How the Nose Speaks to the Lungs: Current Knowledge and Discussion of Future Work

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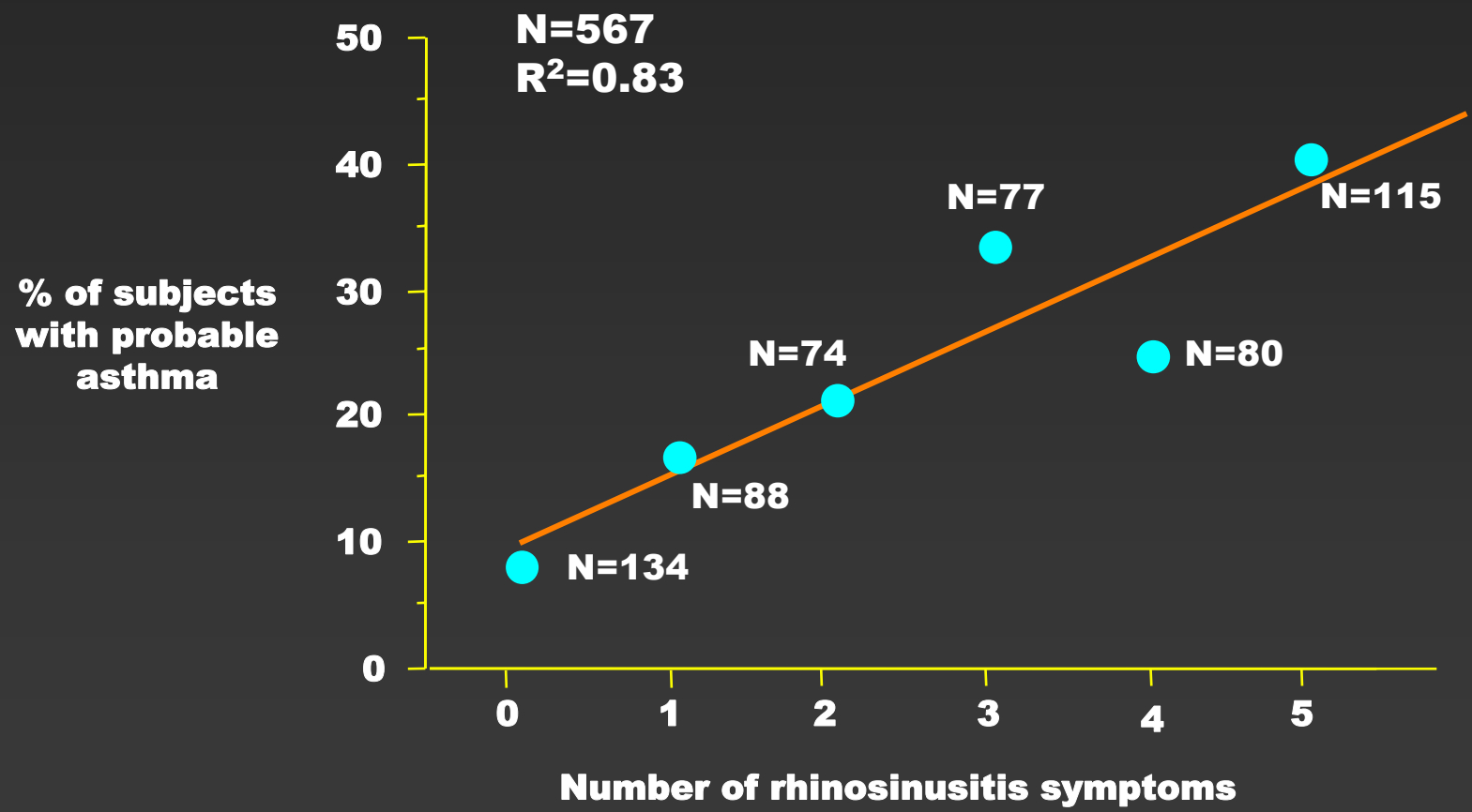
Relationship between rhinosinusitis and asthma symptoms in an urban public housing population

N=610	No Asthma	Possible Asthma	Probable Asthma
No Rhinosinusitis	65% (196)	18.0% (25)	5% (8)
Possible Rhinosinusitis	22.5% (68)	21% (28)	11% (19)
Probable Rhinosinusitis	12.5% (38)	61% (82)	84% (146)
Total	302	135	173

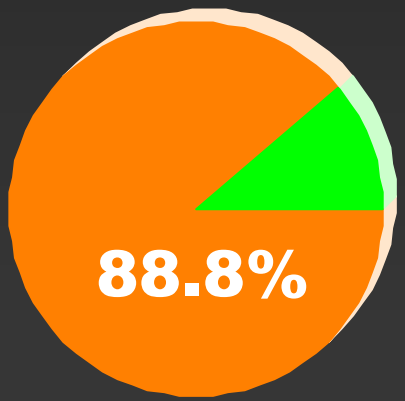
Relationship between symptoms of rhinosinusitis and "probable" asthma in public housing population



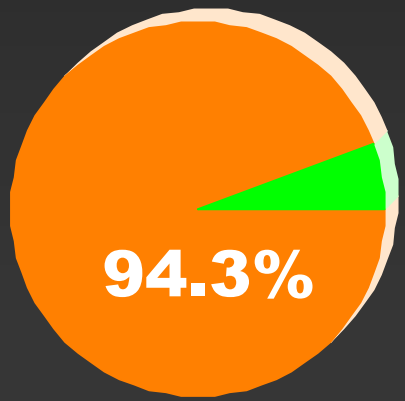
Rhinitis symptoms in patients with asthma

(two or more symptoms, seasonal or year-round, in the absence of a cold or flu)

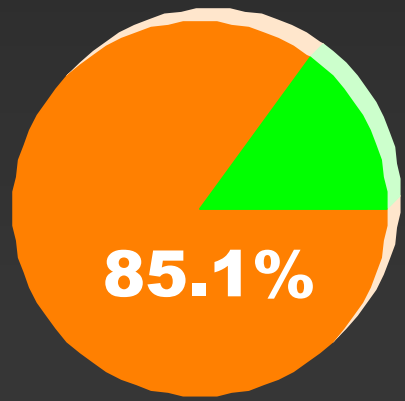
ADOLESCENT ASTHMA STUDY
n = 125



ADULT ASTHMA DATABASE
n = 348



COLLABORATIVE STUDIES FOR THE GENETICS OF ASTHMA
n = 168

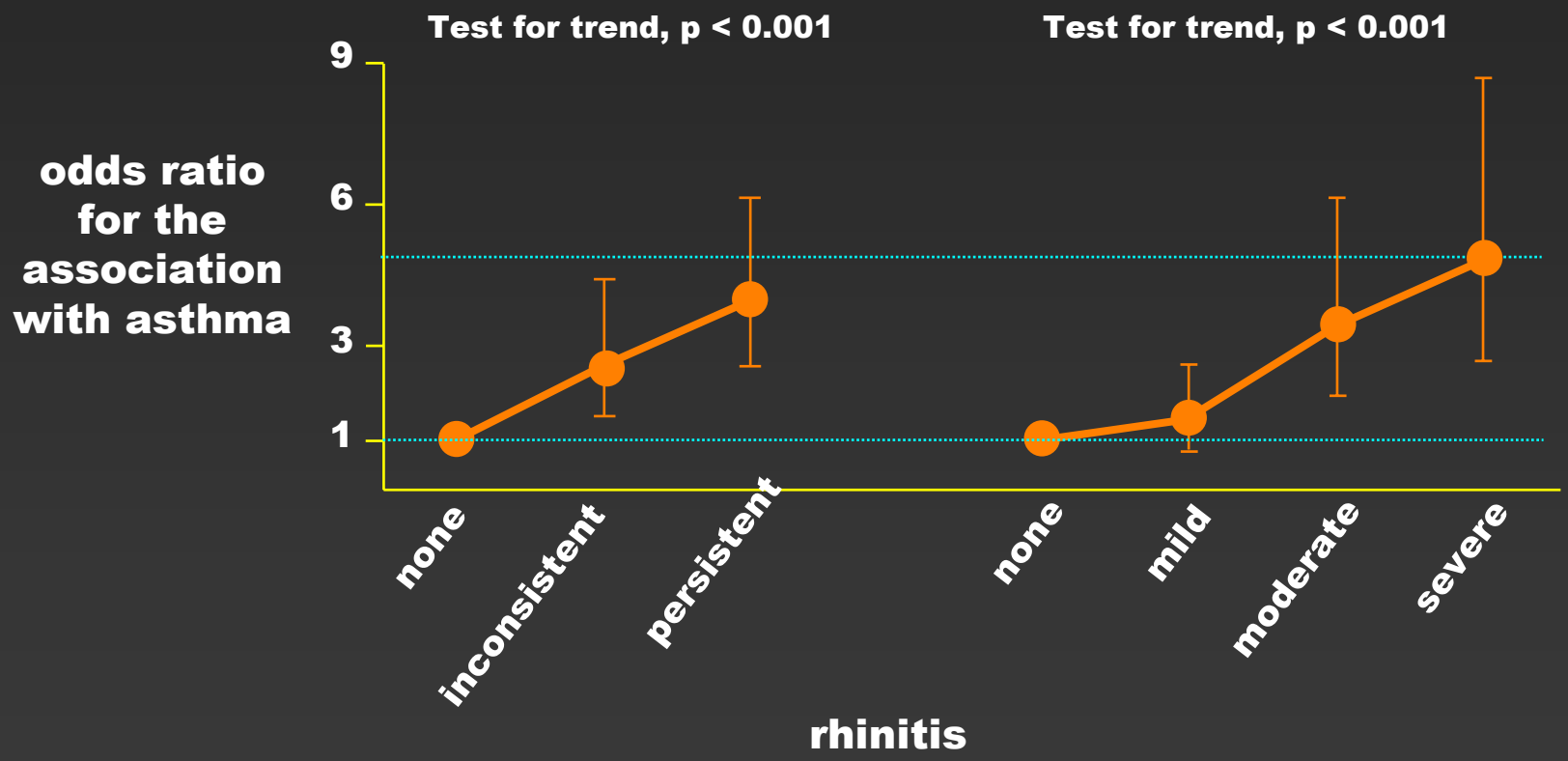


rhinitis symptoms

no rhinitis symptoms

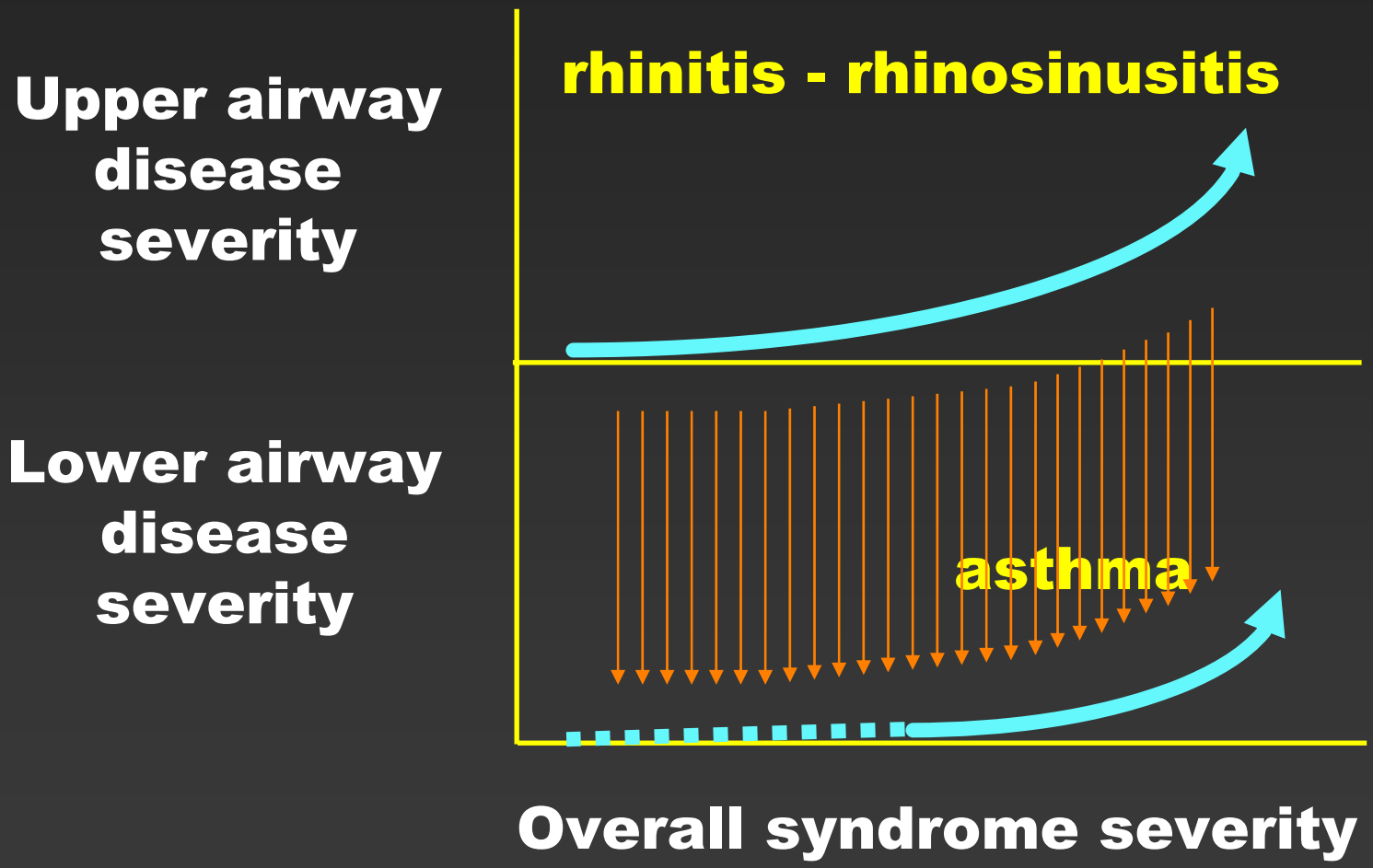
Association of rhinitis with incident asthma in an adult cohort

(173 incident cases and 2,177 controls; approx. 10-yr follow-up)

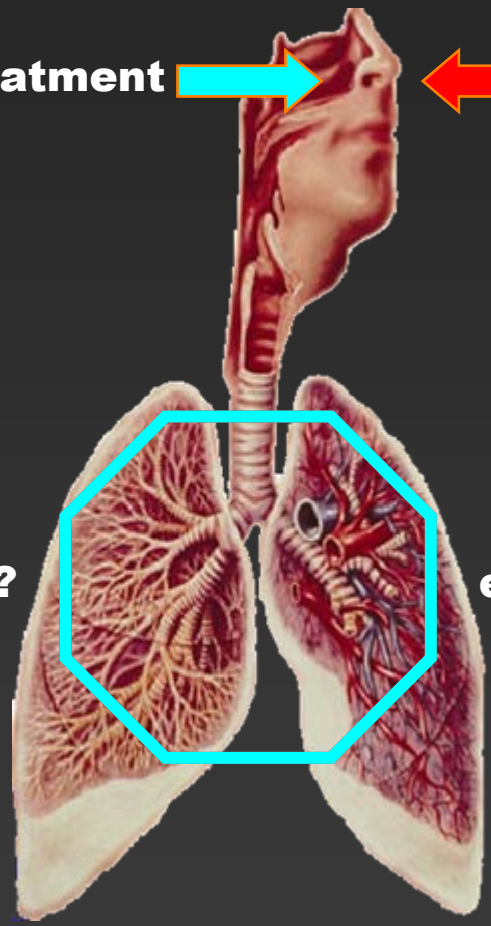


Guerra S et al. *J Allergy Clin Immunol* **2002;109:419**

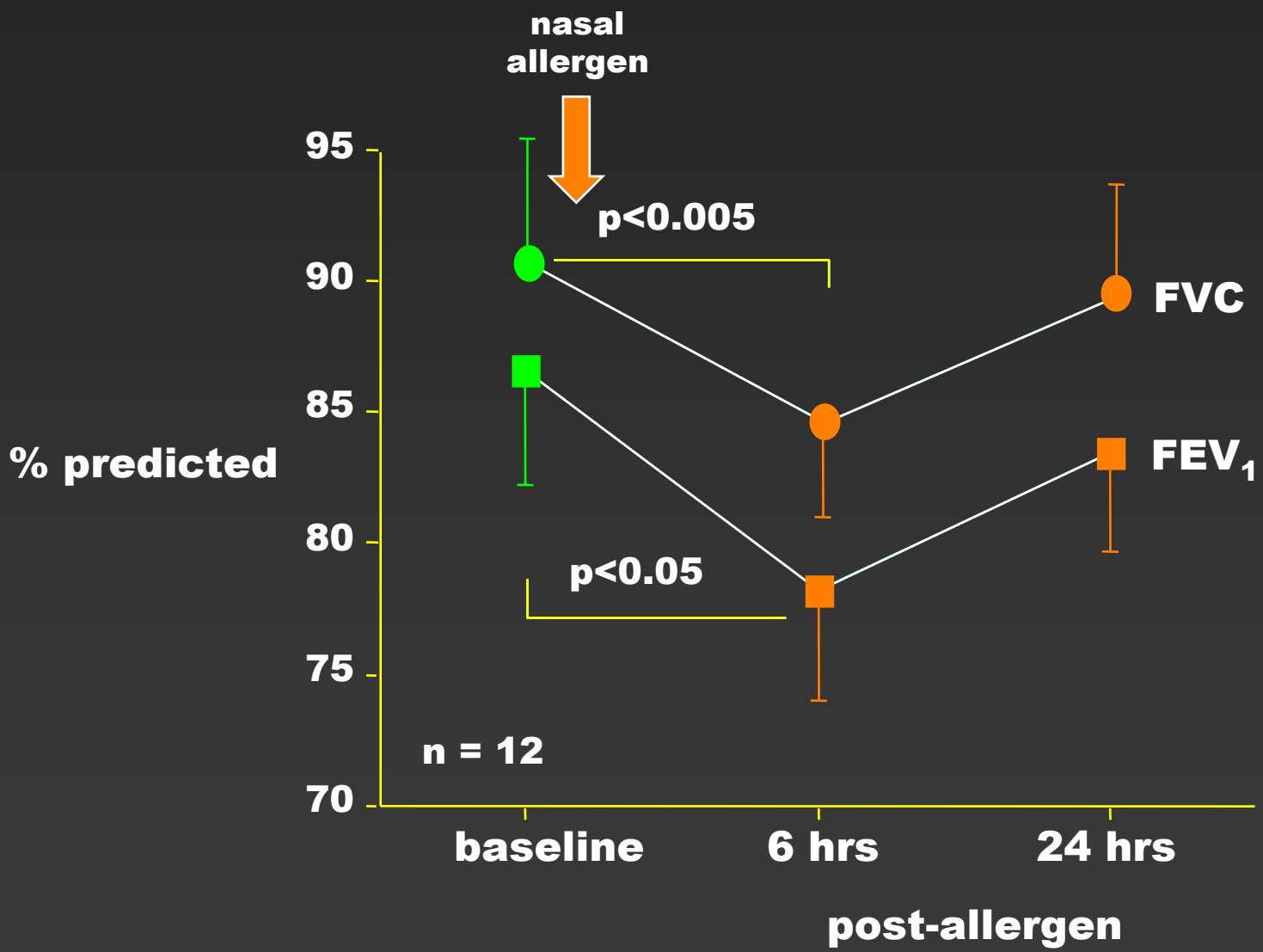
Chronic inflammatory airway syndrome



Assessing the vertical relationship



The effect of nasal allergen challenge on pulmonary function, in asthmatics



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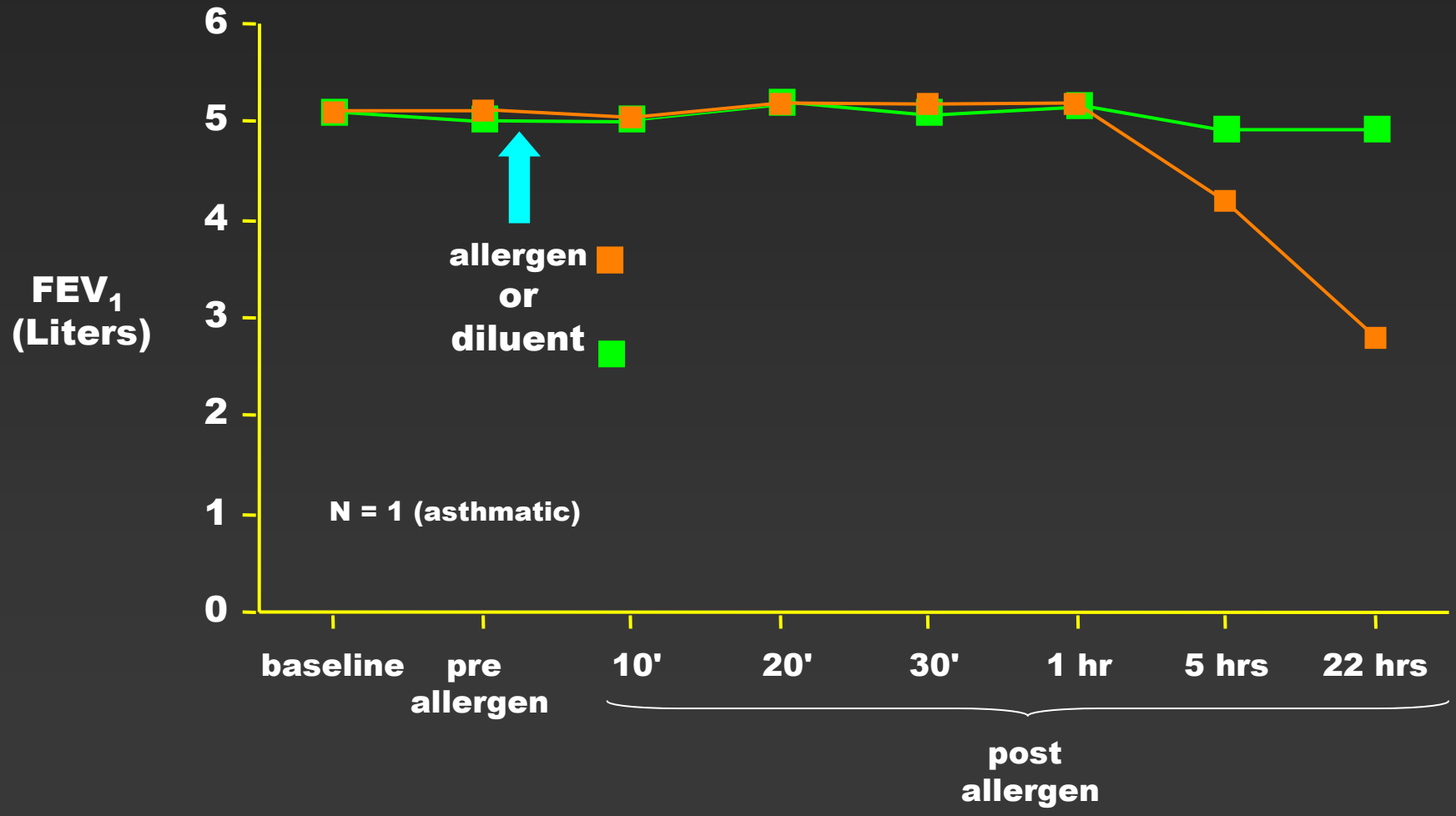
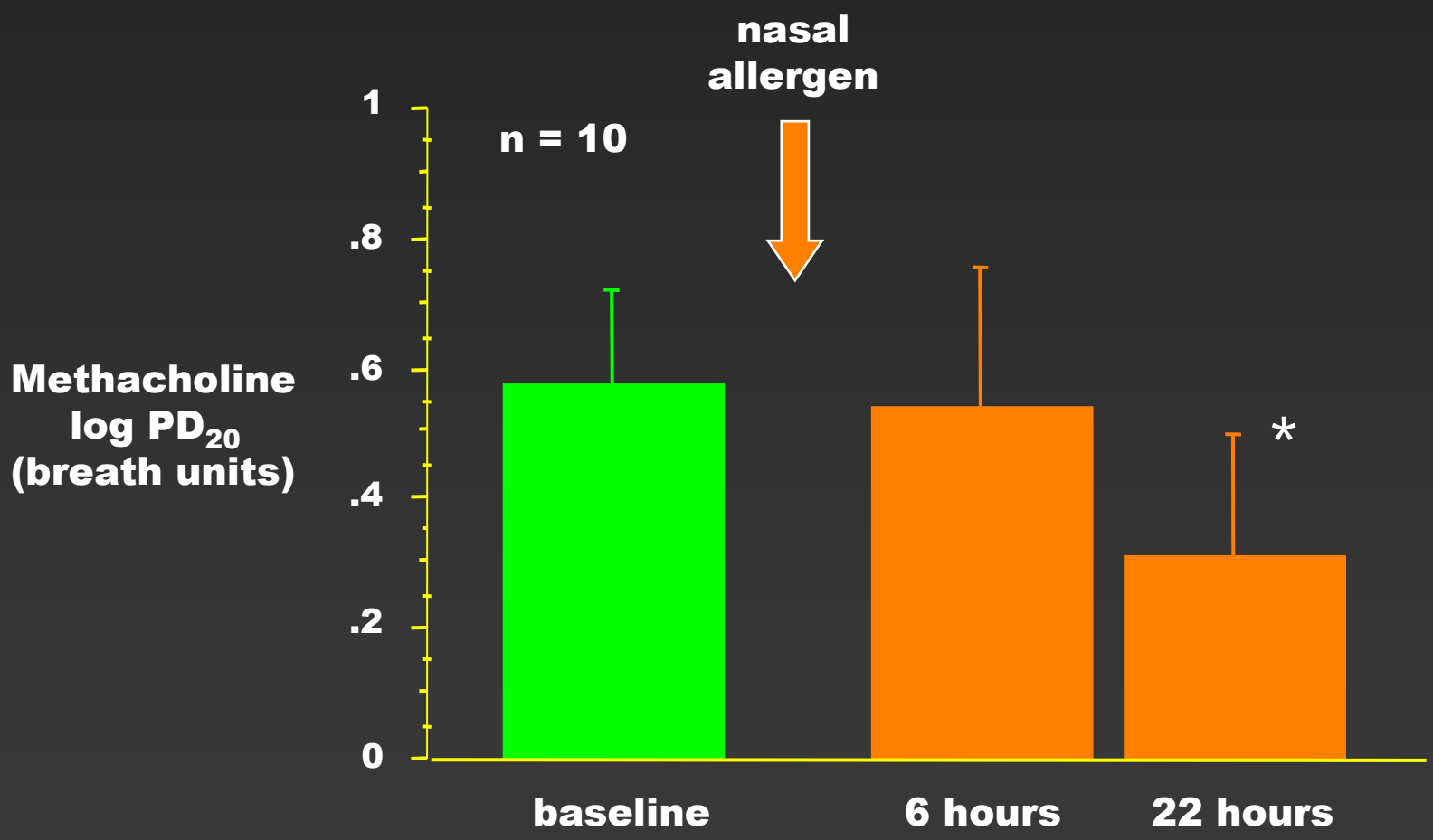
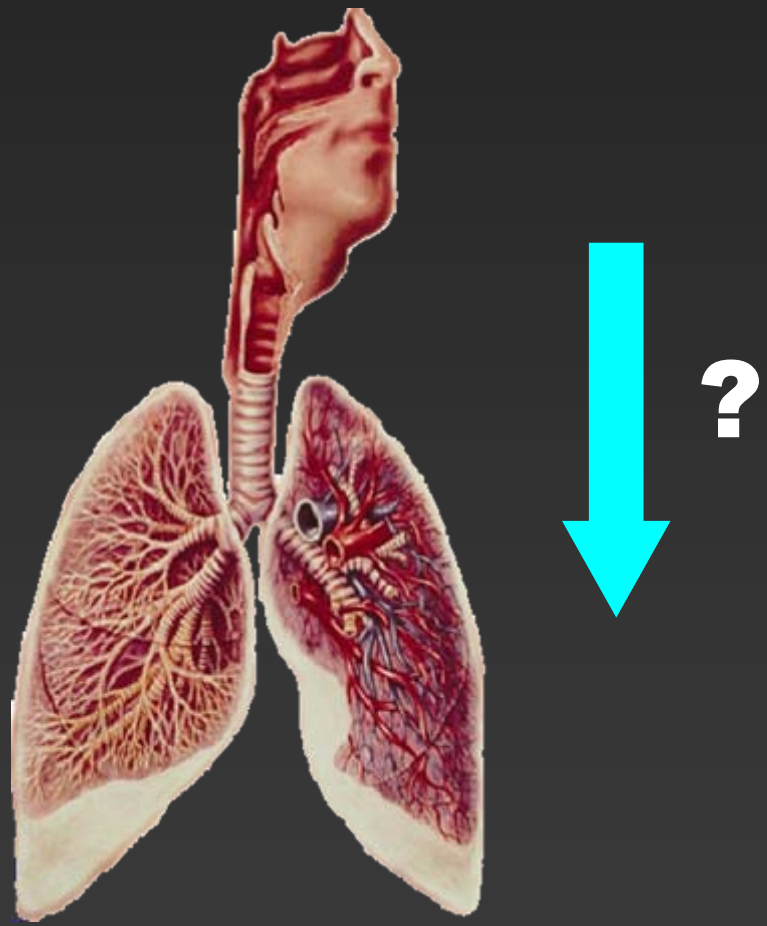


The effect of nasal allergen challenge on lower airways responsiveness, in asthmatics



Nose-lung interaction: potential mechanisms



Nose-lung interaction: potential mechanisms

Systemic propagation of nasal inflammation

Nasal allergen provocation results in bronchial inflammation

N=9 subjects with seasonal allergic rhinitis

Nasal allergen provocation at T_0

Nasal and bronchial biopsy at baseline

Nasal and bronchial biopsy at T_{24}

Braunstahl et al. *J Allergy Clin Immunol* **2001;107:469**

Nasal allergen provocation results in bronchial inflammation

At T_{24}:

Increased nasal eosinophils ($p = 0.01$)

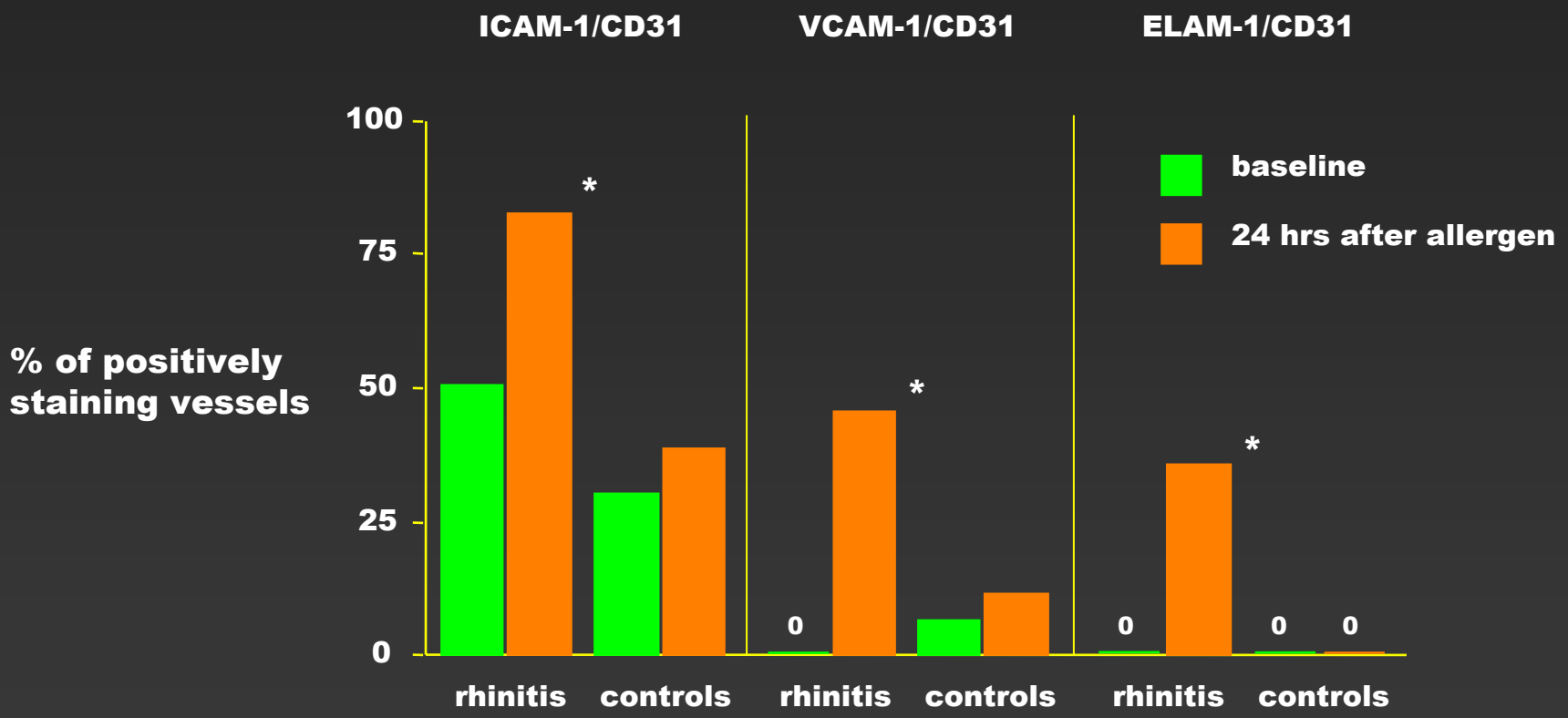
Increased bronchial eosinophils ($p \leq 0.05$)

Increased nasal and bronchial $ICAM^+$, $VCAM^+$ and E-$selectin^+$ vessels

Increased peripheral blood eosinophils ($p \leq 0.01$)

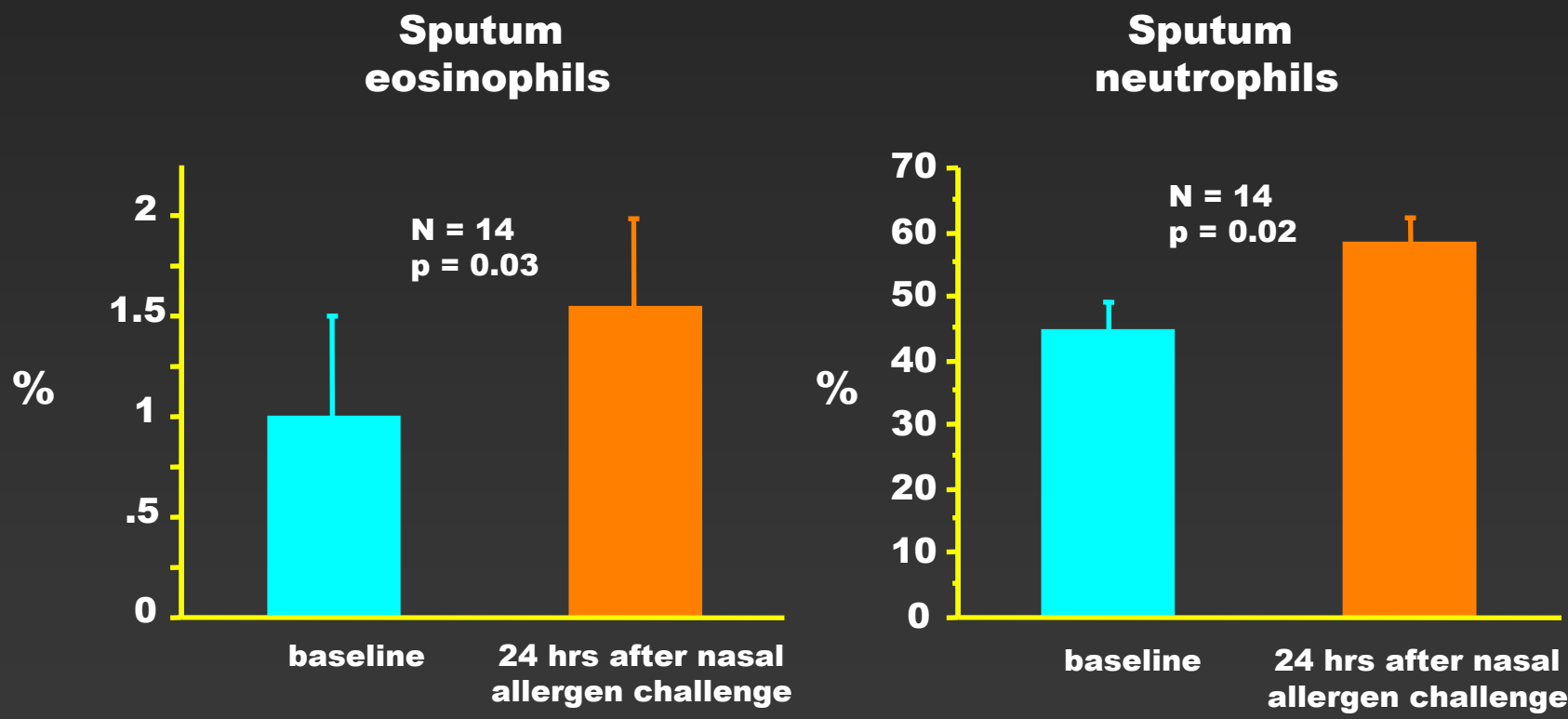
Braunstahl et al. *J Allergy Clin Immunol* **2001;107:469**

Expression of adhesion molecules on bronchial mucosal blood vessels after nasal allergen challenge



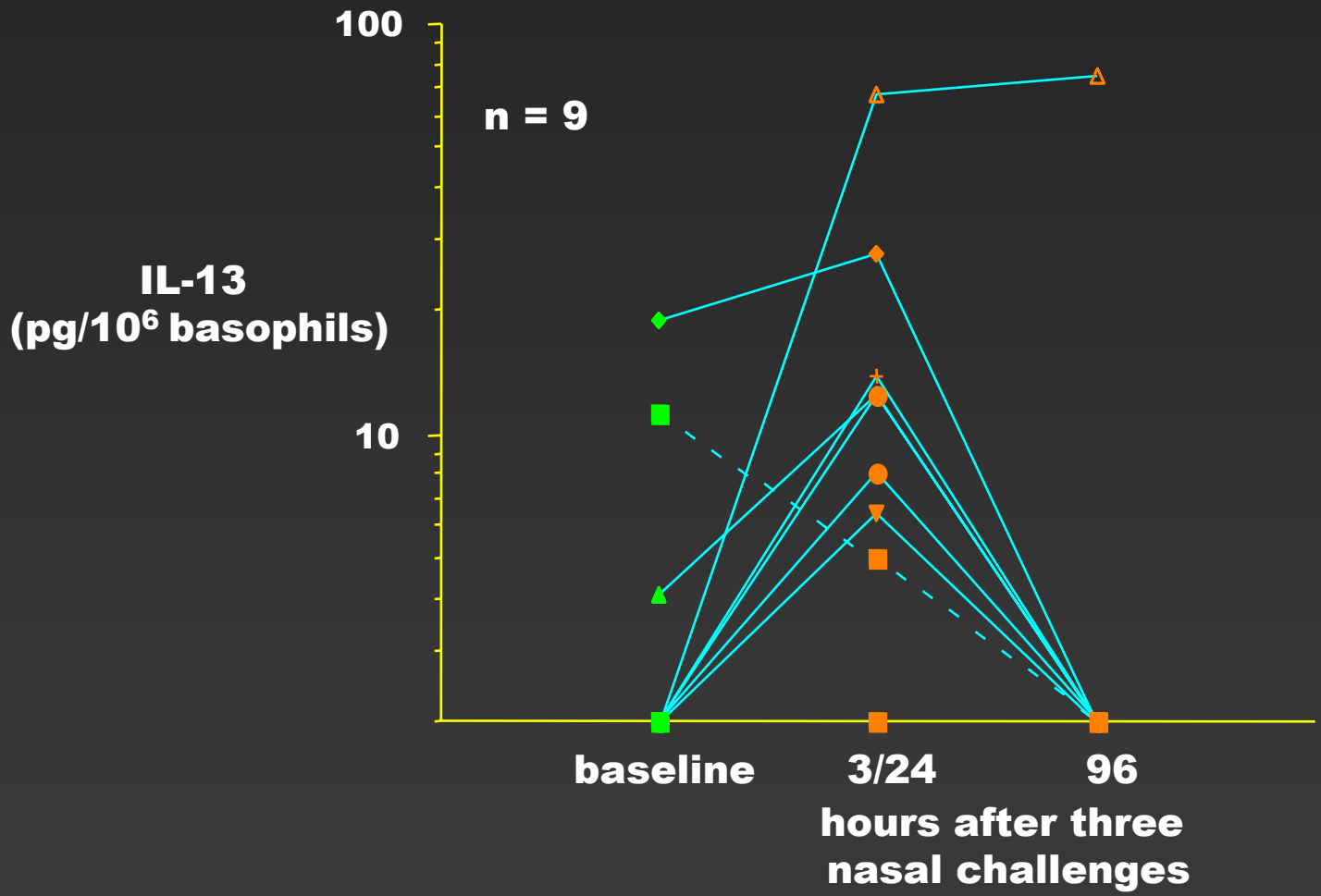
Adapted from: Braunstahl et al. *J Allergy Clin Immunol* **2001;107:469**

Nasal allergen provocation results in bronchial inflammation



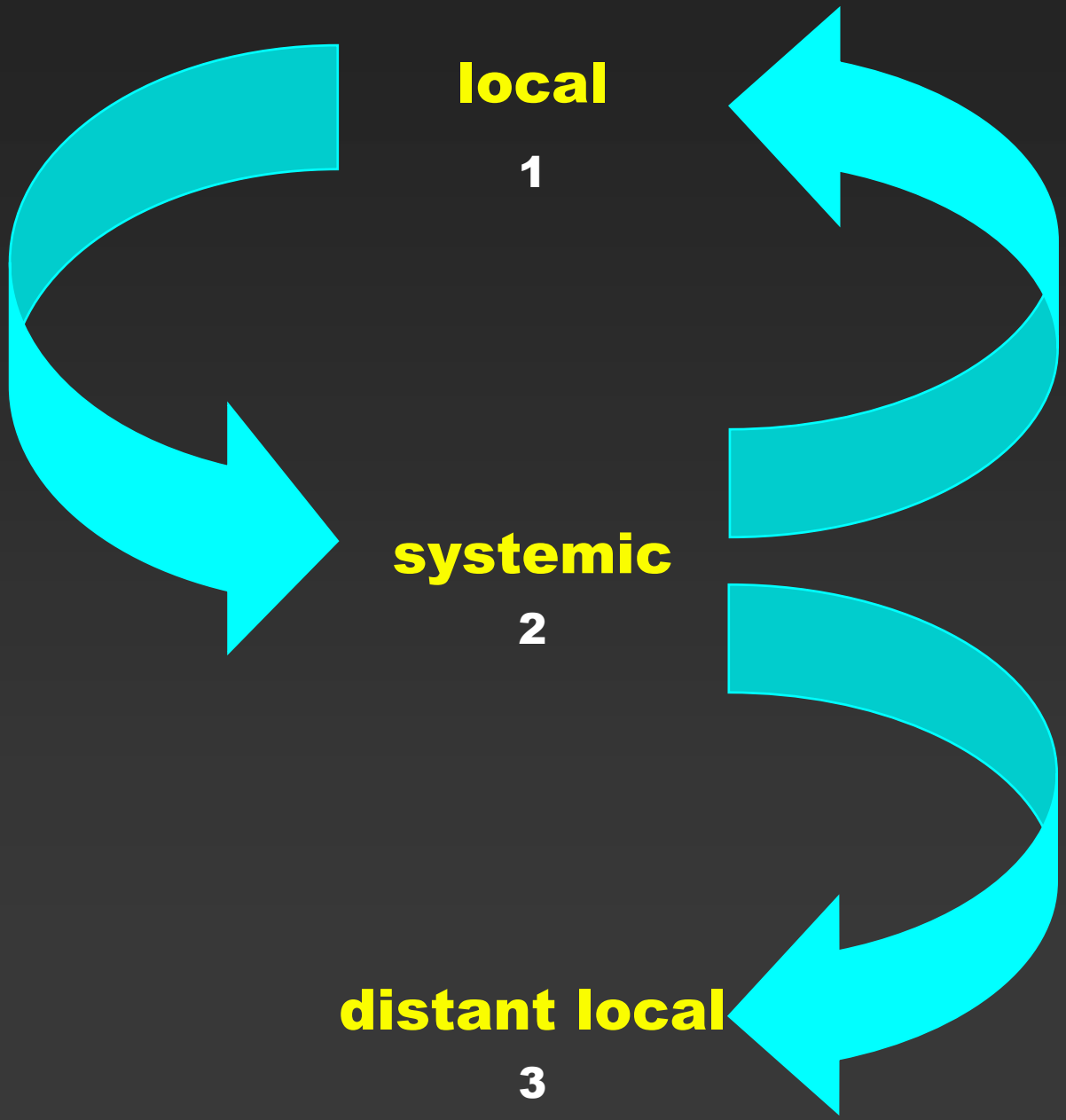
Systemic effects of nasal allergic reactions

Spontaneous release of IL-13 from basophil-enriched peripheral white blood cell preparations



Saini et al. *J Allergy Clin Immunol* **2004;114:768**

Elements of an allergic reaction



For the future

- **Relationship between systemic and distant local elements**
- **Does this model define a clinical phenotype?**
- **Organ specificity**

  respiratory system vs skin vs GI tract

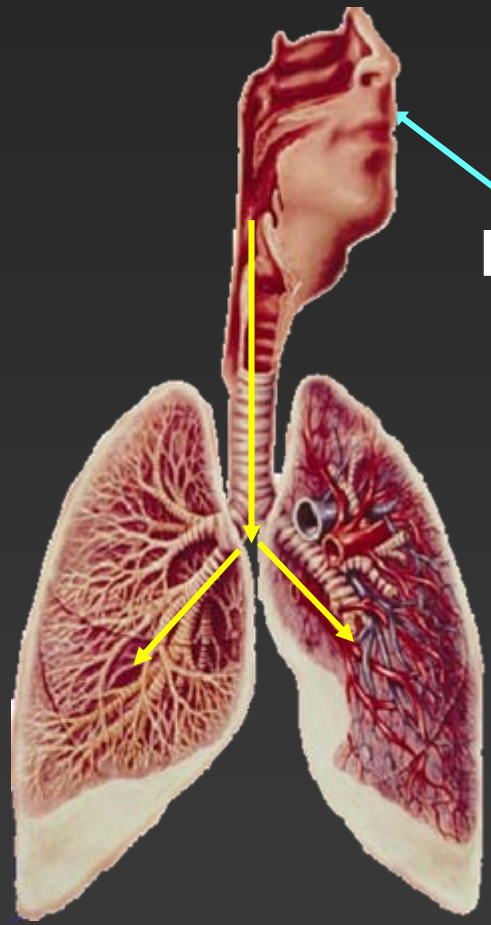
  is baseline inflammation at the distant site a prerequisite?

- **The nature of local versus distant local inflammation**

  effector vs regulatory cells

  organ specific?

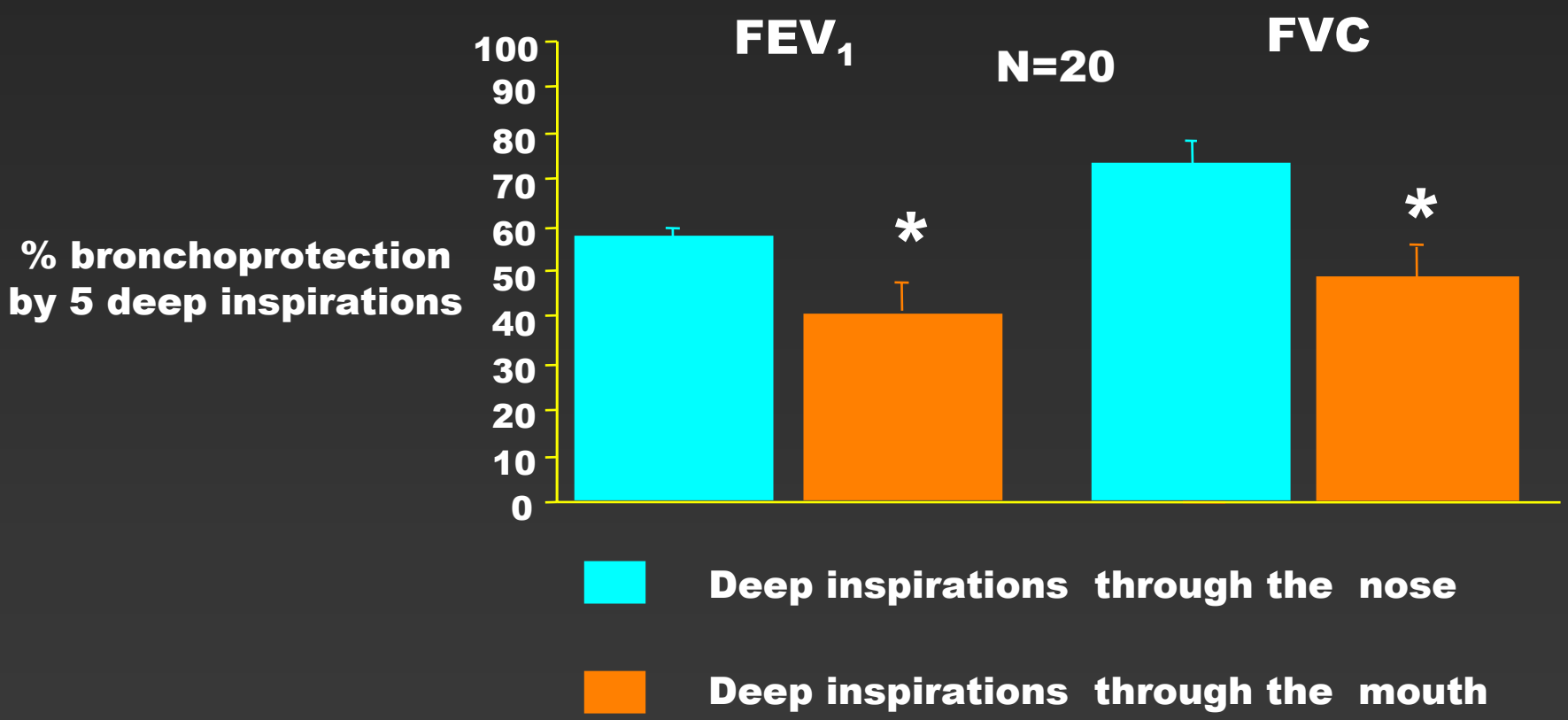
Nose-lung interaction: potential mechanisms



Loss of nasal function (e.g. mouth breathing)

- Air warming and humidification
- Particle/irritant trapping
- Nitric oxide

The benefit of deep inspiration through the nose versus the mouth



For the future

- **Relationship between nasal NO and the benefit of breathing through the nose?**
  - **chronic rhinosinusitis: decreased nasal NO**
  - **nasal steroids: increased NO - increased benefit breathing through the nose?**
- **Does NO inhalation mimic the bronchoprotective effect of lung inflation?**
- **NO synthase inhibitor in the nose**