

Behavioral Sciences

MD3

Behavioral Sciences

Psychopharmacology

Psychopharmacology

Learning Objectives

- Define the side effect profile of different receptors
- Demonstrate understanding of the types of antipsychotics and how they work
- Demonstrate understanding of the types of antidepressants and how they work
- Demonstrate understanding of the types of mood stabilizers and how they work
- Demonstrate understanding of the types of anxiety medications and how they work

Psychopharmacology

SIDE EFFECT PROFILE

Receptor

Effects

Histamine

Sedation, weight gain

Muscarine

Anticholinergic (dry mouth, blurry vision, constipation, confusion, etc.)

Alpha 1

Dizziness, hypotension

Psychopharmacology

ANTIPSYCHOTIC (NEUROLEPTIC) MEDICATIONS

Antipsychotic medications are used to treat 2 types of conditions:

- Schizophrenia and other psychotic disorders
- Hiccups, Tourette syndrome, and bipolar disorders

The **mechanism of action** is dopamine blockage at the postsynaptic receptors.

Side Effect	Peak	Treatment
Dystonic reaction	Hours to days	Anticholinergic, Benztropine, trihexyphenidyl, diphenhydramine
Rigidity	3 weeks	Lower dose or anticholinergics
Tremors	6 weeks	Lower dose or anticholinergics
Akathisia	10 weeks	B-blockers, benzodiazepines; lower dose or switch to atypical
Tardive dyskinesia	>3–6 months	Switch to atypical or clozapine
Neuroleptic malignant syndrome	Any time	May be lethal; dantrolene or bromocriptine

Psychopharmacology

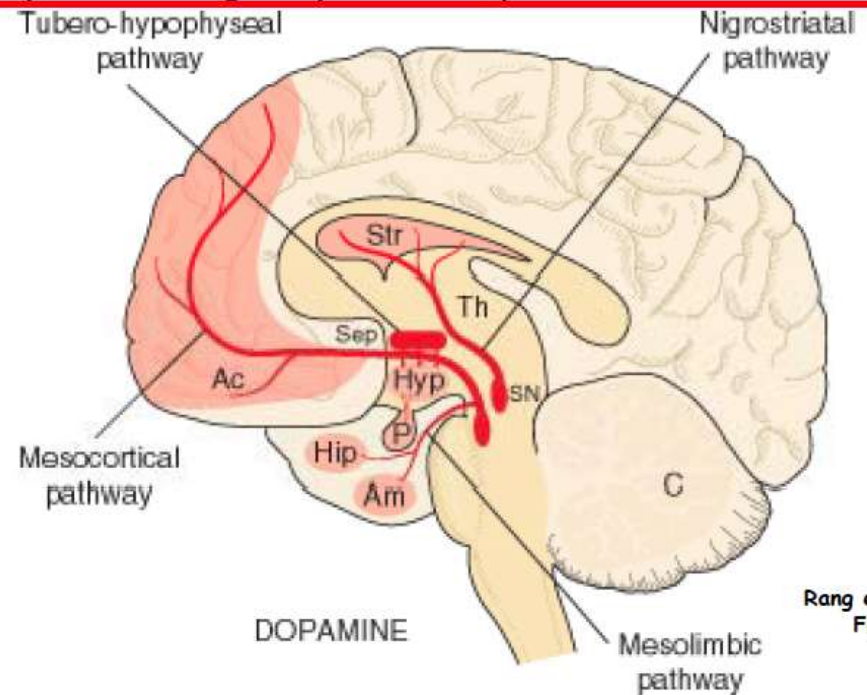
Dopamine tracts include:

- Mesolimbic/Mesocortical: reduces psychotic symptoms
- Nigrostriatal: increases movement disorder
- Tuberoinfundibular: increases prolactin (galactorrhea, amenorrhea, gynecomastia)

Psychopharmacology

Dopaminergic tract include

Dopaminergic pathways in the CNS



Rang et al. (2012)
Fig. 38.3

Psychopharmacology

Types of Antipsychotics

Typical	Atypical
Dopamine	Dopamine and serotonin
Treats mostly positive symptoms	Treats positive and negative symptoms
More side effects	Fewer side effects

Psychopharmacology

The potency of typical antipsychotic medications is as follows:

Potency	Extrapyramidal Symptoms	Anticholinergic Effects
High (haloperidol)	High	Low
Low (chlorpromazine)	Low	High

Psychopharmacology

Typical antipsychotics have movement and prolactin side effects.

- Haloperidol
- Fluphenazine
- Chlorpromazine
- Mesoridazine
- Thioridazine (additional increased risk of Retinitis pigmentosa and Retrograde ejaculation)

Psychopharmacology

Atypical antipsychotics are known for weight gain, increased risk of diabetes, and metabolic syndrome, but also cause movement and prolactin side effects.

- Clozapine (additional increased risk of agranulocytosis (<1%), seizures, drooling)
- Risperidone
- Olanzapine
- Quetiapine
- Ziprasidone
- Aripiprazole (partial dopamine agonist)
- Paliperidone
- Lurasidone

Psychopharmacology

ANTIDEPRESSANT MEDICATIONS

Antidepressant medications are used to treat depression, anxiety, and pain disorders.

The mechanism of action is on the norepinephrine (NE), serotonin (5-HT), and dopamine receptors.

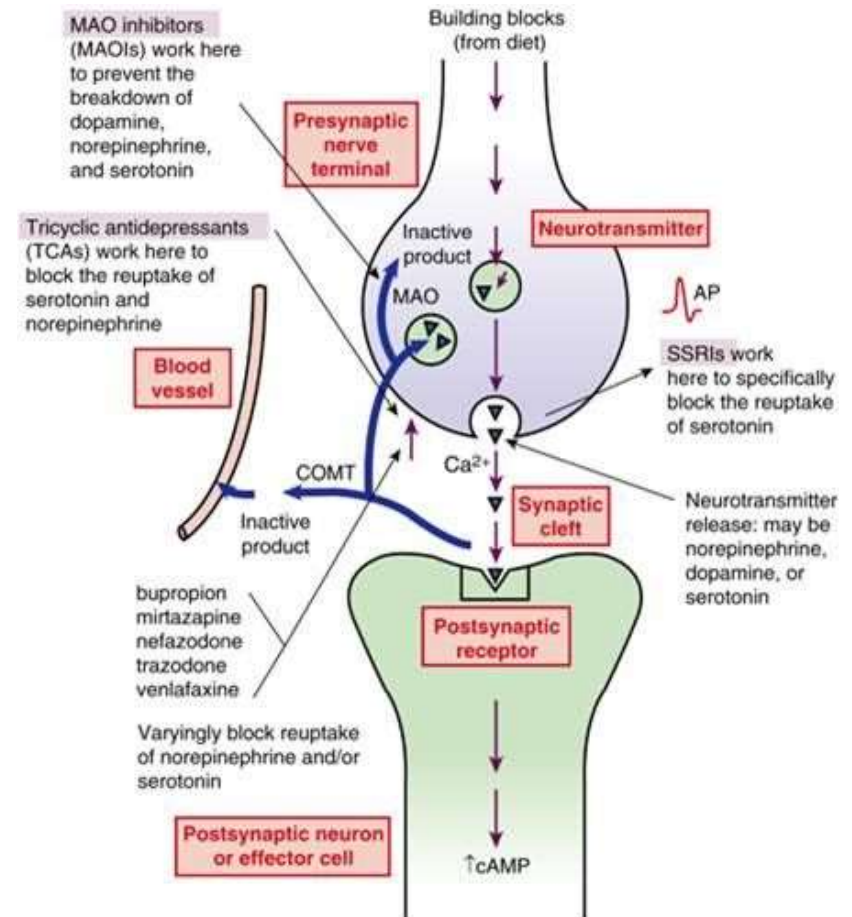
- Tricyclic Antidepressants
- Monoamine Oxidase Inhibitors
- SSRI
- Serotonin Norepinephrine Reuptake Inhibitors

Psychopharmacology

Tricyclic Antidepressants

Tricyclic antidepressants (TCAs) block reuptake of serotonin and norepinephrine, alpha-1 adrenergic receptors, and muscarinic receptors. They cause many side effects and are lethal in overdose.

- Amitriptyline
- Imipramine (monitor levels)
- Nortriptyline (monitor levels)
- Desipramine (monitor levels)
- Clomipramine



Psychopharmacology

Monoamine Oxidase Inhibitors

Monoamine oxidase inhibitors (MAOIs) are the treatment of choice for major depressive disorder with atypical features. The **mechanism of action** is inhibition of MAO, an enzyme that metabolizes serotonin, epinephrine, and NE.

- Phenzelzine
- Tranylcypromine
- Isocarboxazid

MAOI plus tyramine can cause **hypertensive Crisis**.

Signs include occipital headache, stiff neck, nausea/vomiting, chest pain, dilated pupils, nosebleed, and elevated blood pressure.

- Problem foods: aged cheese, dried fish, sauerkraut, sausage, chocolate, avocados, red wine
- Safe foods: cottage cheese, some wine (mostly white)

Psychopharmacology

Selective Serotonin Reuptake Inhibitors

Selective serotonin reuptake inhibitors (SSRIs) are the most used antidepressants. The mechanism of action is inhibition of the reuptake of serotonin. They are also used to treat anxiety and sexual disorders.

- Fluoxetine
- Sertraline
- Paroxetine
- Citalopram
- Escitalopram
- Fluvoxamine

Side effects include weight gain, sexual problems, headaches, and GI complaints.

Serotonin syndrome is associated with high doses, MAOI/SSRI combo, and MAOI/synthetic narcotic combination. Symptoms include general restlessness, sweating, insomnia, nausea, diarrhea, cramps, delirium, and myoclonus.

Treatment is removal of the causative agent, stopping the SSRI, and administering cyproheptadine

Psychopharmacology

Serotonin Norepinephrine Reuptake Inhibitors

Serotonin norepinephrine reuptake inhibitors (SNRIs) are used to treat depression, anxiety, and pain disorders.

The mechanism of action is inhibition of the reuptake of serotonin and norepinephrine.

- Venlafaxine
- Desvenlafaxine
- Duloxetine

Side effects include increased blood pressure and blurry vision (common).

Psychopharmacology

Other Antidepressants

Trazodone

- 5-HT receptor antagonist, alpha-1 blocker
- Almost no anticholinergic adverse effects
- May lead to priapism so sometimes used to treat erectile dysfunction
- Sedation is common side effect

Mirtazapine

- Stimulates NE and 5-HT release; blocks 5-HT₂ and 5-HT₃ receptors
- Sedation and weight gain are common side effects

Bupropion (approved for depression and smoking cessation)

- Relatively weak inhibitor of the neuronal reuptake of norepinephrine and dopamine; does not inhibit the reuptake of serotonin
- Not associated with weight gain or sexual side effects
- Side effect is increased risk of seizures, so it is not used in patients with seizure disorders, eating disorders, or alcohol withdrawal seizures

Psychopharmacology

MOOD STABILIZER MEDICATIONS

Lithium

Valproic acid

Carbamazepine

Lamotrigine

Psychopharmacology

Lithium

Lithium is the drug of choice for bipolar disorders. It is quickly absorbed from the GI tract—not protein-bound or metabolized. Therapeutic index is low, meaning it requires reaching plasma levels very close to toxic levels for full

Effect (reached in 10–14 days). Good kidney function and adequate salt- and fluid-intake are essential with lithium, as 95% is excreted in urine.

The mechanism of action (hypothesized) is blocking of inositol-1-phosphate (second messenger).

- Monitor blood levels; if >2.5 meq/L, consider dialysis as the treatment of choice.
- Potassium-sparing diuretics have no effect; loop diuretics will produce increased serum levels.
- Side effects include:
 - Tremor, thirst, anorexia, GI distress
 - Polyuria, polydipsia, edema
 - Acne
 - Hypothyroidism
 - Nephrotoxicity
 - Teratogenicity (Ebstein's anomaly affecting the tricuspid valve)
 - Diabetes insipidus
 - If toxic, ataxia, seizures and confusion may be seen.

Psychopharmacology

Valproic Acid

Valproic acid is used to treat bipolar disorders and rapid cycling bipolar disorders.

The **mechanism of action** involves augmentation of GABA in CNS.

Side effects include sedation, weight gain, tremors, alopecia, GI distress, and teratogenicity (neural tube defects).

- If toxic, may cause confusion, coma, or cardiac arrest.
- Monitor blood levels, as it can cause hepatotoxicity (liver function impairment).

Psychopharmacology

Carbamazepine

The mechanism of action involves blocking sodium channels in neurons with action potential; it alters central GABA receptors.

- Side effects include GI distress, rash, mild leukopenia, agranulocytosis, and aplastic anemia.
- If toxic, may cause hypotension, tachycardia, respiratory depression, or coma.
- Monitor blood levels and signs of rash.

Psychopharmacology

Lamotrigine

Lamotrigine is associated with Stevens-Johnson syndrome.



© MAYO FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH. ALL RIGHTS RESERVED.

Psychopharmacology

Steven Johnson syndrome



Psychopharmacology

ANTIANSIETY MEDICATIONS

Benzodiazepines

Buspirone

Psychopharmacology

Benzodiazepines

Benzodiazepines are used to treat anxiety disorders, sleep disorders, alcohol withdrawal, and seizures.

The mechanism of action is depression of the CNS at the limbic system, RAS, and cortex. Benzodiazepines bind to GABA-chloride receptors, facilitating the action of GABA.

- All benzodiazepines undergo hepatic microsomal oxidation (except for lorazepam, oxazepam, and temazepam, which undergo glucuronide conjugation).

Side effects include sedation, insomnia, addiction, falls (elderly), confusion, and disinhibition.

Psychopharmacology

Buspirone

Buspirone is used for generalized anxiety disorder and other anxiety disorders when possible abuse of benzodiazepines is a concern. It has no withdrawal effect and is not potentiated by alcohol.

The mechanism of action works on serotonin, not on GABA.

- Full effect is seen >7 days
- Some sedation is seen
- Has low-abuse potential

Psychopharmacology

Psychopharmacology

Psychopharmacology

Psychopharmacology

Psychopharmacology

Psychopharmacology

Psychopharmacology

Psychopharmacology

Psychopharmacology

Psychopharmacology

Psychopharmacology

Psychopharmacology

Psychopharmacology