

Bronchodilators & Other Respiratory Agents





Drugs Affecting the Respiratory System

- **Bronchodilators**
 - Xanthine derivatives
 - Beta-adrenergic agonists
 - **Anticholinergics**
 - **Antileukotriene agents**
 - **Corticosteroids**
 - **Mast cell stabilizers**
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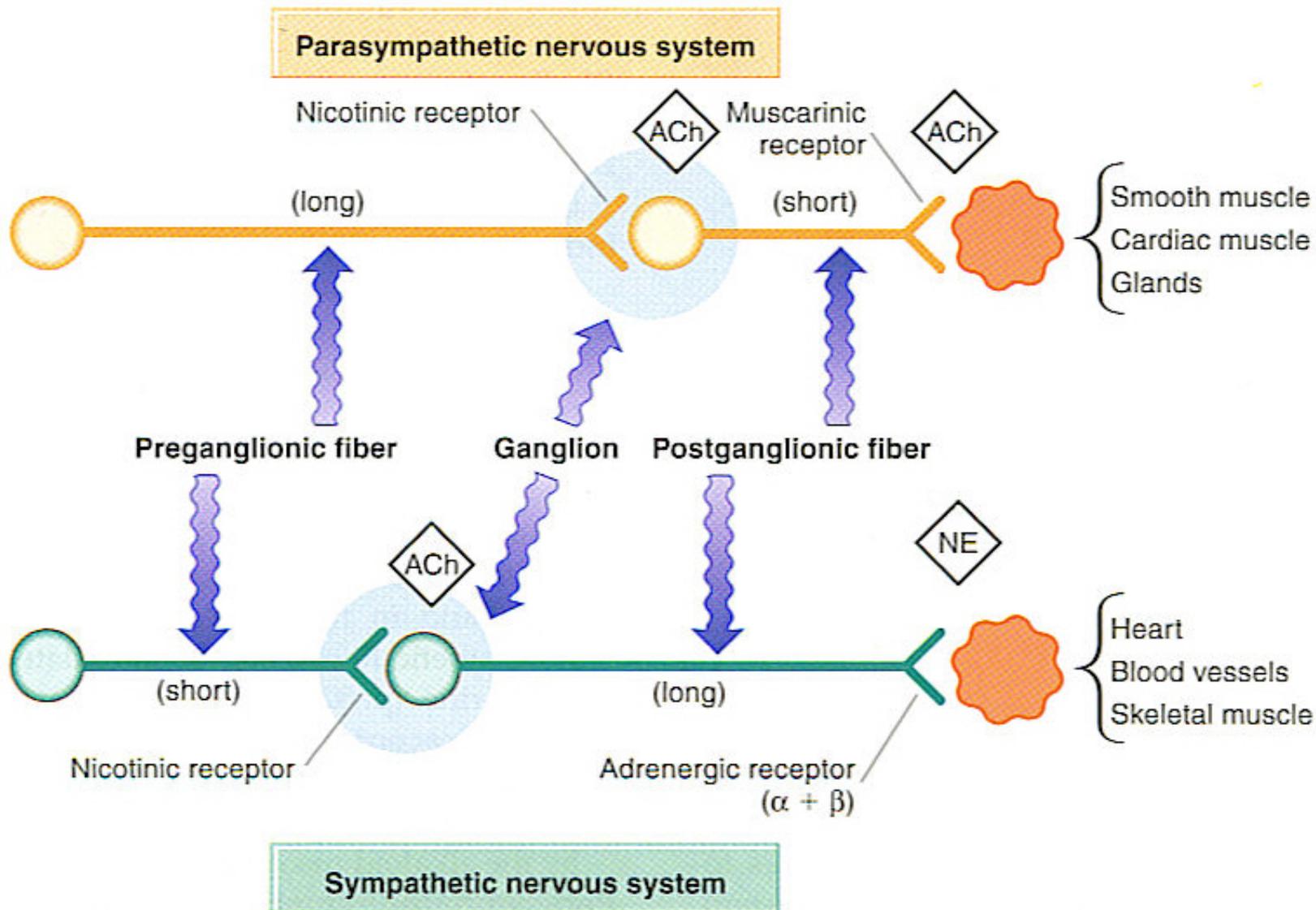


FIG. 19-1 The parasympathetic and sympathetic nervous systems and their relationships to one another. *Ach*, Acetylcholine; *NE*, norepinephrine.

Bold type = sympathetic actions
Light type = parasympathetic actions

LACRIMAL GLANDS

Stimulates tears

EYE

Contraction of iris radial muscle (pupil dilates)

Contraction of iris sphincter muscle (pupil contracts)

Contraction of ciliary muscle (lens accommodates for near vision)

SALIVARY GLANDS

Thick, viscid secretion
Copious, water secretion

TRACHEA AND BRONCHIOLES

Dilates

Constricts, increases secretions

HEART

Increased rate; increased contractility
Decreased rate, and contractility

GASTROINTESTINAL

Decrease in muscle motility and tone; contraction of sphincters
Increased muscle motility and tone

URETERS AND BLADDER

Relaxes detrusor; contraction of trigone and sphincter

Contraction of detrusor; relaxation of trigone and sphincter

GENITALIA-FEMALE

Relaxation of uterus

BLOOD VESSELS (skeletal muscle)

Dilatation

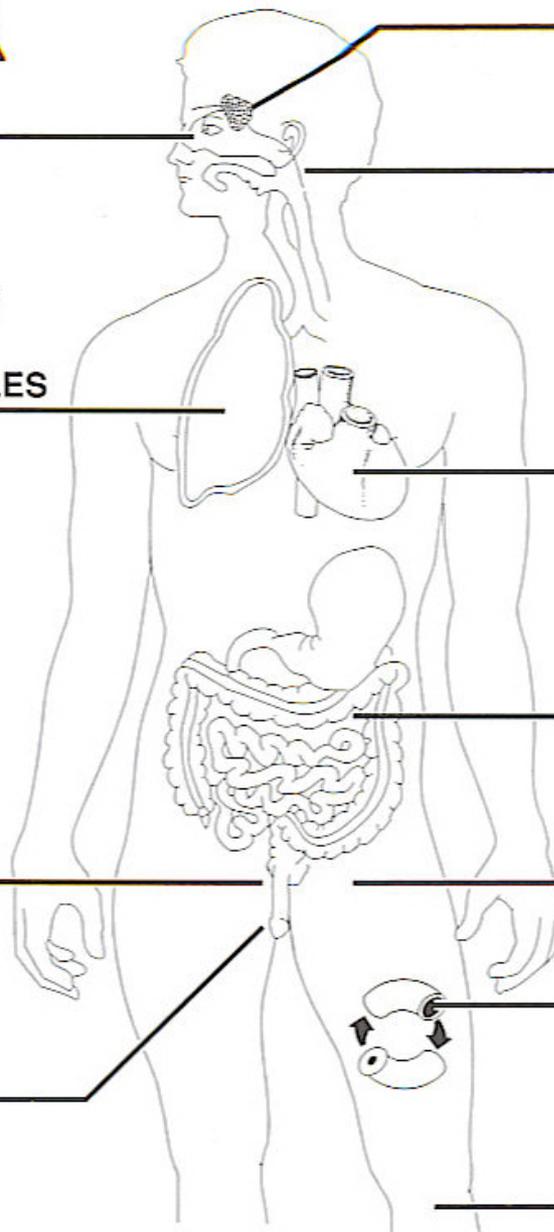
GENITALIA-MALE

Stimulates ejaculation

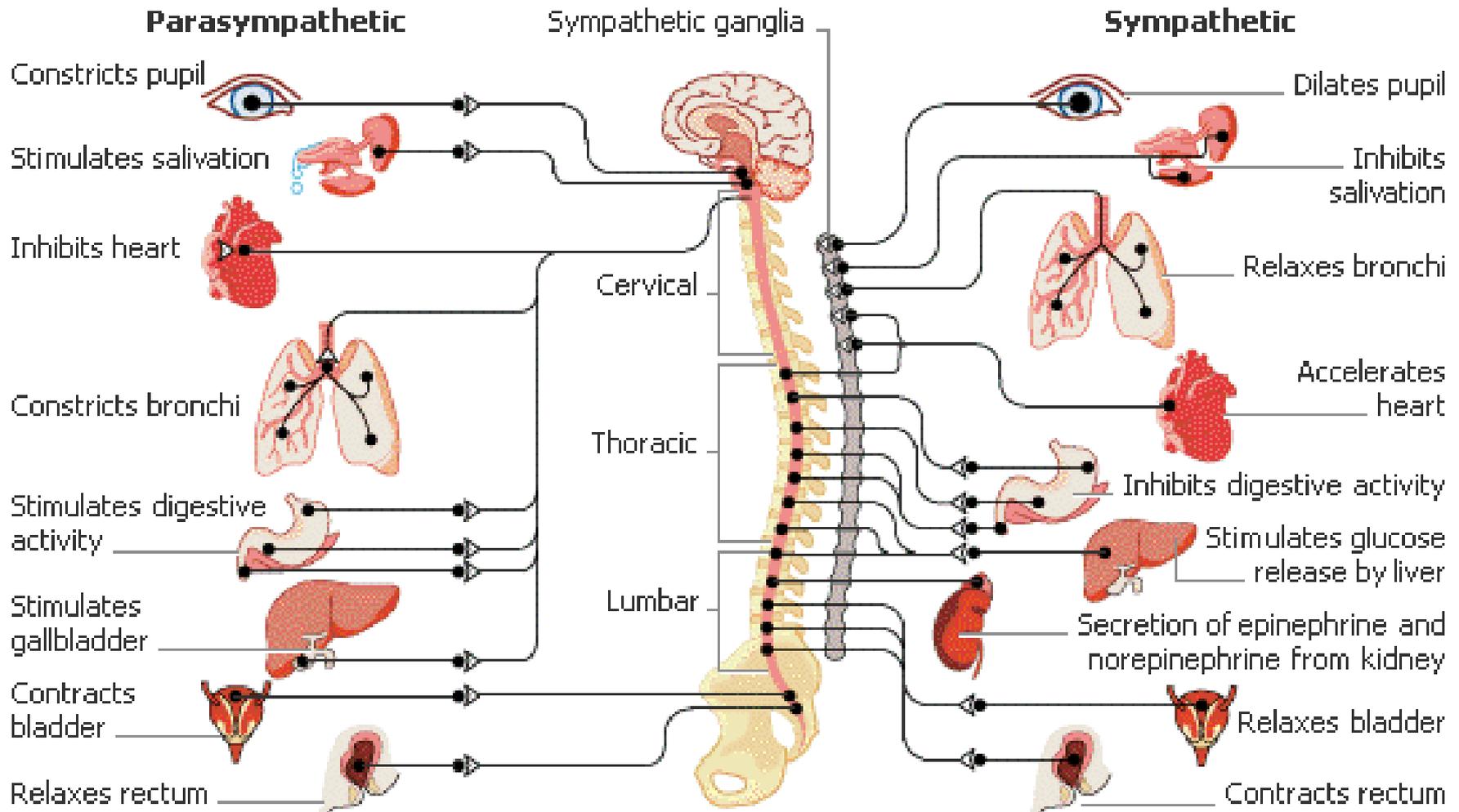
Stimulates erection

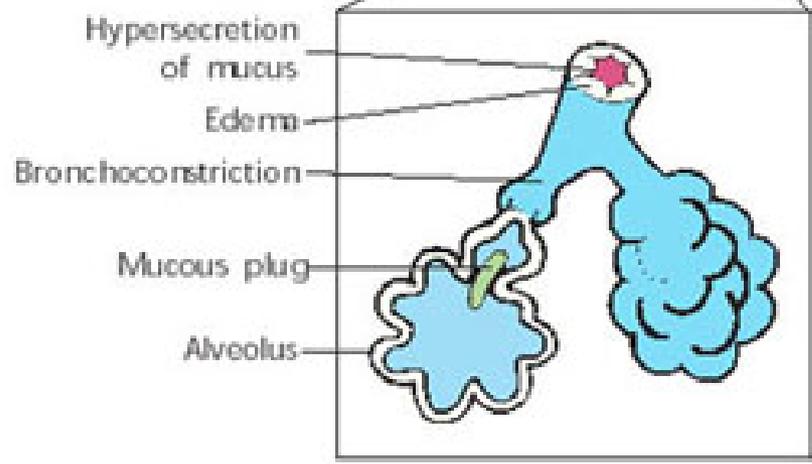
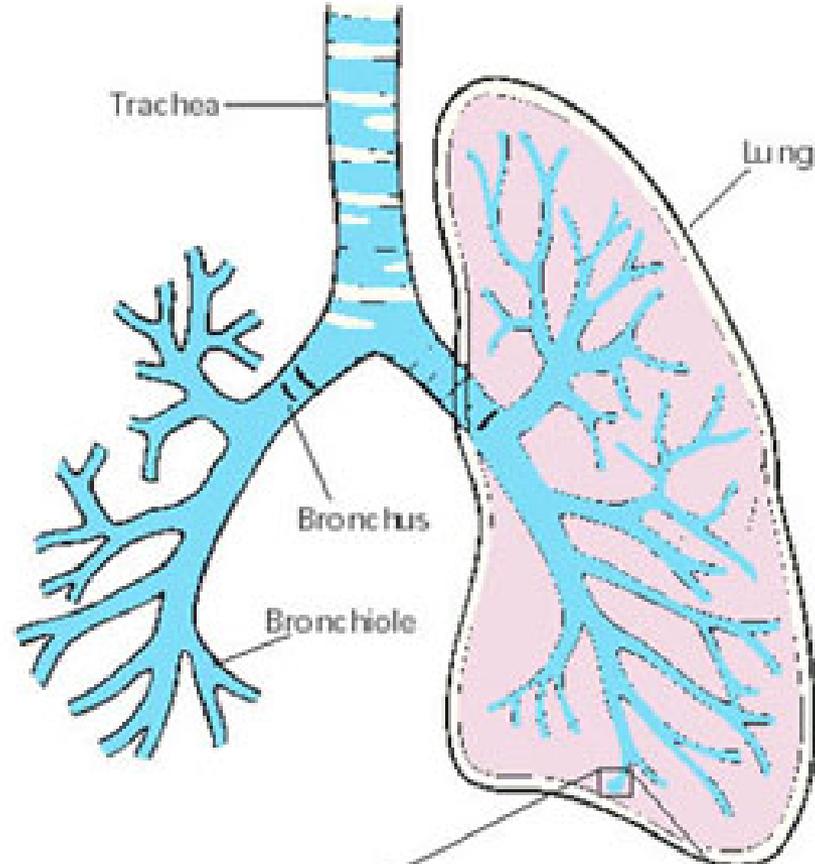
BLOOD VESSELS (skin, mucus membranes and splanchnic area)

Constriction



Autonomic Nervous System

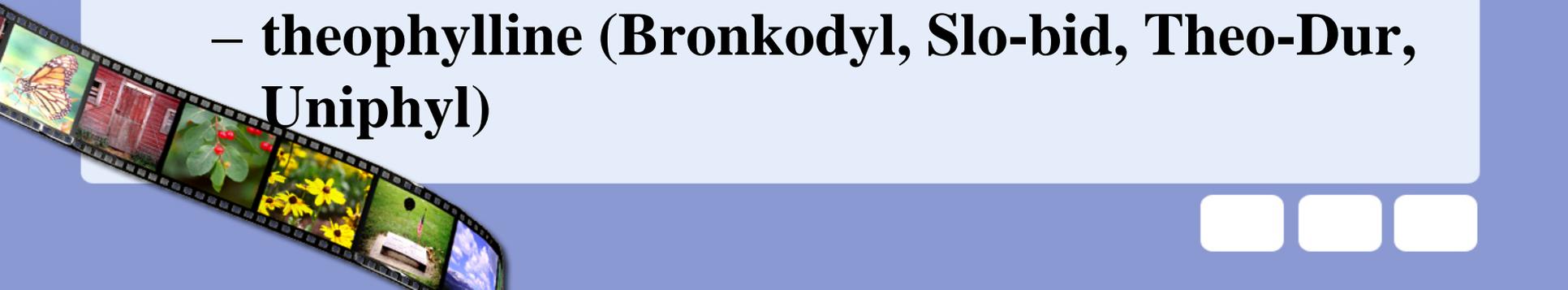


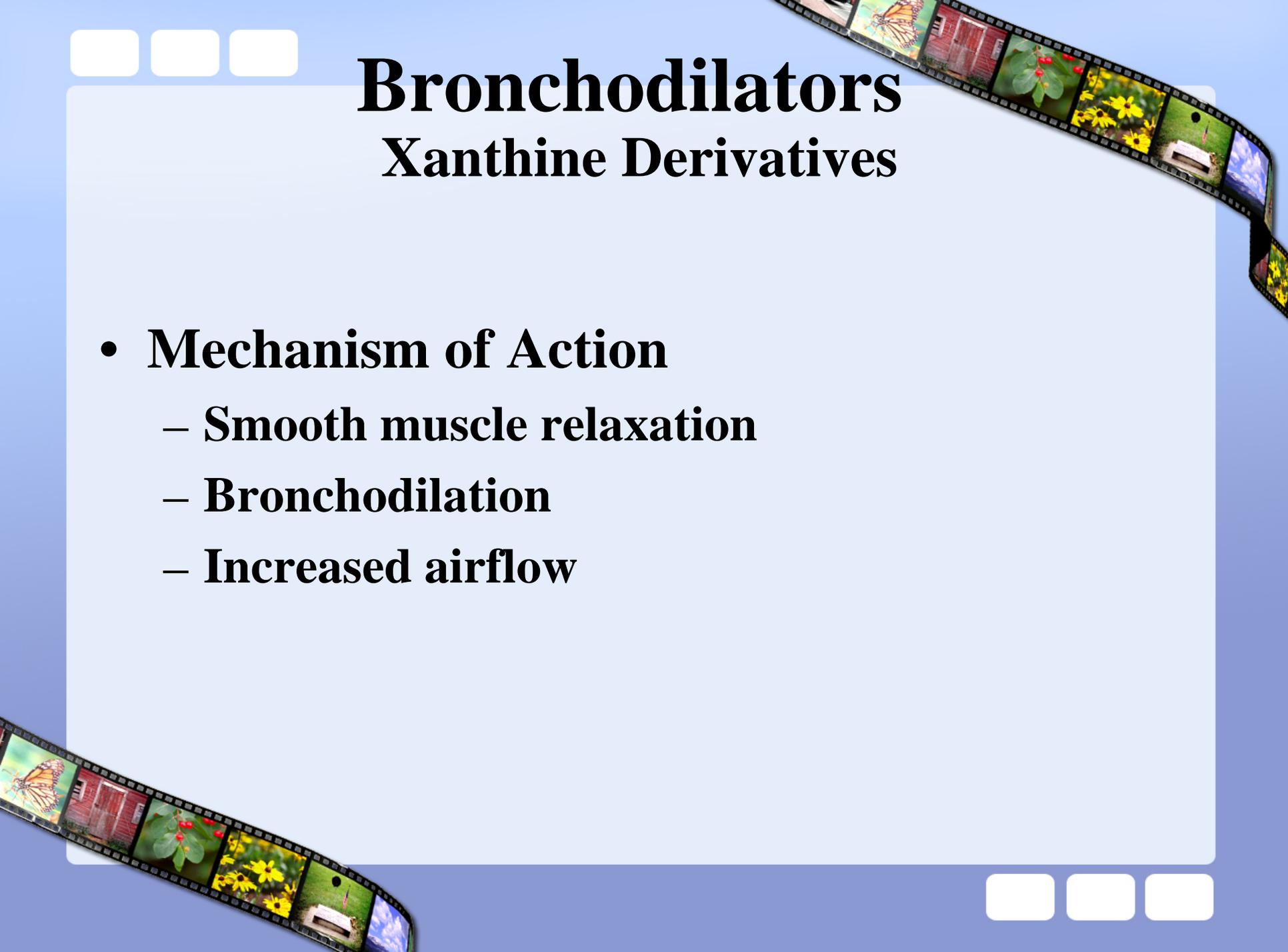




Bronchodilators

Xanthine Derivatives

- **Plant alkaloids: caffeine, theobromine, and theophylline**
 - Only theophylline is used as a bronchodilator
 - **Examples:**
 - Aminophylline - IV
 - theophylline (Bronkodyl, Slo-bid, Theo-Dur, Uniphyl)
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Bronchodilators

Xanthine Derivatives

- **Mechanism of Action**
 - **Smooth muscle relaxation**
 - **Bronchodilation**
 - **Increased airflow**



Bronchodilators

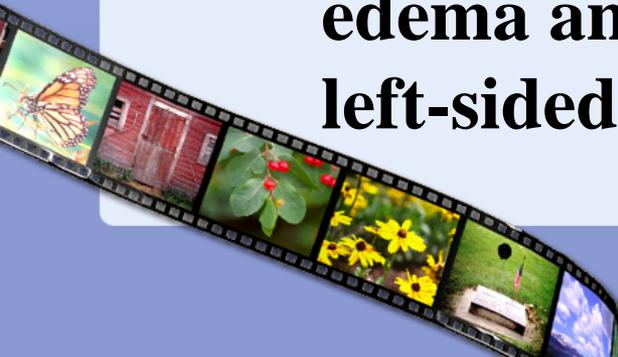
Xanthine Derivatives

- **Drug Effects**
 - **Cause bronchodilation by relaxing smooth muscles of the airways.**
 - **Relief of bronchospasm and greater airflow into and out of the lungs.**
 - **Also causes CNS stimulation.**
 - **Also causes cardiovascular stimulation**
 - **Increased force of contraction and increased HR**
 - **Resulting in increased cardiac output and increased blood flow to the kidneys (diuretic effect)**
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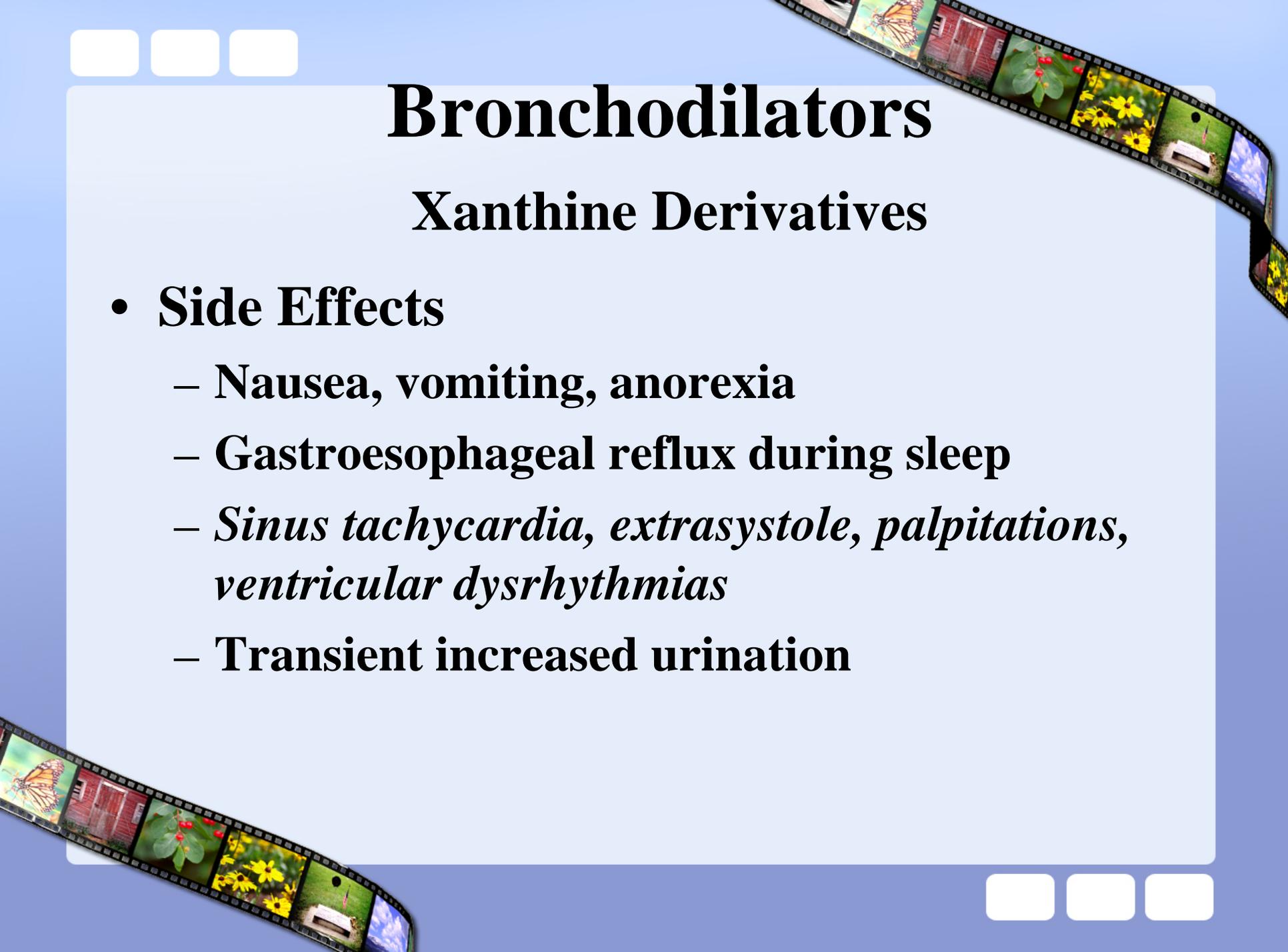


Bronchodilators

Xanthine Derivatives

- **Therapeutic uses**
 - **Dilation of airways in asthma, chronic bronchitis, & emphysema**
 - **Mild to moderate cases of asthma**
 - **Adjunct agent in the management of COPD**
 - **Adjunct therapy for the relief of pulmonary edema and paroxysmal nocturnal edema in left-sided heart failure**
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Bronchodilators

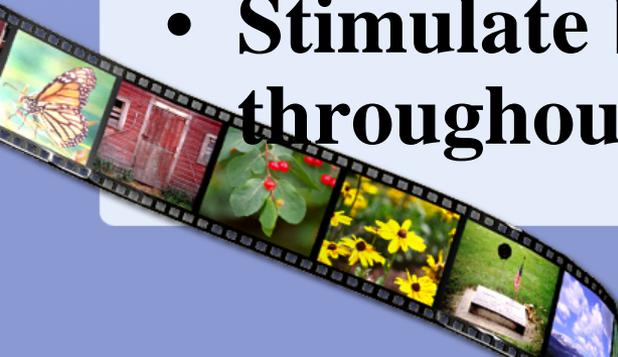
Xanthine Derivatives

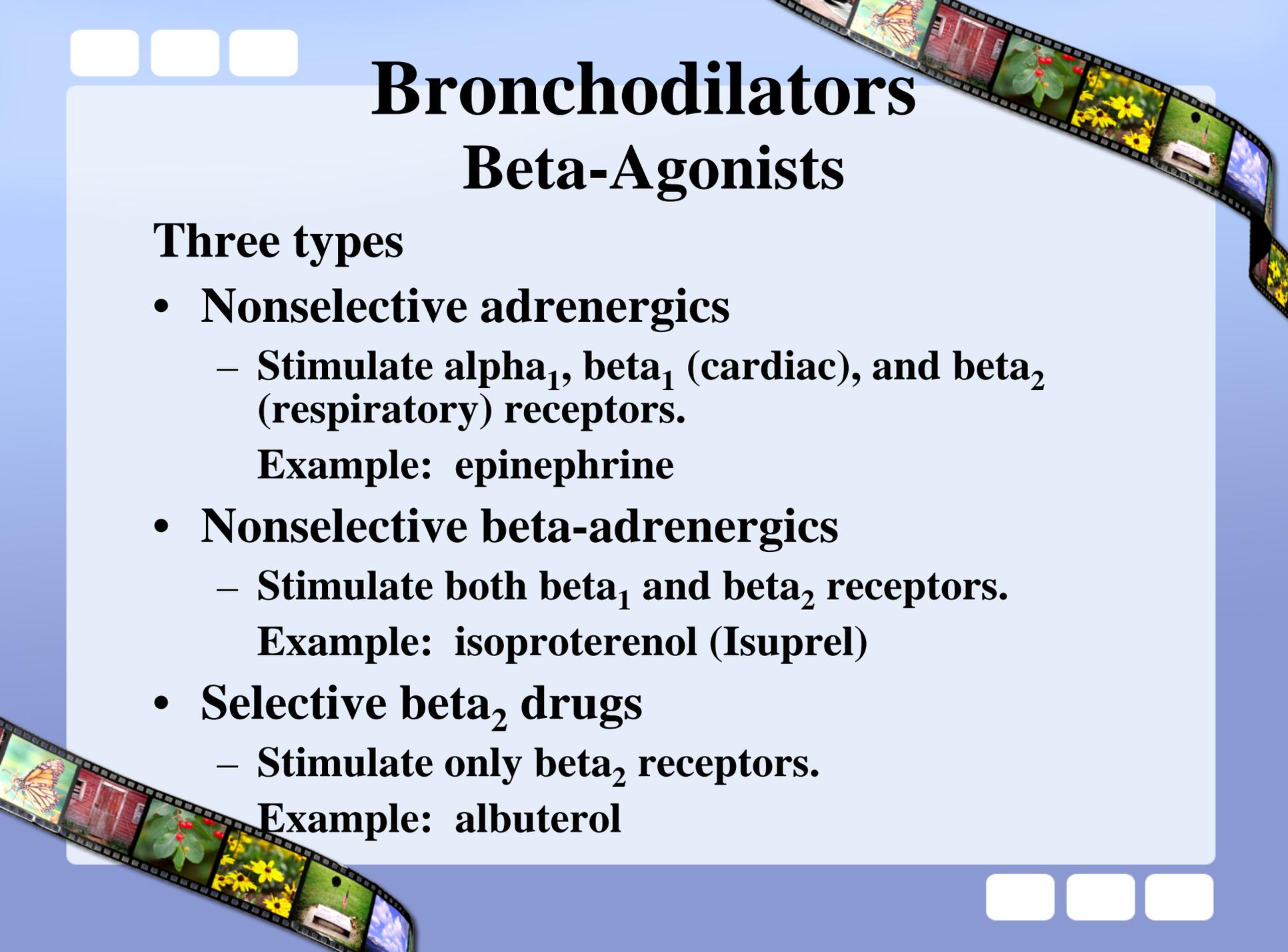
- **Side Effects**
 - Nausea, vomiting, anorexia
 - Gastroesophageal reflux during sleep
 - *Sinus tachycardia, extrasystole, palpitations, ventricular dysrhythmias*
 - Transient increased urination



Bronchodilators

Beta-Agonists

- **Large group**
 - **Aka sympathomimetics**
 - **Used during acute phase of asthmatic attacks**
 - **Quickly reduce airway constriction and restore normal airflow**
 - **Stimulate beta₂ adrenergic receptors throughout the lungs**
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Bronchodilators

Beta-Agonists

Three types

- **Nonselective adrenergics**
 - Stimulate α_1 , β_1 (cardiac), and β_2 (respiratory) receptors.
Example: epinephrine
- **Nonselective beta-adrenergics**
 - Stimulate both β_1 and β_2 receptors.
Example: isoproterenol (Isuprel)
- **Selective β_2 drugs**
 - Stimulate only β_2 receptors.
Example: albuterol

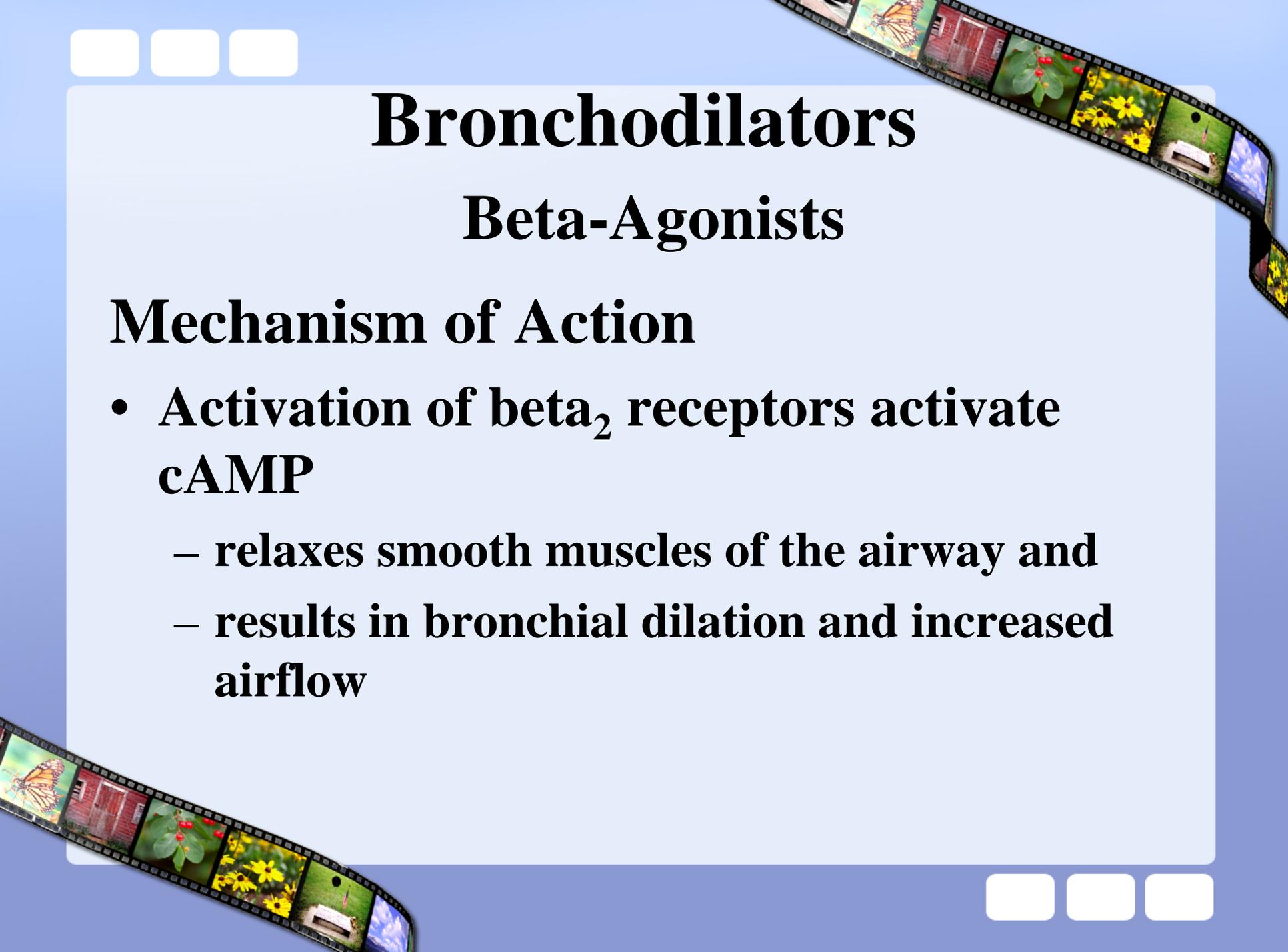
Bronchodilators

Beta-Agonists



VENTOLIN HFA

- Same as albuterol
 - Different manufacturer
- Built-in dose counter
- Does not contain flourocarbons (HFA label)
 - Safe for the environment



Bronchodilators

Beta-Agonists

Mechanism of Action

- **Activation of beta₂ receptors activate cAMP**
 - **relaxes smooth muscles of the airway and**
 - **results in bronchial dilation and increased airflow**



Bronchodilators

Beta-Agonists

Therapeutic Uses

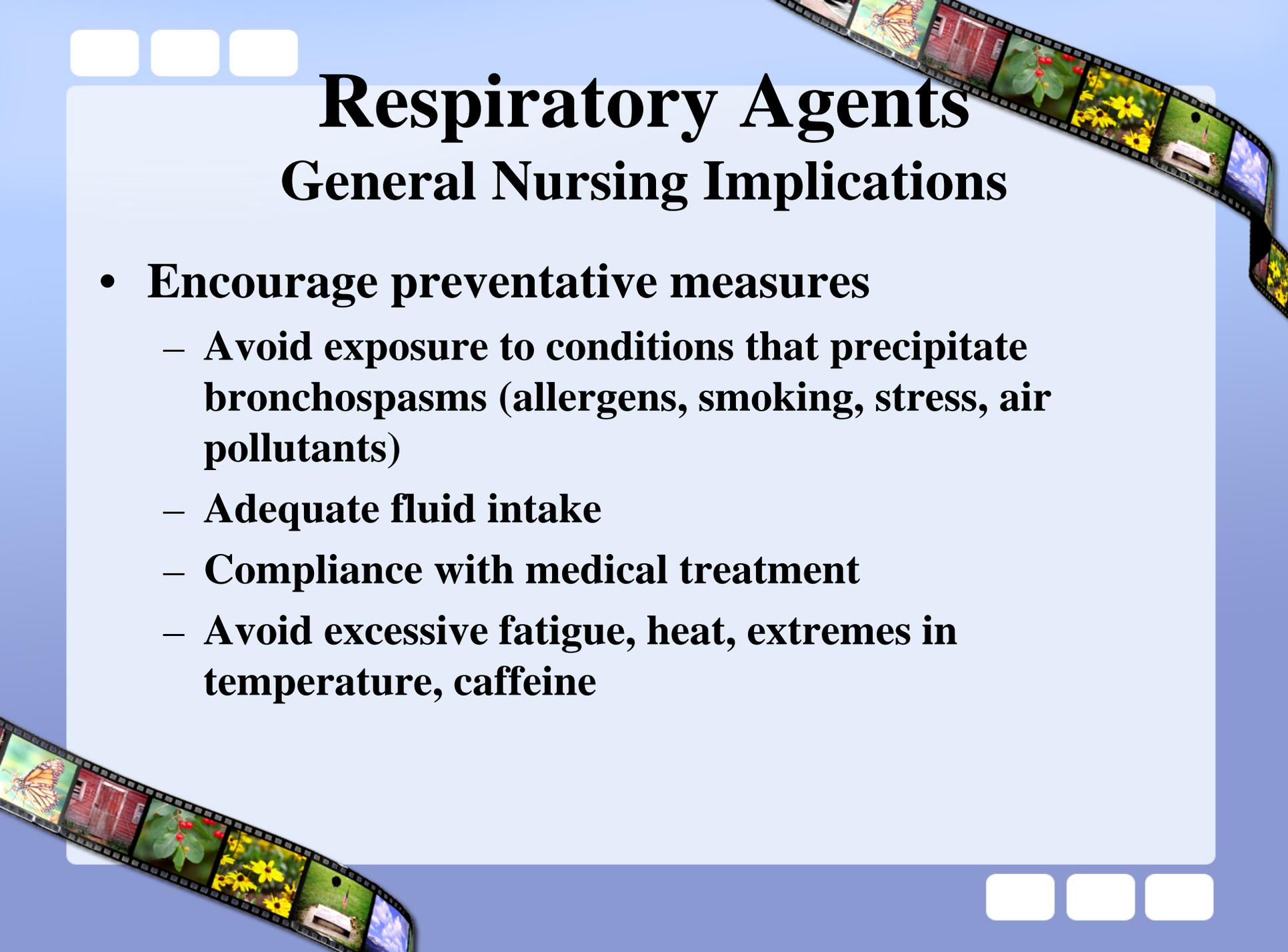
- **Relief of**
 - **Bronchospasm**
 - **Bronchial asthma**
 - **Bronchitis**
 - **Other pulmonary disease**
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Bronchodilators

Beta-Agonists

Side Effects:

<u>Alpha-Beta</u> (epinephrine)	<u>Beta₁ and Beta₂</u> (isoproterenol)	<u>Beta₂</u> (albuterol)
<ul style="list-style-type: none">•Insomnia•Restlessness•Anorexia•Cardiac stimulation•Hyperglycemia•Temor•Vascular headache	<ul style="list-style-type: none">•Cardiac stimulation•Tremor•Anginal pain•Vascular headache	<ul style="list-style-type: none">•Hypertension•Hypotension•Vascular headaches



Respiratory Agents

General Nursing Implications

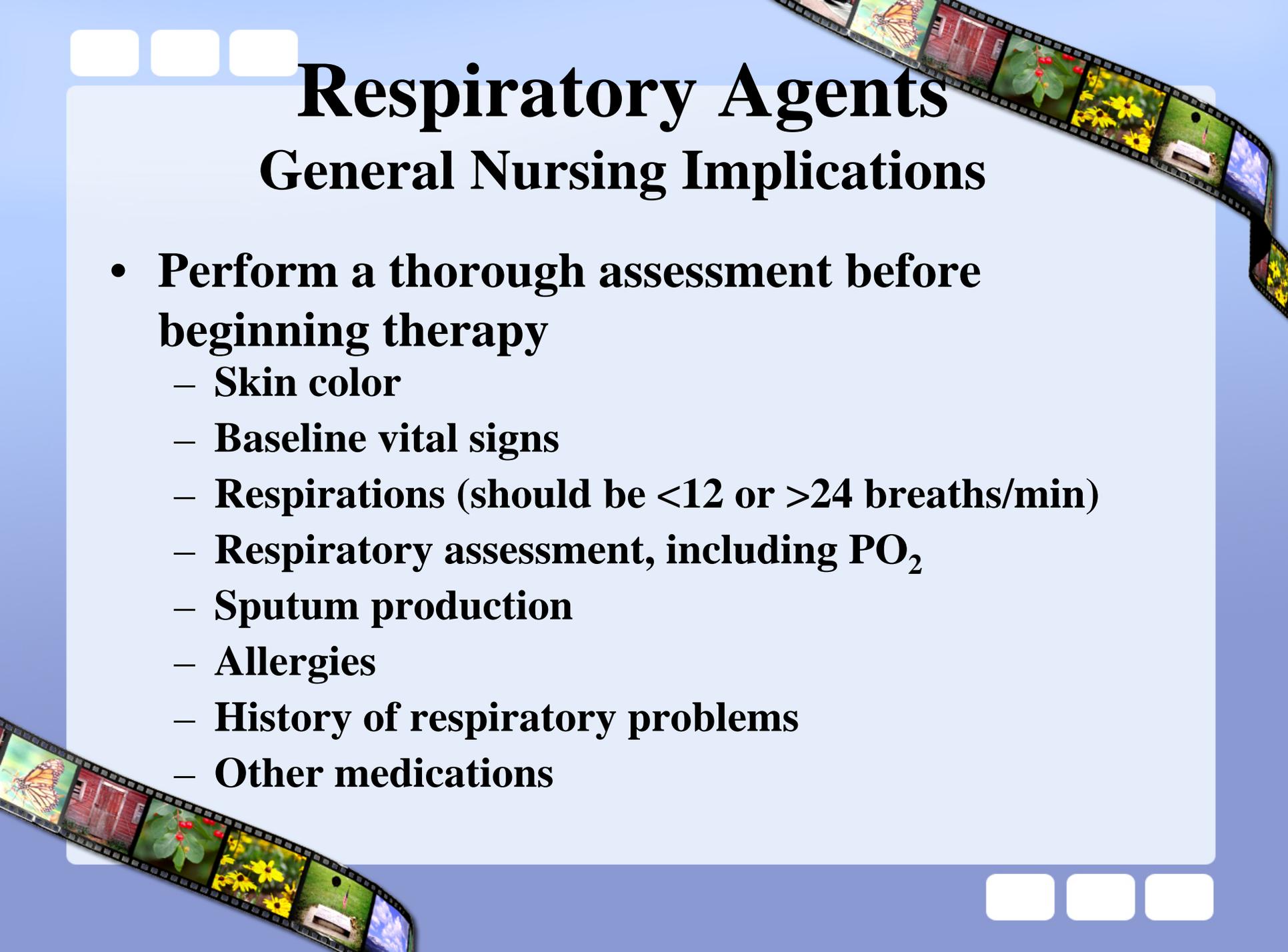
- **Encourage preventative measures**
 - **Avoid exposure to conditions that precipitate bronchospasms (allergens, smoking, stress, air pollutants)**
 - **Adequate fluid intake**
 - **Compliance with medical treatment**
 - **Avoid excessive fatigue, heat, extremes in temperature, caffeine**



Respiratory Agents

General Nursing Implications

- **Encourage patients to get prompt treatment for flu or other illnesses**
 - **Vaccination against pneumonia or flu**
 - **Encourage patients to always check with their physician before taking any other medication**
 - **Including OTC**
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Respiratory Agents

General Nursing Implications

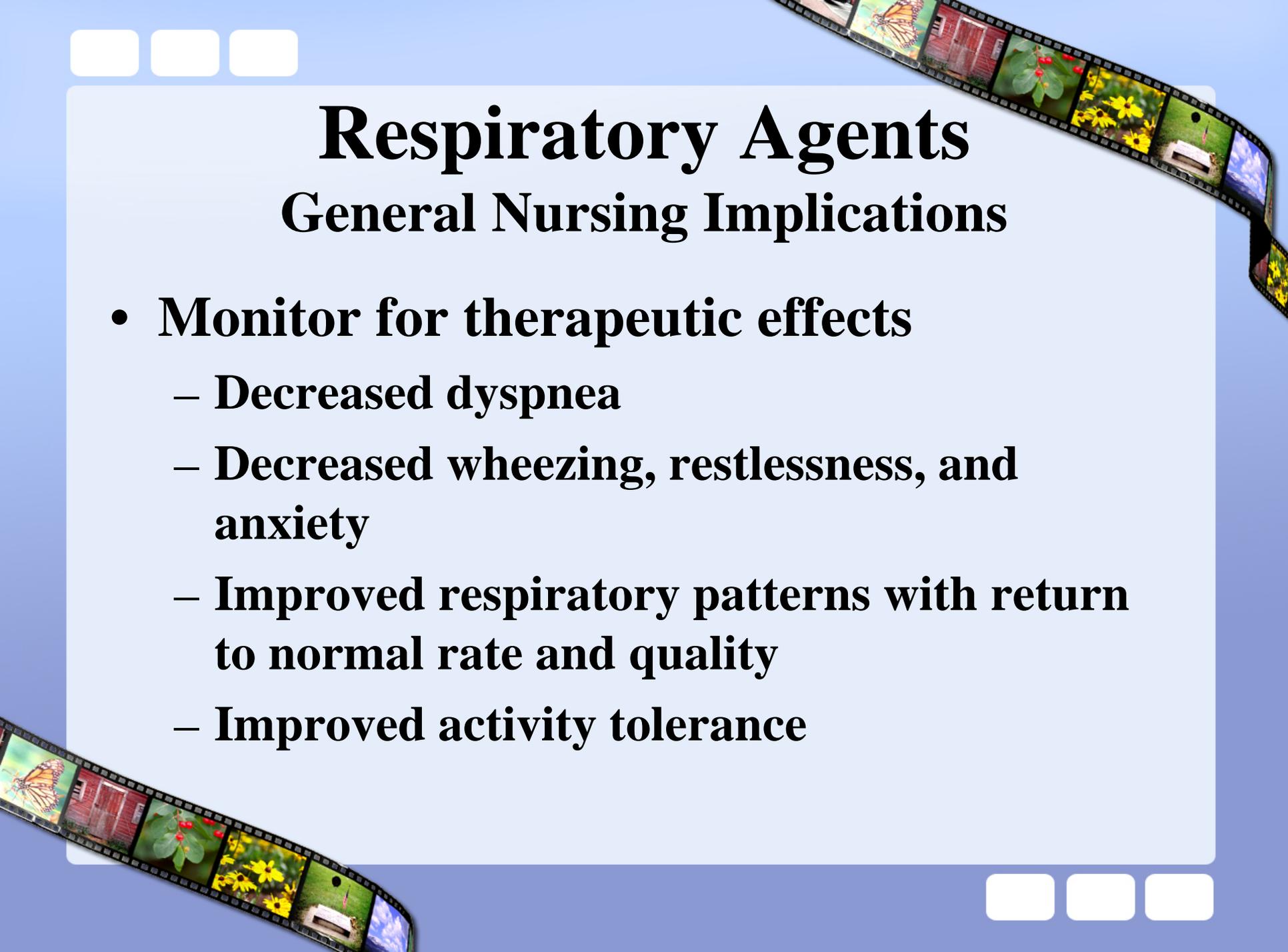
- **Perform a thorough assessment before beginning therapy**
 - **Skin color**
 - **Baseline vital signs**
 - **Respirations (should be <12 or >24 breaths/min)**
 - **Respiratory assessment, including PO₂**
 - **Sputum production**
 - **Allergies**
 - **History of respiratory problems**
 - **Other medications**
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Respiratory Agents

General Nursing Implications

- **Teach patients to take bronchodilators exactly as prescribed**
 - **Teach how to use inhalers & MDIs**
 - **Have the patients demonstrate use of devices**
 - **Monitor for side effects**
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Respiratory Agents

General Nursing Implications

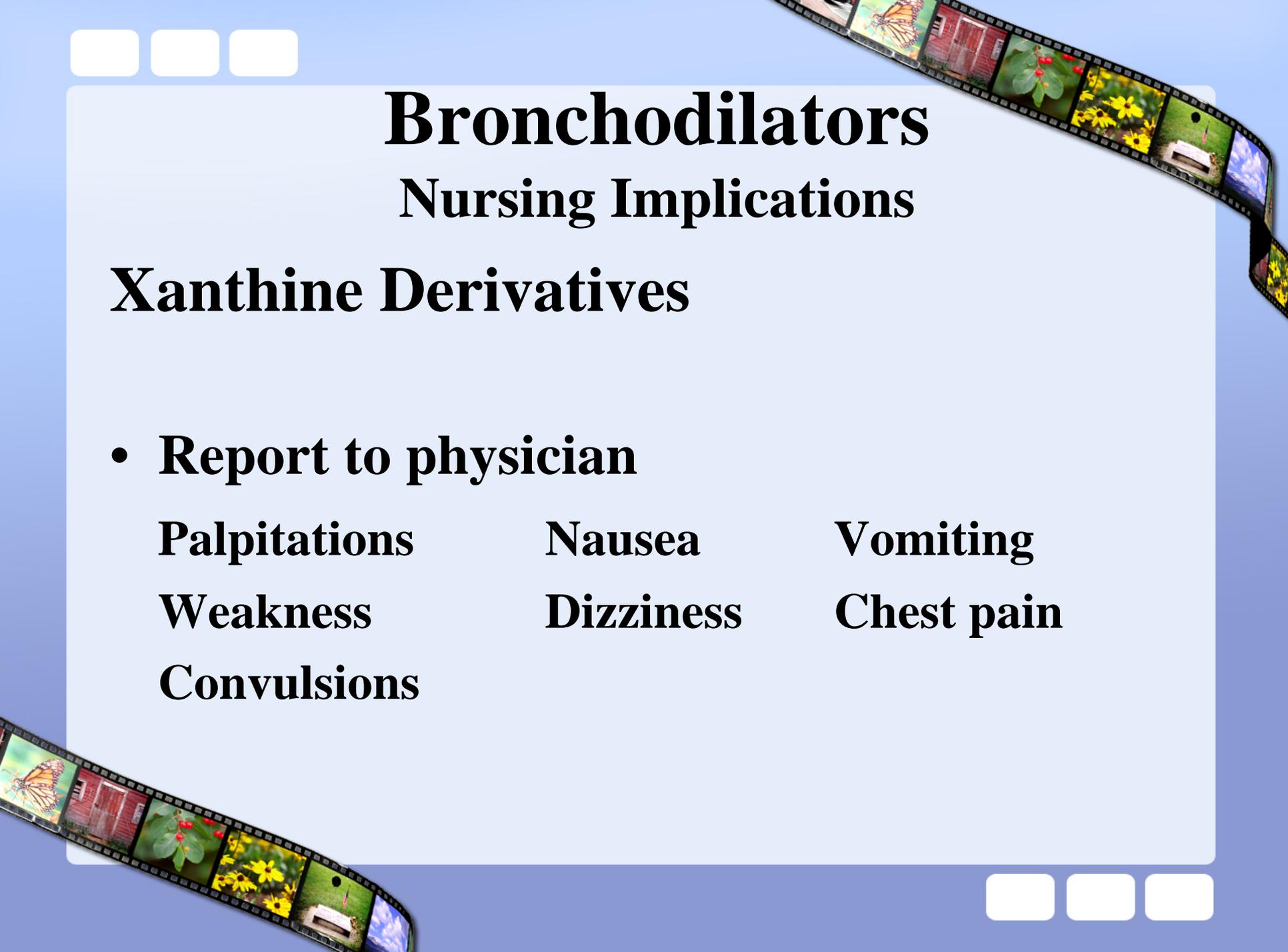
- **Monitor for therapeutic effects**
 - **Decreased dyspnea**
 - **Decreased wheezing, restlessness, and anxiety**
 - **Improved respiratory patterns with return to normal rate and quality**
 - **Improved activity tolerance**



Bronchodilators

Nursing Implications

- **Xanthine Derivatives**
 - **Contraindications**
 - **History of PUD or GI disorders**
 - **Cautious use**
 - **Cardiac disease**
 - **Timed-release preparations should not be crushed or chewed**
 - **Causes gastric irritation**



Bronchodilators

Nursing Implications

Xanthine Derivatives

- **Report to physician**

Palpitations

Nausea

Vomiting

Weakness

Dizziness

Chest pain

Convulsions





Bronchodilators

Nursing Implications

- **Xanthine Derivatives**
 - **Be aware of drug interactions with:**
 - **Cimetidine**
 - **Oral contraceptives**
 - **Allopurinol**
 - **Large amounts of caffeine & nicotine can have deleterious effects**

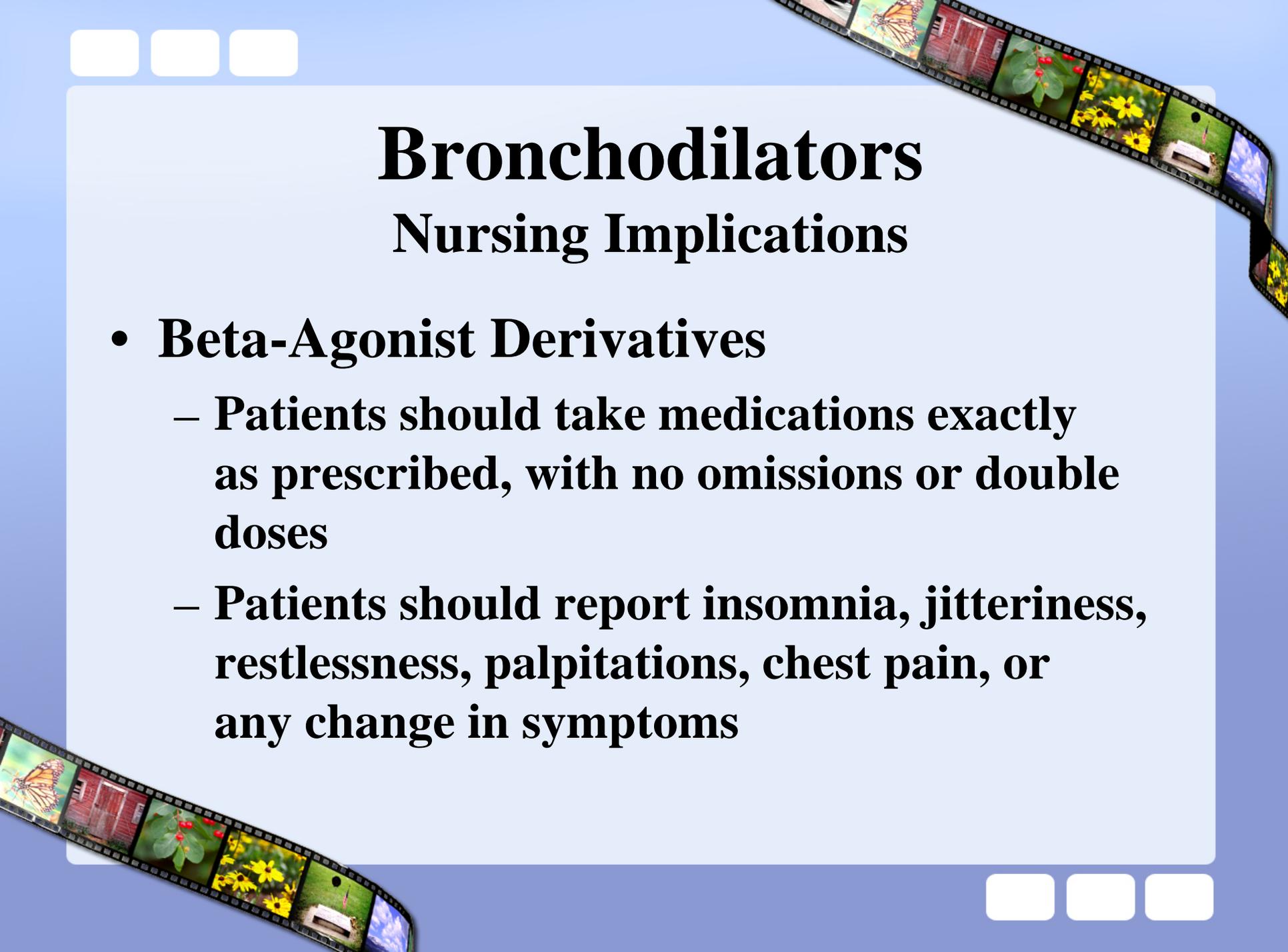




Bronchodilators

Nursing Implications

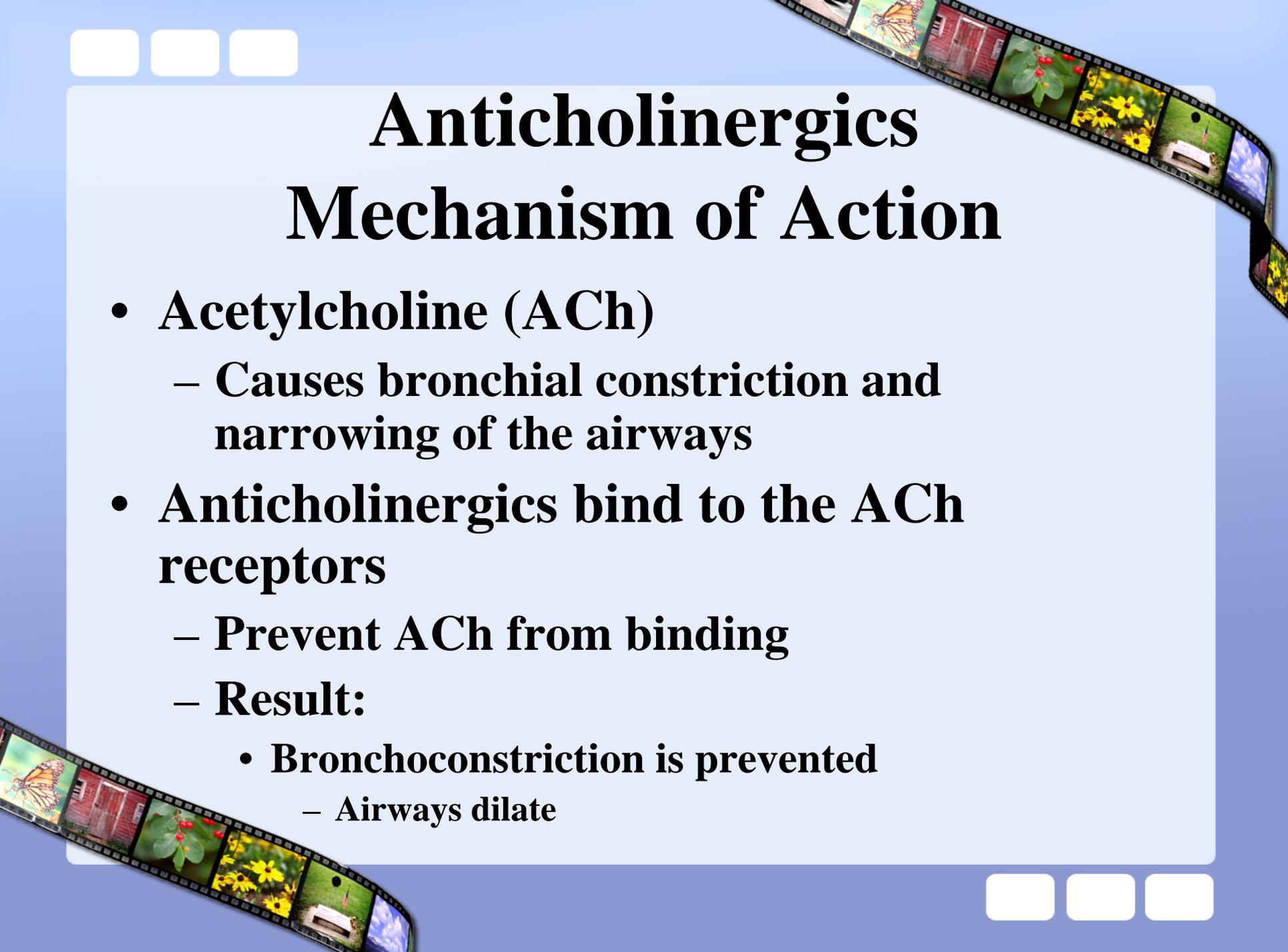
- **Beta-Agonist Derivatives (Albuterol)**
 - **If used too frequently**
 - **Loses its beta₂-specific actions at larger doses**
 - **As a result, beta₁ receptors are stimulated**
 - **Causing nausea, increased anxiety, palpitations, tremors, and increased heart rate**



Bronchodilators

Nursing Implications

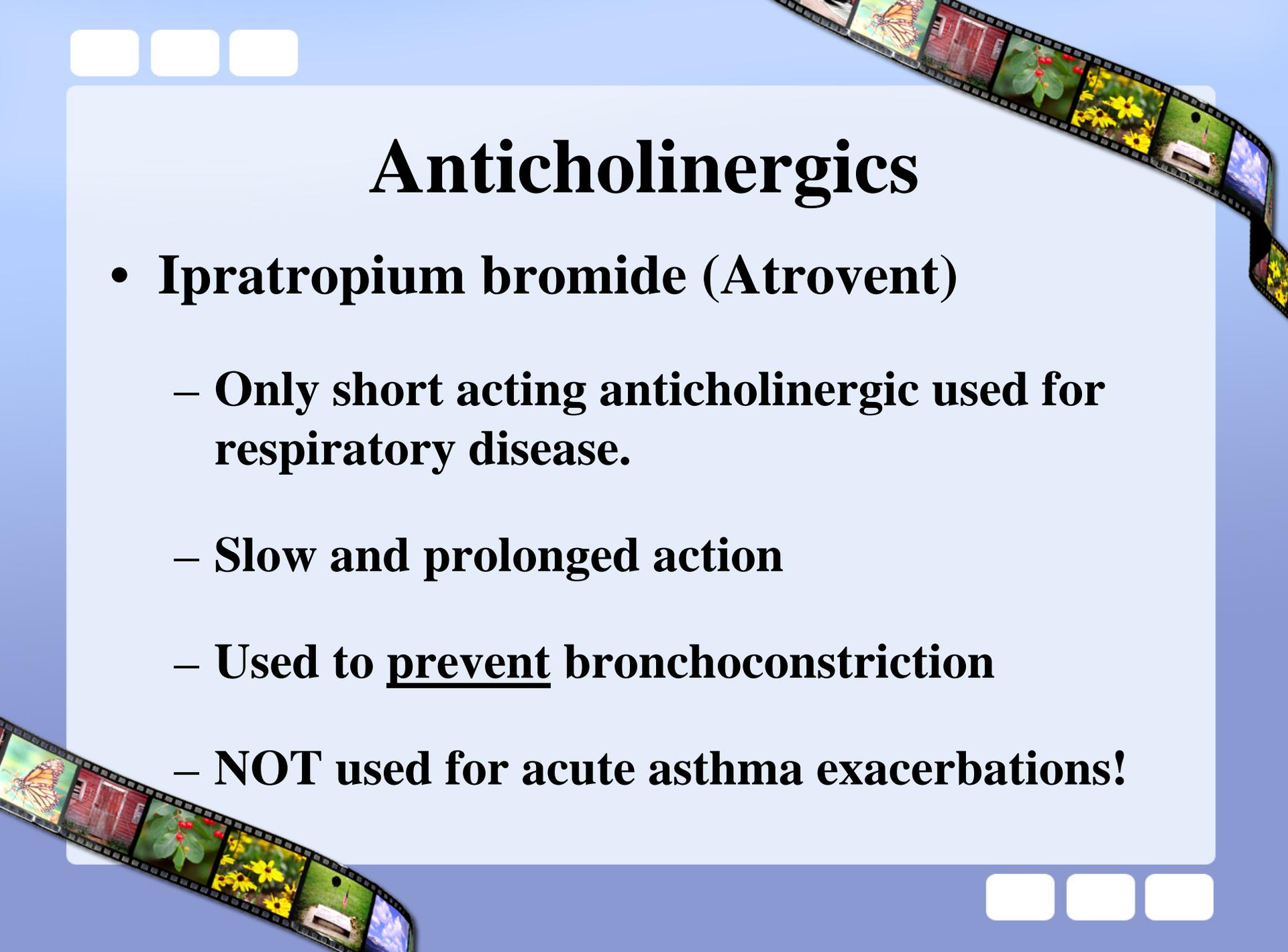
- **Beta-Agonist Derivatives**
 - **Patients should take medications exactly as prescribed, with no omissions or double doses**
 - **Patients should report insomnia, jitteriness, restlessness, palpitations, chest pain, or any change in symptoms**



Anticholinergics

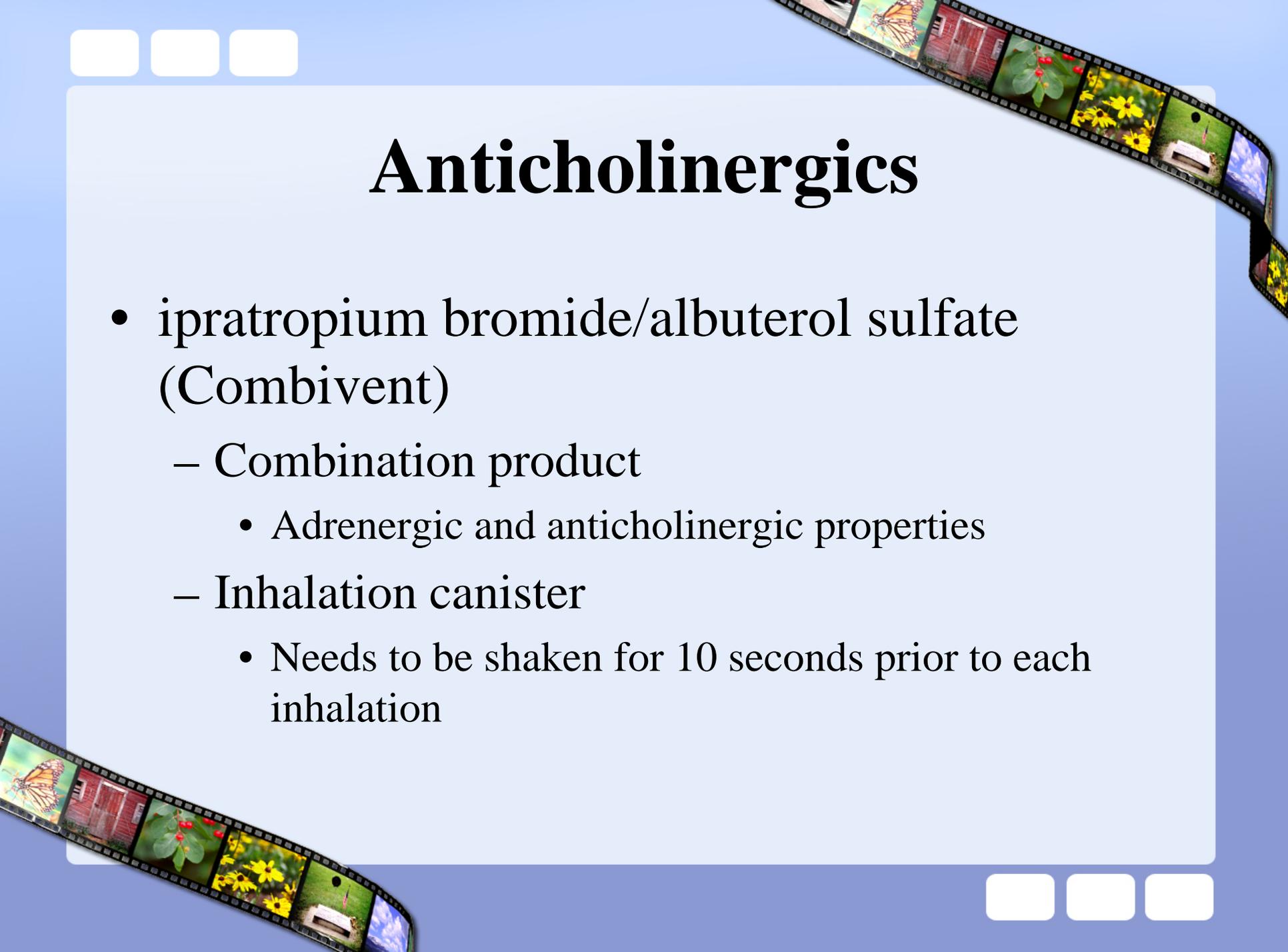
Mechanism of Action

- **Acetylcholine (ACh)**
 - Causes bronchial constriction and narrowing of the airways
- **Anticholinergics bind to the ACh receptors**
 - Prevent ACh from binding
 - **Result:**
 - Bronchoconstriction is prevented
 - Airways dilate



Anticholinergics

- **Ipratropium bromide (Atrovent)**
 - **Only short acting anticholinergic used for respiratory disease.**
 - **Slow and prolonged action**
 - **Used to prevent bronchoconstriction**
 - **NOT used for acute asthma exacerbations!**



Anticholinergics

- ipratropium bromide/albuterol sulfate (Combivent)
 - Combination product
 - Adrenergic and anticholinergic properties
 - Inhalation canister
 - Needs to be shaken for 10 seconds prior to each inhalation



Anticholinergics

Side Effects

- **Dry mouth or throat**
- **Gastrointestinal distress**
- **Headache**
- **Coughing**
- **Anxiety**

No known drug interactions





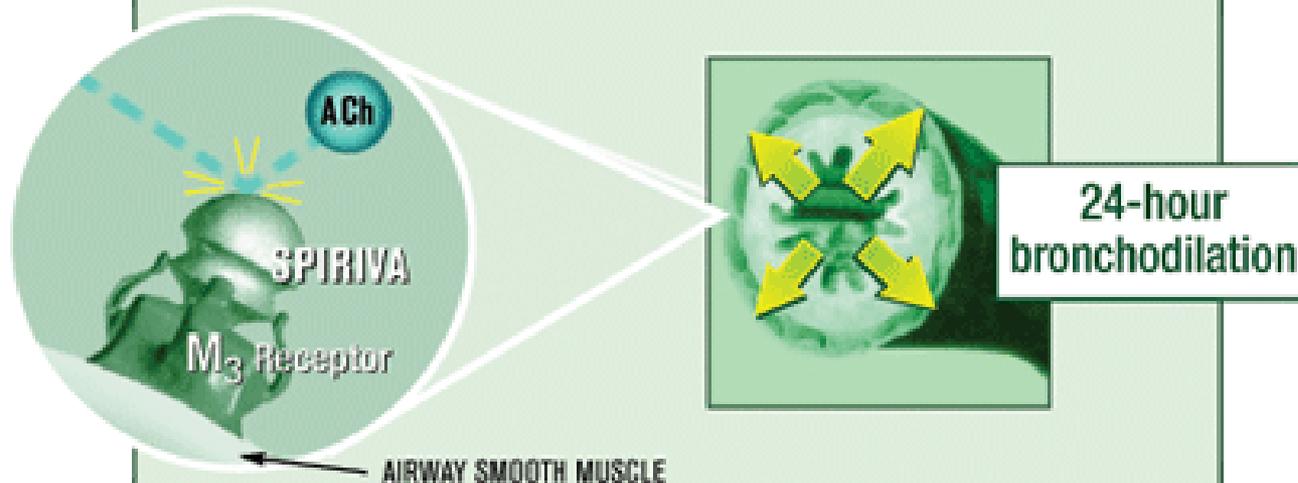
Anticholinergics

(tiotropium bromide)

- **Spiriva**
 - **Long acting**
 - **Once daily maintenance therapy**
 - **Not indicated for rescue therapy**

Pharmacological effects of SPIRIVA

1. SPIRIVA has similar affinity to the subtypes of muscarinic receptors, M_1 to M_5
2. In the airways, SPIRIVA exhibits pharmacological effects through inhibition of M_3 -receptors at the smooth muscle leading to bronchodilation



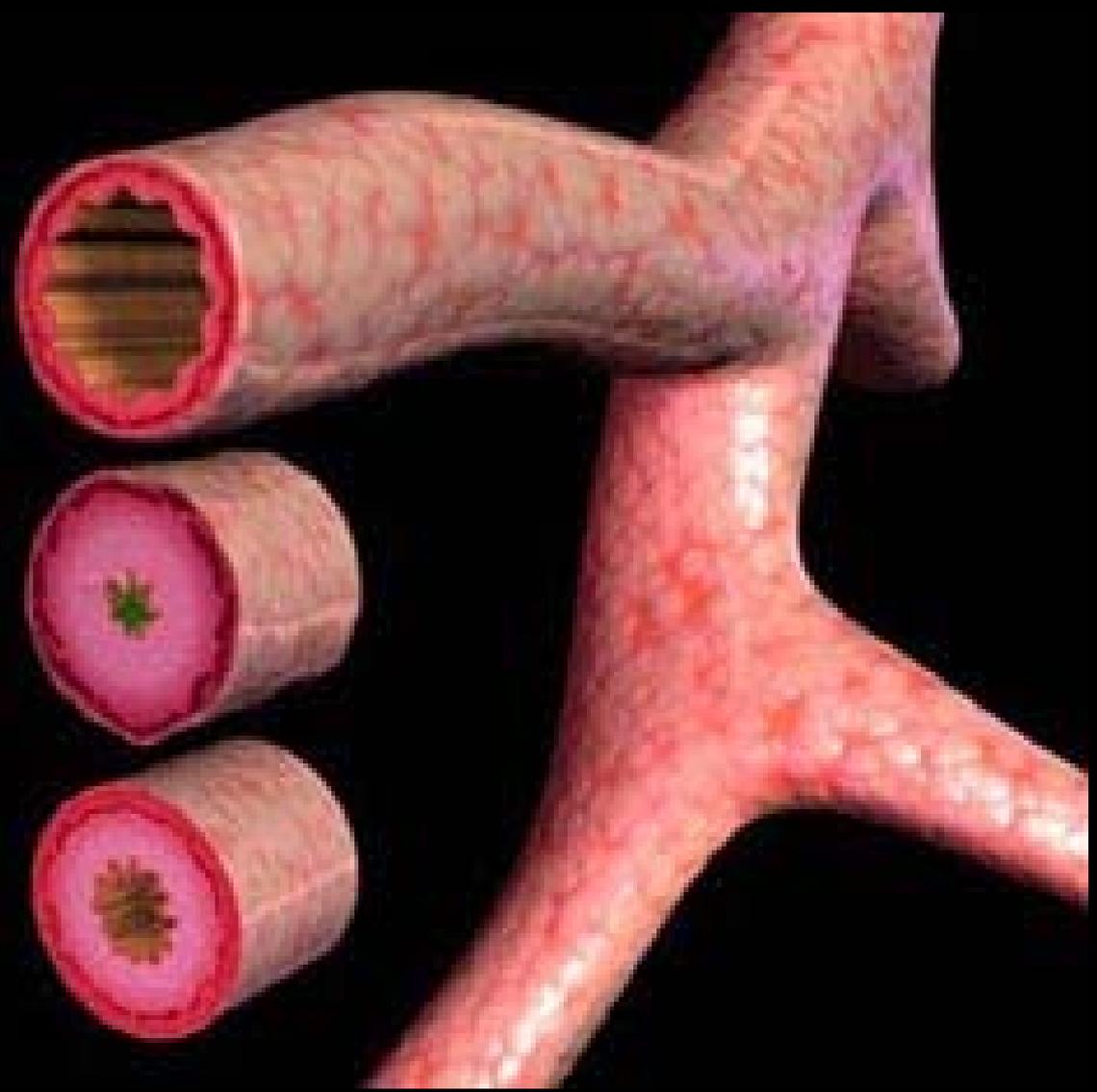
3. Prevents receptor binding by **acetylcholine (ACh)**, the principal neurotransmitter of the parasympathetic nervous system; this blocks receptor stimulation and airway smooth muscle contraction^{6,7}

4. In preclinical *in vitro* and *in vivo* studies, prevention of methacholine-induced bronchoconstriction effects were dose-dependent and lasted longer than 24 hours. The bronchodilation following inhalation of SPIRIVA is predominantly a site-specific effect

Normal airway

**Airway narrowed
by COPD**

**Airway opened
by SPIRIVA**





Antileukotrienes

- **Also called leukotriene receptor antagonists (LRTAs)**
 - **New class of asthma medications**
 - **Three subcategories of agents**
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Antileukotrienes

Currently available agents:

- montelukast (Singulair)
- zafirlukast (Accolate)
- zileuton (Zyflo)

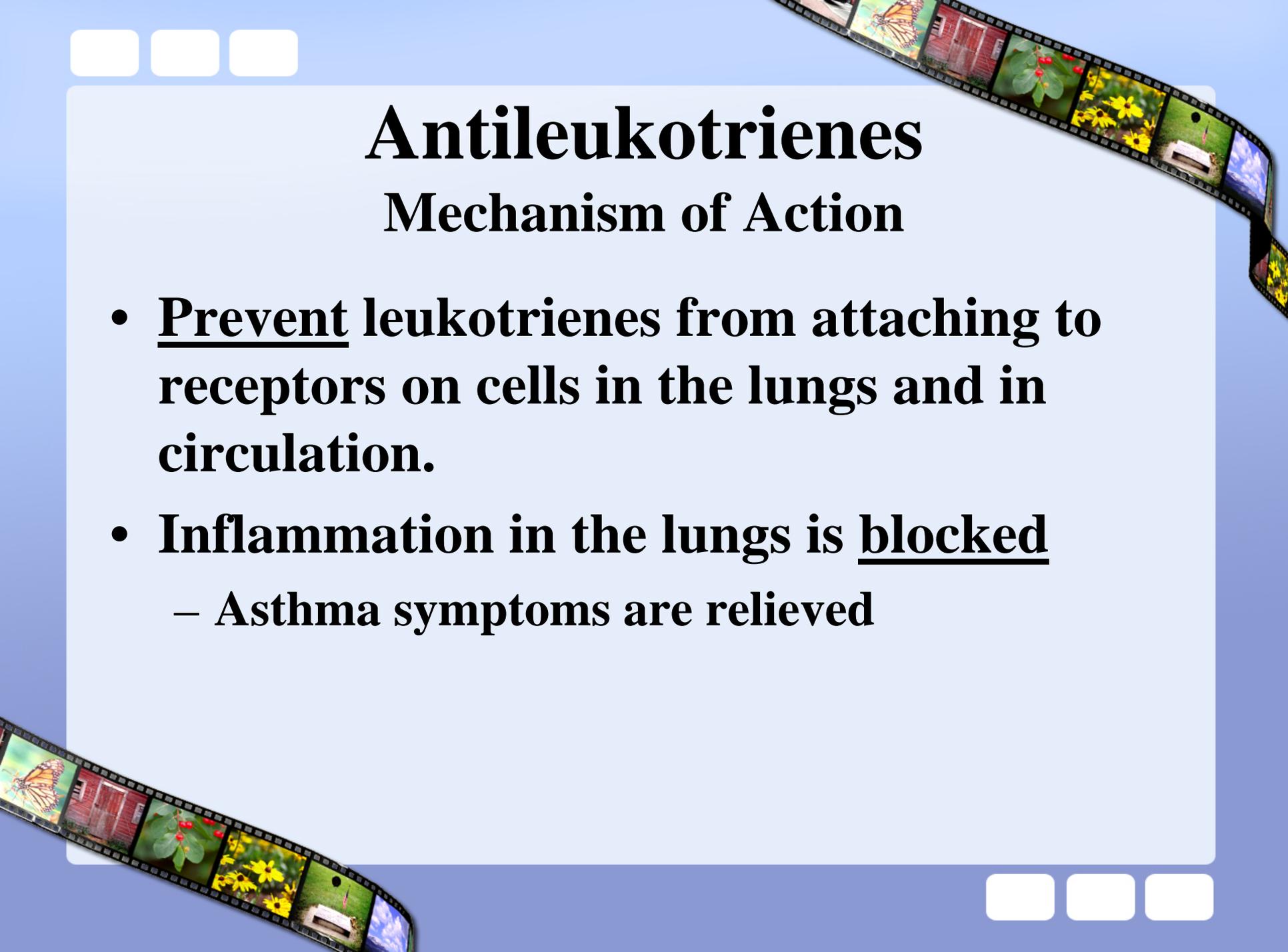


Antileukotrienes

Mechanism of Action

- **Leukotrienes**

- **Substances released when a trigger (i.e., cat hair or dust) starts a series of chemical reactions in the body**
 - **Cause inflammation, bronchoconstriction, and mucus production**
 - **Result:**
 - **Coughing, wheezing, shortness of breath**
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Antileukotrienes

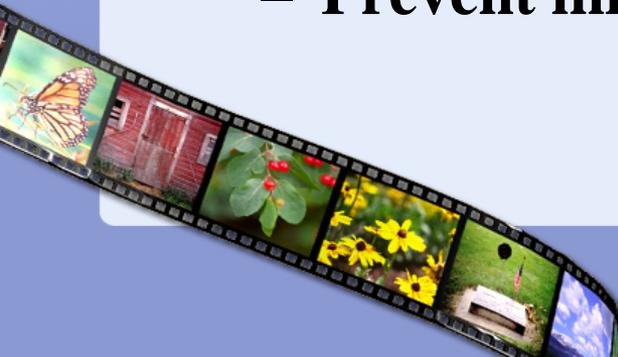
Mechanism of Action

- **Prevent leukotrienes from attaching to receptors on cells in the lungs and in circulation.**
- **Inflammation in the lungs is blocked**
 - Asthma symptoms are relieved



Antileukotrienes

Drug Effects

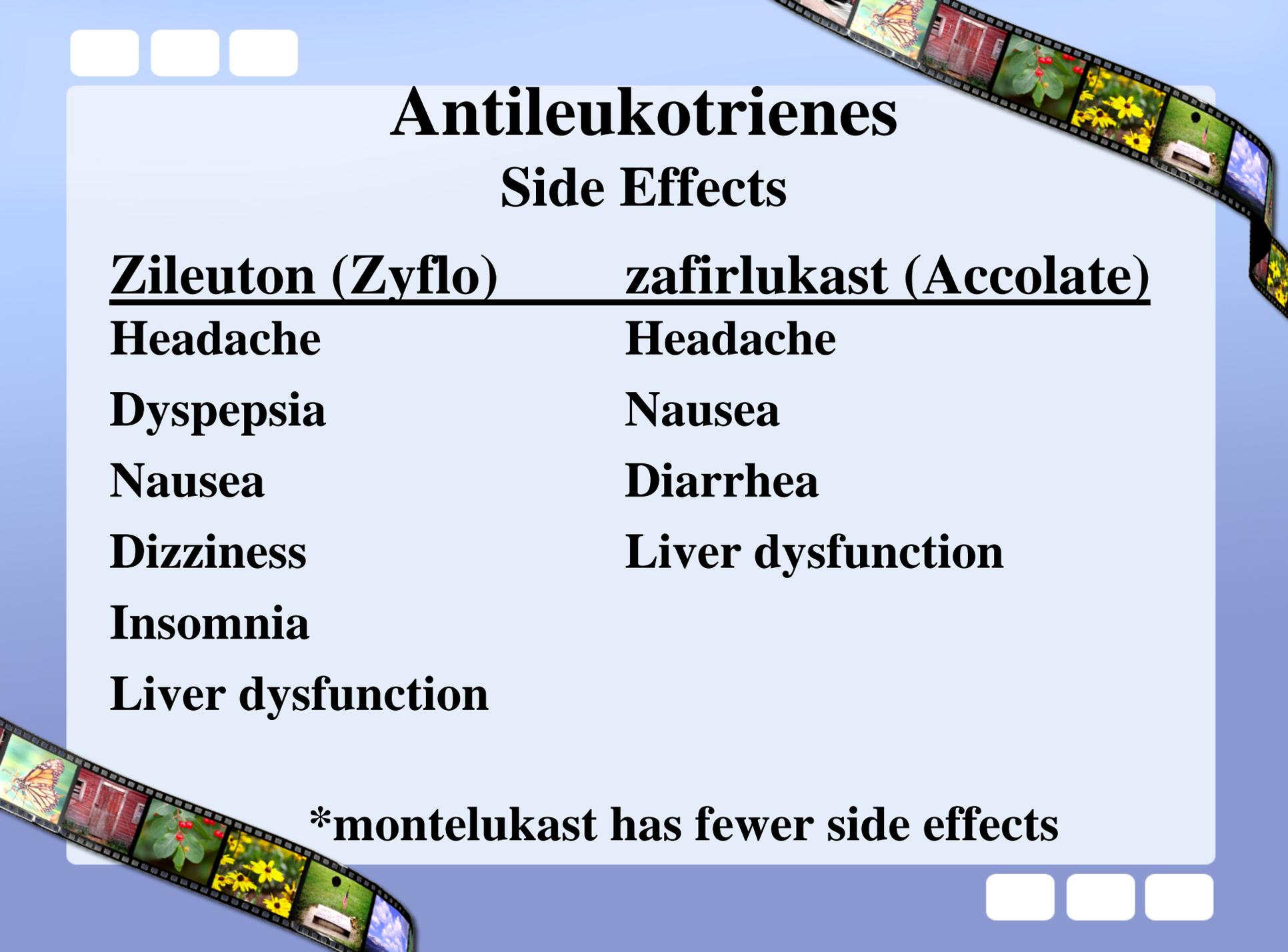
- **Prevent smooth muscle contraction of the bronchial airways**
 - **Decrease mucus secretion**
 - **Prevent vascular permeability**
 - **Decrease neutrophil and leukocyte infiltration to the lungs**
 - **Prevent inflammation**
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Antileukotrienes

Therapeutic Uses

- **Prophylaxis and chronic treatment of asthma in adults and children over age 12**
 - **NOT meant for management of acute asthmatic attacks!**
 - **Montelukast (Singulair) is approved for use in children age 2 and older**
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Antileukotrienes

Side Effects

Zileuton (Zyflo)

Headache

Dyspepsia

Nausea

Dizziness

Insomnia

Liver dysfunction

zafirlukast (Accolate)

Headache

Nausea

Diarrhea

Liver dysfunction

*montelukast has fewer side effects





Antileukotrienes

Nursing Implications

- **Ensure that the drug is being used for chronic management of asthma**
 - **Not acute asthma!**
 - **Teach the patient purpose of the therapy**
 - **Improvement should be seen in about one week**
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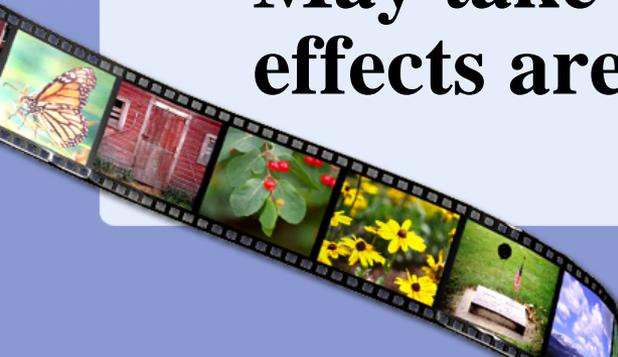
Antileukotrienes

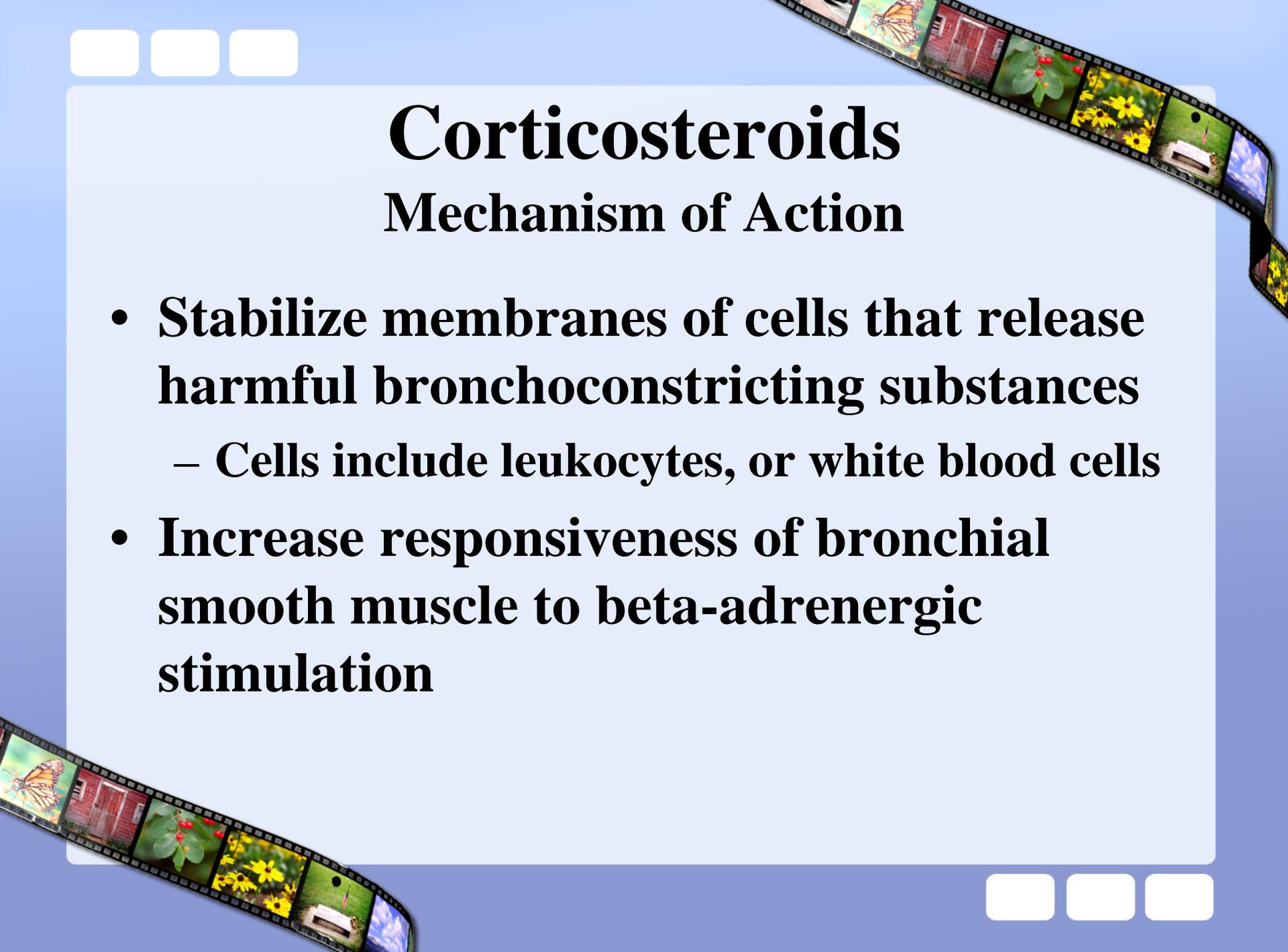
Nursing Implications

- **Check with physician before taking any OTC or prescribed medications**
 - Many drug interactions
- **Assess liver function before beginning therapy**
- **Medications should be taken every night on a continuous schedule**
Even if symptoms improve



Corticosteroids

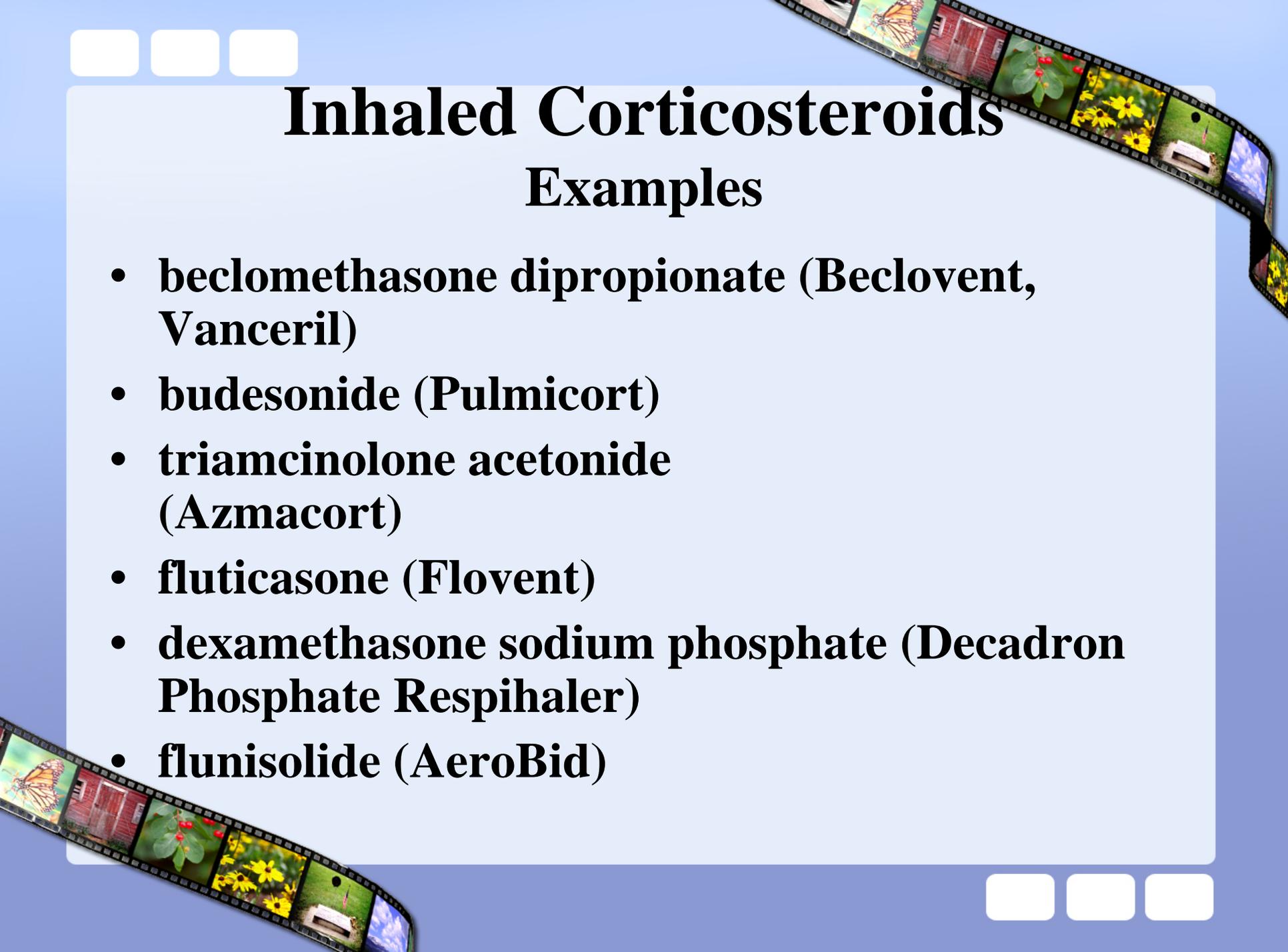
- **Anti-inflammatory drugs**
 - **Used for CHRONIC asthma**
 - **Does not relieve symptoms of acute asthmatic attacks**
 - **Oral or inhaled forms**
 - **Inhaled forms reduce systemic effects**
 - **May take several weeks before full effects are seen**
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Corticosteroids

Mechanism of Action

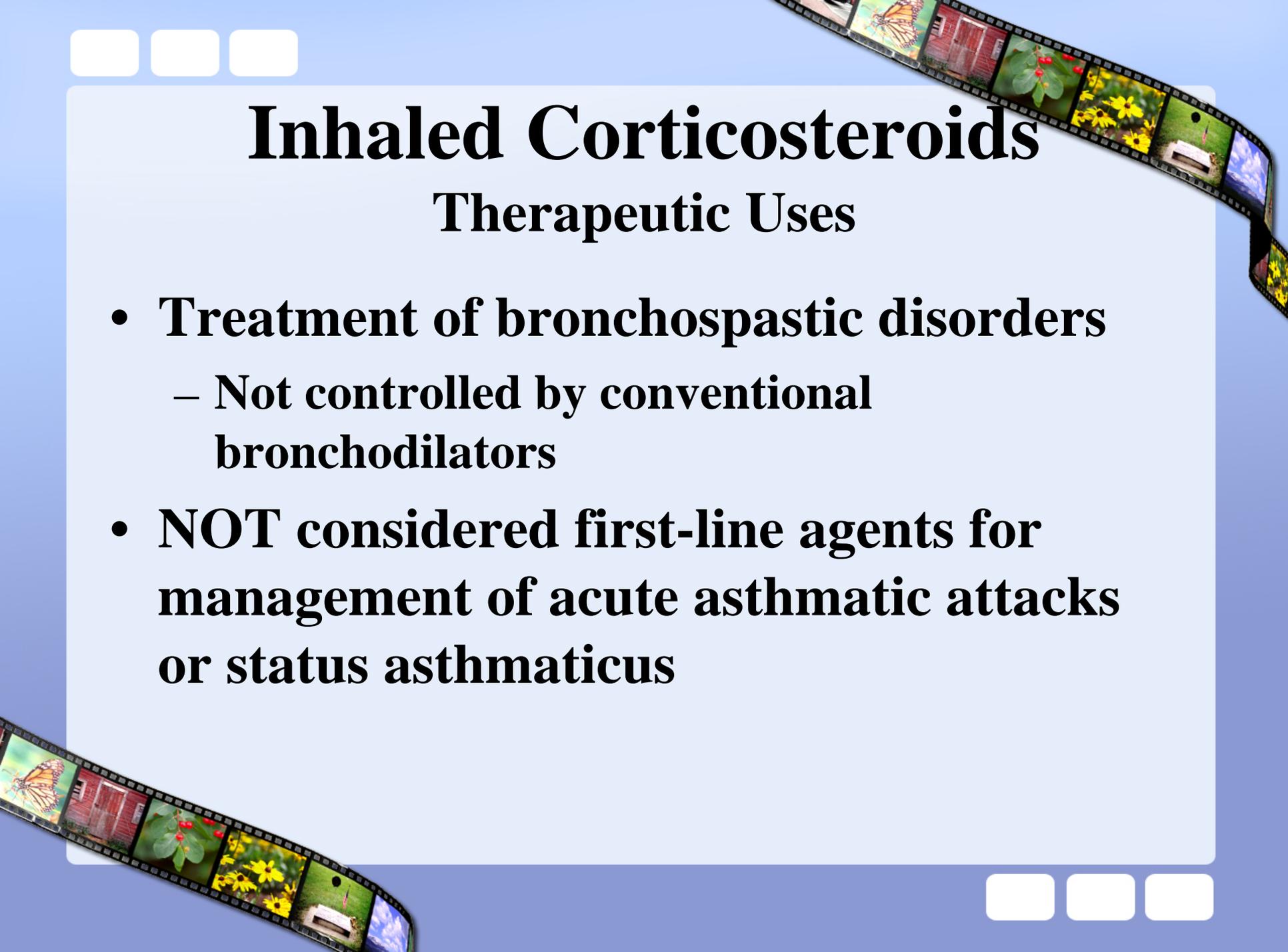
- **Stabilize membranes of cells that release harmful bronchoconstricting substances**
 - Cells include leukocytes, or white blood cells
 - **Increase responsiveness of bronchial smooth muscle to beta-adrenergic stimulation**
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Inhaled Corticosteroids

Examples

- **beclomethasone dipropionate (Beclovent, Vanceril)**
 - **budesonide (Pulmicort)**
 - **triamcinolone acetonide (Azmacort)**
 - **fluticasone (Flovent)**
 - **dexamethasone sodium phosphate (Decadron Phosphate Respihaler)**
 - **flunisolide (AeroBid)**
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Inhaled Corticosteroids

Therapeutic Uses

- **Treatment of bronchospastic disorders**
 - Not controlled by conventional bronchodilators
- **NOT considered first-line agents for management of acute asthmatic attacks or status asthmaticus**

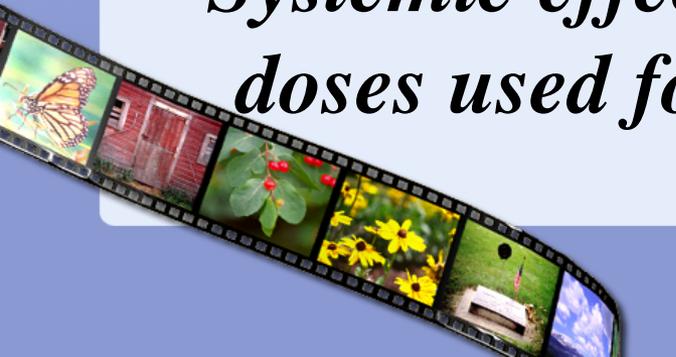


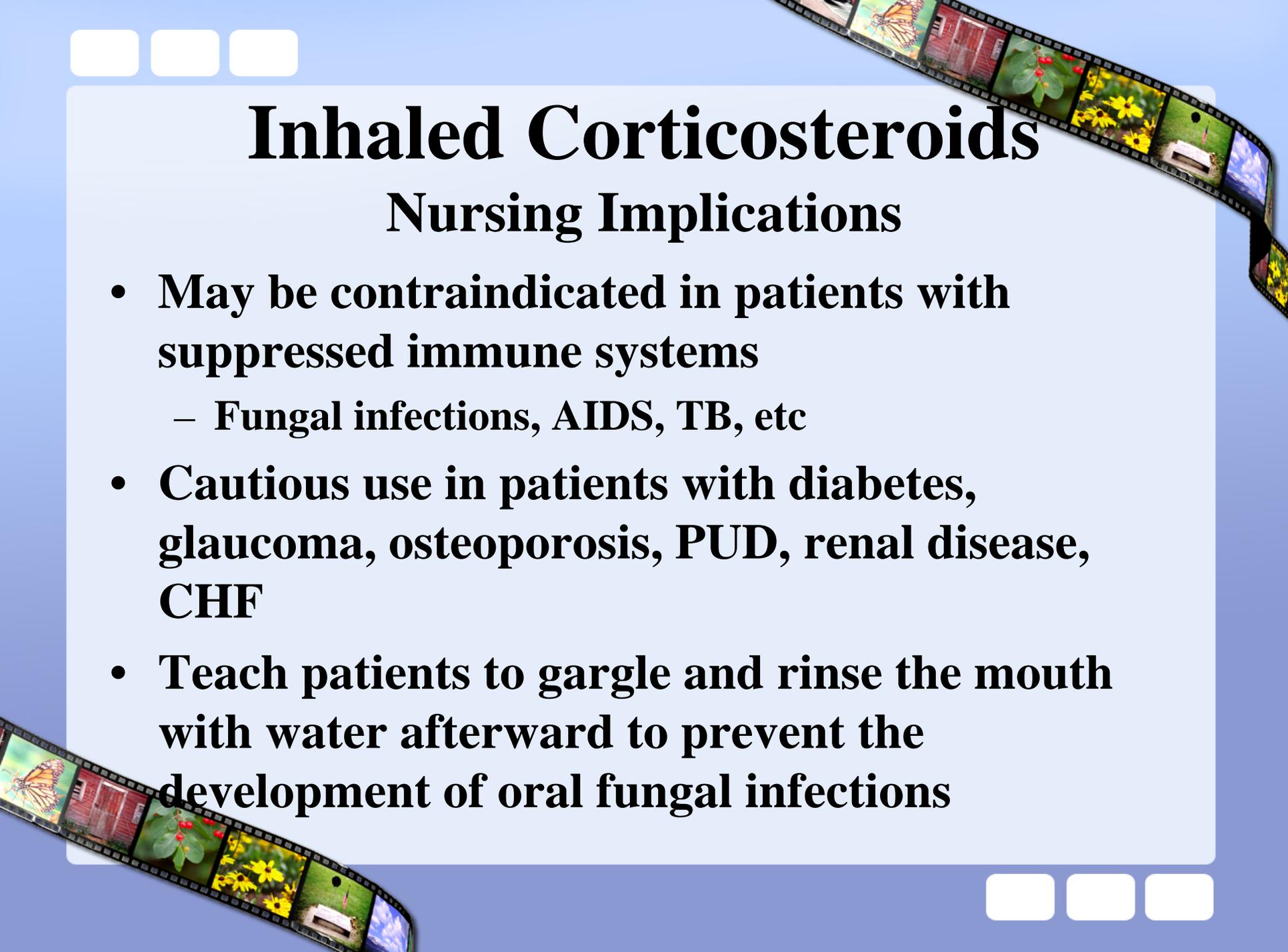
Inhaled Corticosteroids

Side Effects

- **Pharyngeal irritation**
- **Coughing**
- **Dry mouth**
- **Oral fungal infections**

**Systemic effects are rare because of the low doses used for inhalation therapy*





Inhaled Corticosteroids

Nursing Implications

- **May be contraindicated in patients with suppressed immune systems**
 - Fungal infections, AIDS, TB, etc
- **Cautious use in patients with diabetes, glaucoma, osteoporosis, PUD, renal disease, CHF**
- **Teach patients to gargle and rinse the mouth with water afterward to prevent the development of oral fungal infections**

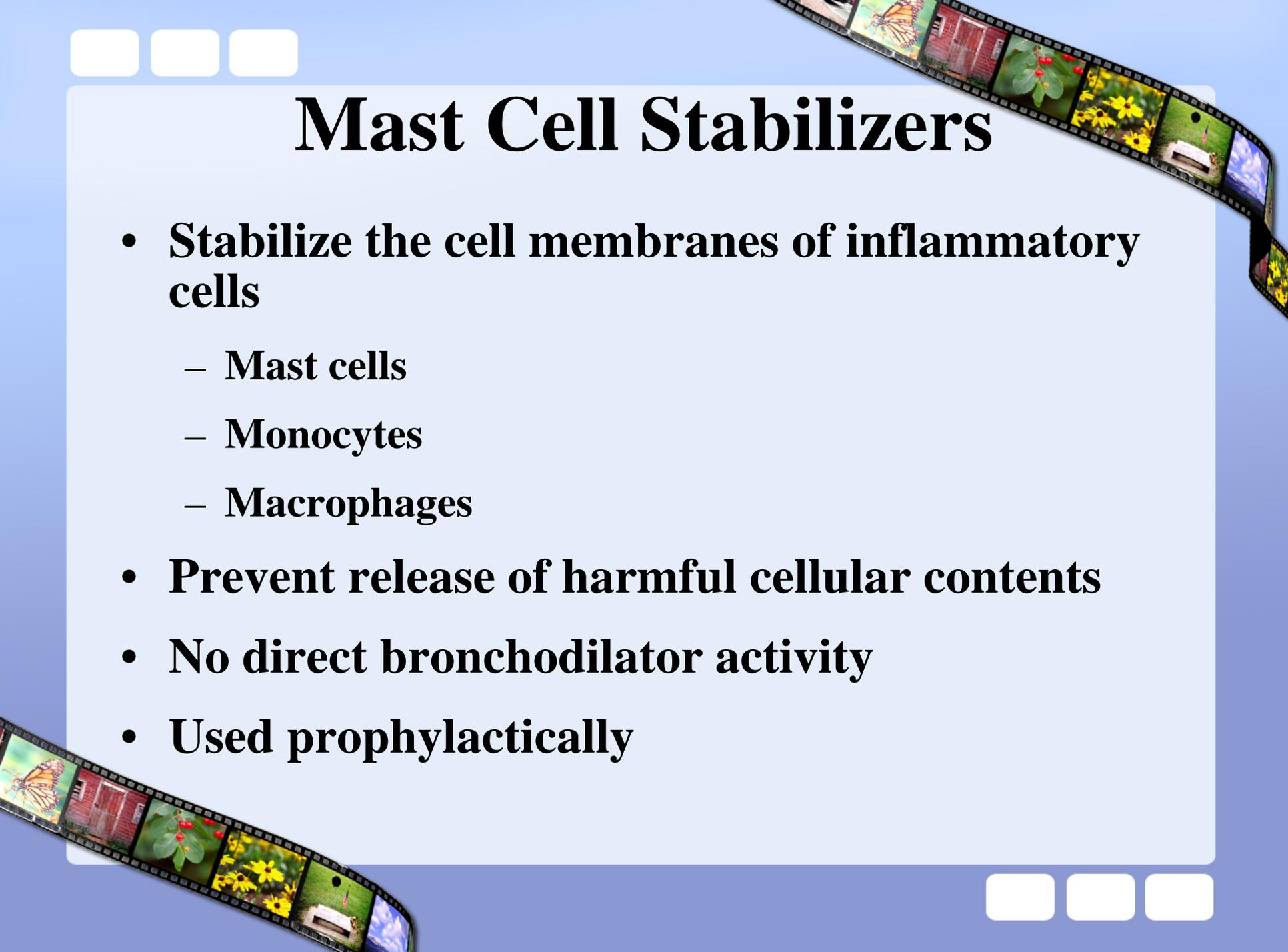


Inhaled Corticosteroids

Nursing Implications

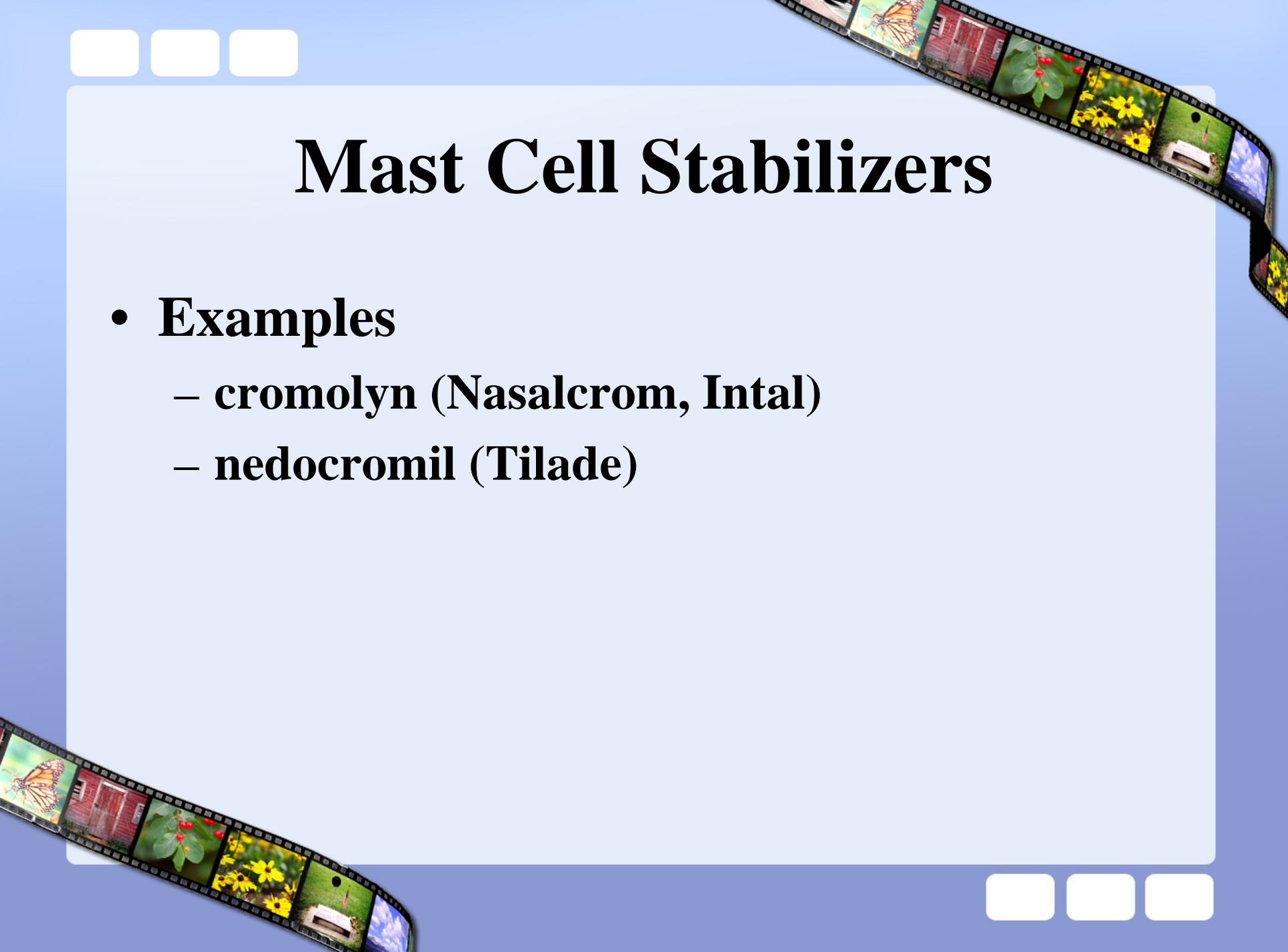
- **Abruptly discontinuing these medications can lead to serious problems.**
 - **Should be weaned for a period of 1 to 2 weeks if discontinued**
 - Only if recommended by physician
 - **REPORT**
 - Weight gain of more than 5 pounds a week
 - Occurrence of chest pain.
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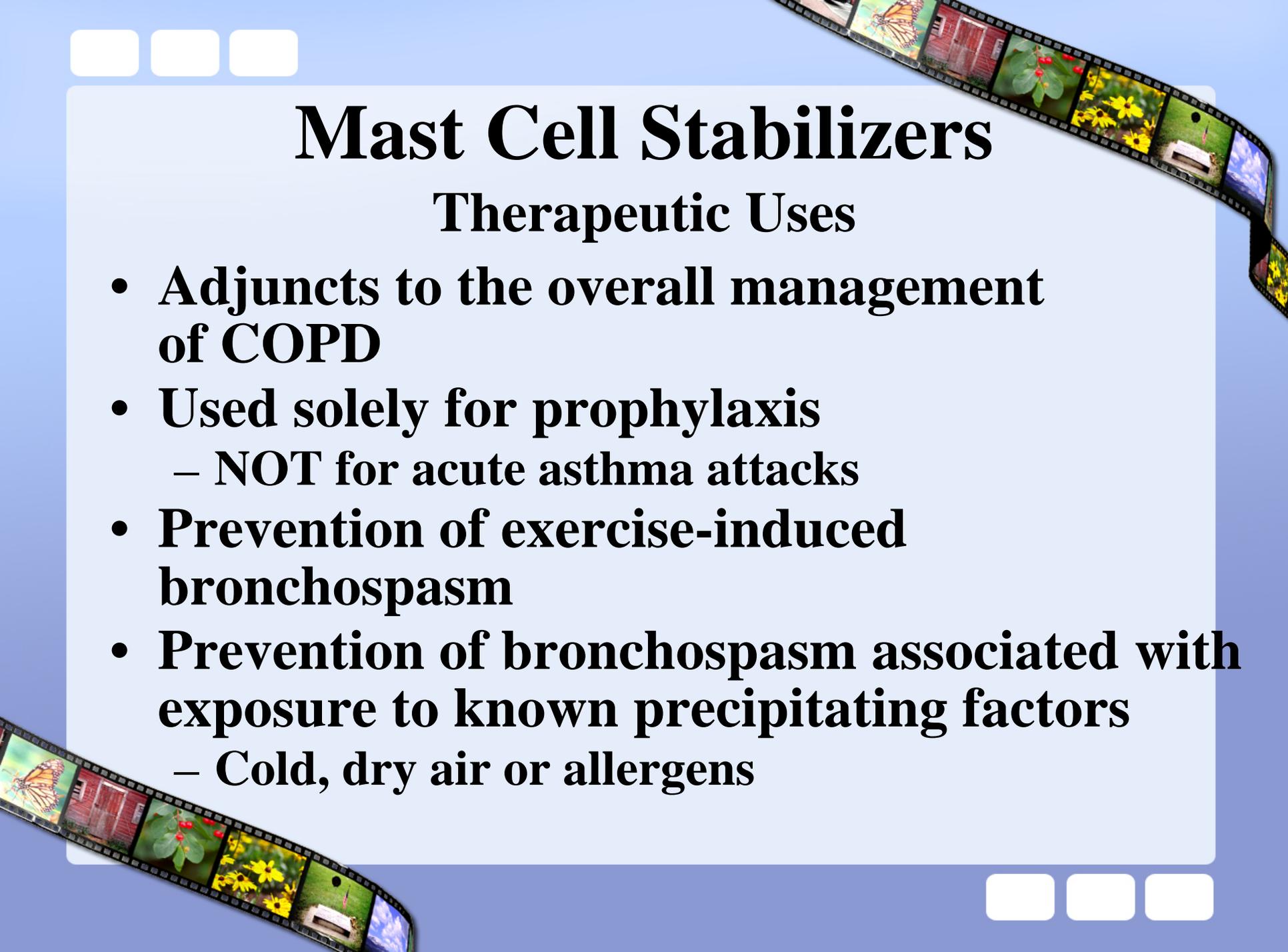
Mast Cell Stabilizers

- **Stabilize the cell membranes of inflammatory cells**
 - Mast cells
 - Monocytes
 - Macrophages
- **Prevent release of harmful cellular contents**
- **No direct bronchodilator activity**
- **Used prophylactically**



Mast Cell Stabilizers

- **Examples**
 - **cromolyn (Nasalcrom, Intal)**
 - **nedocromil (Tilade)**



Mast Cell Stabilizers

Therapeutic Uses

- **Adjuncts to the overall management of COPD**
- **Used solely for prophylaxis**
 - NOT for acute asthma attacks
- **Prevention of exercise-induced bronchospasm**
- **Prevention of bronchospasm associated with exposure to known precipitating factors**
 - Cold, dry air or allergens



Mast Cell Stabilizers

Side Effects

Coughing

Sore throat

Rhinitis

Bronchospasm

Taste changes

Dizziness

Headache





Mast Cell Stabilizers

Nursing Implications

- **For prophylactic use only**
 - **Contraindicated for acute exacerbations**
 - **Not recommended for children under age five**
 - **Therapeutic effects may not be seen for up to 4 weeks**
 - **Teach patients to gargle and rinse the mouth with water afterward to minimize irritation to the throat and oral mucosa**
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