

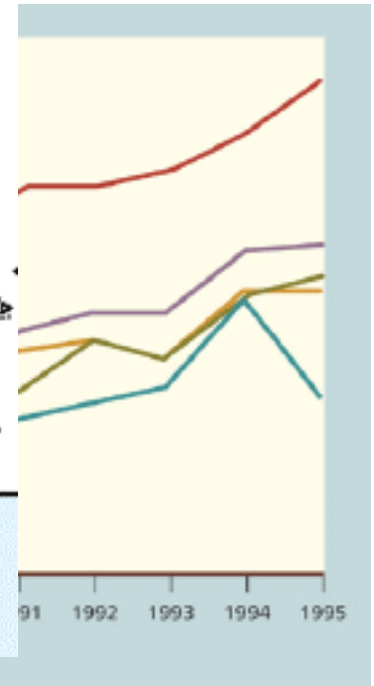
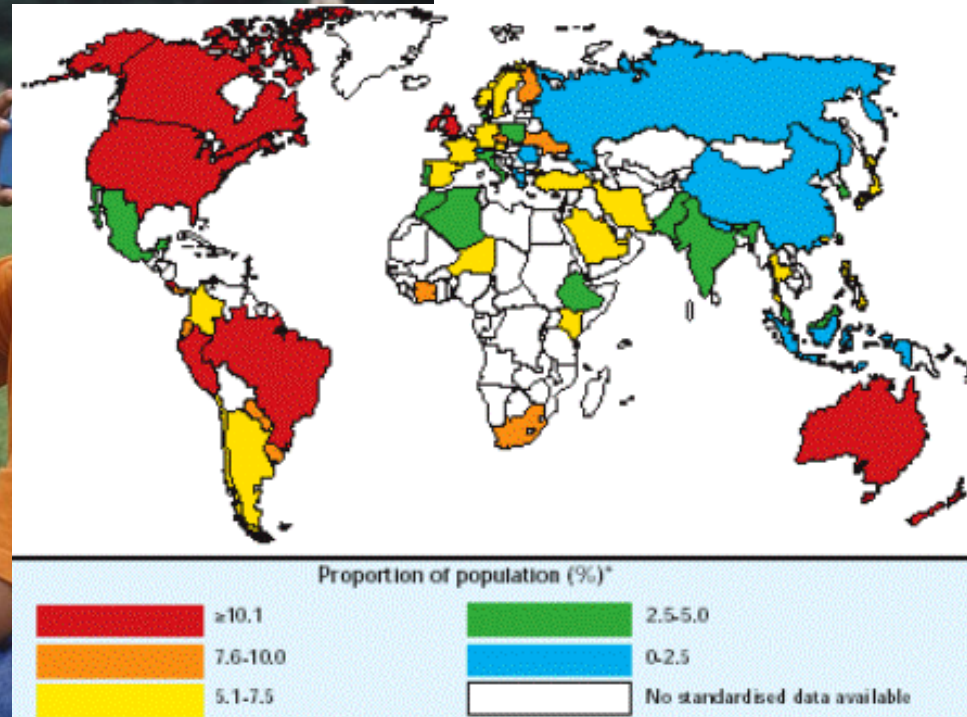
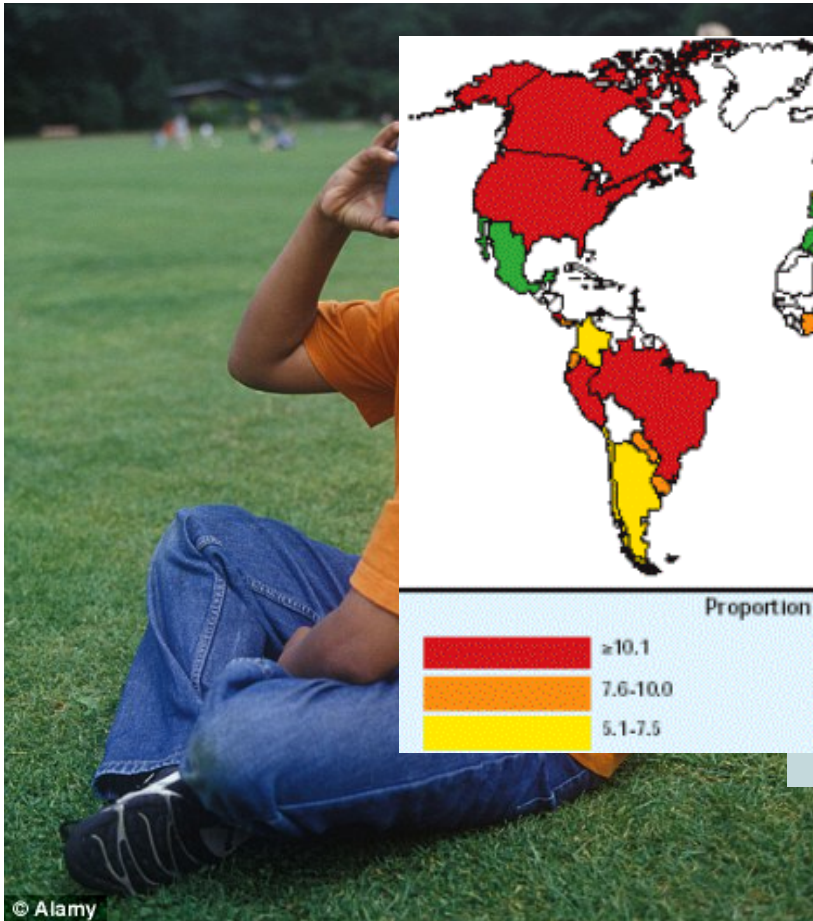
# Household Dust Exposure Modifies Gut Microbiome Composition and Airway Health

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Associate Professor of Medicine  
Director Colitis and Crohn's Disease Research Core  
Division of Gastroenterology,  
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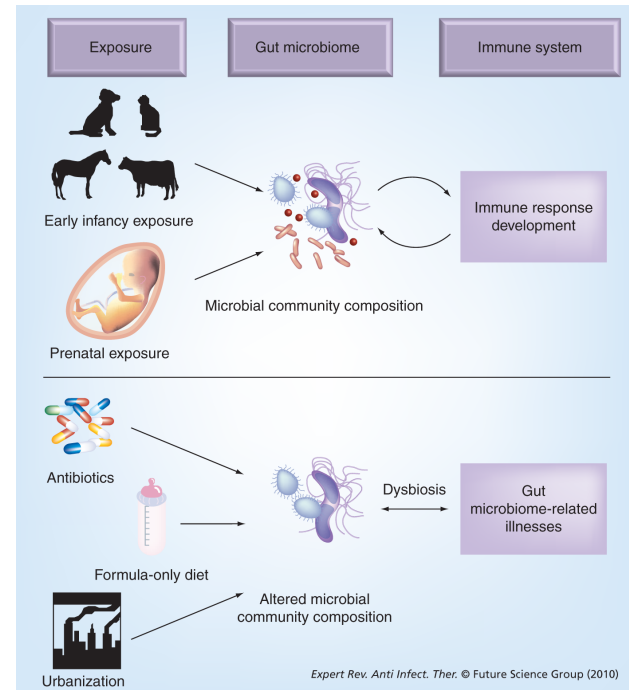


# Pediatric Asthma



# Childhood Allergic Disease and Asthma

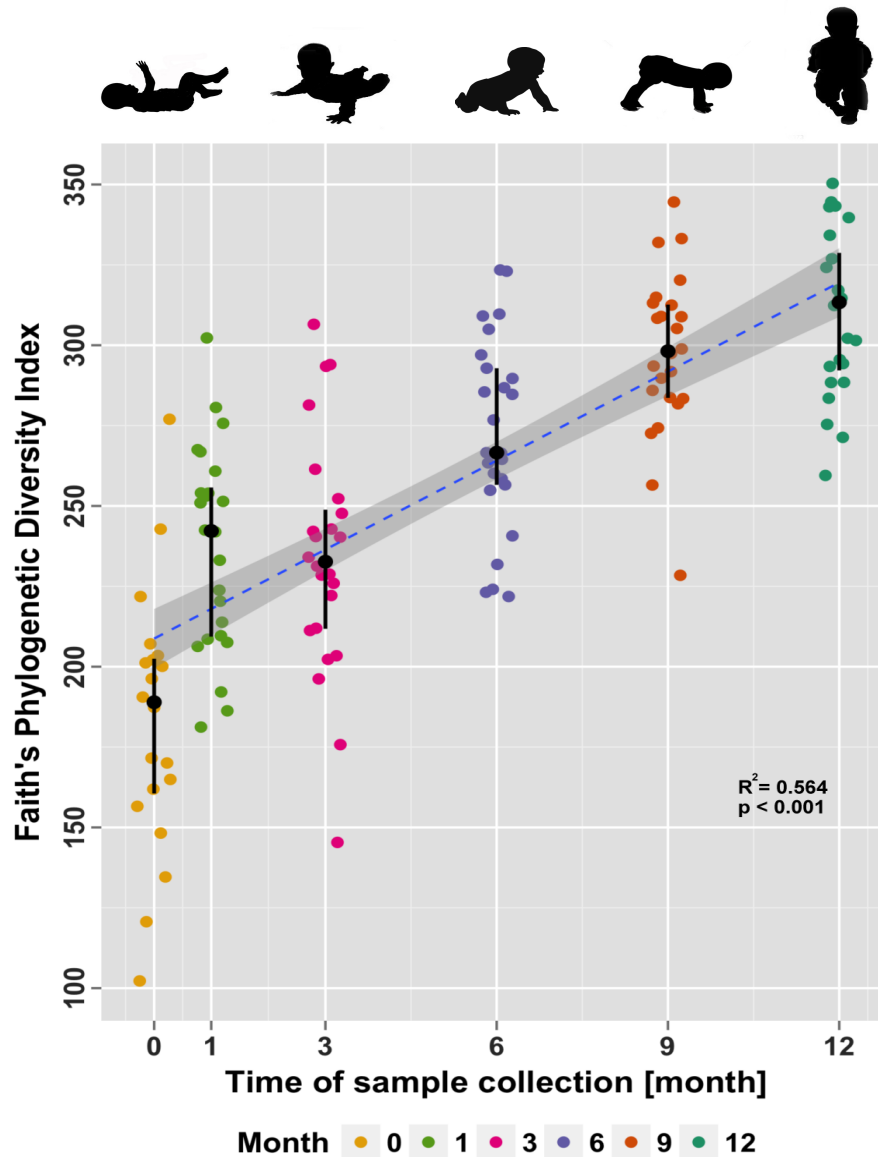
- Factors associated with childhood allergic disease development:
  - Early life antibiotic exposure
  - Formula feeding
  - Caesarian section delivery
  - Lack of maternal exposure to animals during pregnancy
  - Maternal antibiotic use
  - Lack of early life furred pet exposure



Fujimura et al, ERAI 2010

- Early-life gastrointestinal microbial outgrowth is associated with childhood allergic disease development

# Early Life Microbiome Development



# Is the Indoor Microbial Environment Related to Allergic Disease?



86.9%  
(68.7% in residence)

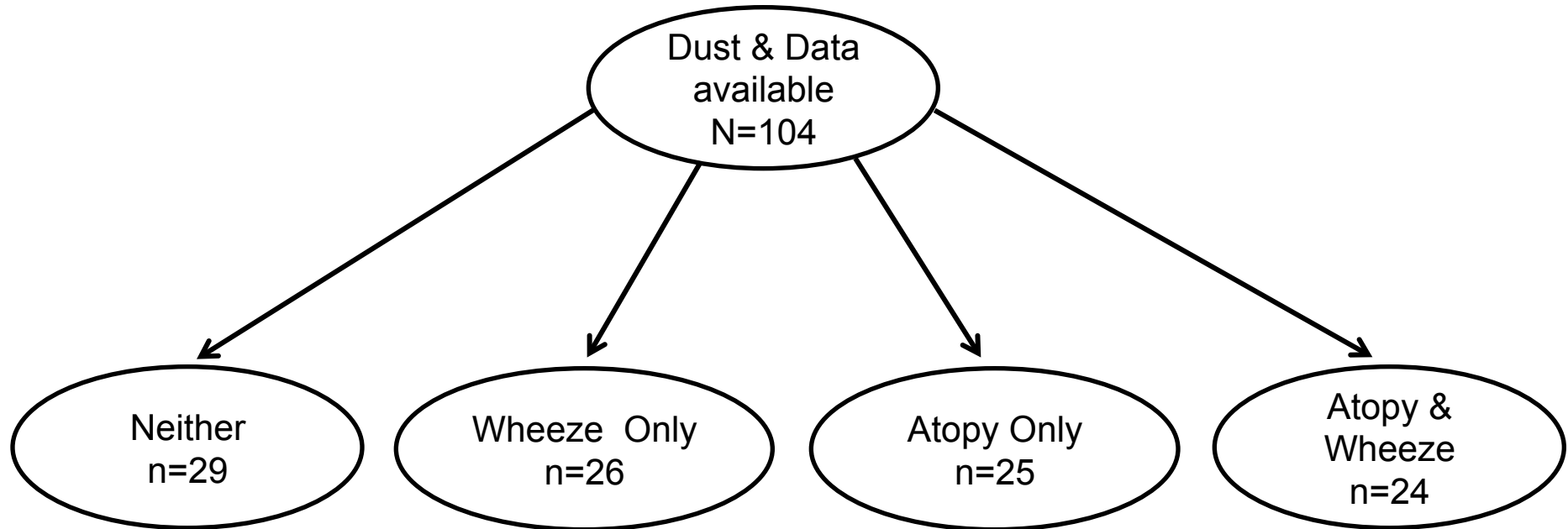


7.6%



5.5%

# Is House Dust Microbiome Related to Childhood Allergic Outcomes?



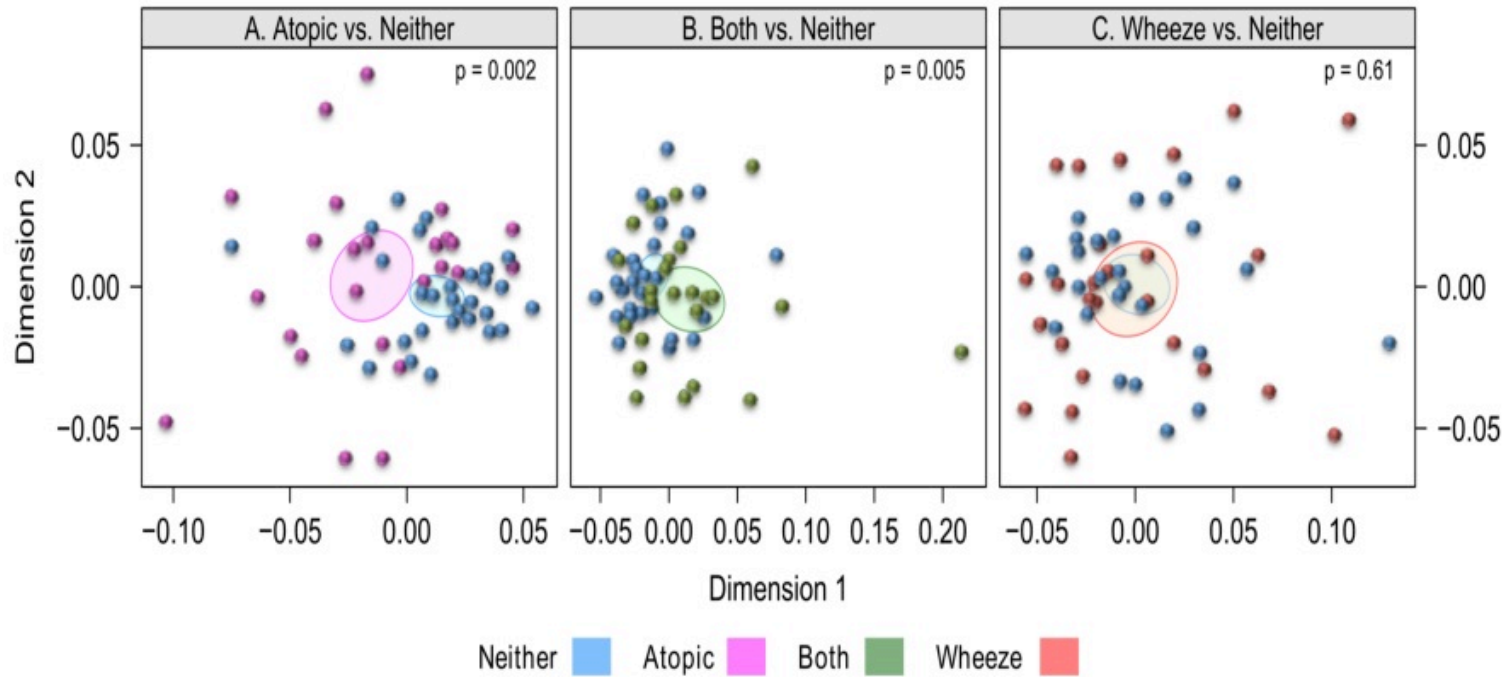
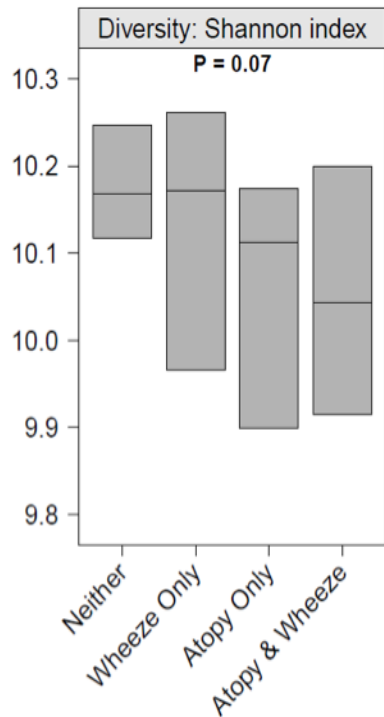
**Atopy defined as:**

IgE  $\geq$  0.35 for any aeroallergen was considered positive  
IgE  $<$  0.10 for all aeroallergens was considered negative

**Wheeze defined as:**

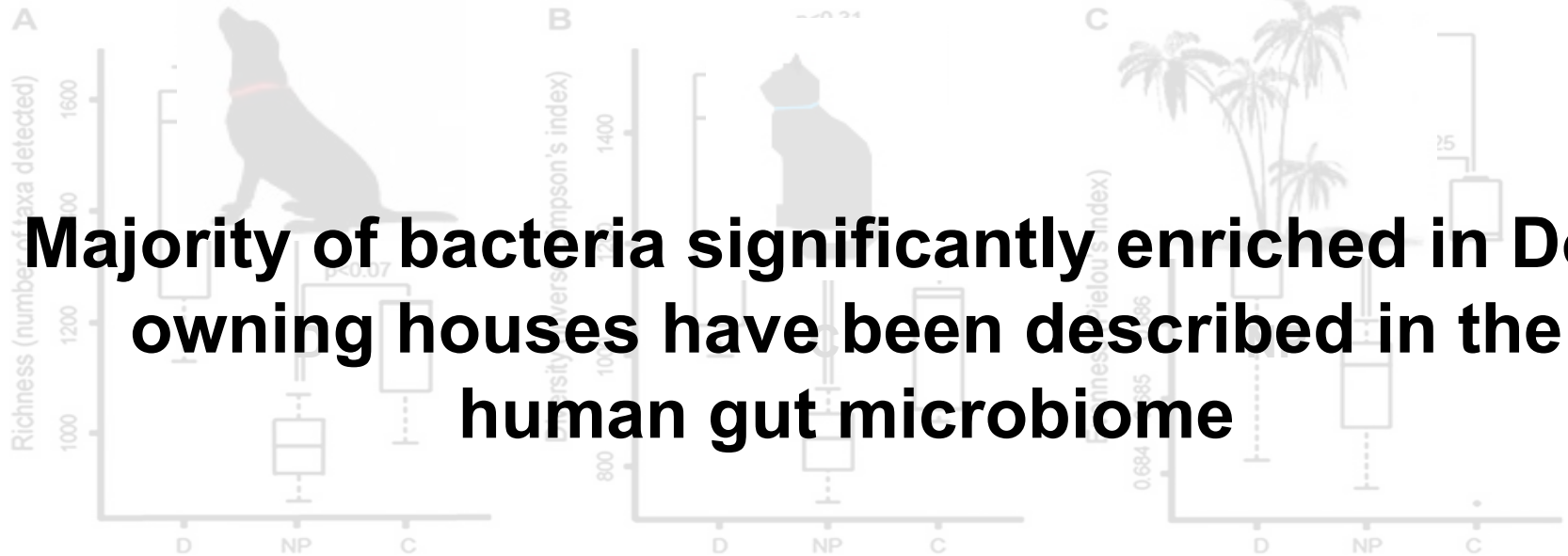
$\geq$  2 episodes of wheeze, with at least 1 occurring at age 3

# Dust Microbiome Composition is Related to Clinical Outcomes



~ 70 taxa in household dust that are associated with protection against disease development – human gut inhabitants

# Does pet ownership influence the microbial exposures in households?



**Majority of bacteria significantly enriched in Dog-owning houses have been described in the human gut microbiome**



# Can Environmental Microbial Exposure Influence Airway Responses?

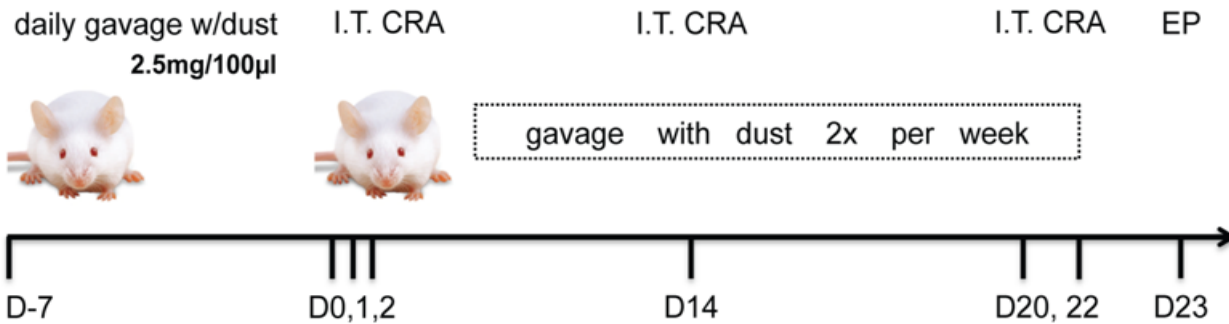


Dog

VS

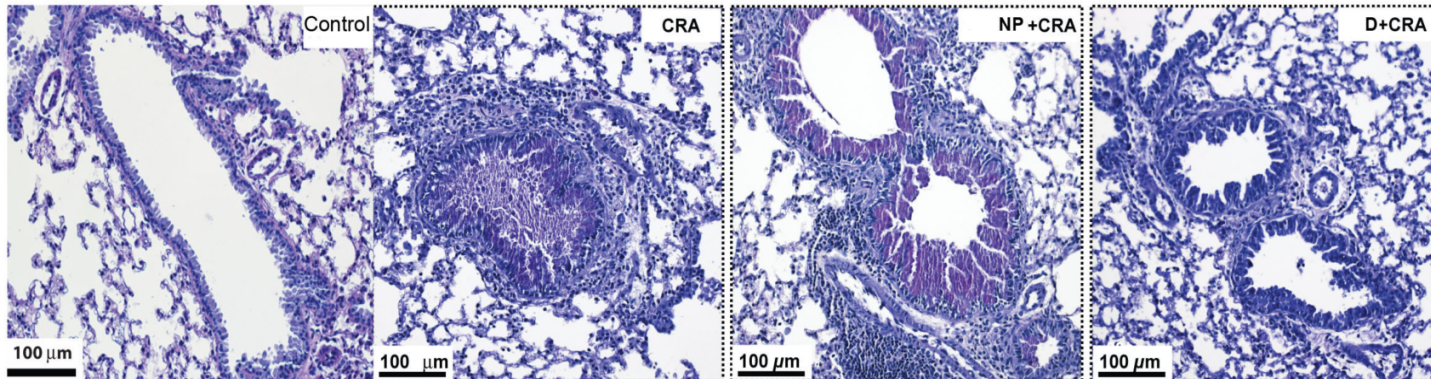
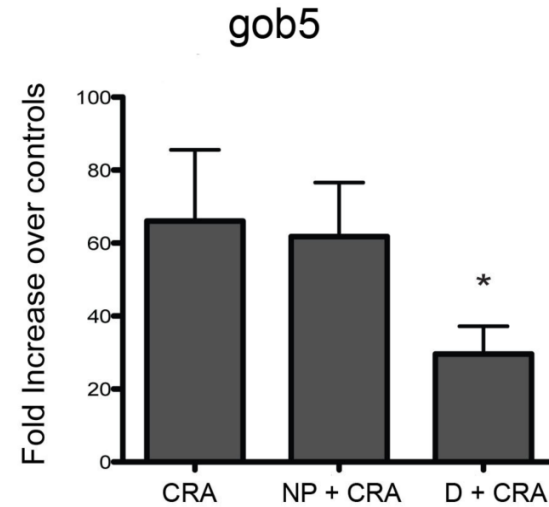
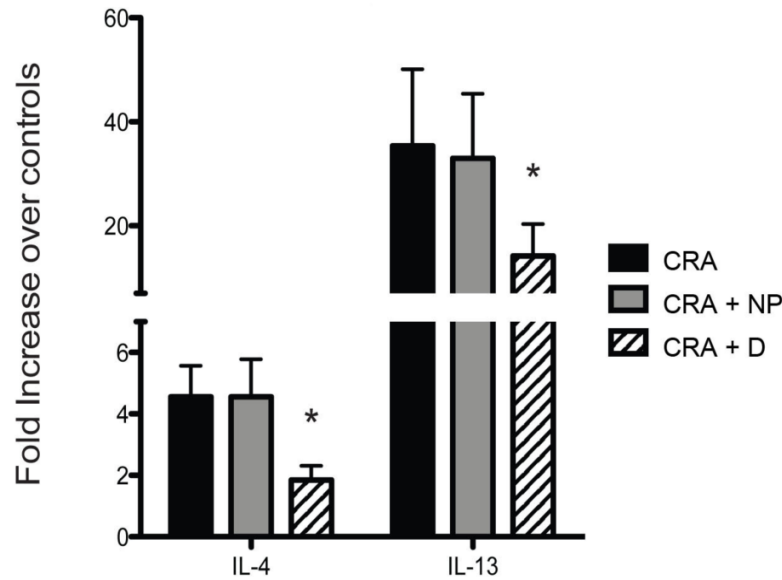


No pets



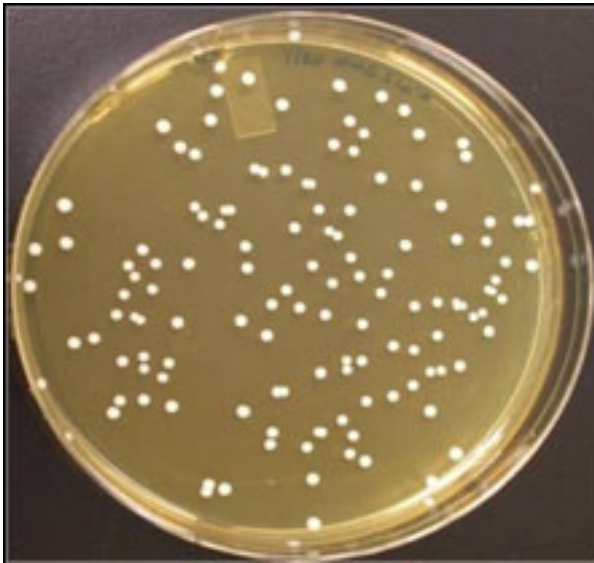
Berlin, A.A., et al, *Lab Invest.* 2006 Jun;86(6):557-65.

# House Dust Exposure Changes Airway Response to Allergen





# Lactobacillus Isolation & Supplementation



Daily gavage *Lactobacillus* sp.  
 $1 \times 10^7$

I.T. CRA

I.T. CRA

I.T. CRA

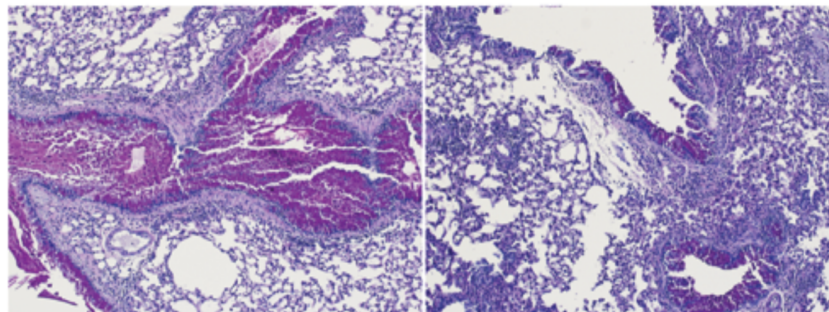
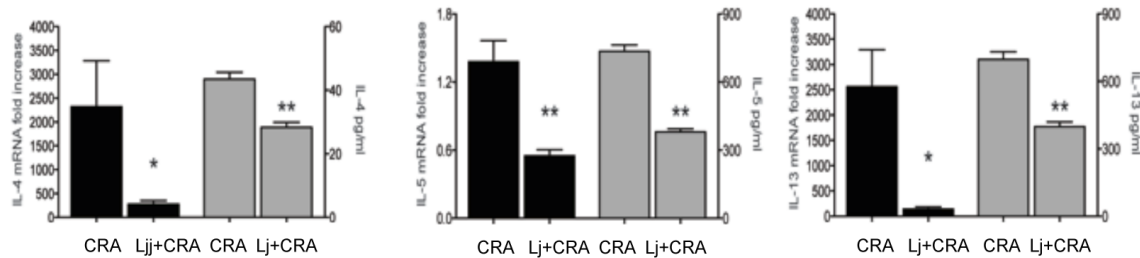
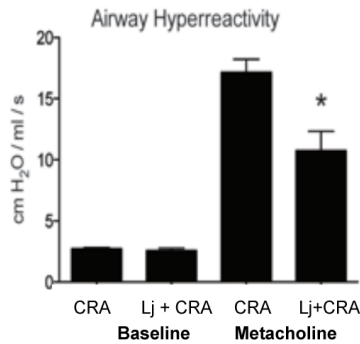
EP



*Lactobacillus* gavage 2 X per week



# Lactobacillus Supplementation Protects against Airway Allergen Challenge

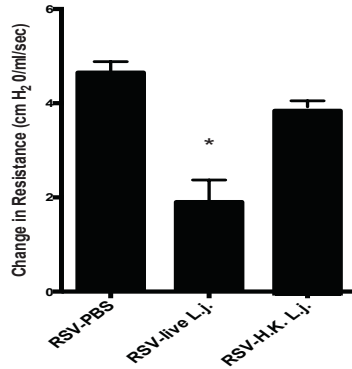


CRA

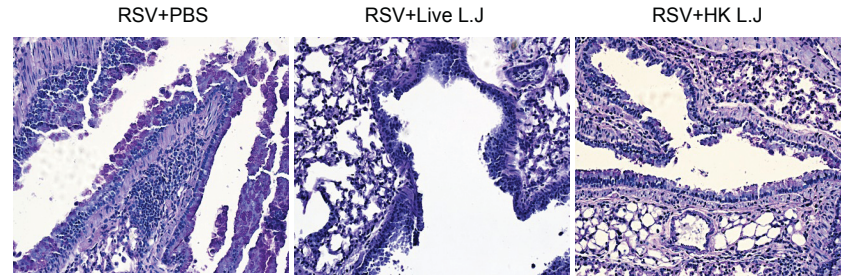
CRA + *Lactobacillus* spp.

# *L. johnsonii* Supplementation Protects Against Viral Infection

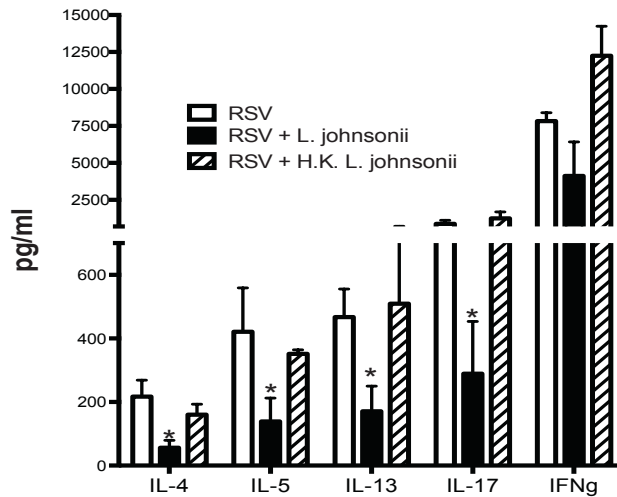
A



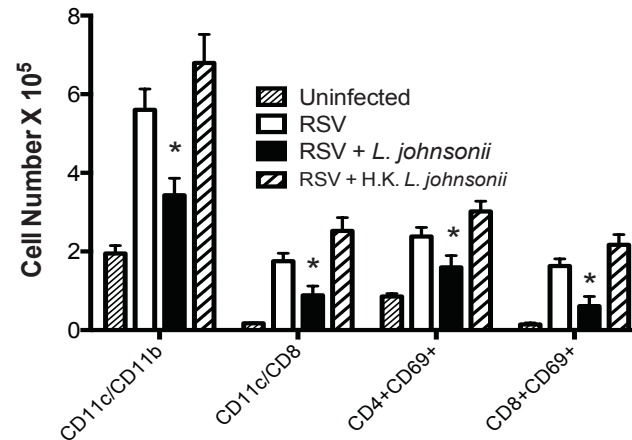
B



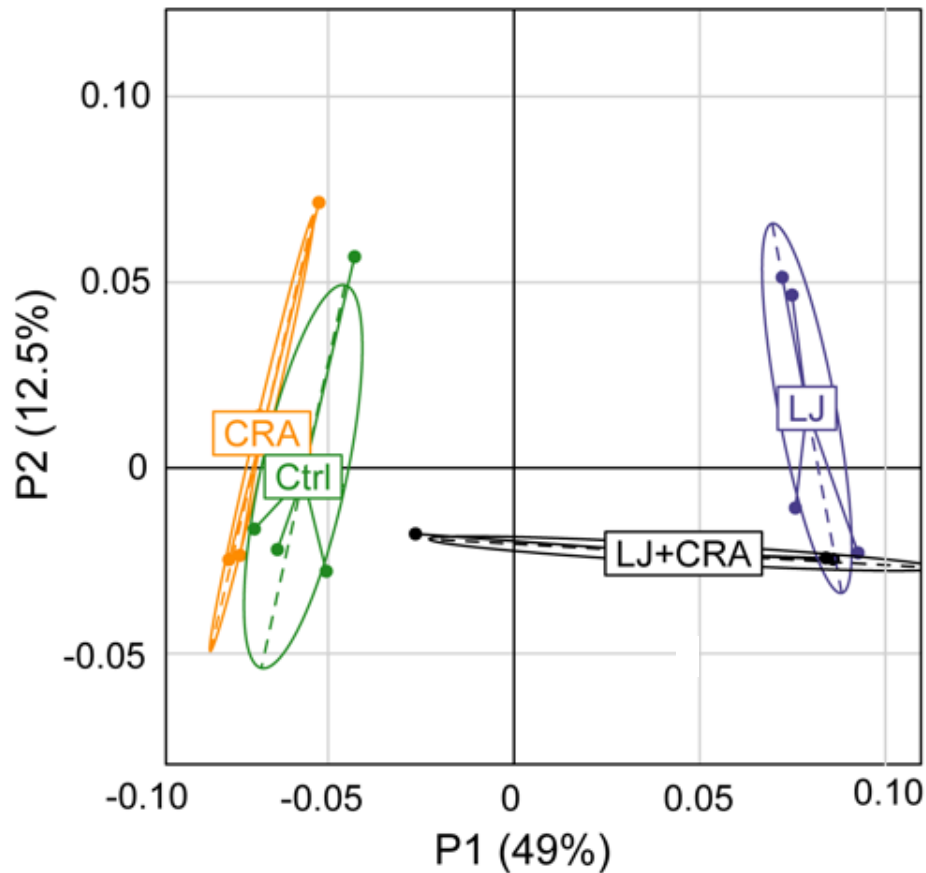
C



D



# *L. johnsonii* Reshapes the Murine Cecal Microbiome



- No enrichment of Lachnospiraceae, Peptococcaceae or Bacillaceae
- Environmentally-sourced species required for full protection

# Conclusions

- Local environmental exposures are related to clinical outcomes of childhood allergic disease
- Gut microbiome can be influenced by environmental exposures
- Gut microbiome manipulation leads to altered host immune response at remote mucosal surfaces



# What's next?



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