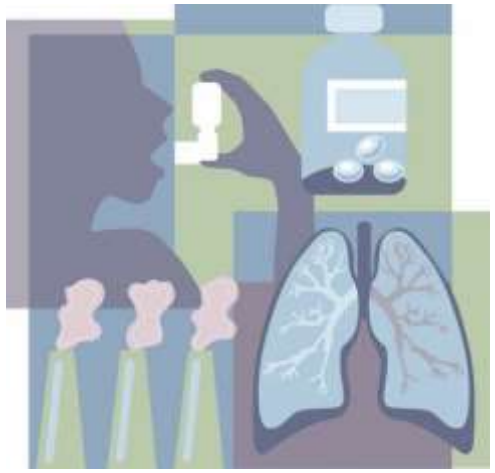
MAHIDOL UNIVERSITY
Wisdom of the Land

Airway Pharmacology for Asthma & COPD

Review & Update 2026



รศ.ดร.ภกญ. วริสรา ปาริชาติกานนท์

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Drugs for asthma & COPD: Update 2026

Bronchodilators

β_2-agonist (BA)

SABA: Short-acting BA

- **4-6 hr**
- Salbutamol, Terbutaline

LABA: Long-acting BA

- **12 hr (twice-daily)**
- Salmeterol, Formoterol

Ultra-LABA: Ultra-long-acting BA

- **24 hr (once-daily)**
- Indacaterol, Vilanterol, Olodaterol

Muscarinic M_3 antagonist (MA)

SAMA: Short-acting MA

- **4-6 hr**
- Ipratropium

LAMA: Long-acting MA

- **12 hr (twice-daily)**
- Aclidinium

Ultra-LAMA: Ultra-long-acting MA

- **24 hr (once-daily)**
- Tiotropium, Glycopyrronium, Umeclidinium, Revefenacin

Anti-inflammatory agents

Anti-inflammatory agent

Inhaled corticosteroid (ICS)

- Budesonide, Fluticasone, Ciclesonide Beclomethasone, Mometasone

Anti-leukotrienes

- Montelukast, Zafirlukast

Biological products

2026

Anti-IgE: Omalizumab, **Omalizumab-igec**

Anti-IL5:

Anti-IL5: Mepolizumab, Reslizumab, **Depemokimab**

Anti-IL5Rα: Benralizumab

Anti-IL4Rα: Dupilumab

Anti-TSLP: Tezepelumab

PDE inhibitors

Methylxanthine: Theophylline SR, aminophylline

PDE4 inhibitor: Roflumilast

PDE3/PDE4 inhibitor: Ensifentrine

Warisara Parichatikanond, Update 2026

GINA 2026
Adults & adolescents 12+ years

Personalized asthma management
Assess, Adjust, Review
for individual patient needs



ASSESS
- Confirmation of diagnosis if necessary
- Symptom control & modifiable risk factors
- Comorbidities
- Inhaler technique & adherence
- Patient (and parent/caregiver) preferences and goals

ADJUST
- Treatment of modifiable risk factors and comorbidities
- Non-pharmacological strategies
- Asthma medication including ICS
- Education & skills training, action plan

REVIEW
- Symptoms
- Exacerbations
- Side-effects
- Comorbidities
- Lung function
- Consider biomarkers
- Patient (and parent/caregiver) satisfaction

2026

TRACK 1: PREFERRED CONTROLLER and RELIEVER
Using ICS-formoterol* as the reliever reduces the risk of exacerbations compared with using a SABA reliever, and Track 1 is a simple, single inhaler, strategy

STEPS 1 – 2	STEP 3	STEP 4	STEP 5
AIR-only:* as-needed low dose ICS-formoterol	MART* with low dose maintenance ICS-formoterol	MART* with medium dose maintenance ICS-formoterol	Consider add-on LAMA. Refer for assessment of phenotype. Consider trial of high dose maintenance ICS-formoterol. Consider anti-IgE, anti-IL5/5R, anti-IL4Rα, anti-TSLP

RELIEVER: As-needed low dose ICS-formoterol*

TRACK 2: Alternative **CONTROLLER and RELIEVER**
Before considering a regimen with a SABA reliever, check if the patient is likely to adhere to their ICS treatment

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
AIR-only:* as-needed low dose ICS+SABA (combination or separate inhalers)	Low dose maintenance ICS	Low dose maintenance ICS-LABA	Medium dose maintenance ICS-LABA	Consider add-on LAMA. Refer for assessment of phenotype. Consider trial of high dose maintenance ICS-LABA. Consider anti-IgE, anti-IL5/5R, anti-IL4Rα, anti-TSLP

RELIEVER: As-needed low dose ICS-SABA* (or, if not available, as-needed SABA)

GINA 2026 Box 4-6

AIR: anti-inflammatory reliever; ICS: inhaled corticosteroid; Ig: immunoglobulin; IL: interleukin; LAMA: long-acting muscarinic antagonist; MART: maintenance-and-reliever therapy with ICS-formoterol; SABA: short-acting beta$_2$-agonist; TSLP: thymic stromal lymphopoietin

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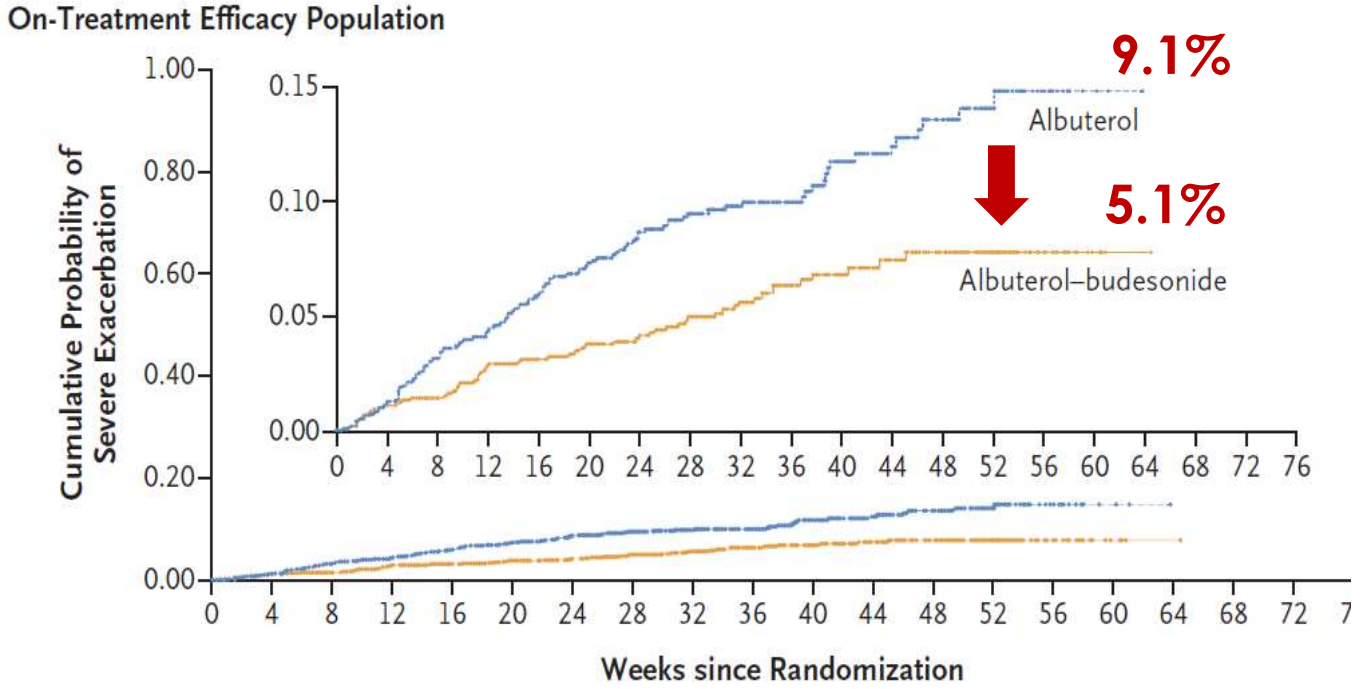
Changes in GINA Track 2: BATURA Trial

Step 1: AIR-only (as-needed low-dose ICS + SABA)

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JULY 10, 2025 VOL. 393 NO. 2

As-Needed Albuterol–Budesonide in Mild Asthma



- **Population**: Poorly controlled asthma, using SABA alone, or maintenance ICS + as-needed SABA (N = 2,516)
- **Randomized**: Budesonide-Salbutamol (80/90 mcg) or Salbutamol (90 mcg), 2 inhalations as-needed, 52 wks
- **Primary outcome**: Proportion with a severe exacerbation **5.1% & vs 9.1%, HR 0.53**
- **Other outcomes:**
  - Annual rate of severe exacerbation: **Reduced by 53%**
  - Quality of life: No differences
  - Lung function: Not measured

LaForce C, et al. N Engl J Med. 2025;393(2):113-124.

GINA Track 1 in practice

GINA TRACK 1 example with budesonide-formoterol 160/4.5 mcg or BDP-formoterol 100/6 mcg, by DPI or pMDI

STEPS 1 – 2
Take 1 inhalation as needed (AIR-only*)

STEP 3
Take 1 inhalation morning and evening, and 1 inhalation as needed (Step 3 MART*)

STEP 4
Take 2 inhalations morning and evening, and 1 inhalation as needed (Step 4 MART*)

STEP 5
Refer for expert assessment, phenotyping, and add-on treatment for severe asthma

See Box 4-8 for other formulations.

GINA TRACK 1: the PREFERRED treatment for adults and adolescents.

Using low dose ICS-formoterol as an anti-inflammatory reliever (AIR*), with or without maintenance ICS-formoterol, reduces the risk of exacerbations compared with using a SABA reliever, and is a simple regimen, with a single medication, device and dose across treatment steps.

© Global Initiative for Asthma, www.ginasthma.org

Medications and doses for GINA Track 1 AIR therapy with ICS-formoterol

Medications: mcg/inhalation*	Dosing frequency for AIR/MART with ICS-formoterol, by age group and treatment step	
Children 6–11 years		
Budesonide-formoterol DPI or pMDI 80/4.5 (100/6) or beclometasone-formoterol‡ DPI or pMDI 100/6	Step 1–2 AIR-only	1 inhalation as needed
	Step 3 MART	1 inhalation once daily plus 1 as needed
* Seek medical care if >8 inhalations needed in any day	Step 4 MART	1 inhalation twice daily plus 1 as needed
	Step 5 MART	Not recommended
Adolescents 12–17 years and adults 18 years and older		
Budesonide-formoterol DPI or pMDI 160/4.5 (200/6) or beclometasone-formoterol‡ DPI or pMDI 100/6	Step 1–2 AIR-only	1 inhalation as needed
	Step 3 MART	1 inhalation twice (or once) daily plus 1 as needed
* Seek medical care if >12 inhalations needed in any day	Step 4–5 MART	2 inhalations twice daily plus 1 as needed

* Previously worded as 'maximum number of inhalations in any day'

AIR: anti-inflammatory reliever; DPI: dry powder inhaler; MART: maintenance-and-reliever therapy with ICS-formoterol; pMDI: pressurized metered dose inhaler

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Avoid SABA overuse: SYGMA Trial

Not recommend SABA alone
ICS initiates as soon as possible

Regular use of SABA is associated with

- β-receptor downregulation
- ↑ Airway hyperresponsiveness
- ↓ Bronchodilator effect
- ↑ Allergic response & eosinophils

SABA overuse:

- Lactic acidosis
- Compensatory hyperventilation

Higher use of SABA:

- ≥3 canisters/year- ↑ Severe exacerbation
- ≥12 canisters/year- ↑ Death

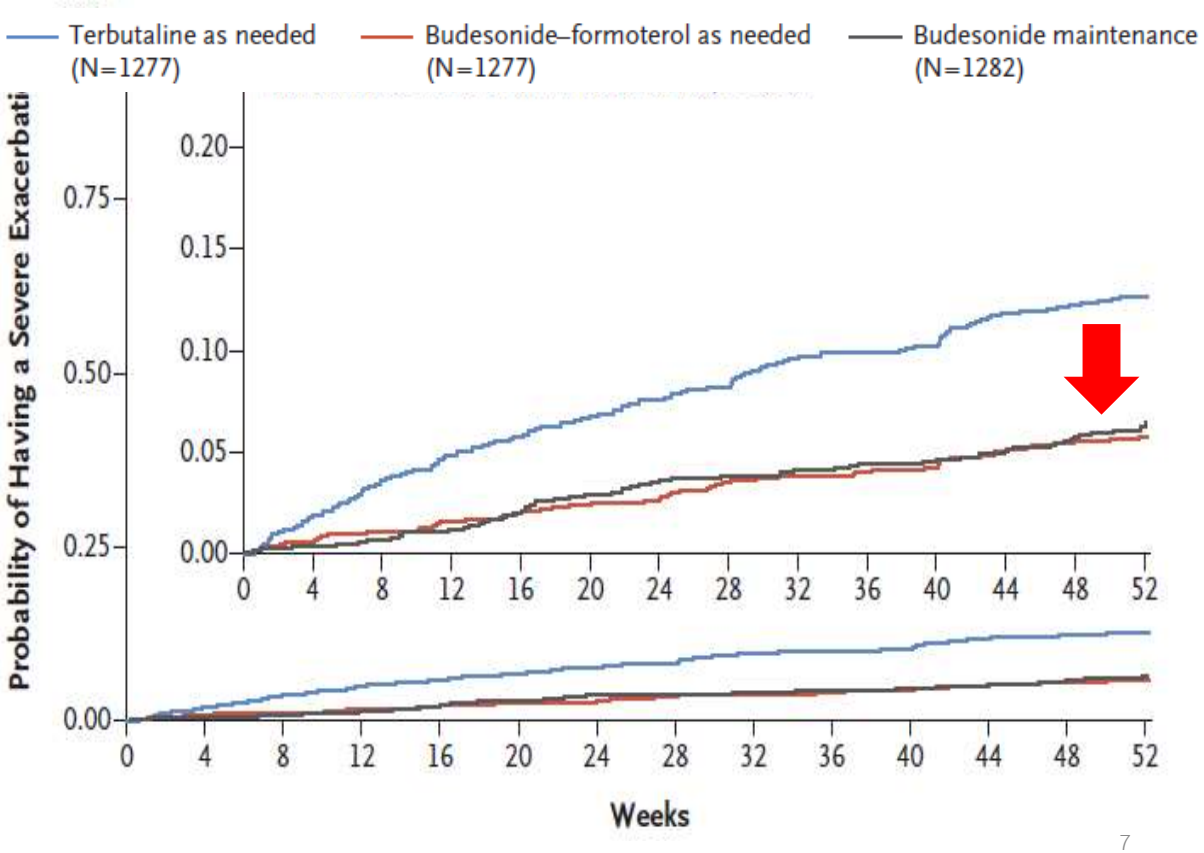
**** AIR therapy has strong evidence for a safer and more effective than SABA alone ****

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MAY 17, 2018 VOL. 378 NO. 20

Inhaled Combined Budesonide–Formoterol as Needed in Mild Asthma

Patients with mild asthma (N = 3,849, 52 wks)



O'Byrne, et al. N Engl J Med 2018;378:1865-76.

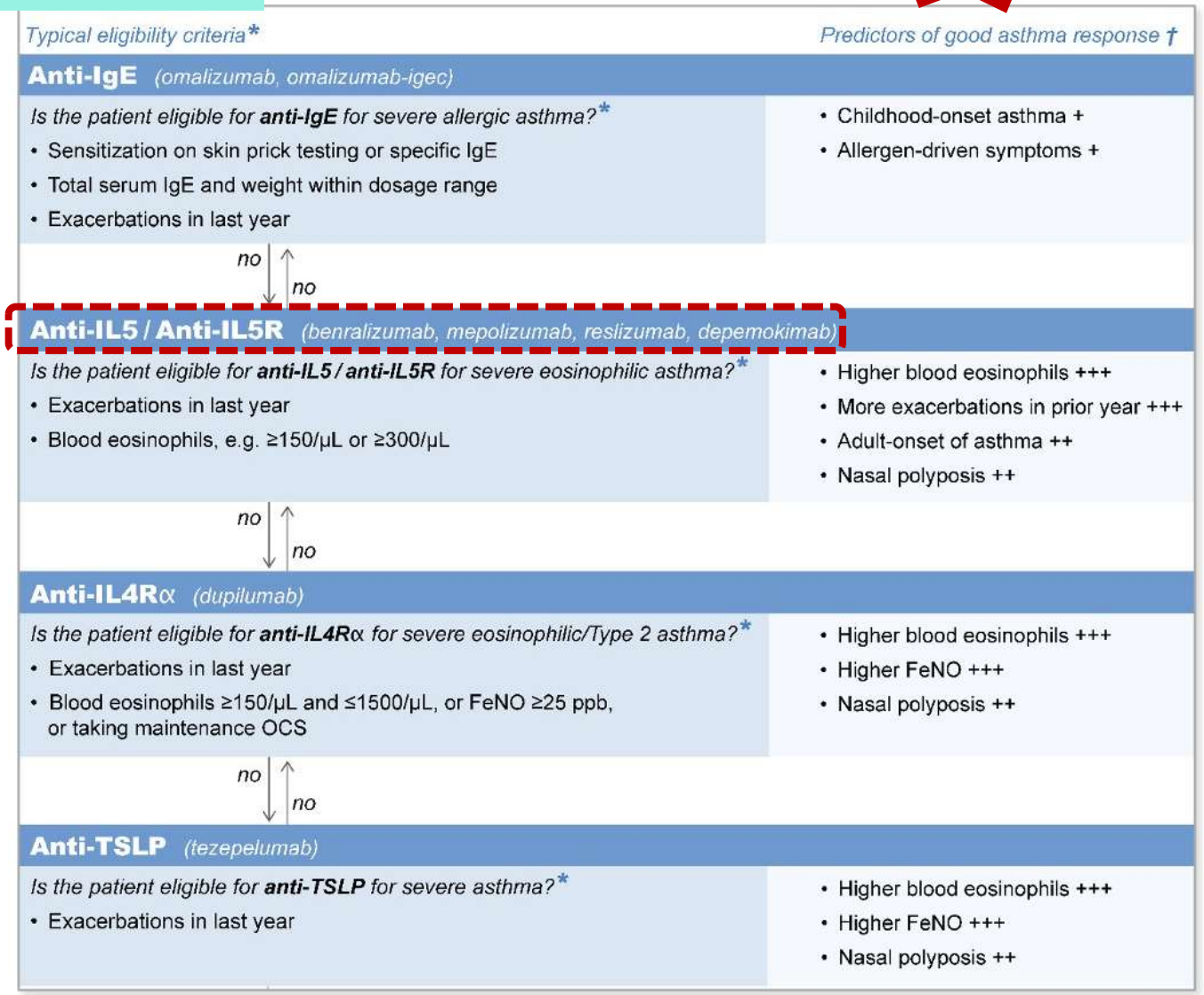
GINA for severe asthma:

Depemokimab: New long-acting anti-IL5

(q 6 mth), for severe eosinophilic asthma

2026

- Consider **add-on Type 2-targeted biologics** for patients with poor symptom control on high-dose ICS-LABA
- When choosing between available therapies, consider;
  - Local payer criteria
  - Predictors of response
  - **Co-morbid with a co-indication for biologics (non-asthma indications)**
  - Cost, frequency, route, and patient preference



Global INitiative for Asthma (GINA) 2026

GINA for severe asthma:

Choice of biological therapy: Co-morbidities

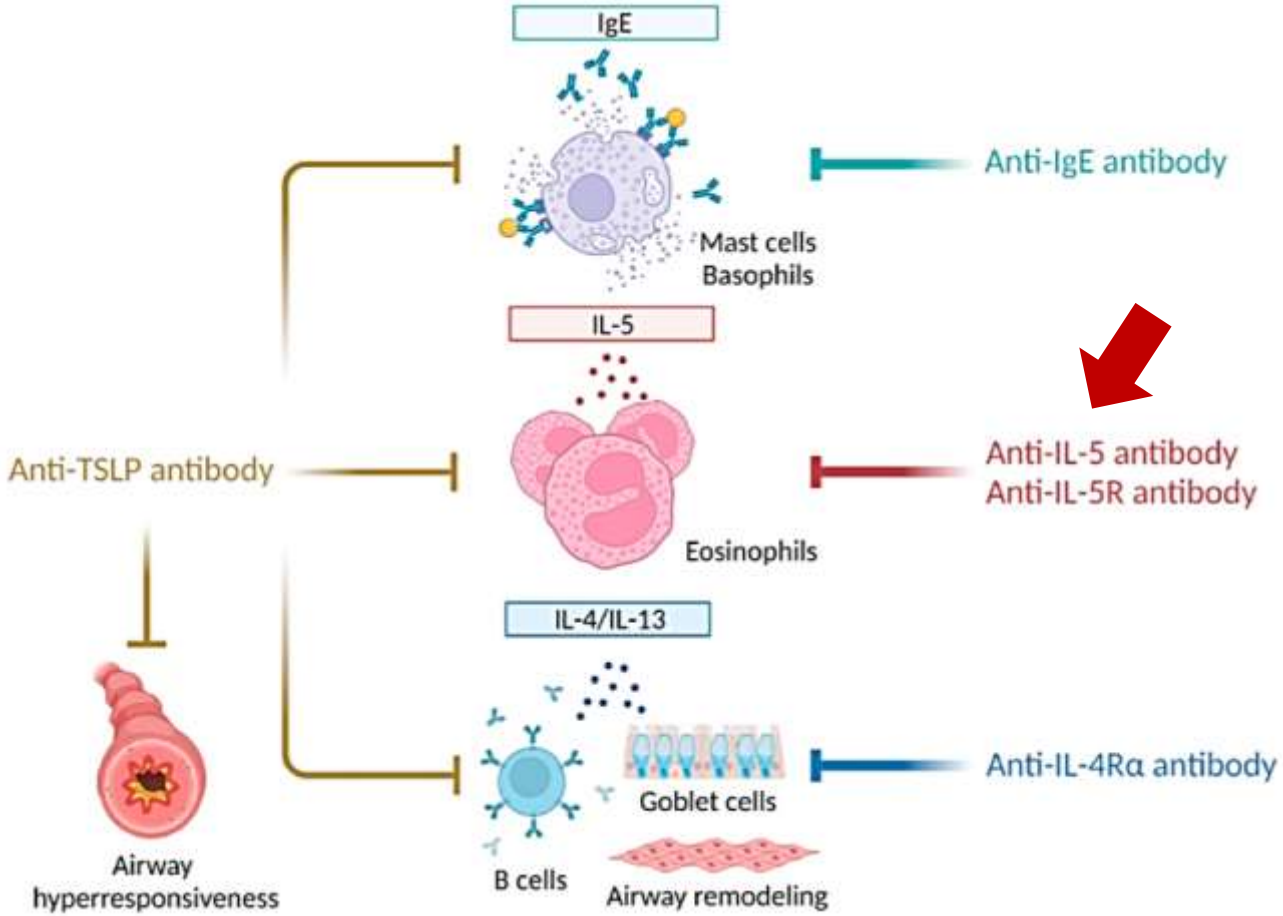
2026

Biologic	Non-asthma indications include…	Dose and frequency	Ages
Anti-IgE			
Omalizumab and omalizumab-igec	IgE-mediated food allergy	Based on weight and serum IgE	≥1 year
	CRSwNP	Based on weight and serum IgE	≥18 years
	Chronic spontaneous urticaria	150 mg or 300 mg SC every 4 weeks	≥12 years
Anti-IL5/5R			
Mepolizumab	CRSwNP	100 mg SC every 4 weeks	≥18 years
	COPD with eosinophilic phenotype	100 mg SC every 4 weeks	≥18 years
	EGPA	300 mg SC every 4 weeks	≥18 years
	Hypereosinophilic syndrome	300 mg SC every 4 weeks	≥12 years
Depemokimab	CRSwNP	100 mg SC every 26 weeks	≥18 years
Reslizumab	–	–	–
Benralizumab	EGPA	30 mg SC every 4 weeks	≥18 years
Anti-IL4Rα			
Dupilumab*	Moderate-to-severe atopic dermatitis	Adults: 300 mg SC every 2 weeks Children: based on age and weight	≥6 months
	Chronic spontaneous urticaria	Based on age and weight	≥2 years
	CRSwNP	300 mg SC every 2 weeks	≥12 years
	COPD with chronic bronchitis and eosinophilic phenotype	300 mg SC every 2 weeks	≥18 years
	Eosinophilic esophagitis	Based on weight	≥1 year
Anti-TSLP			
Tezepelumab	Chronic rhinosinusitis with nasal polyps	210 mg every 4 weeks	≥12 years

Global INitiative for Asthma (GINA) 2026

Depemokimab (Exdensur®): Long-acting anti-IL-5 (Twice-yearlY)

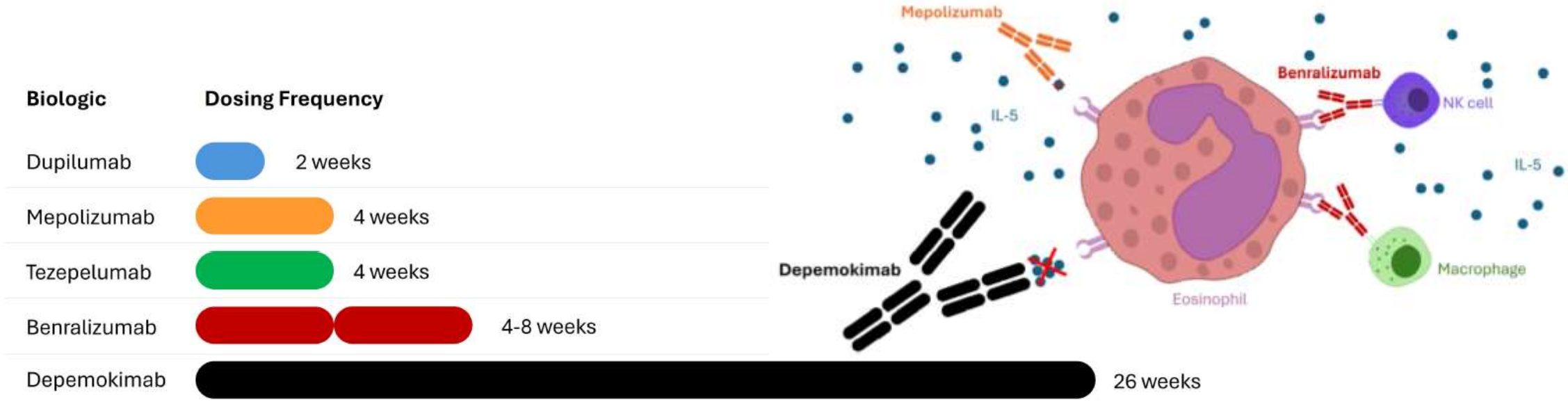
- Depemokimab is **humanized IgG1 mAb anti-IL-5** for **severe asthma with an eosinophilic phenotype** (FDA Approved: Dec16, 2025)
- **Mechanism: Targets IL-5 pathway**
  - Selectively binds soluble IL-5 and prevents it from binding to IL-5Rα on surface of eosinophils and basophils
  - Induces apoptosis in existing eosinophils and stops bone marrow from producing new eosinophils
- **Route:** Sc, 100 mg, every 26 wks (administered **biannually**)



Kurihara M, et al. Allergol Int. 2023;72(1):24-30.

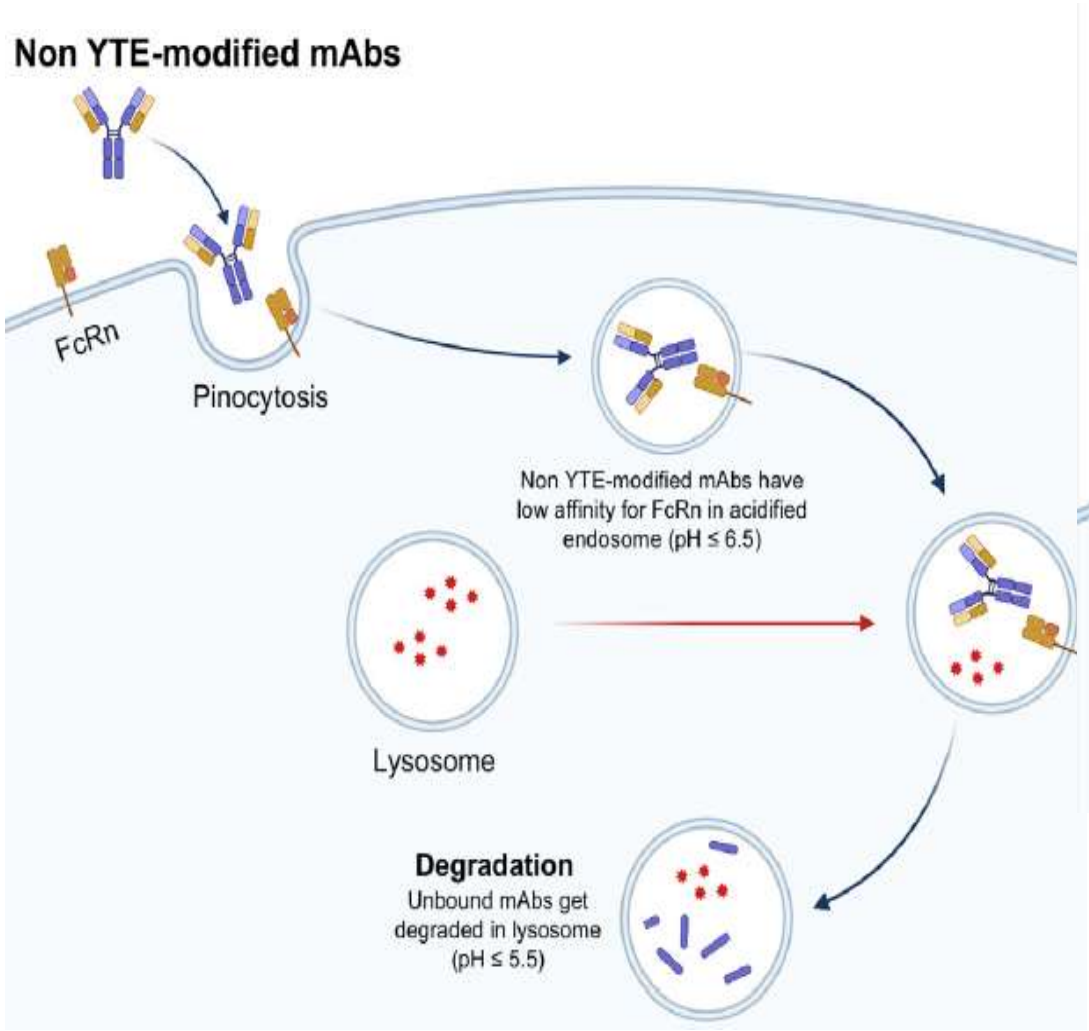
Comparative pharmacology of Type 2 biologics (Sc)

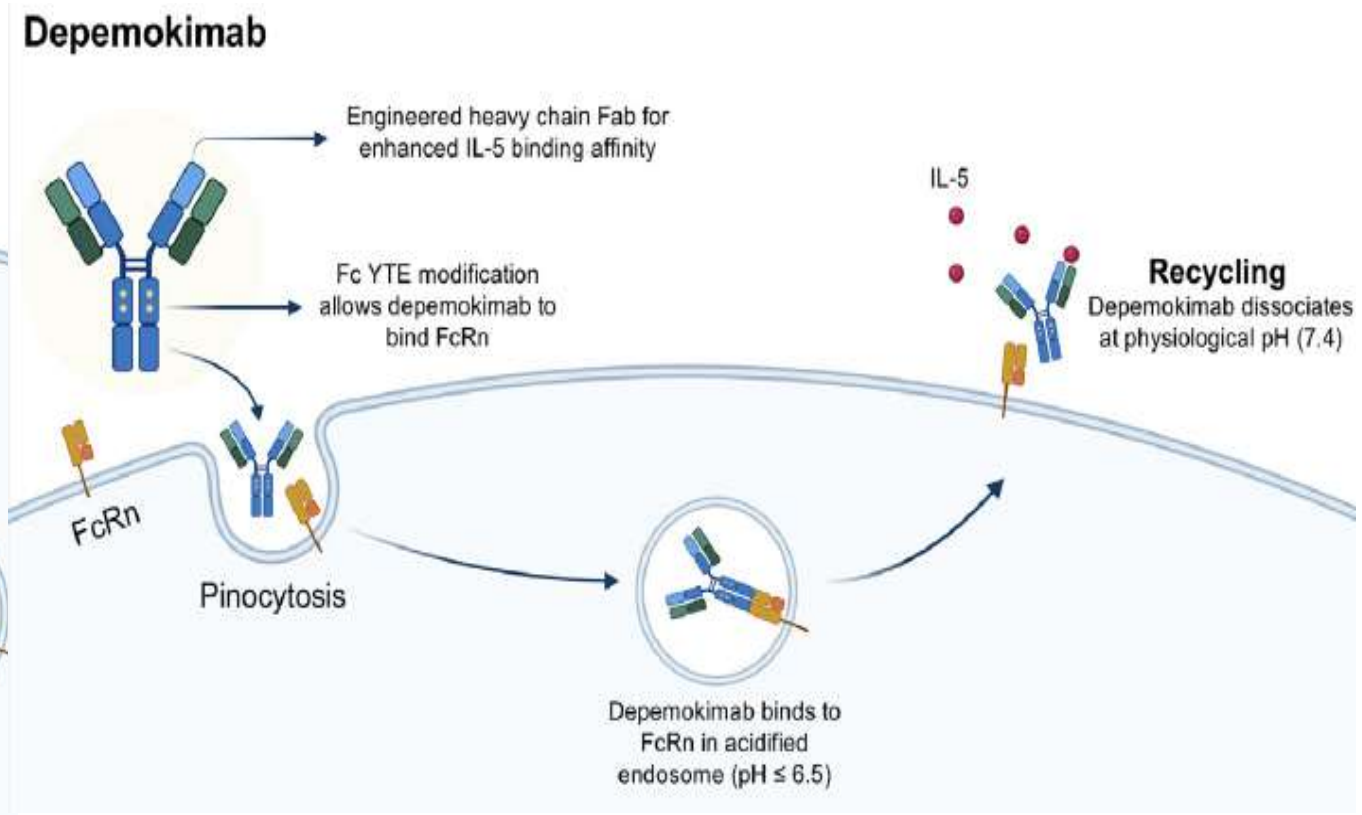
Feature	Depemokimab	Mepolizumab	Benralizumab	Dupilumab	Tezepelumab
Primary Target	IL 5 Ligand	IL 5 Ligand	IL 5R alpha	IL 4R alpha	TSLP
Dosage	100 mg	100 mg	30 mg	200 or 300 mg	210 mg
Dosing Frequency	Every 6 months	Every 4 weeks	Every 8 weeks*	Every 2 weeks	Every 4 weeks
Best Phenotype	High Eosinophils	High Eosinophils	High Eosinophils	Eos + FeNO	Broad T2
Immunogenicity	Low	Low	Low	Low	Low
Admin Route	SC (HC Prof)	SC (Self/HC Prof)	SC (Self/HC Prof)	SC (Self admin)	SC (Self/HC Prof)



Marra AM, et al. Front Immunol. 2026;17:1783889.

Depemokimab: Twice-yearly regimen

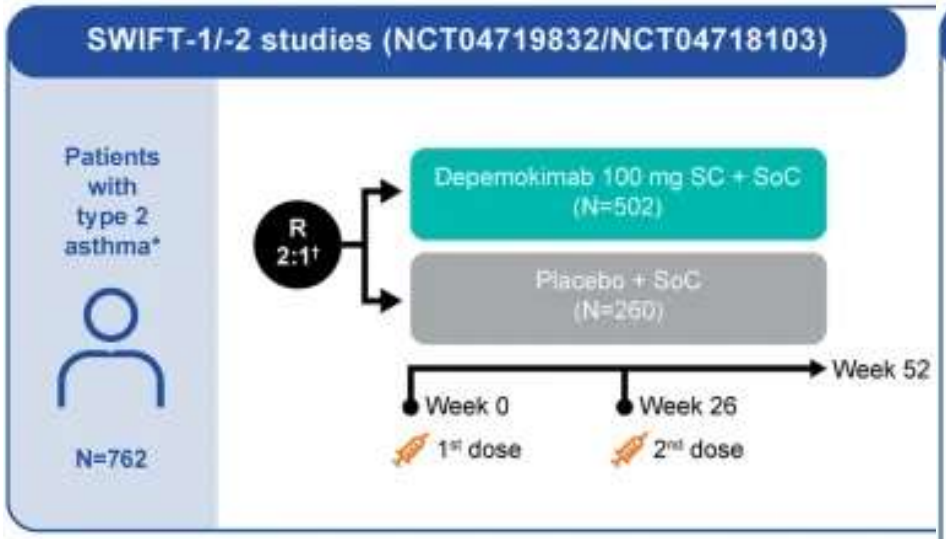


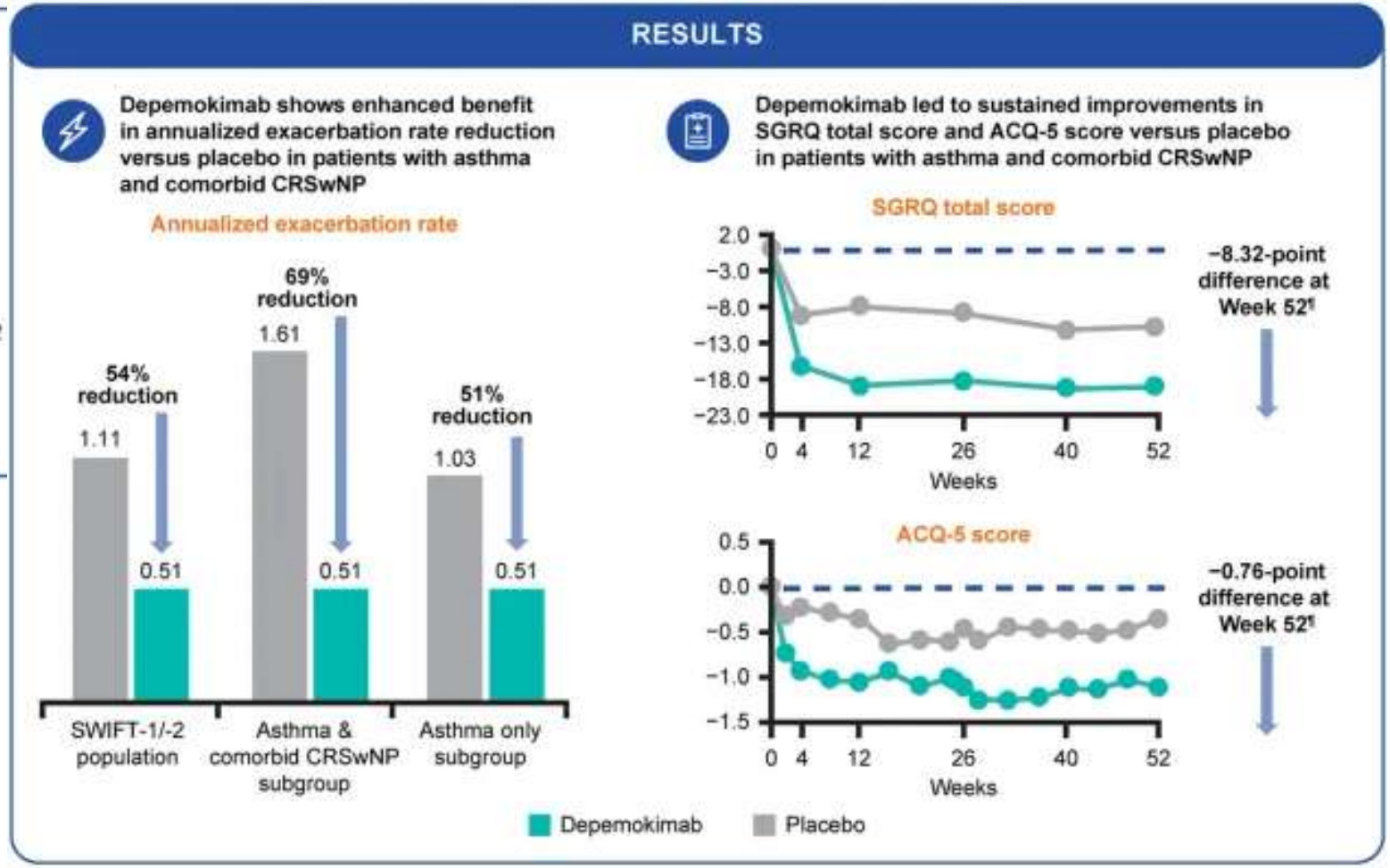


The triple amino acid substitution (**YTE modification**) **increases binding affinity for Fc receptor (FcRn) at acidic pH**, promoting endosomal recycling and extending the systemic half-life to 20 weeks.

Nolasco S, et al. Med. 2024;5(12):1452-1455.

SWIFT-1/-2 Trials: Depemokimab shows efficacy in type 2 asthma with comorbid CRSwNP





Depemokimab, At wk 52 (2 doses)

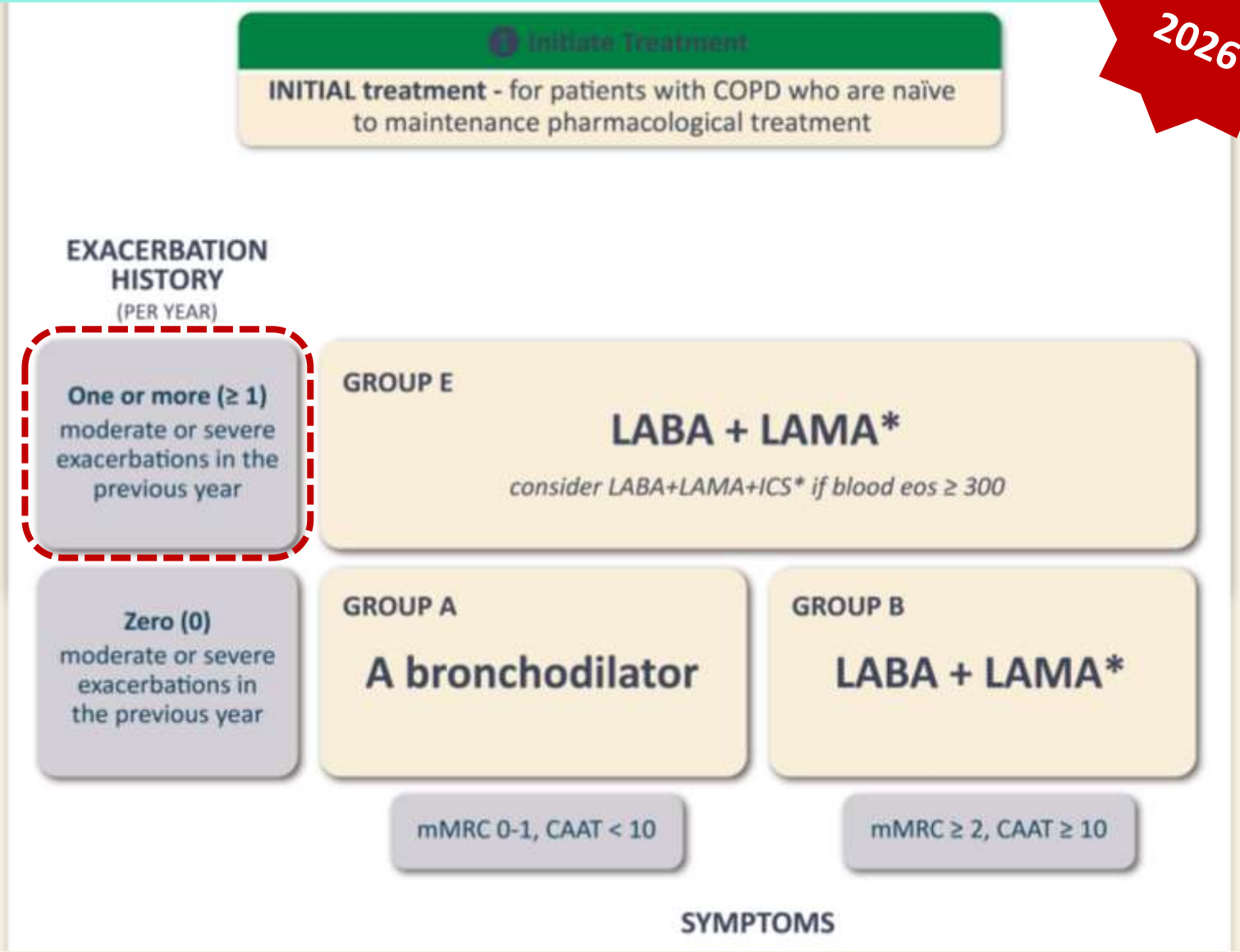
- ↓ **Annual exacerbation rate**
- ↓ **SGRQ score**
- ↓ **ACQ-5 score**

Heffler E, et al. Front Allergy. 2026;7:1766647.

GOLD for COPD: Initial pharmacological treatment

2026

2026 Teaching Slide Set



© 2025, 2026 Global Initiative for Chronic Obstructive Lung Disease

GOLD for COPD: Follow-up pharmacological treatment

2026

2026 Teaching Slide Set

IF PERSISTENT DYSPNEA

LABA or LAMA

↓

LABA + LAMA[a]

↓

- Consider switching inhaler device or molecules
- Implement or escalate non-pharmacological treatment(s)
- Consider adding ensifentrine
- Investigate (and treat) other causes of dyspnea

IF ONE OR MORE MODERATE OR SEVERE EXACERBATION

LABA or LAMA

- if blood eos < 300 → LABA + LAMA[a]
- if blood eos ≥ 300 → LABA + LAMA + ICS[a]

LABA + LAMA[a]

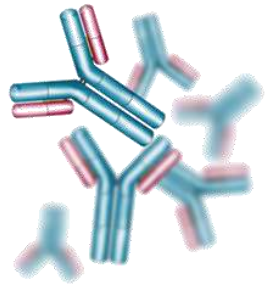
- if blood eos < 100 → Roflumilast *if FEV1 < 50% & chronic bronchitis*
- if blood eos ≥ 100 → LABA + LAMA + ICS[a]

LABA + LAMA + ICS[a]

- → Azithromycin *preferentially in former smokers*
- if two moderate or one severe exacerbation **AND** if blood eos ≥ 300 → **Biologic Therapy:**[b] (see Figure 3.11)
  - Dupilumab (*if chronic bronchitis*)[c]
  - Mepolizumab

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Summary: Airway Pharmacology 2026



- Asthma and COPD management has shifted from a “one-size-fits-all” approach to “personalized treatment” based on disease features, exacerbation risk, biomarkers, and treatable traits
- In asthma, ICS-containing therapy remains the cornerstone, with ICS–formoterol preferred to reduce exacerbations.
- In COPD, LABA and/or LAMA are the foundation of treatment, with triple therapy guided by exacerbation history and blood eosinophil counts
- Biological therapies are advancing precision medicine for severe asthma and selected COPD phenotypes
- Optimal outcomes also require correct inhaler use, adherence, smoking cessation, vaccination, and regular reassessment.





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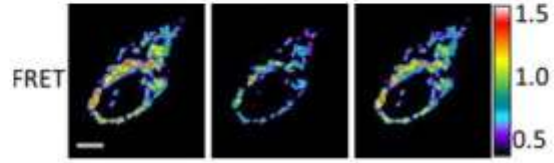
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warisara.par@mahidol.ac.th

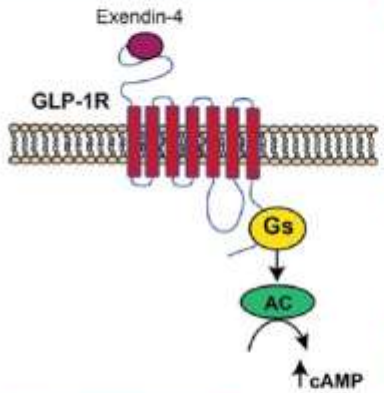
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(Last update: May 2026)

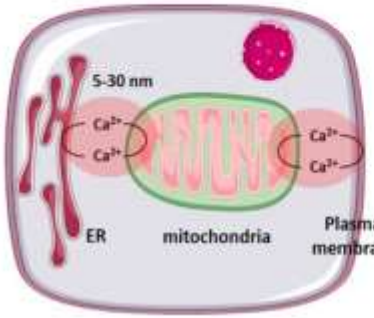
Cardiovascular Pharmacology

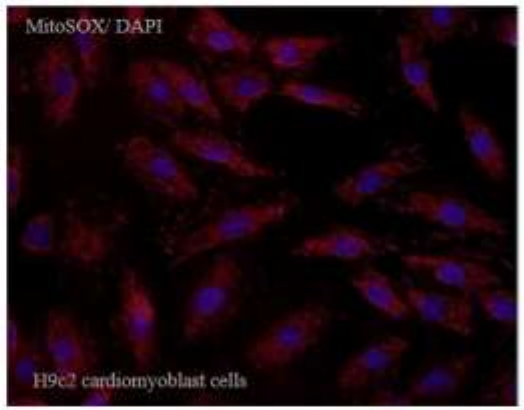
Research Interest:

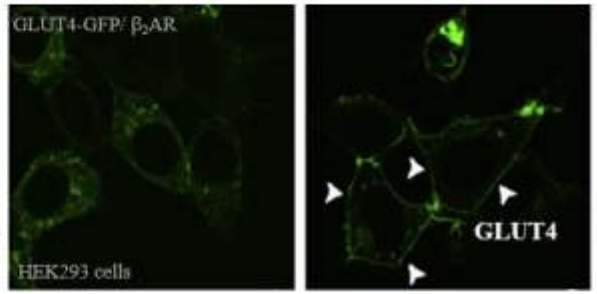
- G protein-coupled receptors linked to mitochondrial dysfunction in insulin resistance and cardiovascular diseases
- Mitochondrial function in aging and aging-related diseases
- Mitochondrial calcium signaling and uptake machinery
- Pharmacological activities of herbal medicine and chemical compounds











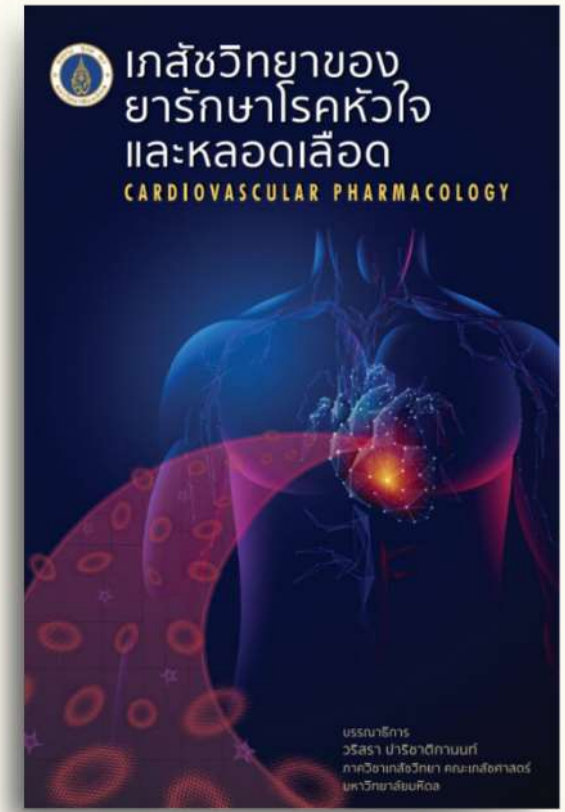
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Textbook



เภสัชวิทยาของยารักษาโรคหัวใจและหลอดเลือด



โดย รศ.ดร.ภญ. วริสรา ปาริชาติกานนท์
ภาควิชาเภสัชวิทยา คณะเภสัชศาสตร์
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"I stopped to smell the flowers. Where's my inhaler?"