

Allergies and Asthma

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Disclosures

- I am employed by the University of Arizona and Banner University Medical Center.
- I have received funding for basic science research related to asthma from the National Institutes of Health, the State of Arizona, and the University of Arizona.
- I have received funding for clinical research related to asthma from Sanofi (who makes Dupilumab, used to treat asthma)
- I may mention off label uses of medications used to modify biological responses in allergies and asthma

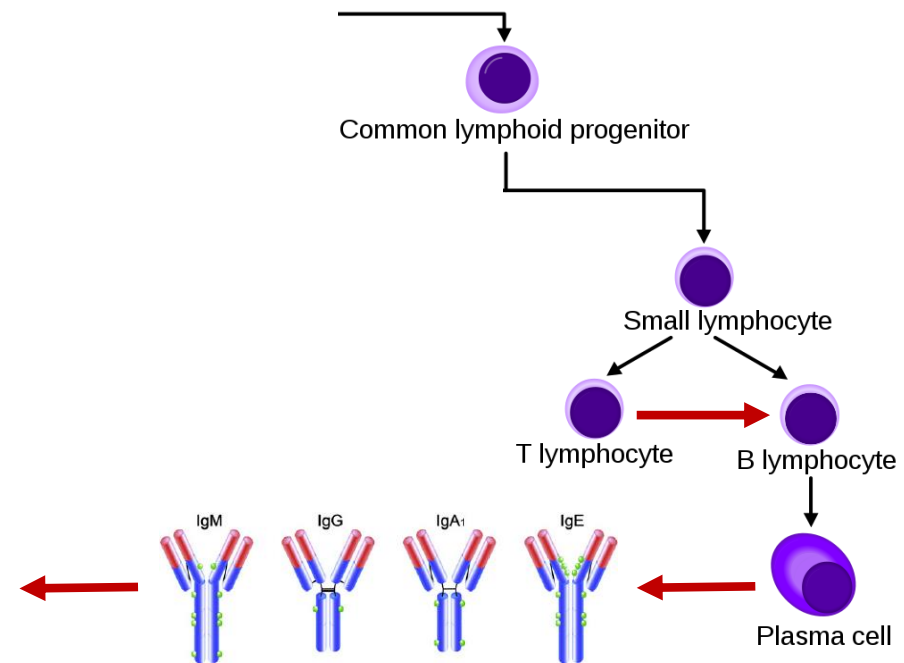
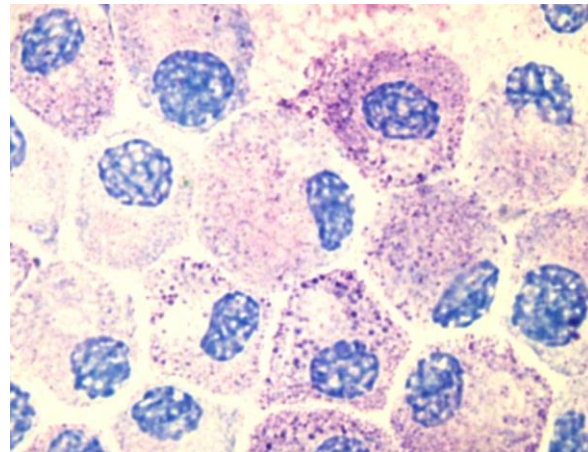
Learning Objectives

- To understand how environmental allergies can impact asthma
- To understand which allergens associate with the development of asthma
- To understand how some treatment options can improve both allergies and asthma

Lets start with definitions

- T cells
- B cells
- Mast cells
- IgE

Histamine and other inflammatory mediators



What is the point of having allergies?

- Immune processes that lead to allergies have roles on host defense
- Mostly protection from parasites, probably
- This misdirected type of immune response to other exposures leads to allergies

What are the systems that can be impacted by allergies?

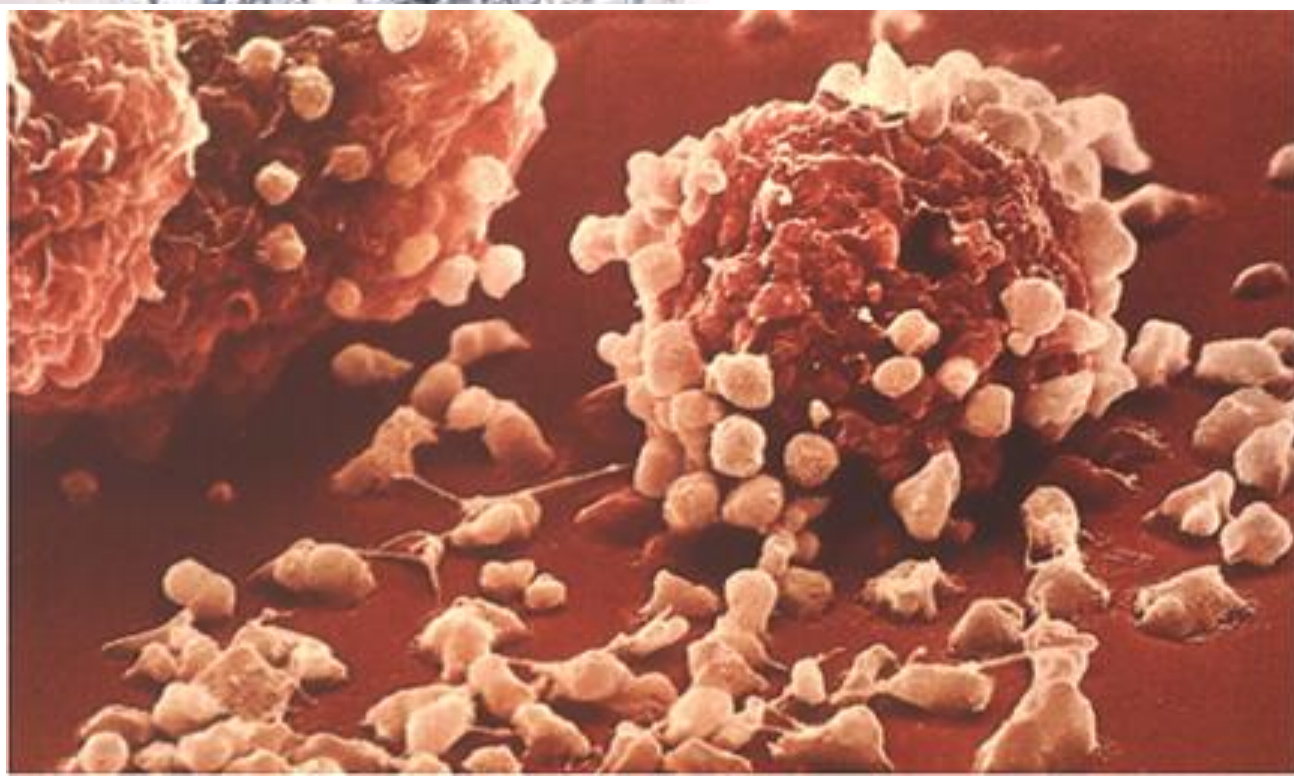
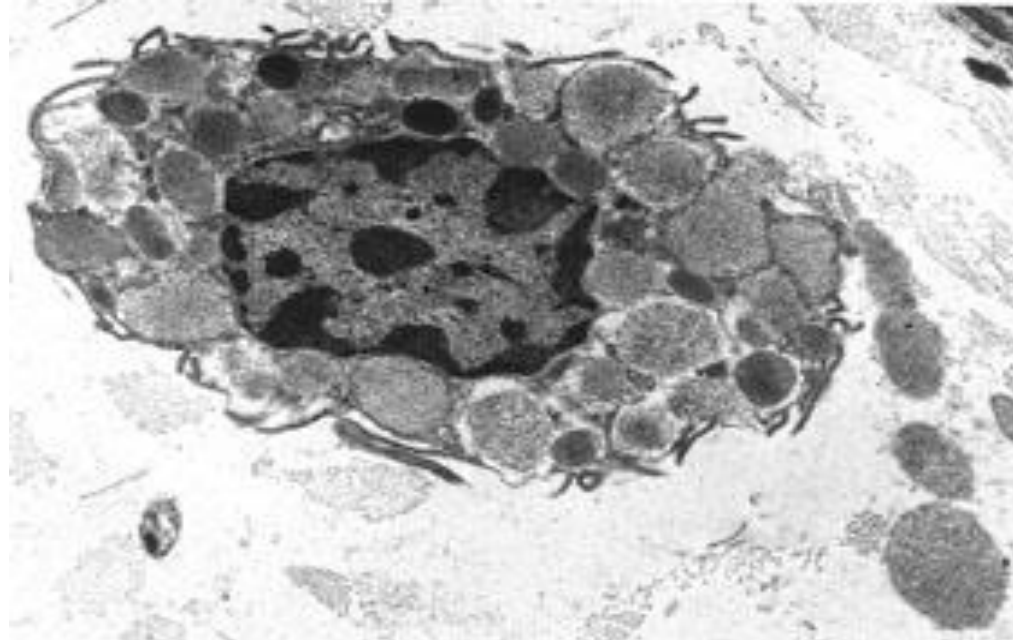
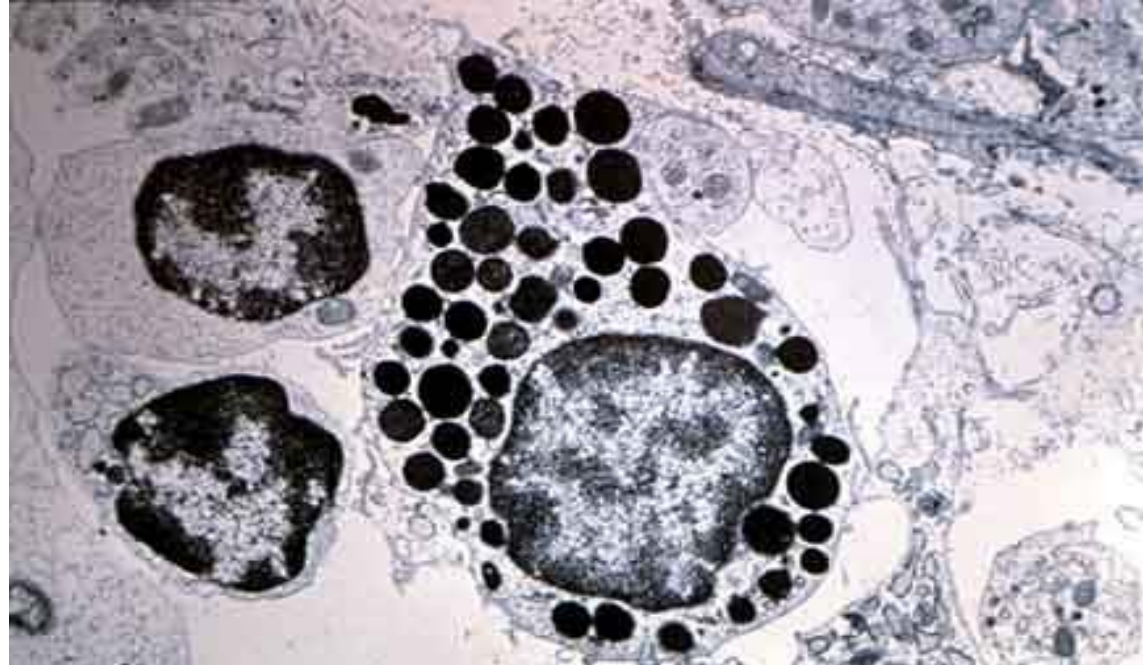
- GI tract
 - -Eosinophilic esophagitis
 - food allergies
- Skin
 - Eczema
- Systemic
 - Drug
 - Venom
- Respiratory tract
 - Allergic rhinitis
 - Asthma

What kind of things can you be allergic to?

- Virtually anything
 - But remember definitions are important, so we focus on IgE mediated reactions to proteins
- These proteins can come from plants, animals, fungi, arthropods.
 - Basically any living thing capable of making a protein

Can more than one system be impacted by allergies? Does that make things worse?

- Propensity to developing allergies has a strong genetic condition
- People will find their allergen, a lot depends on exposures and their timing
- There are critical windows where there are higher and lower risks of developing allergy or tolerance.



What is asthma

- Asthma is a common and serious chronic disease that can be controlled but not cured affecting 10% of school aged children
- National institutes of Health Institutes of of Health Expert Panel defines asthma as:
 - Airway obstruction that is reversible - partially or completely
 - Airway inflammation
 - Airway hyperresponsiveness

Asthma symptoms

- Common asthma symptoms include wheezing, shortness of breath, chest tightness and cough
- Children often have a difficult time breathing air out of the lungs due to bronchoconstriction (airway narrowing), airway wall thickening and increased mucous
- Potential triggers can include viral infection, allergens, tobacco smoke, exercise, changes in the weather, irritants, strong smells, laughter and stress
- Symptoms vary over time and intensity

Signs of well-controlled asthma

- No troublesome symptoms at night (ie cough, needing to use rescue inhaler at night)
- Need to use reliever medications <2 times per week during the day and <2 times during the night per month
- Can have physically active lives
- Have normal lung function
- Have no exacerbations or severe attacks

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Where does all this information come from? What does it mean for people in Arizona?

- ‘I moved here for my allergies’
- Different regions have different allergens
- Different allergens can be more likely to associate with the development of asthma
- Arizona has a unique climate/environment and assortment of allergens that make things very challenging

Two things to consider

- Are there allergic sensitizations that make you more likely to have asthma
- Does allergic sensitization and exposure make asthma worse

Yes and Yes

Are there things you can be allergic to that make you more likely to have asthma?

- YES! It depends on where you live, but
 - Cockroaches
 - Dust mites
 - Mold (indoor and outdoor)
 - Mouse urine

Are there things that you can be allergic to that make your asthma worse?

- Yes, same allergens as make you more likely to have asthma, but also pets, pollen

What about non-allergen exposures?

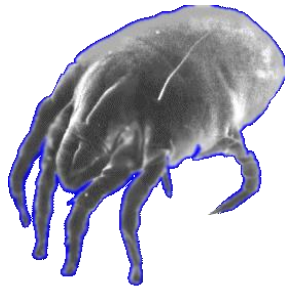
- Only a small set of allergens cause asthma
 - Cockroaches, fungi, and mites
 - Chitin production characteristic to these asthmagens.
- Chitin, a proinflammatory polysaccharide, serves as exoskeletons arthropods and spore walls of fungi
- Endotoxins (LPS) and glucans also lead to lung inflammation and asthma
- Tobacco smoke, viruses, irritants all can make symptoms worse

NAEPP Guidelines and Indoor Allergens

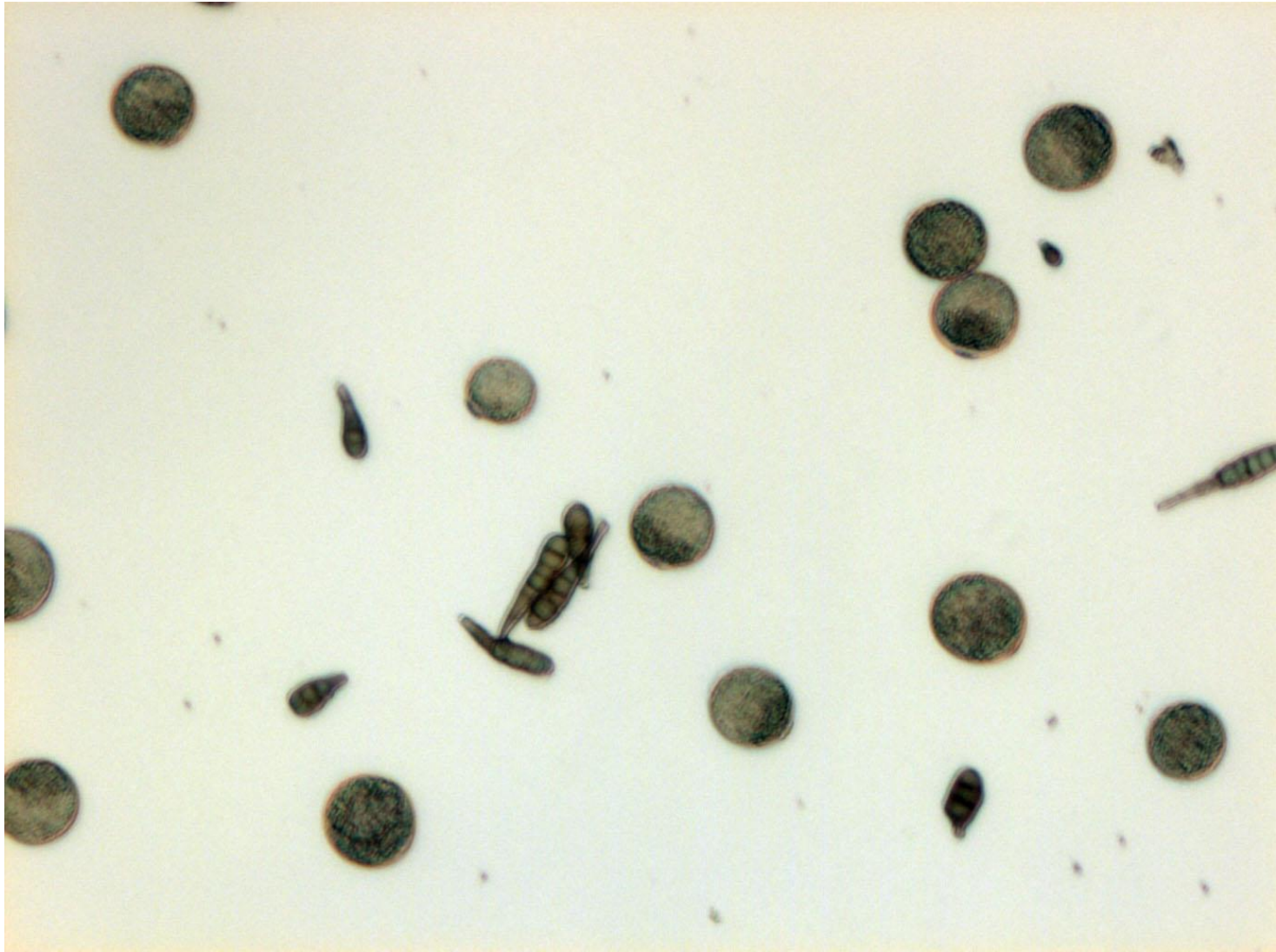
- In asthma patients who are sensitized, allergen exposure:
 - increases asthma symptoms
 - precipitates asthma exacerbations
- For at least patients with persistent asthma:
 - evaluate the potential role of allergens, particularly indoor inhalant allergens

The Major Clinically Relevant Aeroallergens of North America: Indoor Aeroallergens

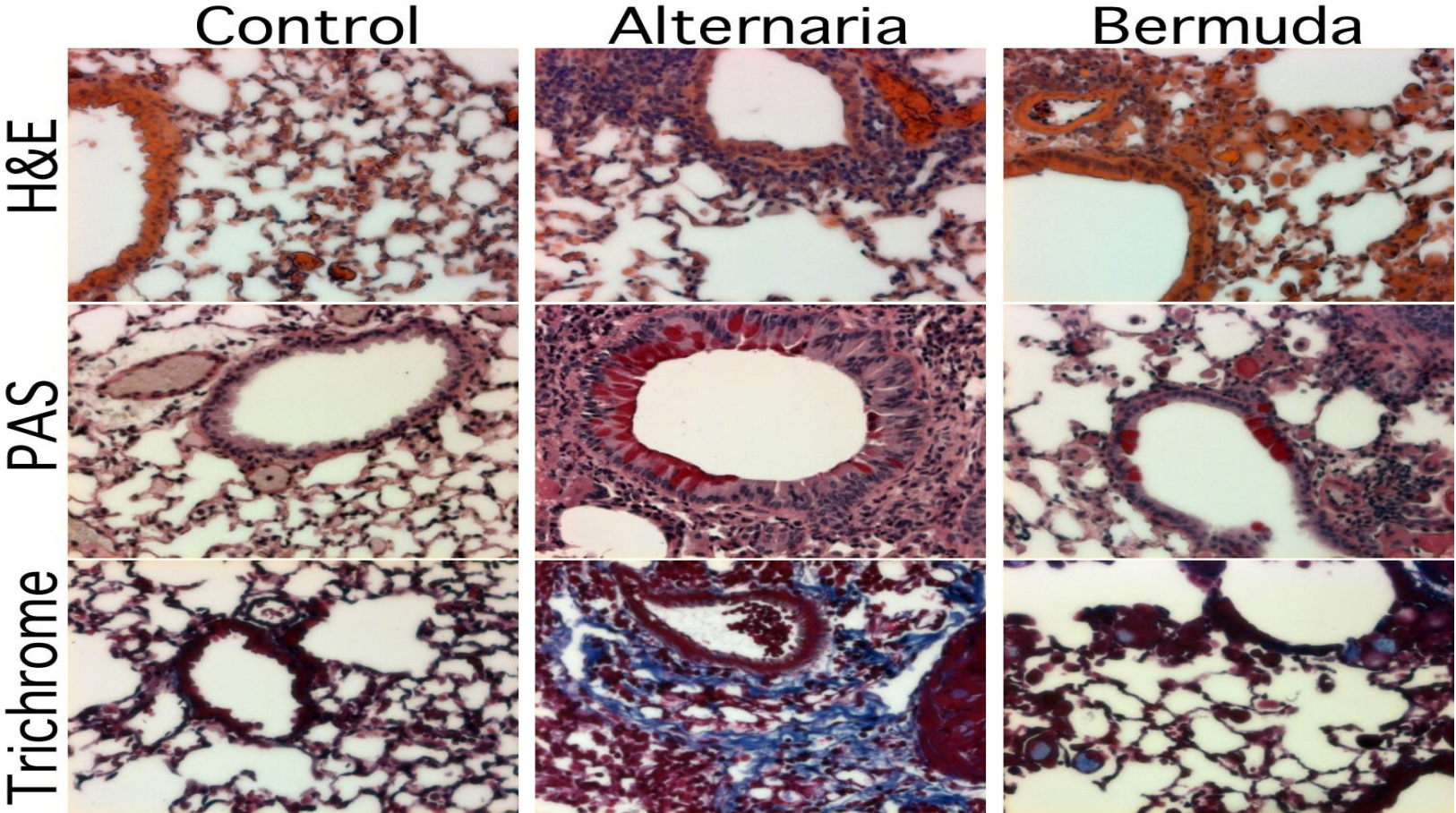
- Cat epithelium (*Felis domesticus*)
- Dog epithelium (*Canis familiaris*)
- Rodents (*Mus musculus*, *Rattus rattus/norvegicus*)
- Arthropods (domestic mites):
 - *Dermatophagoides farinae*,
 - *Dermatophagoides pteronyssinus*
- Insects (German cockroach: *Blattella germanica*)







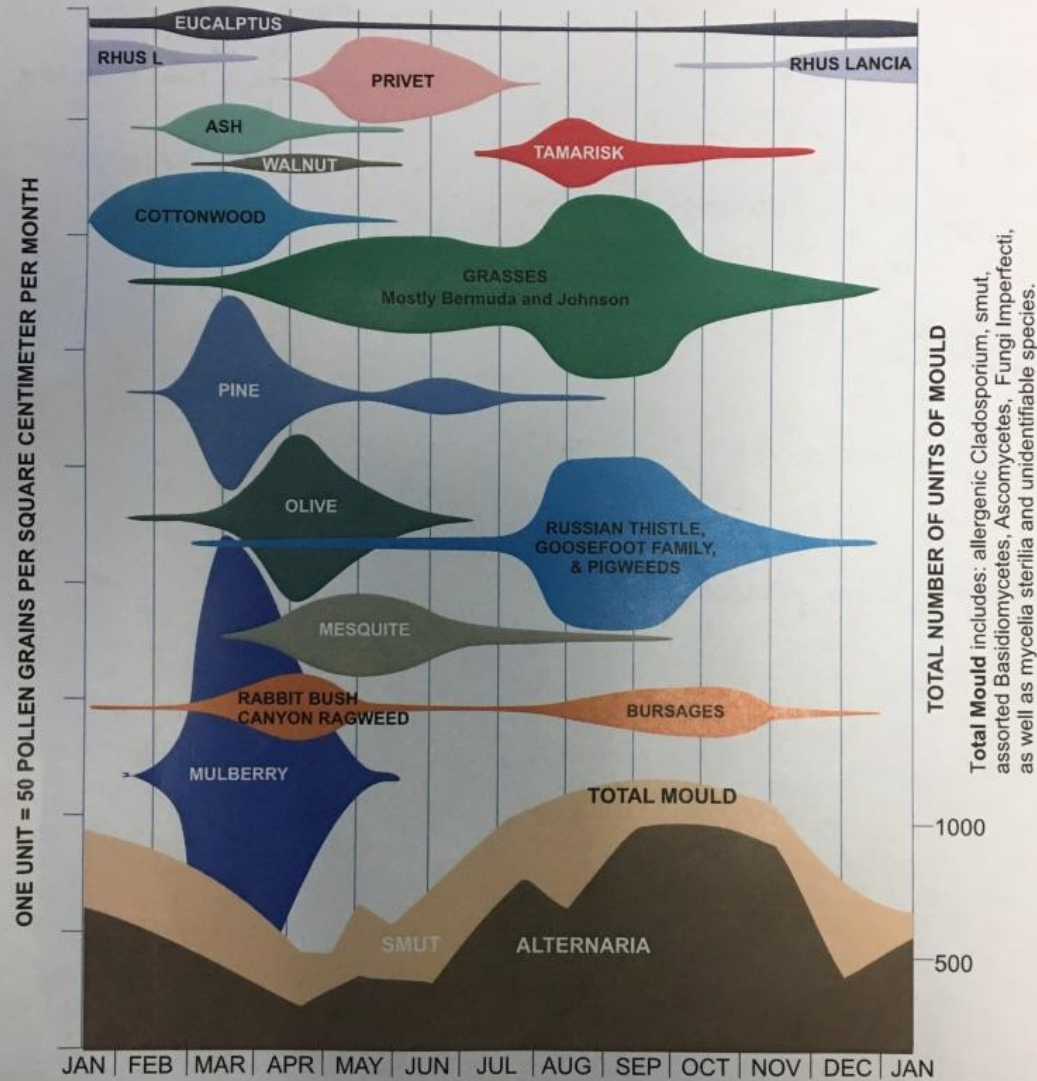
Remodeling in allergen and asthmagen exposure



Where does all this information come from? What does it mean for people in Arizona?

- Different regions have different allergens, and Arizona has unique climate issues
- Minimal humidity, so dust mites aren't as much of an issue
- Minimal rain, so pollen stays in the air FOREVER
- Alternaria (outdoor mold) sensitization is the strongest predictor for the development/persistence of asthma
- Other allergens don't associate with the development of asthma, but can make asthma worse

TUCSON POLLEN and MOULD CALENDAR



Total Mould includes: allergenic Cladosporium, smut, assorted Basidiomycetes, Ascomycetes, Fungi Imperfecti, as well as mycelia sterilia and unidentifiable species.

* Based on Mean Monthly Pollen and Mould Particle Deposition over 20 year period measured at 116 N. Tucson Blvd.

DATA COLLECTION COMMISSIONED BY TUCSON MEDICAL ASSOCIATES
 POLLEN ANALYZED BY H.D. HAYES
 DATA ANALYZED AND ILLUSTRATED BY A.M. SOLOMON AND H.D. HAYES
 MOULD DATA ANALYZED BY M. SNELLER
 Indoor pollen and mould may follow outdoor incidence.

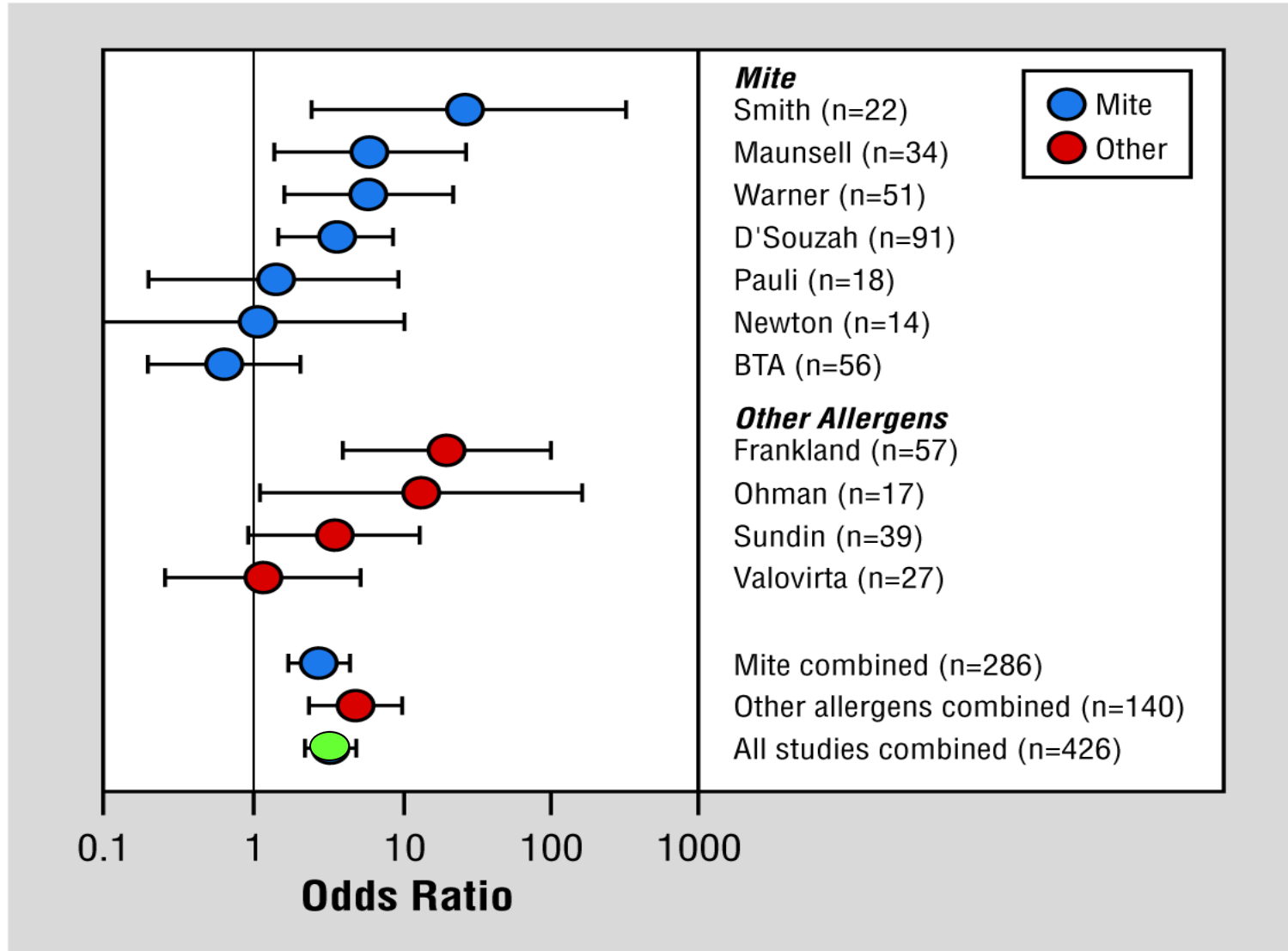
Does treating allergies help asthma?

- Yes, of course.

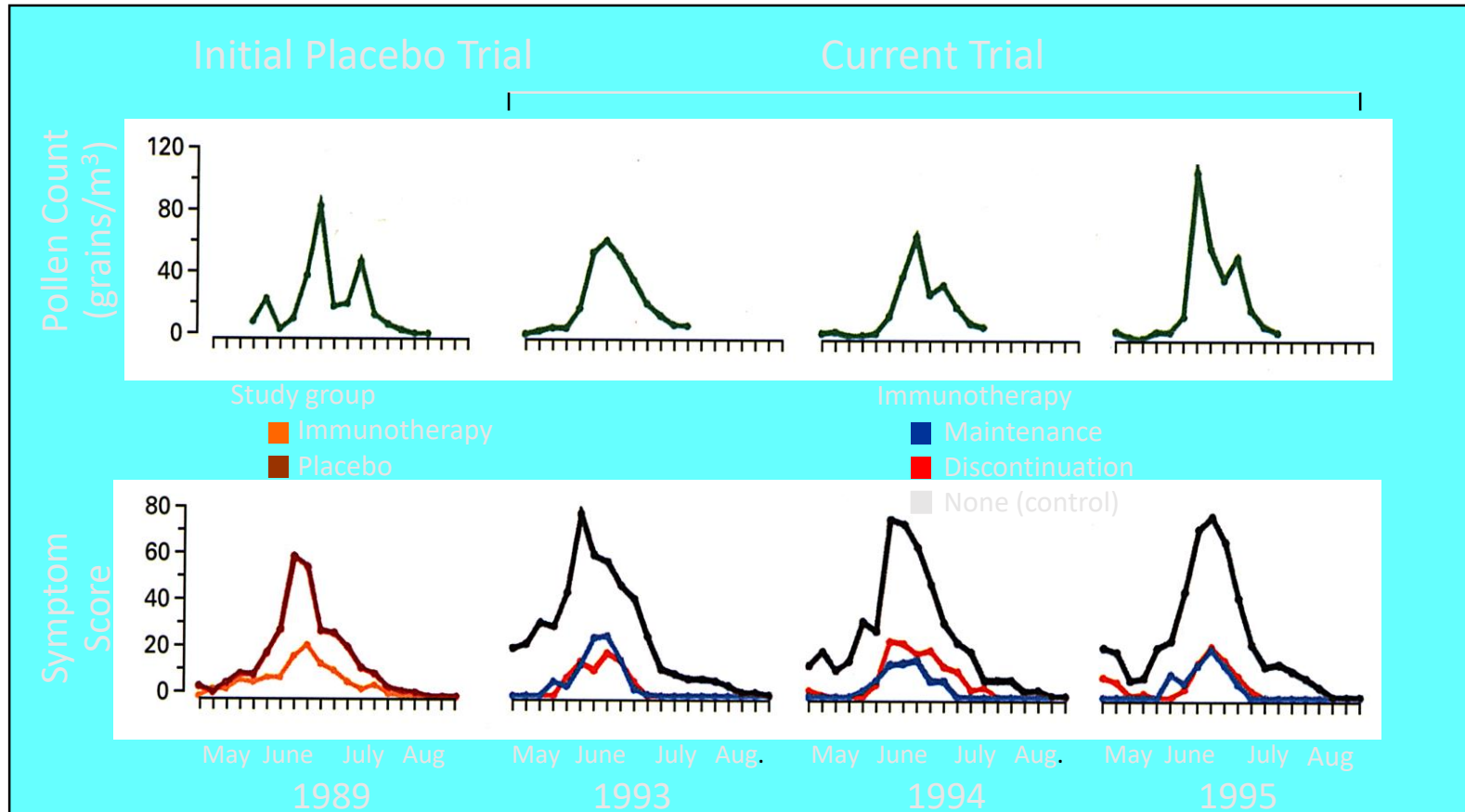
Efficacy of Allergen Injection Immunotherapy for Seasonal Allergic Rhinitis

- Meta-analysis
 - 51 studies, 2871 participants (1645 active)
- Results
 - ↓ Symptoms: SMD -0.73 (95% CI -0.97 to -0.50, $P < 0.00001$)
 - ↓ Medications: SMD -0.57 (95% CI -0.82 to -0.33, $p < 0.00001$)
- Conclusion
 - Significant reduction in symptom scores and medication use with no long term adverse effects

Improvement in Asthma Symptoms after IT



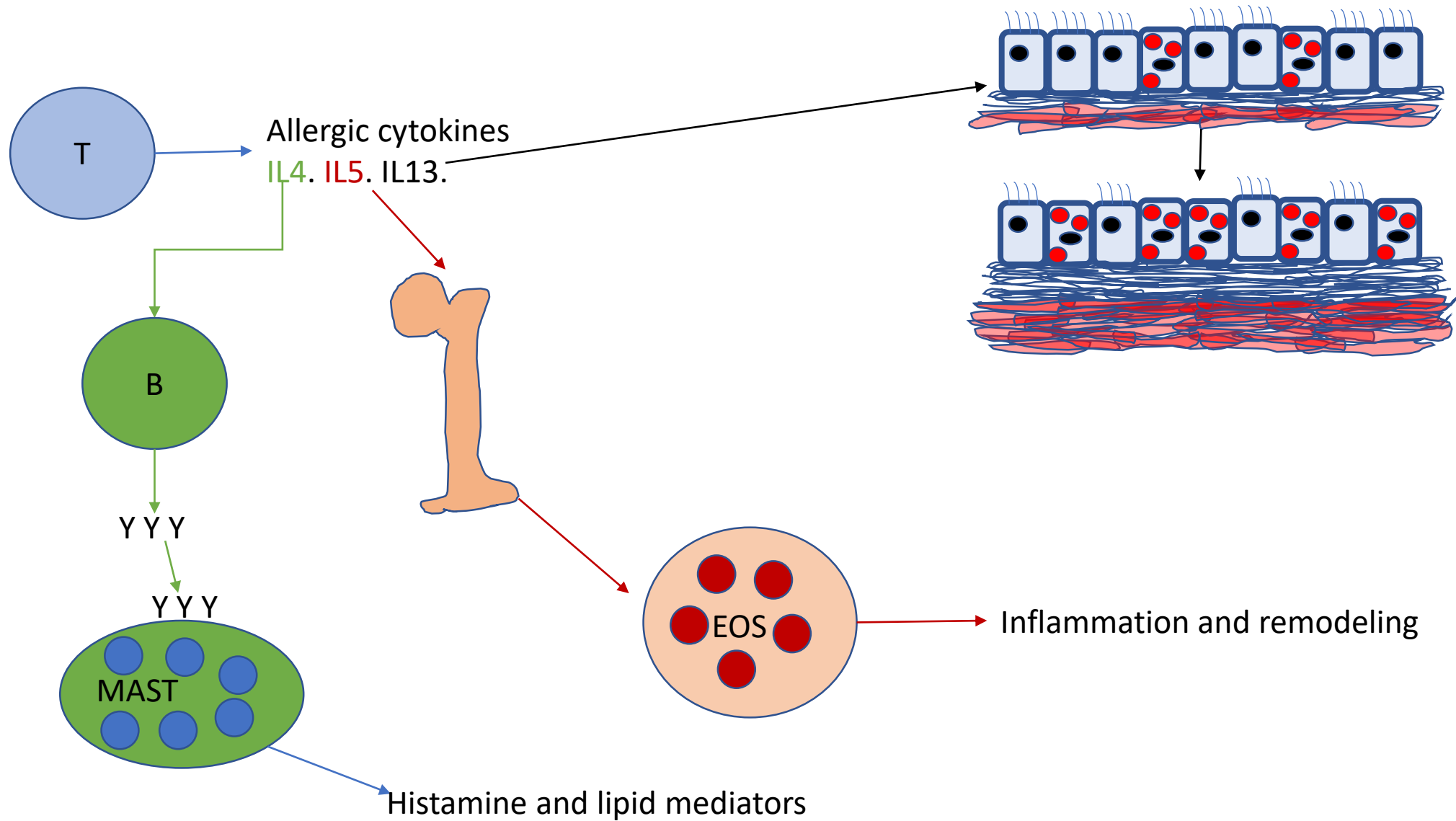
Beneficial Effects of 3 to 4 Years of SIT Persist for at Least 3 Years After Discontinuation



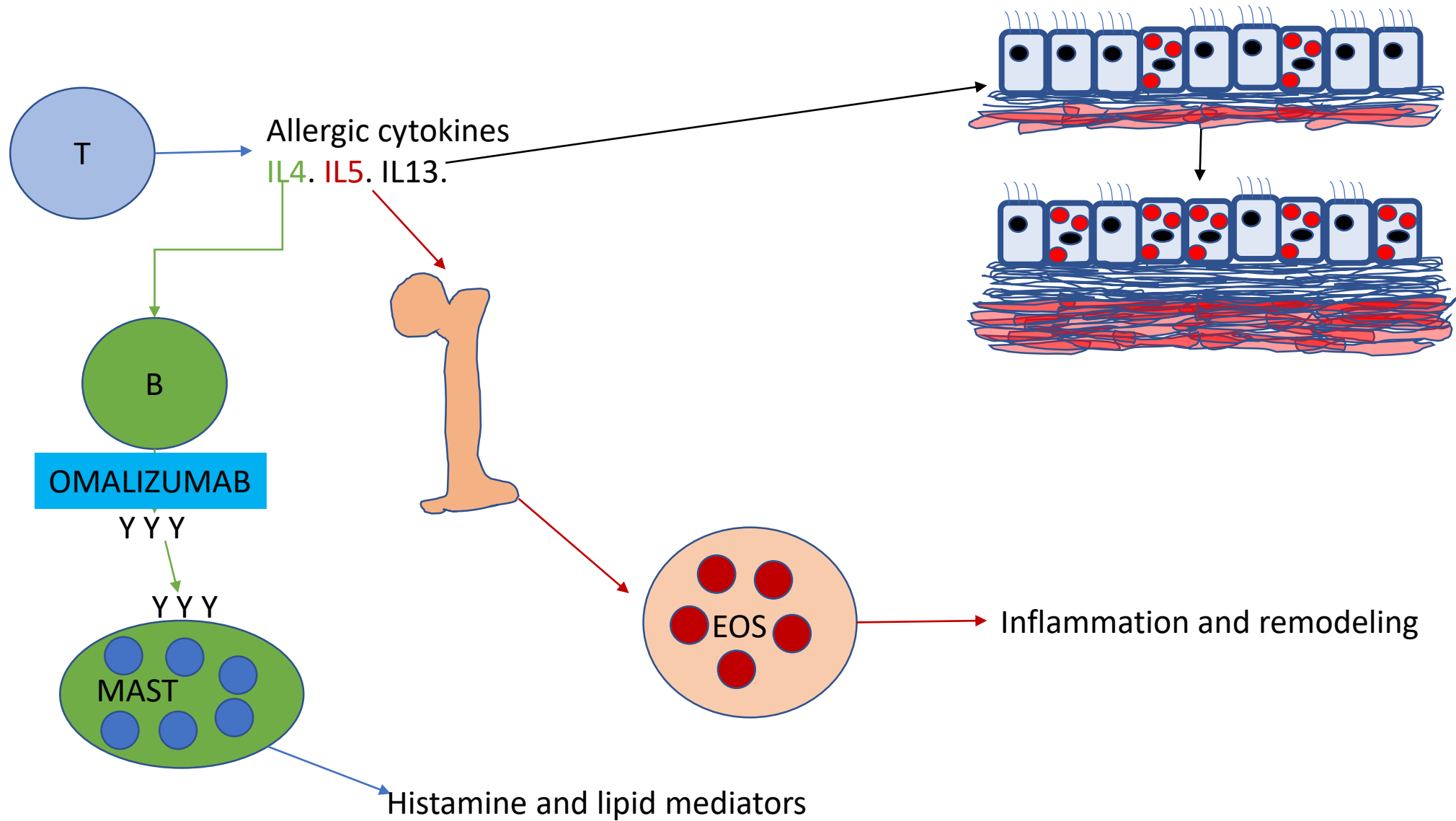
What are the treatment options for allergies?

- Nothing
- Short acting beta agonists
- Leukotriene modifiers
- Inhaled corticosteroids
- Long acting beta agonists
- Biological agents

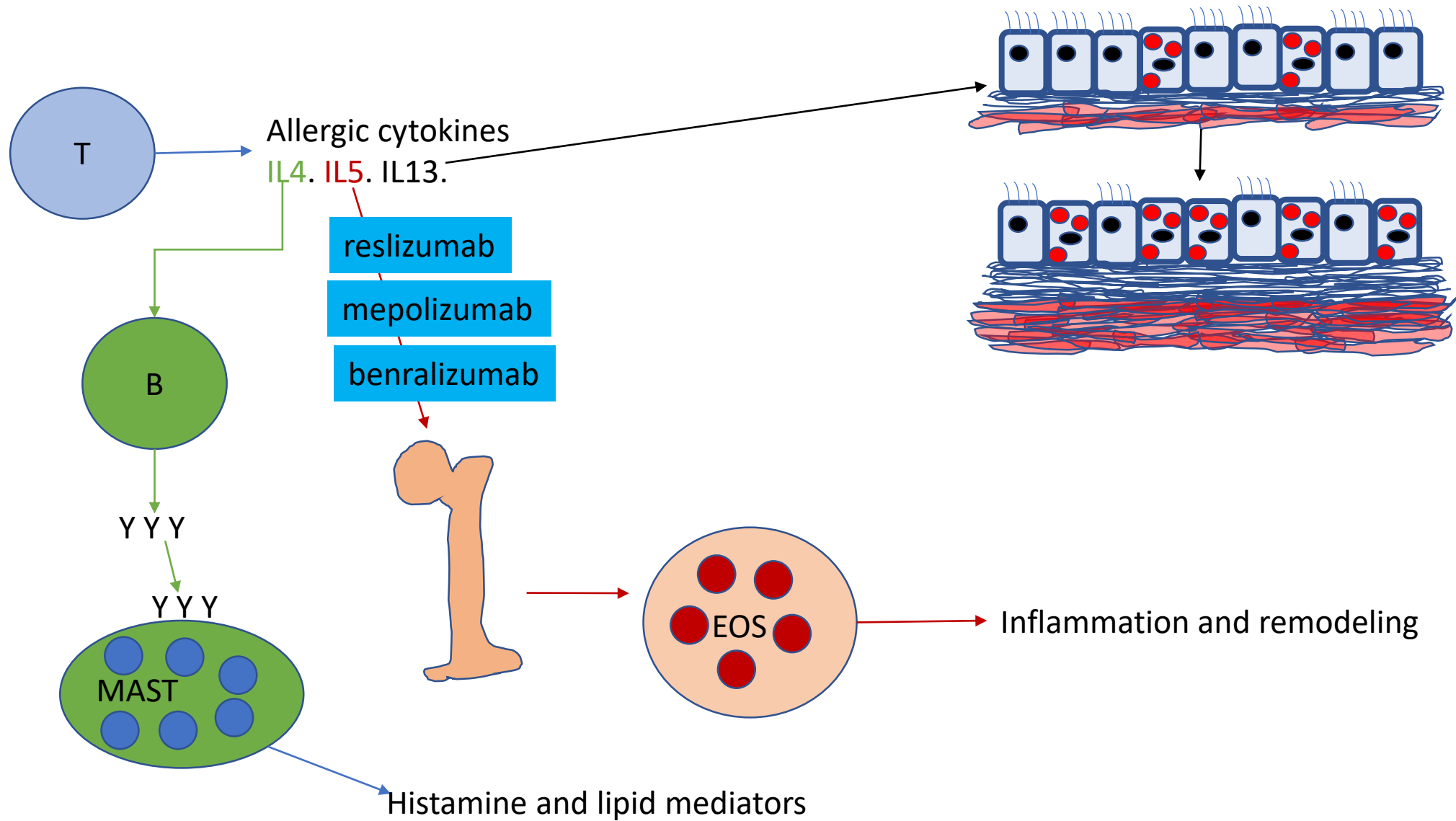
Biologicals



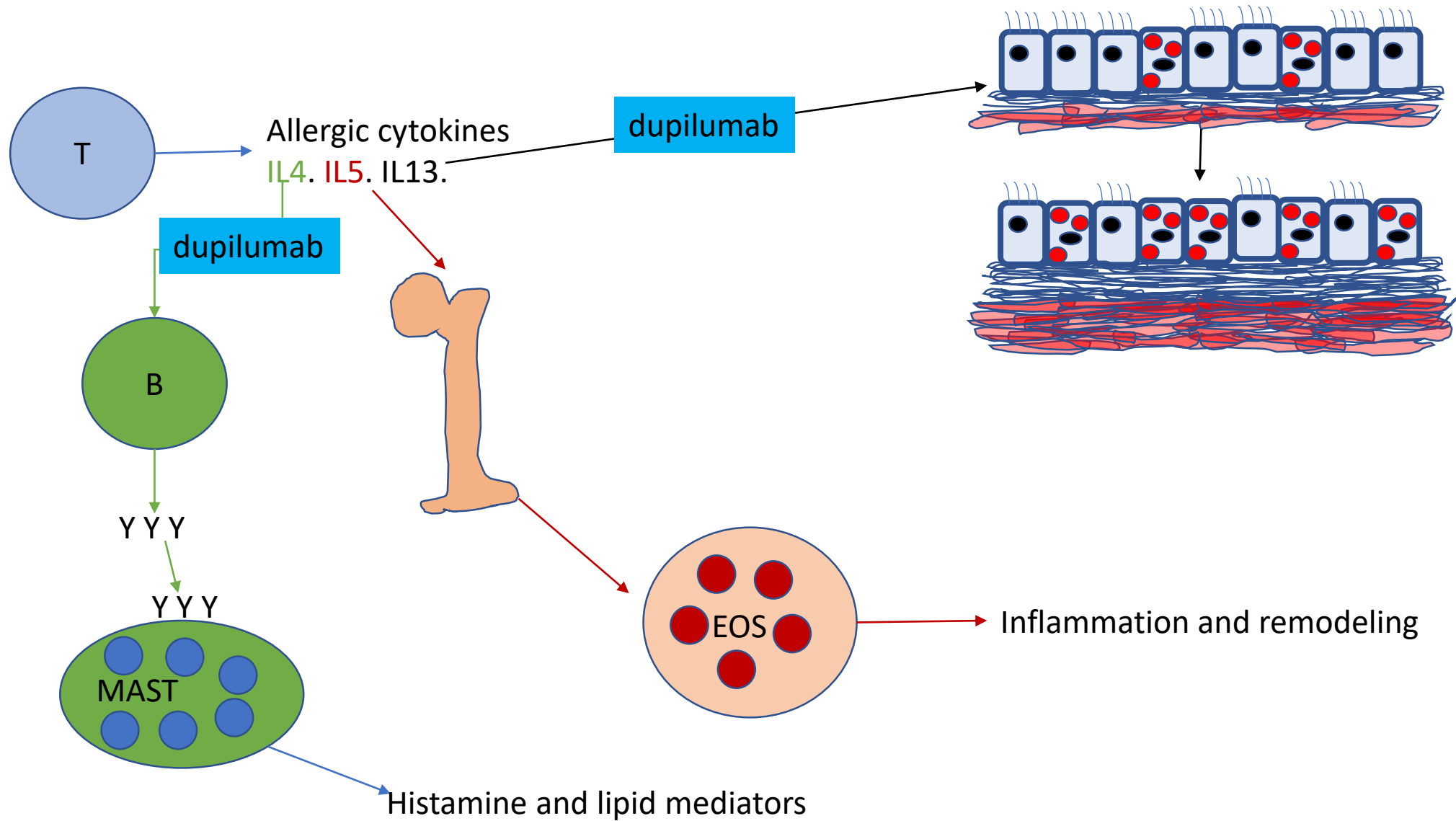
Biologicals



Biologicals



Biologicals



Are there going to be better treatment options in the future?

- YES!
- There is ongoing work to find new medications to treat asthma including very precise biologicals and inhaled steroids that work better, have fewer side effects, and are easier to use.

Are there ways to prevent allergies or asthma?

- We're working on it

Conclusions and questions

