability of the human blood–brain barrier are not available. However, in severely jaundiced infants with high plasma levels of free bilirubin and an immature hepatic bilirubin-conjugating system, free bilirubin enters the brain and, in the presence of asphyxia, damages the basal ganglia (kernicterus). The counterpart of this situation in later life is the Crigler–Najjar syndrome in which there is a congenital deficiency of glucuronyl transferase. These individuals can have very high free bilirubin levels in the blood and develop encephalopathy. In other conditions, free bilirubin levels are generally not high enough to produce brain damage.

V. Clinical Implications:

Physicians must know the degree to which drugs penetrate the brain in order to treat diseases of the nervous system intelligently. For example, it is clinically relevant that the amines dopamine and serotonin penetrate brain tissue to a very limited degree but their corresponding acid precursors, L-dopa and 5-hydroxytryptophan, respectively, enter with relative ease.

Another important clinical consideration is the fact that the blood–brain barrier tends to break down in areas of infection or injury. Tumors develop new blood vessels, and the capillaries that are formed lack contact with normal astrocytes. Therefore, there are no tight junctions, and the vessels may even be fenestrated. The lack of a barrier helps in identifying the location of tumors; substances such as radioactive iodine-labeled albumin penetrate normal brain tissue very slowly, but they enter tumor tissue, making the tumor stand out as an island of radioactivity in the surrounding normal brain. The blood–brain barrier can also be temporarily disrupted by sudden marked increases in blood pressure or by intravenous injection of hypertonic fluids.

Breakdown of the BBB

Breakdown of the blood–brain barrier (BBB) is an important contributing factor to injury in many brain diseases, including stroke. A number of different, partially independent components, including the extracellular matrix, tight junctions (TJs), pericytes, and astrocyte endfeet, together with adherents junctions, form junctional complexes and play a central role in the control of BBB permeability and maintenance of cell polarity (Bazzoni et al., 2000; Zlokovic, 2008). After stroke in the adult, BBB disruption can either occur transiently, in two distinct phases (Belayev et al., 1996; Rosenberg et al., 1998), or be continuous (McColl et al., 2008) during the acute injury phase, with the extent and timing dependent on age, genetic background, and gender. Stroke severity is also exacerbated by predisposing factors, such as infection or systemic inflammation, that affect various components of the BBB (Denes et al., 2010).

Once the blood-brain barrier is broken down, it can harm our body in many ways. For example, in some patients, Alzheimer's disease may be caused (or more likely, aggravated) by a breakdown in the blood–brain barrier[5].

Based on researches, it's known that the BBB can be weaken by[5,7]

Meningeal Invasion

There are three potential bacterial routes of entry into the CSF: hematogenous, via a contiguous structure, and direct implantation. The hematogenous route is the most common; the primary foci of infection may be the nasopharynx, skin, lung, heart, gastrointestinal or genitourinary tract, umbilical stump, or elsewhere. Bacteria may enter the CSF through the dural sinuses or the choroid plexus, the precise mode of penetration is unknown. There

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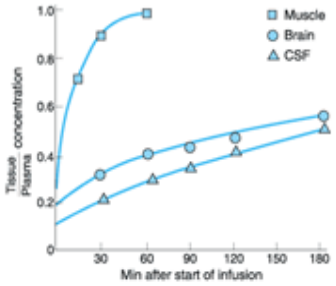

Figure 32-5. Penetration of urea into muscle, brain, spinal cord, and CSF. Urea was administered by constant infusion.

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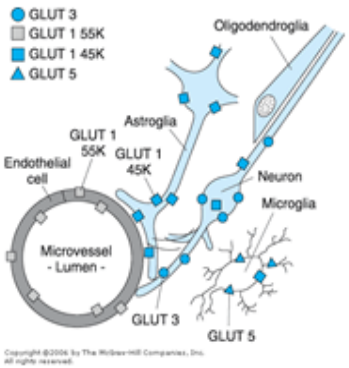

Figure 32-6. Localization of the various GLUT transporters in the brain.

Another transporter in the cerebral capillaries is a unique Na+–K+–2Cl– cotransporter that is stimulated by ET-1 and ET-3 and apparently induced by a humoral factor from astrocytes. It may help keep the brain K+ concentration low. In addition, transporters for thyroid hormones, several organic acids, choline, nucleic acid precursors, and neutral, basic, and acidic amino acids are present.

A variety of drugs and peptides actually cross the cerebral capillaries but are promptly transported back into the blood by a multidrug nonspecific transporter in the apical membranes of the endothelial cells. This P-glycoprotein is a member of the family of ATP-binding cassettes that transport various proteins and lipids across cell membranes. In mice in which the function of this cassette has been disrupted by gene inactivation, much larger proportions of systemically administered doses of various chemotherapeutic drugs, analgesics, and opioid peptides are found in the brain than in controls. If pharmacologic agents that inhibit this transporter can be developed, they could be of value in the treatment of brain tumors and other CNS diseases in which it is difficult to introduce adequate amounts of therapeutic agents into the brain.

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Other suggested functions for the blood–brain barrier is protection of the brain from endogenous and exogenous toxins in the blood and prevention of the escape of neurotransmitters into the general circulation.

IV. Development of the Blood–Brain Barrier:

In experimental animals, many small molecules penetrate the brain more readily during the fetal and neonatal period than they do in the adult. On this basis, it is often stated that the blood–brain barrier is immature at birth. Humans are more mature at birth than rats and various other experimental animals, and detailed data on passive permeability of the human blood–brain barrier are not available. However, in severely

Content example

- Learning need : **Tylenol**
- Content:
  - What type of drugs does tylenol belongs to?
  - Commercial and generic names
  - Structure
  - Mechanism of action (illustrate with diagrams)
  - Pharmacokinetics
  - Pharmacodynamics
  - Doses
  - Uses
  - Contraindications
  - Side effects
  - Drug interactions
  - Effects on the oral cavity

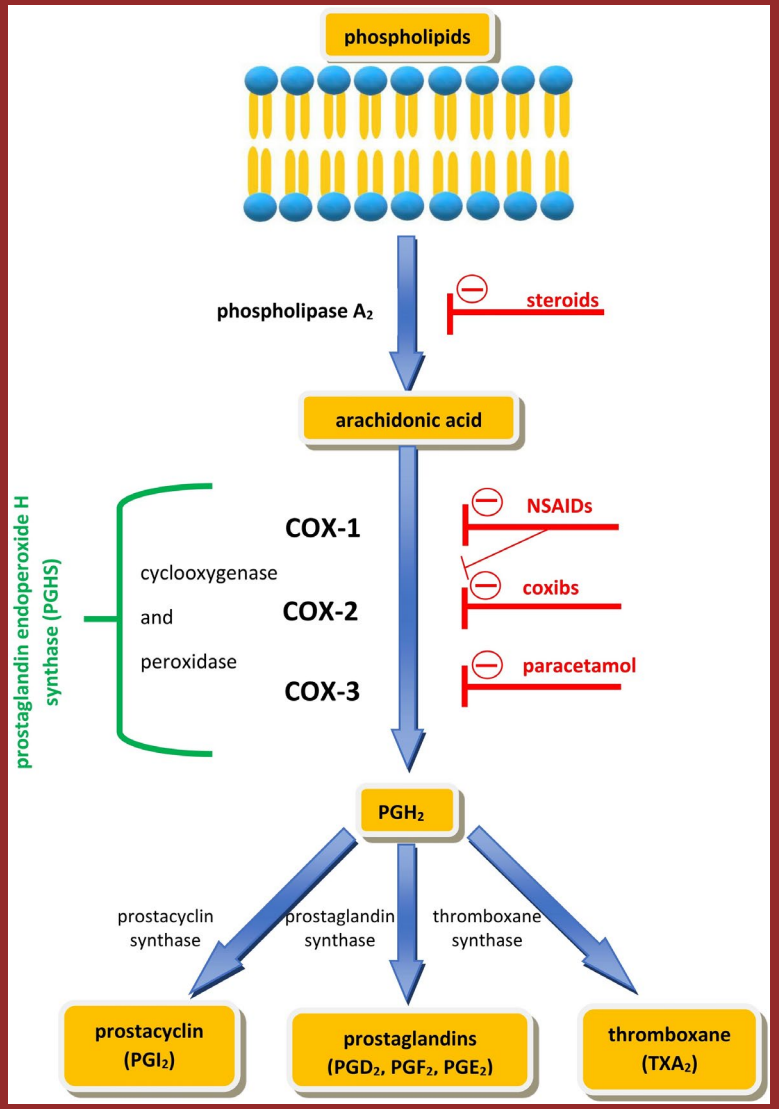
Where am I going to get this information?
Pharmacology textbooks, Pharmacological databases, Lexicomp

Mechanism of Action

Acetaminophen, also called N-**a**cetyl **p**ara-**a**mino**p**henol (APAP) or paracetamol, is one of the most widely used over-the-counter analgesic and antipyretic agents. Although its exact mechanism of action remains unclear, it is historically categorized along with NSAIDs because it inhibits the cyclooxygenase (COX) pathways. Like NSAIDs, acetaminophen has analgesic and antipyretic properties. However, studies have shown that acetaminophen lacks peripheral anti-inflammatory properties. Acetaminophen may inhibit the COX pathway in the central nervous system but not peripheral tissues. Additionally, acetaminophen does not appear to bind to the active site of either the COX-1 or COX-2 enzyme; instead, it reduces the activity of COX by a different mechanism. It also has been theorized that acetaminophen inhibits a splice variant of COX-1, also called COX-3, but this has not been confirmed in humans.

Regardless, the reduction of the COX pathway activity by acetaminophen is thought to inhibit the synthesis of prostaglandins in the central nervous system, leading to its analgesic and antipyretic effects. The analgesic properties may be due to a stimulating effect on the descending serotonergic pathways in the central nervous system (CNS). Other studies have suggested that acetaminophen or one of its metabolites, e.g., AM 404, also can activate the cannabinoid system e.g., by inhibiting the uptake or degradation of anandamide and 2-arachidonoylglyerol, contributing to its analgesic action.

https://www.ncbi.nlm.nih.gov/books/NBK482369/#:~:text=Mechanism%20of%20Action&text=Regardless%2C%20the%20reduction%20of%20the,its%20analgesic%20and%20antipyretic%20effects.



https://onlinelibrary.wiley.com/doi/abs/10.1111/1440-1681.13392

How to proceed

1. References
2. Content
3. Hypothesis/Idea validation
4. New Ideas
5. Summary
6. Patient analysis

Hypothesis/Idea Validation

- State and analyze each one of the ideas assigned to your learning need
- Validate or invalidate the idea based on your learning need
- Provide an explanation as why you validate/invalidate the idea
- Revise the idea based on your newly acquired knowledge after you addressed the original idea

Example of idea validation

Idea #1. Tylenol is an analgesic that relieves pain because it inhibits the synthesis of prostaglandins".

Valid. Tylenol (acetaminophen) has analgesic and antipyretic properties. It inhibits the COX pathway in the central nervous system but not peripheral tissues. The reduction of the COX pathway activity by acetaminophen inhibits the synthesis of prostaglandins in the central nervous system, leading to its analgesic and antipyretic effects. The analgesic properties may be due to a stimulating effect on the descending serotonergic pathways in the central nervous system (CNS).

How to proceed

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4. New ideas
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New ideas

- Use the newly acquired knowledge to create new ideas
- The new idea should address areas that need further or deeper understanding
- The new ideas should be mechanistic to facilitate the validation
- It can be any number of new ideas

Example of a new idea

Idea #1. Tylenol is an analgesic that relieves pain because it inhibits the synthesis of prostaglandins".

Valid. Tylenol (acetaminophen) has analgesic and antipyretic properties. It inhibits the COX pathway in the central nervous system but not peripheral tissues. The reduction of the COX pathway activity by acetaminophen inhibits the synthesis of prostaglandins in the central nervous system, leading to its analgesic and antipyretic effects. The analgesic properties may be due to a stimulating effect on the descending serotonergic pathways in the central nervous system (CNS).

New idea. Tylenol has analgesic and antipyretic activities but compared to other medications like aspirin, it does not possess anti=inflammatory activities.

How to proceed

1. References
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Summary

sum·ma·ry

noun

1. a brief statement or account of the main points of something.

"a summary of Chapter Three"

synonyms: synopsis, précis, résumé, abstract, digest, encapsulation, abbreviated version

adjective

1. dispensing with needless details or formalities; brief.

"summary financial statements"

synonyms: abridged, abbreviated, shortened, condensed, concise, capsule, succinct, short, brief, pithy; formal compendious "a summary financial statement"

What is in Summary?

- A brief description of the major points or highlights of your content
- **Not** an introduction of your learning need.
- **Not** a repetition of the facts
- No more than one page
- Do not place tables, pictures, diagrams, etc.
- Enough information and detail to understand all aspects of the topic
- Not designed to replace the content but to summarize it

Content

The tight junctions between capillary endothelial cells in the brain and between the epithelial cells in the choroid plexus (a highly vascular portion of the pia mater that projects into the ventricles of the brain and is thought to secrete the cerebrospinal fluid) effectively prevent proteins from entering the brain in adults and slow the penetration of smaller molecules. An example is the slow penetration of urea (Figure 32–5). This uniquely limited exchange of substances into the brain is referred to as the blood–brain barrier. Some physiologists use this term to refer to the barrier in the capillary walls and the term blood–CSF barrier to refer to the barrier in the choroid epithelium. However, the barriers are similar, and it seems more appropriate to use the term blood–brain barrier to refer to exchange across both barriers.

Passive diffusion across the tight cerebral capillaries is very limited, and little vesicular transport takes place. However, there are numerous carrier-mediated and active transport systems in the cerebral capillaries. These move substances out of as well as into the brain, though movement out of the brain is generally freer than movement into it because of bulk flow of CSF into venous blood via the arachnoid villi.

II. Penetration of Substances into the Brain:

Water, CO2, and O2 penetrate the brain with ease. So do the lipid-soluble free forms of steroid hormones, whereas their protein-bound forms and, in general, all proteins and polypeptides do not. The easy penetration of CO2 contrasts with the slow penetration of H+ and HCO3– and has physiologic significance in the regulation of respiration.

Glucose is the major ultimate source of energy for nerve cells. Its passive penetration of the blood–brain barrier is slow, but it is transported across the walls of brain capillaries by the glucose transporter GLUT 1. The brain contains two forms of GLUT 1: GLUT 1 55K and GLUT 1 45K. Both are encoded by the same gene, but they differ in the extent to which they are glycosylated. GLUT 1 55K is present in high concentration in brain capillaries (Figure 32–6). Infants with congenital GLUT 1 deficiency develop low CSF glucose concentrations in the presence of normal plasma glucose, and they have seizures and delayed development.

Another transporter in the cerebral capillaries is a unique Na+–K+–2Cl– cotransporter that is stimulated by ET-1 and ET-3 and apparently induced by a humoral factor from astrocytes. It may help keep the brain K+ concentration low. In addition, transporters for thyroid hormones, several organic acids, choline, nucleic acid precursors, and neutral, basic, and acidic amino acids are present.

A variety of drugs and peptides actually cross the cerebral capillaries but are promptly transported back into the blood by a multidrug nonspecific transporter in the apical membranes of the endothelial cells. This P-glycoprotein is a member of the family of ATP-binding cassettes that transport various proteins and lipids across cell membranes. In mice in which the function of this cassette has been disrupted by gene inactivation, much larger proportions of systemically administered doses of various chemotherapeutic drugs, analgesics, and opioid peptides are found in the brain than in controls. If pharmacologic agents that inhibit this transporter can be developed, they could be of value in the treatment of brain tumors and other CNS diseases in which it is difficult to introduce adequate amounts of therapeutic agents into the brain.

III. Function of the Blood–Brain Barrier:

The blood–brain barrier probably maintains the constancy of the environment of the neurons in the central nervous system. These neurons are so dependent on the concentrations of K+, Ca2+, Mg2+, H+, and other ions in the fluid bathing them that even minor variations have far-reaching consequences. The constancy of the composition of the ECF in all parts of the body is maintained by multiple homeostatic mechanisms, but because of the sensitivity of the cortical neurons to ionic change, it is not surprising that an additional defense has evolved to protect them.

Other suggested functions for the blood–brain barrier is protection of the brain from endogenous and exogenous toxins in the blood and prevention of the escape of neurotransmitters into the general circulation.

IV. Development of the Blood–Brain Barrier:

In experimental animals, many small molecules penetrate the brain more readily during the fetal and neonatal period than they do in the adult. On this basis, it is often stated that the blood–brain barrier is immature at birth. Humans are more mature at birth than rats and various other experimental animals, and detailed data on passive permeability of the human blood–brain barrier are not available. However, in severely jaundiced infants with high plasma levels of free bilirubin and an immature hepatic bilirubin-conjugating system, free bilirubin enters the brain and, in the presence of asphyxia, damages the basal ganglia (kernicterus). The counterpart of this situation in later life is the Crigler–Najjar syndrome in which there is a congenital deficiency of glucuronyl transferase. These individuals can have very high free bilirubin levels in the blood and develop encephalopathy. In other conditions, free bilirubin levels are generally not high enough to produce brain damage.

V. Clinical Implications:

Physicians must know the degree to which drugs penetrate the brain in order to treat diseases of the nervous system intelligently. For example, it is clinically relevant that the amines dopamine and serotonin penetrate brain tissue to a very limited degree but their corresponding acid precursors, L-dopa and 5-hydroxytryptophan, respectively, enter with relative ease.

Another important clinical consideration is the fact that the blood–brain barrier tends to break down in areas of infection or injury. Tumors develop new blood vessels, and the capillaries that are formed lack contact with normal astrocytes. Therefore, there are no tight junctions, and the vessels may even be fenestrated. The lack of a barrier helps in identifying the location of tumors; substances such as radioactive iodine-labeled albumin penetrate normal brain tissue very slowly, but they enter tumor tissue, making the tumor stand out as an island of radioactivity in the surrounding normal brain. The blood–brain barrier can also be temporarily disrupted by sudden marked increases in blood pressure or by intravenous injection of hypertonic fluids.

Breakdown of the BBB

Breakdown of the blood–brain barrier (BBB) is an important contributing factor to injury in many brain diseases, including stroke. A number of different, partially independent components, including the extracellular matrix, tight junctions (TJs), pericytes, and astrocyte endfeet, together with adherents junctions, form junctional complexes and play a central role in the control of BBB permeability and maintenance of cell polarity (Bazzoni et al., 2000; Zlokovic, 2008). After stroke in the adult, BBB disruption can either occur transiently, in two distinct phases (Belayev et al., 1996; Rosenberg et al., 1998), or be continuous (McColl et al., 2008) during the acute injury phase, with the extent and timing dependent on age, genetic background, and gender. Stroke severity is also exacerbated by predisposing factors, such as infection or systemic inflammation, that affect various components of the BBB (Denes et al., 2010).

Once the blood-brain barrier is broken down, it can harm our body in many ways. For example, in some patients, Alzheimer's disease may be caused (or more likely, aggravated) by a breakdown in the blood–brain barrier[5].

Based on researches, it's known that the BBB can be weaken by[5,7]

Meningeal Invasion

There are three potential bacterial routes of entry into the CSF: hematogenous, via a contiguous structure, and direct implantation. The hematogenous route is the most common; the primary foci of infection may be the nasopharynx, skin, lung, heart, gastrointestinal or genitourinary tract, umbilical stump, or elsewhere. Bacteria may enter the CSF through the dural sinuses or the choroid plexus, the precise mode of penetration is unknown. There

Content

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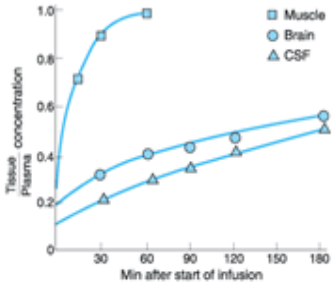

Figure 32-5. Penetration of urea into muscle, brain, spinal cord, and CSF. Urea was administered by constant infusion.

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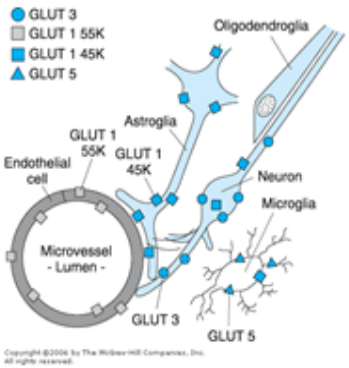

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Water, CO_2, and O_2 penetrate the brain with ease. So do the **lipid-soluble free forms of steroid hormones**, whereas their protein-bound forms and, in general, all proteins and polypeptides do not. The easy penetration of CO_2 contrasts

A variety of drugs and peptides actually cross the cerebral capillaries but are promptly transported back into the blood by a multidrug nonspecific transporter in the apical membranes of the endothelial cells. This P-glycoprotein

How to proceed

1. References
2. Content
3. Hypothesis/Idea validation
4. New ideas
5. Summary
6. Patient analysis

Patient Analysis

Apply the information you learned to the case

- Search, copy, paste, read, understand and then: apply!
- How does this knowledge help you understand what is going on with the case
- Explain with your own words what is happening to the patient based on what you learned
- Analyze using the necessary facts and new knowledge what is happening
- Do not repeat all the facts! Only use what is necessary for your analysis.

Example

Learning need: Tylenol

Patient analysis:

Verna stated on her medical history that she takes Tylenol for headaches. Since Tylenol (also known as paracetamol and acetaminophen) is a drug that has analgesic and antipyretic activities by inhibiting the production of prostaglandins, it will be quite effective to treat Verna's headache. However, Verna should be aware that she can take two tablets of 325 mg every 4-6 while symptoms last and should be very careful not to exceed 3250 mg/24 hours. Verna should also be aware that high doses of Tylenol are hepatotoxic, and use of alcohol should be avoided while taking Tylenol. Although Tylenol is effective for fever, minor pain and headaches, it does not have anti-inflammatory properties like other NSAIDS, therefore, it does not induce GI tract bleeding, and should be the medication of choice for people with GI problems like ulcers. Verna didn't report any GI problems therefore we can prescribe her either one; Tylenol or NSAIDs.

Grammar & Format

- Learning need packet should be free of grammatical and spelling errors
- Edit to avoid repetition
- Appropriate length: There are NO minimum pages! There are NO maximum pages! How long or how short will always depend on the topic assigned!
- Should have all the information necessary to acquire the appropriate knowledge of the topic and address the hypothesis/ideas
- Don't skip parts that you think you know….maybe other members of the group don't!

Finished?

- Send/upload your learning needs packets on time
- Read all learning needs, not only yours, and come prepared to the sessions.

PBL Session part 2

Verna takes Tylenol for headaches

"Tylenol is an analgesic that relieves pain because it inhibits the synthesis of prostaglandins.

Tylenol

- Names
- Mechanism of action
- pharmacodynamics
- pharmacokinetics
- Indications/contraindications
- Doses
- Side effects
- Drug interactions

Advice

- Do not despair! Working on the LN will get easier and faster as we go along
- Do your best to find good reliable information on your topic. It is your responsibility to yourself and the group
- Even if you are absent from a PBL session, you are responsible for that LN and you will be assigned a new LN
- If getting frustrated, ask for help!
- Get organized! Create your template and make sure you don't miss any components
- Save all Learning Needs! They might be useful for future cases
- Time management skills!

- Learning needs belong to you and your group. Do not share them with other groups
- Be objective! Don't be biased and manipulate the information you provide
- Do not use upper classes learning needs as yours.
- There might be situations when there is overlap of a topic in different cases. What do you do?
  - You can use the previous LN to learn, not to submit as yours.
  - If the emphasis is different in the current case, you can use some of the data, update and give credit to the person that created the original LN.

Never, ever, ever, use someone else's learning needs and pretend there are yours!

It is a violation of the Code of Ethics. It is plagiarism. It will get you sent to the Student Professional Performance Evaluation Committee (SPPEC) and it will get you suspended or kicked out of school

Can I use ChatGTP (or other AI sites) for my learning needs?

Not recommended, you still need to check all the information that is giving you because there is a tendency to "create" inaccurate information or mix the facts. It also provides wrong or non-existent References. It is your responsibility to provide reliable accurate information on your LN.

Not needed, you do not have to write a paper for publication on your learning need topic. For the majority of your packet, you need to copy, paste and edit.

Components

- Summary – copy and paste
- Patient analysis – your words
- Hypothesis/Idea validation – copy and paste and your words
- New ideas – your words
- Content – copy and paste
- References – copy and paste

Questions?