Antipsychotics (neuroleptics)

• Pharm
• Psych

1. Antipsychotics are used to treat... *(Select all that apply.)*
   a. anxiety
   b. mania
   c. paranoia
   d. schizophrenia

2. Antipsychotics that are second generation (atypical) have a higher risk of causing what side effects? *(Select all that apply.)*
   a. hyperlipidemia
   b. new-onset diabetes
   c. weight gain
   d. extrapyramidal symptoms (EPS)

3. A homeless client with schizophrenia receives primary care at your clinic. He struggles with the organization required to maintain a daily schedule of oral antipsychotic medication. The provider is most likely to recommend changing to:
   a. a first generation (typical) antipsychotic pill
   b. St. John's Wort capsules available over the counter
   c. visiting the clinic every 3 months for a long-acting intramuscular (depot) injection

4. A female client taking an antipsychotic daily has yeast infections of the mouth (thrush) and vagina that keep recurring despite treatment. The client should be evaluated for what potential side effect of antipsychotics?
   a. agranulocytosis
   b. anticholinergic effects
   c. neuroleptic malignant syndrome (NMS)

Identify which schizophrenic symptoms are classified as "positive" or "negative" by putting a **+** or **−** in each circle:

5. ◯ blunted affect
6. ◯ delusions
7. ◯ hallucinations
8. ◯ low motivation
9. ◯ poor self-care
10. ◯ poverty of speech *(minimal, must be prompted)*

Antipsychotics (neuroleptics)

• Pharm
• Psych

treat symptoms caused by schizophrenia, paranoia, & mania.
Symptom relief only, not curative. Long-term use required: monitor for adverse effects.
• *Available as long-acting IM (depot) injections designed to last either 2 wk, 4 wk, or 3 months*

POSITIVE SYMPTOMS exaggeration or distortion of normal function	•visual/auditory hallucinations •delusions *(fixed false belief)* •paranoia *and more*
NEGATIVE SYMPTOMS missing emotions/behaviors that should be present	•blunted affect •poor self-care or motivation •poverty of speech *and more*

Initial effect: few days. *Significant improvement: 2-4* weeks. *Full effect:* several months.

1st generation (typical) antipsychotics	*type*	**2nd generation (atypical)** antipsychotics
dopamine antagonist *plus other neurotransmitters (see below)*	*med action*	**serotonin & dopamine antagonist** *plus other neurotransmitters (see below)*
MOVEMENT side effects: **extrapyramidal symptoms (EPS)**	*higher risk for...*	METABOLIC side effects: **weight gain, hyperlipidemia, new-onset diabetes**

Other Adverse Effects

- **Neuroleptic Malignant Syndrome (NMS):** Altered mental status, high fever, muscle stiffness, & autonomic dysregulation can lead to organ failure.
- **Agranulocytosis:** deficiency of white blood cells called *granulocytes*. Can lead to infection and sepsis. *(Closely monitor with clozapine, which is 2nd gen.)*

All antipsychotics cause additional neurotransmitter blockade, which might cause...

- **Orthostatic Hypotension:** *due to blocking norepinephrine at* α_1 *receptors*
- **Sedation**: *due to blocking histamine (key neurotransmitter for wakefulness/alertness)*
- **Anticholinergic Effects:** *due to blocking acetylcholine (key neurotransmitter for parasympathetic "rest & digest" system) causes dry mouth, constipation, etc.*

BLOOD DYSCRASIAS: Understand by Cell Type

- Circulatory
- Immune

Place each term by appropriate arrow in table below.
Each term only used once.

- ❑ agranulocytosis
- ❑ anemia
- ❑ bleeding
- ❑ bruising
- ❑ carries O_2 to cells
- ❑ clotting
- ❑ fight infection
- ❑ flu-like symptoms
- ❑ heavy menstrual bleeding
- ❑ leukopenia
- ❑ low-grade fever
- ❑ melena *(black, tarry stools)*
- ❑ neutropenia
- ❑ pallor
- ❑ pancytopenia
- ❑ recurrent infections
- ❑ thrombocytes
- ❑ thrombocytopenia
- ❑ thrush *(yeast infection in mouth)*
- ❑ vaginal yeast infection

Blood Cell Type	What is this cell's function?	Condition name when too few of this cell:	Symptoms caused by this cell deficit:
1. RBC	▶	▶	▶ **fatigue** ▶
2. platelets *also called:* ▶	▶	▶	▶ ▶ ▶ ▶
3. WBC (leukocytes) *There are many types of WBCs—the largest percentage are granulocytes:* • *neutrophils* • *eosinophils* • *basinophils*	▶	▶ -or- ▶ -or- ▶	▶ ▶ ▶ ▶ ▶

Condition name when ALL THREE cell types too low: ▶

Blood Dyscrasias:
Understand by Cell Type

- Circulatory
- Immune

Blood Cell Type	This cell's function	Condition name when too few of this cell:	Symptoms caused by this cell deficit:
1. RBC	**carries O_2 to cells**	**anemia**	▶ **fatigue** ▶ **pallor**
2. platelets *also called:* **thrombocytes**	**clotting**	**thrombo-cytopenia**	▶ **bleeding** ▶ **bruising** ▶ **melena (black, tarry stools)** ▶ **heavy menstrual bleeding**
3. WBC (leukocytes) *There are many types of WBCs– the largest percentage are granulocytes:* • *neutrophils* • *eosinophils* • *basinophils*	**fight in-fection**	**neutropenia*** -or- **agranulocytosis*** -or- **leukopenia***	▶ **low-grade fever** ▶ **flu-like symptoms** ▶ **recurrent infections** ▶ **thrush (yeast infection in mouth)** ▶ **vaginal yeast infections**

Condition name when ALL THREE cell types are too low: **pancytopenia**

**Formal Definitions:*

- **neutropenia:** shortage of neutrophils, which are largest percentage *(~65%)* of WBCs
- **agranulocytosis** *(also called agranulosis or granulopenia):* shortage of WBCs that are granulocytes (neutrophils, eosinophils, & basinophils)
- **leukopenia:** shortage of all types of WBCs

Note: "**NEUTROPENIC PRECAUTIONS**"
This term is used for the infection-prevention precautions used for ***any*** deficit of WBCs.

Anticholinergic Side Effects

• Pharm
• Cardiac
• GI/GU

Instructions:

- *Fill in blanks & put ↑ (for increased) or ↓ (for decreased) in each circle.*
- *Check your answers against key on next page.*

PARASYMPATHETIC RESPONSE is activated by:

- **neurons:** cholinergic
- **main neurotramsitter:** acetylcholine (ACh)

ANTICHOLINERGIC EFFECTS

PLUS names of *adverse* effects caused by *excessively blocking* cholinergic neurons & parasympathetic response:

peripheral nervous system (PNS) actions:

- **pupil _____**

◯ **salivation**

◯ **heart rate**

◯ **peristalsis**

◯ **digestion**

◯ **urination**

(hint: the parasympathetic response is "rest & digest")

PNS actions + adverse effects:

- **pupil _____ : blurry vision**

◯ **salivation: _____ _____**

◯ **heart rate** *(if >100:* **t_____***)*

◯ **peristalsis: c_____**

- **urinary r_____**

central nervous system (CNS) adverse effects: (high risk in older adults)

- **c_____**
- **h_____**

(hint: both symptoms relate to the brain)

Drug classes that can cause adverse anticholinergic side effects:

- anticholinergics
- antipsychotics
- tricyclic antidepressants (TCAs)
- skeletal muscle relaxants
- antihistamines

The American Geriatrics Society (AGS) Beers Criteria 2019 recommends avoiding these meds in older adults, who are more at risk for anticholinergic side effects.

Anticholinergic Side Effects

• Pharm
• Cardiac
• GI/GU

PARASYMPATHETIC RESPONSE is activated by:

- **neurons:** cholinergic
- **main neurotramsitter:** acetylcholine (ACh)

peripheral nervous system (PNS) actions:

- **pupil constriction**
- **salivation**
- **heart rate**
- **peristalsis**
- **digestion**
- **urination**

(hint: the parasympathetic response is "rest & digest")

ANTICHOLINERGIC EFFECTS

PLUS names of *adverse* side effects caused by *excessively blocking* cholinergic neurons & parasympathetic response:

PNS actions + adverse effects:

- **pupil dilation: blurry vision**
- **salivation: dry mouth**
- **heart rate** *(if >100:* **tachycardia***)*
- **peristalsis: constipation**
- **urinary retention**

central nervous system (CNS) adverse effects: (high risk in older adults)

- **confusion**
- **hallucinations**

(hint: both symptoms relate to the brain)

Be intentional about assessing for this drug class: **antihistamines**

Why? *Because when you ask clients to tell you what meds they take, often they only list their* **prescribed** *meds, and forget to mention* **over-the-counter (OTC)** *drugs.*

Of the 5 classes identified by AGS Beers Criteria, **only** *antihistamines are available OTC – that means without a prescription. Such as:*

- *diphenhydramine (Benadryl, Sominex, also part of Tylenol PM and Advil PM)*
- *fexofenadine (Allegra)*
- *loratadine (Claritin)*
- *cetirizine (Zyrtec)*

Note: treat seasonal allergies

Memory tip: *Anticholinergic side effects = "can't see, can't pee, can't spit, can't s***"*

AUTONOMIC NERVOUS SYSTEM: Overview

SYMPATHETIC
("fight or flight")

- **Neurons:** adrenergic
- **Receptors:** alphas (α_1 α_2), betas (β_1 β_2), & dopamine
- **Main neurotransmitters:** *catecholamines:* norepinephrine, epinephrine ("adrenaline"), & dopamine

PARASYMPATHETIC
("rest & digest")

- **Neurons:** cholinergic
  - *vagus nerve is largest, most important*
- **Receptors:** muscarinics & nicotinics
- **Main neurotransmitter:** acetylcholine (ACh)

PUPILS
- dilate *via* α_1
- constrict

HEART RATE
- *via* β_1
- ↓

β_1 *also causes:*
↑ *AV conduction &*
↑ *force of myocardial contraction*

muscarinic *receptors cause <u>all</u> parasympathetic actions shown here*

BRONCHIOLES
- dilate *via* β_2
- constrict

β_2 *also <u>dilates</u> arterioles to heart, lungs, & skeletal muscle – organs vital for "fight or flight"*

SALIVATION
- ↓
- ↑

DIGESTION
- ↓
- ↑

α_1 *shunts blood to organs vital for "fight or flight" by <u>constricting</u> (a) veins & (b) arterioles to mucous membranes, intestines, skin*

↑ *gastric secretions,*
↑ *peristalsis, supports defecation & dilates veins*

URINATION
- **Inhibits:** α_1 *relaxes bladder & contracts urethral sphincter* ↓
- ↑ **Facilitates:** *contracts bladder & relaxes urethral sphincter*

SEX ORGANS
- **orgasm**
  ejaculation
- **vaginal lubrication**
  erection

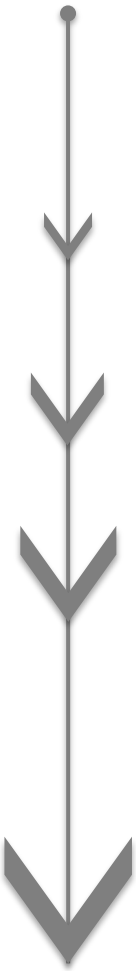
EPS: Extrapyramidal Symptoms

• Pharm
• Psych
• Neuro

Instructions: Put terms in correct boxes (1 through 4) below, indicating what is *typically* the earliest to the latest reaction.

tardive dyskinesia (TD)
acute dystonia
akathisia
Parkinson-like symptoms

EARLIER reactions



ACUTE EPS:

Reaction	*Onset*	*Features*
1.	hours to days	Spasms of tongue, neck, face and back (can fluctuate & even temporarily abate with reassurance)
2.	5 – 30 days	Resting tremor, rigidity, masklike face, shuffling gait, decreased arm swing
3.	5 – 60 days	Obvious motor restlessness evidenced by pacing, rocking, shifting from foot to foot; subjective sense of not being able to sit or be still

CHRONIC SYNDROME:

4.	Months to years	Abnormal oral-facial movements: lip smacking, worm-like tongue movement or arms/legs

LATER reactions

EPS: Extrapyramidal Symptoms

• Pharm
• Psych
• Neuro

Abnormal movements resulting from antipsychotic drugs having an adverse effect on the extrapyramidal motor system.

EARLIER reactions

ACUTE EPS:

Reaction	*Onset*	*Features*
Acute dystonia	hours to days	Spasms of tongue, neck, face and back (can fluctuate & even temporarily abate with reassurance)
Parkinson-like symptoms	5 – 30 days	Resting tremor, rigidity, masklike face, shuffling gait, decreased arm swing
Akathisia	5 – 60 days	Obvious motor restlessness evidenced by pacing, rocking, shifting from foot to foot; subjective sense of not being able to sit or be still

CHRONIC SYNDROME:

Tardive Dyskinesia (TD)	Months to years	Abnormal oral-facial movements: lip smacking, worm-like tongue movement or arms/legs

LATER reactions

Parkinson's Symptoms

• Neuro
• Psych

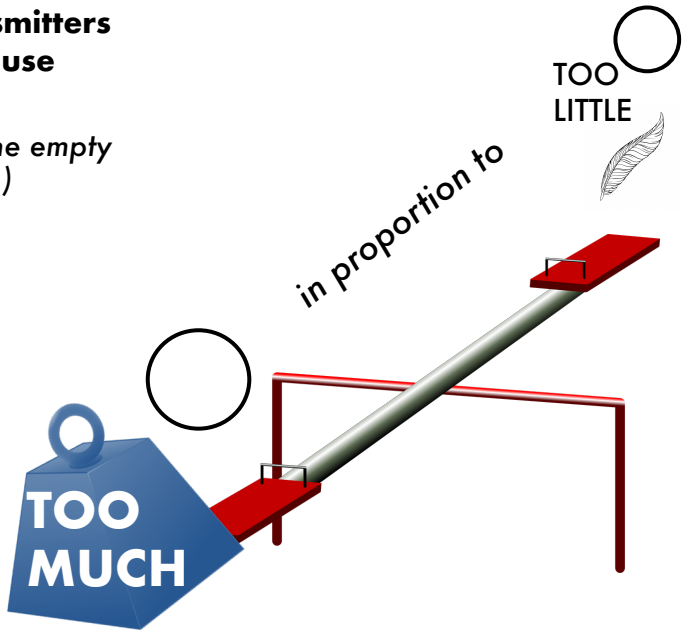
Instructions: In each row, put a ★ in one circle to indicate which is the actual Parkinson's symptom.

Hand Paralysis *Absolutely no movement, no sensation.*	◯ or ◯	**Pill-Rolling Tremor** *Looks like trying to roll a pill between thumb & index finger.*
Resting Tremor *Muscle tremor at rest, stops when muscle moves or client sleeps.*	◯ or ◯	**Tremor with Movement** *Tremor appears during movement only, also occurs when client sleeps.*
Bradykinesia *Slowness of movement.*	◯ or ◯	**Akathisia** *Restlessness, cannot stay still.*
Muscle rigidity *Stiffness or "tightness" of limbs.*	◯ or ◯	**Hyperreflexia** *Overactive/overresponsive reflexes.*
Mask-like face *("masked facies")* *Face lacks expression.*	◯ or ◯	**Hyper-expressive** *Exaggerated facial expressions.*
Stooped posture *Hunched shoulders, forward lean of body.*	◯ or ◯	**Hyper-erect** *Looks like standing at attention.*
Shuffling gait *Short steps.*	◯ or ◯	**Exaggerated walk-run** *Movements have a manic quality.*

Identify the 2 neurotransmitters out of proportion that cause Parkinson's symptoms.

(Place one letter in each of the empty circles in the graphic at right.)

a. acetylcholine (ACh)
b. serotonin
c. norepinephrine
d. dopamine
e. epinephrine



Parkinson's Symptoms

tremor
(often **at rest***)*

- **pill-rolling tremor** *(looks like trying to roll pill between thumb & index finger)*
- **bradykinesia** *(slowed movement)*
- **muscle rigidity**
- **stooped posture**
- **shuffling gait**

face lacks expression
("masked")

CAUSES

PARKINSON'S DISEASE

Progressive nervous system disorder that affects movement. Treatable, but no cure yet.

DRUG-INDUCED PARKINSONISM

A type of drug-induced movement disorders called extrapyramidal symptoms (EPS). Reversible.

ETIOLOGY

Permanent loss of *substantia nigra* brain cells that produce dopamine (DA)

Adverse side effect of antipsychotics or some antiemetics

PRIMARY TREATMENT

DA as med not effective since it cannot cross blood-brain barrier. Instead: DA precursor (levodopa) given, which crosses barrier then converts into DA within brain.

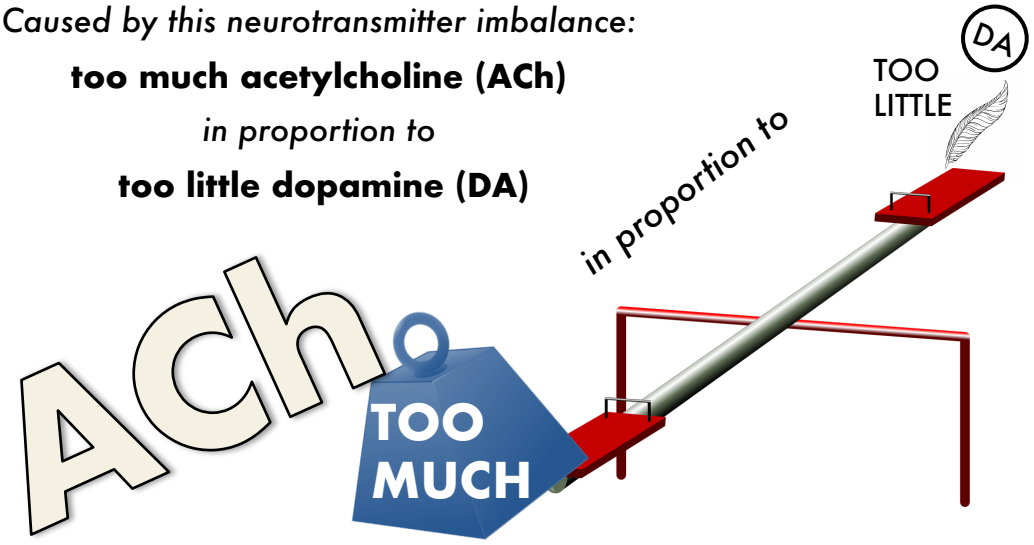
Discontinue causative med or administer anticholinergic

Caused by this neurotransmitter imbalance:

too much acetylcholine (ACh)

in proportion to

too little dopamine (DA)



Mental Health Med Emergencies:

- Pharm
- Psych
- Neuro

SS **Serotonin Syndrome**

NMS **Neuroleptic Malignant Syndrome**

Both are mental health med reactions that can become life-threatening emergencies.

1. SS and NMS both have these symptoms: *(Select all that apply.)*
   a. fever
   b. diaphoresis
   c. tachycardia
   d. tardive dyskinesia (TD)

Because both share the symptoms above, it is possible to confuse the two conditions.

In the circles below, identify the unique symptoms for each condition by entering **SS** or **NMS**.

2. ( ) GI symptoms like hyperactive bowel sounds or diarrhea
3. ( ) hyperreflexia
4. ( ) hyporeflexia
5. ( ) bradykinesia (slowed movement)
6. ( ) "lead pipe" muscle rigidity
7. ( ) tremors
8. ( ) clonus

9. *True or false?* Monitoring temperature is essential when taking mental health meds because it can identify onset of SS or NMS.

Mental Health Med Emergencies

SS and NMS are life-threatening med reactions. How to tell them apart...

SEROTONIN SYNDROME (SS)

NEUROLEPTIC MALIGNANT SYNDROME (NMS)

CAUSATIVE AGENTS

combo of 2 or more serotonergic agents

SSRI, SNRI, TCA, MAOI, lithium, bupropion, St. John's Wort & more
(also street drugs: cocaine, meth, MDMA, LSD)

1 or more dopamine antagonists

antipsychotics *(typical or atypical) and some* ***antiemetics***

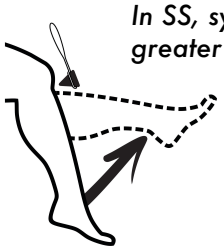
ONSET

rapid/abrupt
over 24 hours

gradual
days to weeks

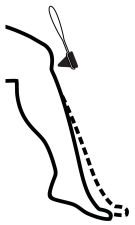
NEURO-MUSCULAR EFFECTS

In SS, symptoms below are often greater in lower extremities...



HYPERreflexia

HYPOreflexia



tremors
involuntary quivering

bradykinesia
slowed movement

clonus
muscle spasm with repeated, rhythmic contractions

"lead pipe" muscle rigidity
stiff, inflexible muscles

RECOVERY and more

rapidly resolving
recovery in few days

p r o l o n g e d . . .
recovery in 9-14 days

- ***Mental status:*** *often normal, may be agitated*
- ***Pupils:*** *dilated*
- ***GI:*** *hyperactive bowel sounds, diarrhea*
- ***Treatment:*** *Stop med(s). Stabilize vitals. May give benzos or serotonin receptor blocker.*

- ***Mental status:*** *confused, agitated, or catatonic*
- ***Pupils:*** *normal*
- ***GI:*** *normal*
- ***Treatment:*** *Stop med(s). Stabilize vitals. May admit to ICU. May use ECT.*

★ *Know the 3 symptoms SS & NMS share:* **fever, diaphoresis & tachycardia** ★

Monitor temp with mental health meds: a fever can identify onset of NMS or SS.

MATCHING: Drug Class Suffixes

• Pharm

Each term is only used once:

- ☐ ACE inhibitor
- ☐ $alpha_1$ adrenergic blocker
- ☐ anticoagulant
- ☐ antilipidemic
- ☐ antiviral
- ☐ ARB: angiotensin receptor blocker
- ☐ benzodiazepine
- ☐ $beta_2$ adrenergic agonist
- ☐ beta adrenergic blocker
- ☐ CCB: calcium channel blocker
- ☐ cephalosporin antibiotic
- ☐ diuretic
- ☐ H2RA: $histamine_2$ receptor antagonist
- ☐ penicillin antibiotic
- ☐ PPI: proton pump inhibitor

---

cef- *or* **ceph-**

-cillin

-dipine

-lol

-parin

-prazole

-pril

-sartan

-statin

-terol

-thiazide

-tidine

-vir

-zepam *or* **-zolam**

-zosin

Suffixes for Common Drug Classes

• Pharm

Note: these rules apply only to generic drug names, not trade names. Also, there can be occasional exceptions to the rule.

**Memory tip:*
★ adrenergic → adrenaline → sympathetic *"fight or flight"* response

ACE inhibitor	**-pril**
alpha$_1$ adrenergic* blocker	**-zosin**
anticoagulant	**-parin**
antilipidemic *(HMG-CoA reductase inhibitor)*	**-statin**
antiviral *(influenza, HIV, or herpes)*	**-vir**
ARB: angiotensin receptor blocker	**-sartan**
benzodiazepine	**-zepam** *or* **-zolam**
beta$_2$ adrenergic* agonist	**-terol**
beta adrenergic* blocker	**-lol**
CCB: calcium channel blocker	**-dipine**
cephalosporin antibiotic	**cef-** *or* **ceph-**
diuretic	**-thiazide**
H2RA: histamine$_2$ receptor antagonist	**-tidine**
penicillin antibiotic	**-cillin**
PPI: proton pump inhibitor	**-prazole**

SLEEP MEDS: EASY AS 1, 2, 3...

To understand how sleep meds work, focus on 3 things.

- Pharm
- Neuro
- Sleep

Instructions:
Fill in missing letters to complete the name of each neuro-active substance.

1. G___ ___ ___

- primary inhibitory neurotransmitter for the central nervous system (CNS)
- makes neurons less excitable, which blocks impulses and slows nerve activity in the brain
- this effect is potentiated (increased) by benzodiazepines and alcohol

2. M___ ___ ___ ___ ___ ___ ___ ___

- the pineal gland in the brain transforms serotonin into this neurohormone
- secreted in dark and suppressed in light, helps regulate the sleep-wake cycle (circadian rhythm)

3. H___ ___ ___ ___ ___ ___ ___ ___

- organic compound that has many varied effects throughout the body:
  - in the central nervous system, it acts as the key neurotransmitter for alertness/wakefulness
  - regulates immune response
  - in the stomach, stimulates secretion of acid via histamine$_2$ (H_2) receptor

When counting sheep doesn't help bring on sleep...

SLEEP MEDS: EASY AS 1, 2, 3...

To understand how sleep meds work, focus on 3 things.

Instructions:
Fill in missing 3 words.

G_____
neurotransmitter that ↓ activity of neurons

Classes that potentiate *(intensify)* G_____ effect:

a) benzodiazepines:
- *Generic drug names end in –ZEPAM (temazepam) or –ZOLAM (triazolam)*

b) benzo-like drugs:
zolpidem (Ambien), zaleplon (Sonata), eszopiclone (Lunesta)

M_____
hormone that promotes circadian rhythm.

Released when dark at night, encouraging body to sleep.

a) m_____:
For sleep & jet lag. Used in children. Research mixed on effectiveness. In US, classified as dietary supplement, so not FDA regulated – which makes it only hormone available over the counter (OTC) in US.

b) m_____ receptor agonist:
- **ramelteon:** newer drug approved by FDA

H_____
key neuro-transmitter promoting alertness/ wakefulness

Also other actions, such as immune response.

Classes that block h_____$_1$ (H_1) receptor:

a) 1st gen. anti-h_____:
- **diphenhydramine** *(Benadryl, Sominex): Tolerance occurs in 1-2 weeks. Significant anticholinergic effects, so avoid in elderly.*

b) These anti-depressants *block H_1 receptor (lower doses used to treat insomnia than for depression):*
- **doxepin** *(a TCA): FDA approved ("on label") for use as sleep aid.*
- **trazodone** *(atypical antidepressant affecting serotonin): "Off-label" use as sleep aid.*
- *Both meds low risk for dependence or abuse.*

BAD MEDICINE: Do not use alcohol for sleep – it disrupts more than it helps...

Surveys indicate 20% or more Americans use alcohol to help fall sleep.

Alcohol does potentiate G____ – but it also reduces REM stage, disrupts circadian rhythm by suppressing m_____ release, and can worsen sleep apnea.