D.PHARM • SECOND YEAR

Pharmacology

CHAPTER 7

Drugs Acting on the Respiratory System



ENGLISH CHAPTER NOTES

DIPLOMA IN PHARMACY

BRONCHODILATORS: CLASSIFICATION

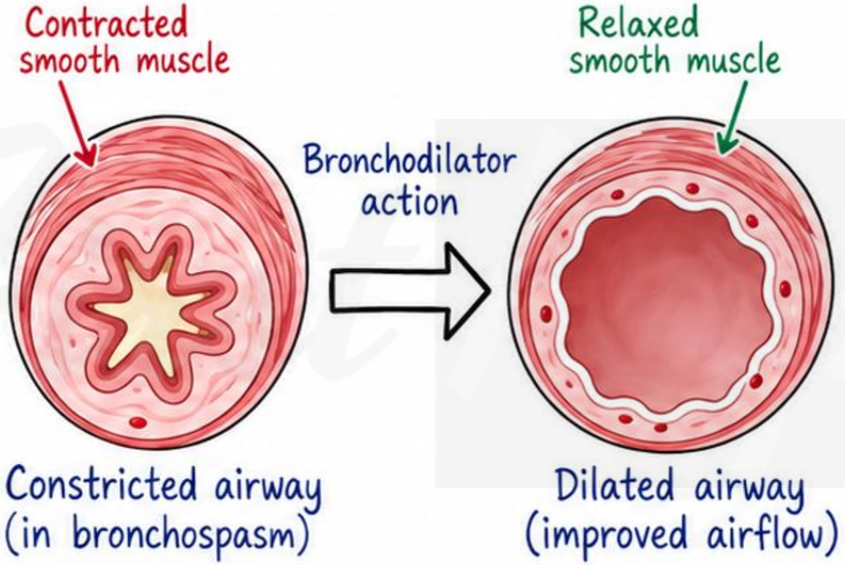
Bronchodilators relax bronchial smooth muscle and widen the airways, so airflow improves. They give symptomatic relief in bronchospasm, especially in asthma and COPD.

1. BETA$_2$-ADRENERGIC AGONISTS

SHORT-ACTING, SABA — rescue
- salbutamol, albuterol
- terbutaline

LONG-ACTING, LABA — maintenance
- salmeterol
- formoterol

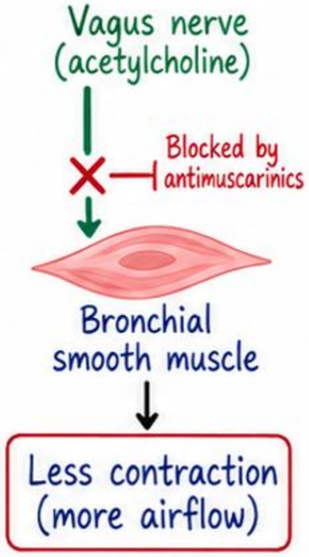
ULTRA-LONG-ACTING — once-daily maintenance in selected regimens
- indacaterol
- vilanterol



2. ANTIMUSCARINIC BRONCHODILATORS

SHORT-ACTING, SAMA
- ipratropium bromide

LONG-ACTING, LAMA
- tiotropium
- aclidinium



3. METHYLXANTHINES

- theophylline
- aminophylline

Use is limited by interactions and a narrow therapeutic range.

CONTROLLER ADJUNCTS — NOT RAPID BRONCHODILATORS

- montelukast: leukotriene-receptor antagonist; reduces leukotriene-mediated bronchoconstriction and inflammation
- omalizumab: anti-IgE biologic for selected severe allergic asthma

} Neither replaces a rescue inhaler during an acute attack.

MEMORY LINE: Beta$_2$ opens by cAMP, antimuscarinic removes the vagal brake, methylxanthine raises cyclic nucleotides.

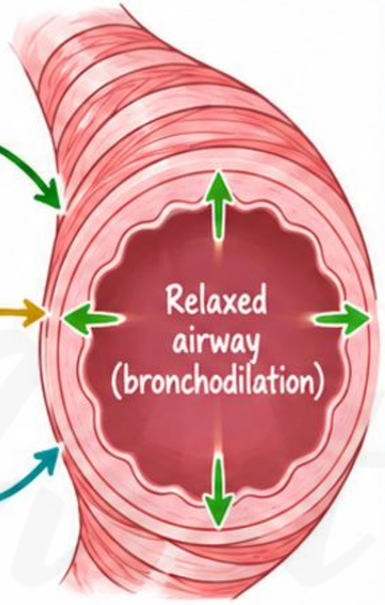
BRONCHODILATOR ACTIONS, USES AND SAFETY

HOW THEY ACT

beta2 agonists:
stimulate beta2 receptors → adenylyl cyclase → ↑ cAMP → bronchial smooth-muscle relaxation

antimuscarinics:
block airway M3 receptors → reduce vagal bronchoconstriction and secretion

methylxanthines:
inhibit phosphodiesterase and antagonize adenosine → bronchodilation; toxic effects rise when blood level is high



RESCUE OR MAINTENANCE?



- **SABA**, such as salbutamol: rapid relief of acute bronchospasm
- **LABA or ultra-LABA:** maintenance; in asthma use with an inhaled corticosteroid, not alone
- **LAMA:** mainly maintenance in COPD and selected asthma regimens
- **theophylline:** alternative add-on in selected patients; not a first-choice rescue drug

MAJOR SAFETY POINTS



beta2 agonists:
tremor, tachycardia, palpitations and hypokalaemia; use care with arrhythmia or heart disease



antimuscarinics:
dry mouth, blurred vision and urinary retention; avoid spraying into eyes, and use care in narrow-angle glaucoma or bladder-outflow obstruction



theophylline:
nausea, vomiting, tremor, arrhythmia or seizures; many interactions, so therapeutic drug monitoring may be needed



montelukast is not for immediate relief of an acute attack

DOSE EXAMPLES — DEVICE AND PRODUCT MATTER

salbutamol inhaler:	100 micrograms/puff, 1–2 puffs when needed, commonly every 4–6 hours
salmeterol inhaler:	50 micrograms twice daily; not for immediate relief
ipratropium inhaler:	about 20 micrograms/puff, commonly 2 puffs 3–4 times/day
tiotropium inhaled:	once daily; dose depends on device
theophylline oral:	often 200–400 mg/day, individualized by response, interactions and blood level

MAIN USES

- bronchial asthma
- COPD
- exercise-induced bronchospasm
- **acute severe asthma:** inhaled SABA, often ipratropium, plus systemic corticosteroid and emergency care
- **anaphylaxis:** inhaled bronchodilator may be an adjunct for wheeze, but **IM epinephrine is first-line.**

INHALER RULE



Correct inhaler technique and adherence are as important as the prescribed drug.

EXPECTORANTS: CLASSIFICATION AND ACTIONS

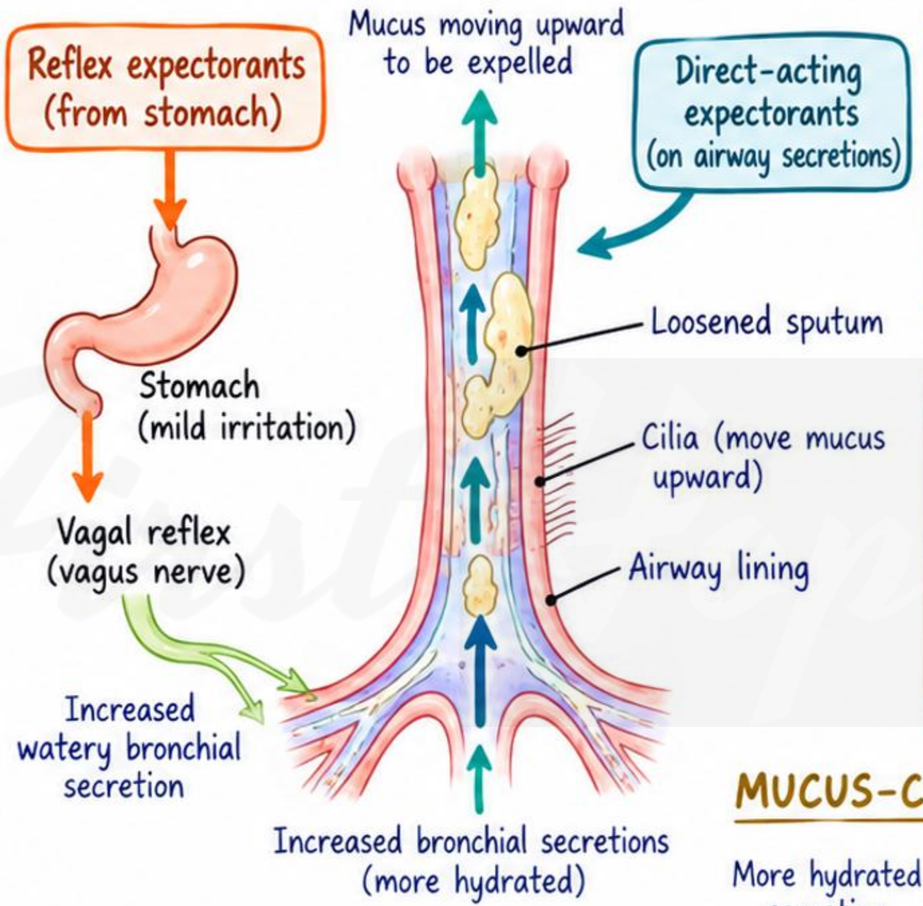
DEFINITION

Expectorants increase the hydration or volume of respiratory secretions and help loosen sputum, so a productive cough can clear mucus more easily. They do not treat the cause of cough.

1. REFLEX EXPECTORANTS

Mild gastric irritation → vagal reflex → increased watery bronchial secretion.

- guaifenesin
- ipecacuanha, historical and rarely used now because higher doses cause vomiting and toxicity



2. DIRECT-ACTING EXPECTORANTS

Reach or stimulate bronchial secretions directly and increase mucus fluidity.

- potassium iodide, now rarely used
- sodium citrate

3. COMBINATION COUGH PRODUCTS

May contain an expectorant with bronchodilator, antihistamine or decongestant. Use only when each ingredient has a clear need; combinations can add sedation and other adverse effects.

MUCUS-CLEARANCE PATHWAY

More hydrated secretion → less tenacious sputum → cilia move mucus upward → productive cough expels sputum.

PHARMACOLOGICAL ACTIONS

- **guaifenesin**: increases respiratory-tract fluid and may support ciliary mucus clearance
- **ipecacuanha**: low doses stimulate secretion by a gastric-vagal reflex; it is not preferred for routine use
- **potassium iodide**: increases the fluidity of secretions, but thyroid and iodism risks limit use

IMPORTANT DISTINCTION

Expectorant adds fluid to secretion; **mucolytic** breaks the mucus structure.

EXPECTORANT USES AND SAFETY

WHEN THEY MAY HELP

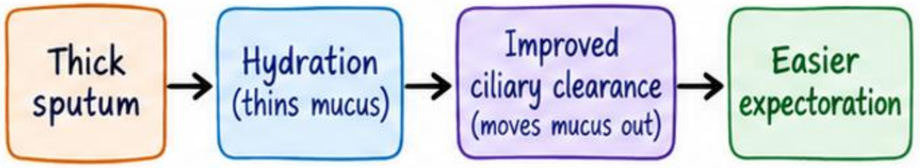
- short-term symptomatic relief in a productive cough with difficult-to-clear sputum
- acute or chronic bronchitis and respiratory infection when mucus is troublesome
- selected COPD or asthma patients with mucus buildup, as an adjunct to disease-specific treatment
- sputum induction in supervised diagnostic procedures

Good hydration and treatment of the underlying cause remain important.

NOT FOR EVERY COUGH

- a simple dry cough has no sputum to loosen, so an expectorant is usually not useful; this is lack of indication, not an automatic absolute contraindication
- avoid suppressing or self-treating a persistent cough without finding the cause

HOW EXPECTORANTS HELP (PRODUCTIVE COUGH PATHWAY)



DOSE EXAMPLES

Guaifenesin (oral)	Potassium iodide (oral)	Ipecacuanha
200–400 mg every 4 hours; maximum commonly 2.4 g/day in adults	300–600 mg/day in divided doses; now seldom used and only with clinical supervision	not recommended as a routine expectorant; emetic and toxic effects make older drop regimens unsuitable for self-medication

Check the exact product because immediate-release and extended-release doses differ.

SAFETY AND CAUTIONS

- **guaifenesin**: nausea, vomiting, dizziness or rash; avoid in hypersensitivity and do not give OTC cough/cold products to a child under 2 years unless specifically directed
- **potassium iodide**: avoid or use specialist advice in thyroid disease, pregnancy and iodide hypersensitivity; prolonged use may cause iodism, salivary swelling and metallic taste
- **ipecacuanha**: higher doses cause vomiting; repeated use may cause serious toxicity and is obsolete for routine expectorant therapy
- combination products may duplicate ingredients or cause sedation

RED FLAGS — SEEK ASSESSMENT

Breathlessness, chest pain, blood in sputum, cyanosis, high fever, recurrent wheeze, dehydration, or cough lasting more than about 3 weeks.

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