

Allergic Diseases, Allergic March and Climate Change

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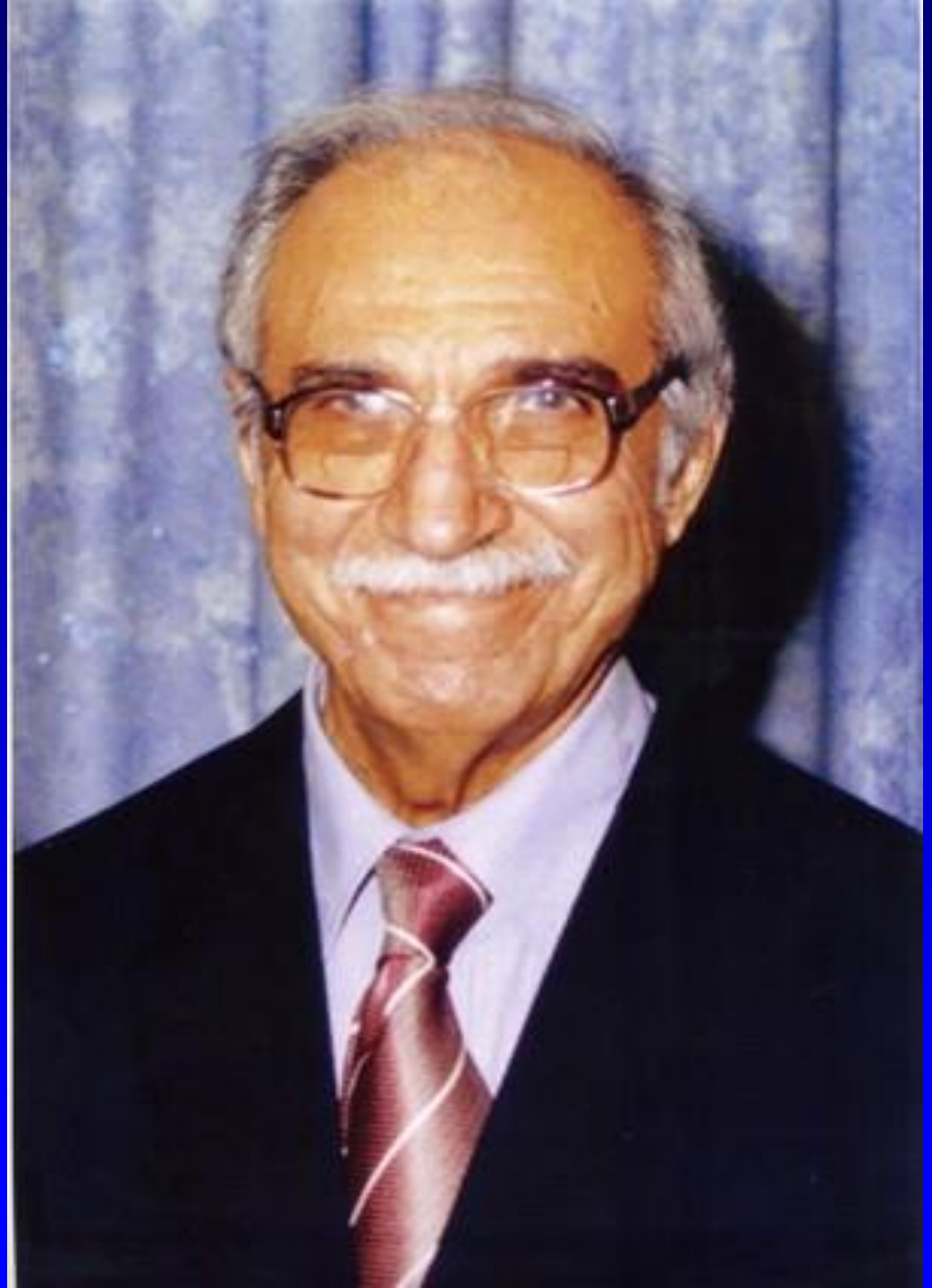
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پایه گذار آلرژى بالینی



Climate Change, Asthma & Allergies



Introduction

- Allergy or atopy: altered state of reactivity to common environmental and food antigens that do not cause clinical reactions in unaffected people
- Patients with clinical allergy usually produce
IgE → illness

Introduction

Allergy:

- Clinical expression: GI, lung, skin, nose, ...
- Familial predisposition

 **Prevalence** of allergy in recent decades is attributed to changes in environmental factors:

- tobacco smoke, **air pollution**, indoor and outdoor allergens, respiratory viruses, obesity and perhaps a decline in certain infectious diseases (hygiene hypothesis)

Introduction

- **Prevalence** of allergic diseases worldwide: **rising** (developed and developing countries)
- Include asthma; rhinitis; anaphylaxis; drug, food, and insect allergy; eczema; and urticaria and angioedema
- This increase: problematic in **children**,
the greatest burden of the rising: last two decades
- The **care** of patients with allergic diseases is **fragmented** and **far from ideal**.

The prevalence of allergic diseases and asthma is escalating

Approximately 30 to 40 percent of the world's population suffers from allergic diseases.

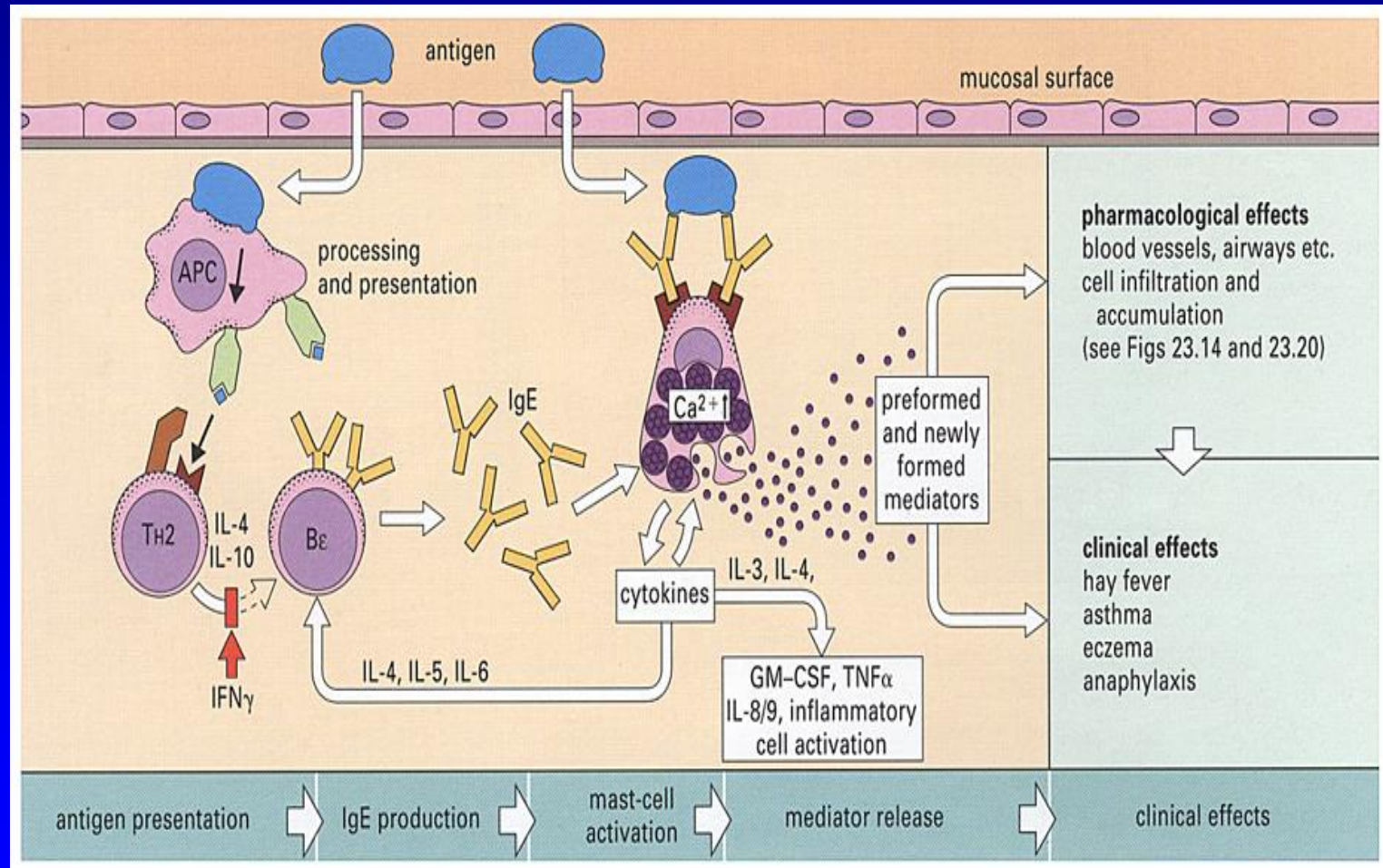
An estimated 300 million individuals worldwide have asthma, and this is likely to increase to 400 million by the year 2025.*

Allergic rhinitis, a risk factor for asthma, affects 400 million people annually, and food allergies affect 200 to 250 million.

The number of avoidable deaths from asthma occurring every year is estimated at 250,000.*

*World Health Organization (WHO))

Pathophysiology of an allergic reaction



The essential components of allergy diagnosis

Clinical History and Physical Examination

Symptoms versus Exposure

Diagnostic Confirmatory Test

Skin Test (Puncture, Intradermal)

Allergen-specific IgE antibody serology

Provocation Test

Oral, Nasal, Bronchial Challenge

Allergy History

- Demographics (age)
- Symptoms: frequency and severity
- Pattern: intermittent, persistent or seasonal
- Response to environmental factors:
 - Temperature changes, odors, humidity, alcohol
- Occupation and hobbies
- Identification of allergens/irritants in the home, office or environment
- Treatment, past and present: efficacy, compliance, side effects

Allergy Symptoms

Clinical History Drives the Diagnosis

- Hypersensitivity to an injected, ingested, or inhaled antigen in response to a first exposure.
 - Skin: itch, rash, swelling, redness
 - Eyes: itchy, tears, watery, redness, crusting
 - Nose: runny, itchy, congestion, sneezing
 - Lung: wheezing, cough, tightness, shortness of breath
 - Stomach-Intestines: nausea, vomiting, bloating, diarrhea
 - Heart-Blood Vessels: anaphylaxis, syncope, faintness, death

Atopic Dermatitis



Asthma



Allergic Rhinitis



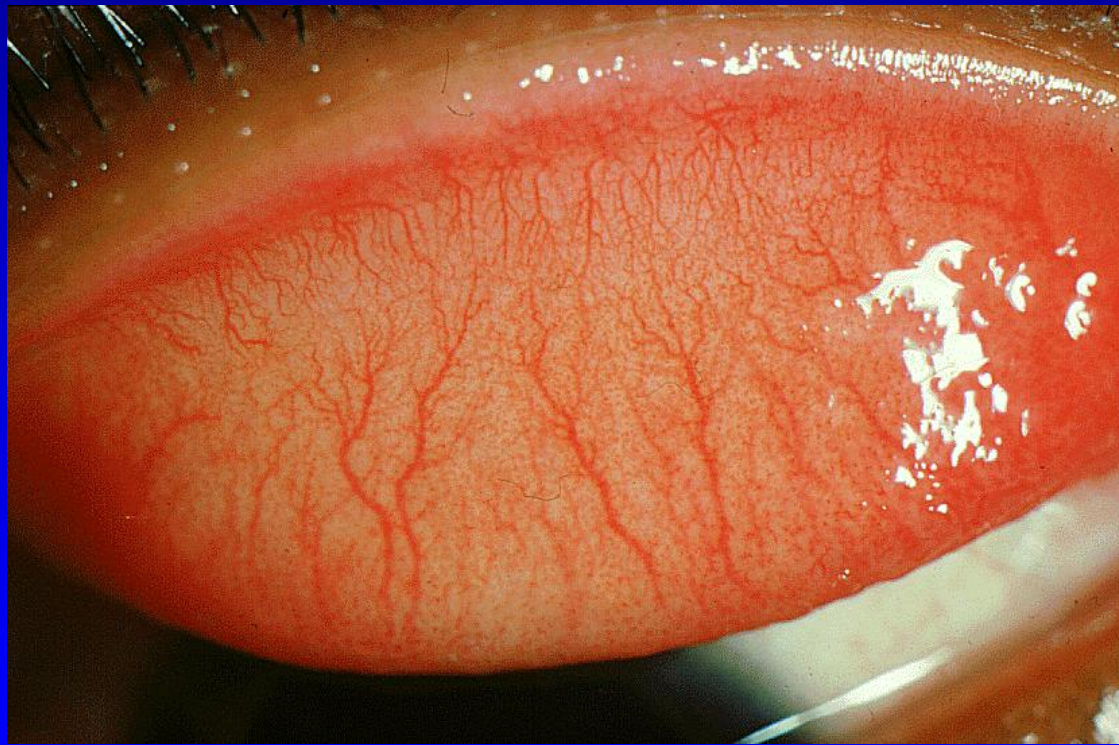
Allergy Physical Examination: The Swollen Nasal Mucosa



Allergic conjunctivitis



Allergy Physical Examination: The Everted Eyelid



Spectrum of allergen sources



Allergic (Atopic) March



Allergic (Atopic) March

Natural history of atopic manifestations:
typical sequence of IgE antibody responses
and clinical symptoms which may appear
early in life, persist over years or decades and
often remit spontaneously with age

Allergic (Atopic) March

اصطلاح «رژه آلرژیک»

تاریخچه طبیعی تظاهرات اتوپیک:
بروز پی در پی و مشخص پاسخ های IgE و علائم
بالینی مرتبط،
ممکن است در اوایل زندگی ظاهر شوند، سال ها
یا دهه ها پایدار بمانند،
و اغلب به طور خود به خود با افزایش سن
خاموش می شوند.

Allergic (Atopic) March

frequently **misunderstood**:

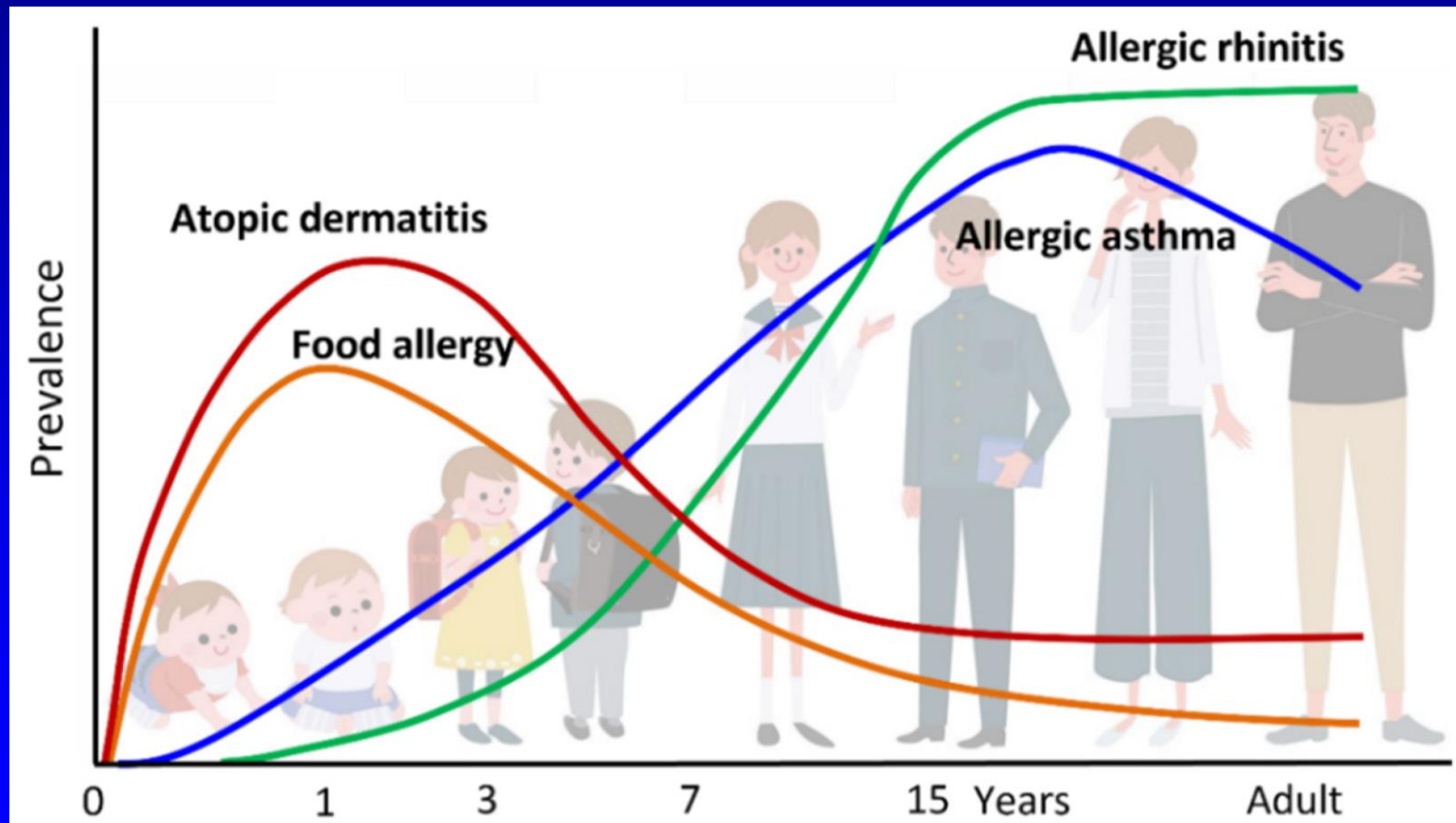
...development from *minor symptoms* over a *mild disease* expression towards *more severe chronic* manifestations.

Misinterpreted as the exclusive development from atopic dermatitis in infancy to airway disease, particularly asthma in **school-age**.

Underestimate the variations and heterogeneity of atopy development during the first decade of life.

This first decade of life turns out to be special and **unique** compared to later ages

Allergic (Atopic) March



Facts

- The prevalence of allergic diseases has increased around the world in recent decades

(Asher et al., 2006; Cakmak et al., 2010; Nicolaou et al., 2005; Solomon, 2011; Szyszkowicz et al., 2009).

- Increase in short period of time, genetics insufficient to explanation

(Lobdell et al., 2011).

Exposure to environmental pollutants or microorganisms especially in air (both indoors and outdoors) identified as the main cause of many common ailments along with allergies (and chemical sensitivities)

(Englert, 2004).

Objectives

- Environmental changes
- Air pollution
- Pollen
- Health effects
- Asthma and allergies

DEFINITION OF CLIMATE CHANGE

- “ It is a change which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparative time periods”



CAUSES OF CLIMATE CHANGE

- NATURAL CAUSES
 - Volcanic eruptions



- Ocean currents



- Solar Variation



➤ HUMAN CAUSES (Anthropogenic or Man-made causes)

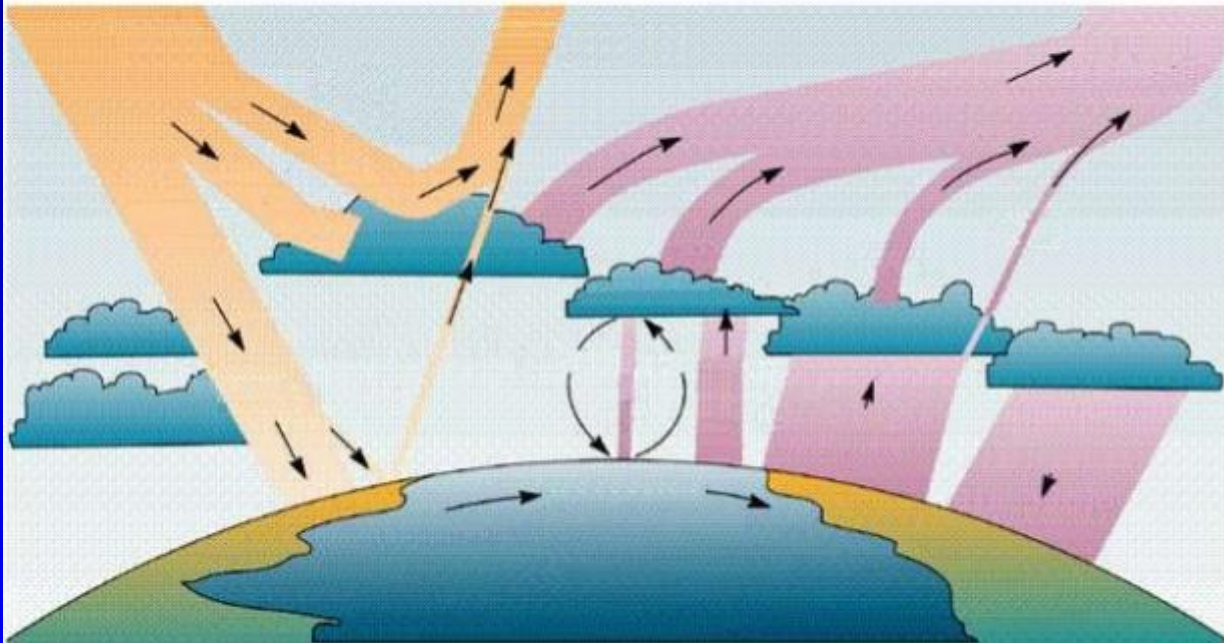
- Greenhouse gases
- Deforestation
- Coal mining
- Burning of fossil fuels
- Industrial processes
- Agriculture

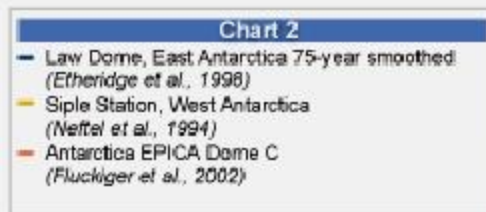
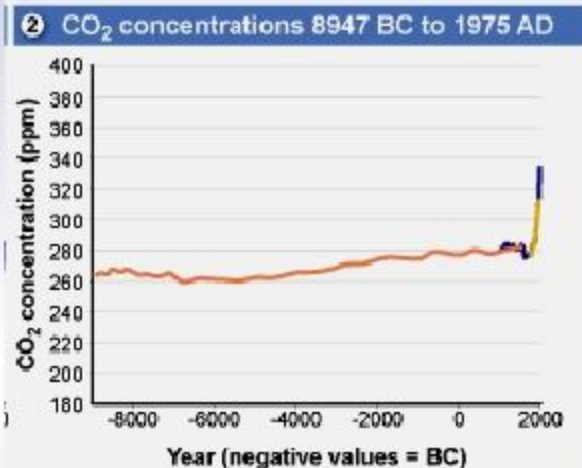


Climate change and air pollution

-  Climate change and air pollution have, to a large extent, a common cause –emissions from fossil fuel burning.
-  The combustion of fossil fuel leads to emissions of greenhouse gases (GHGs) (CO₂, methane, nitrous oxide)
-  GHGs accumulate in the atmosphere, warming its lower layers and causing knock-on effects in the Earth System
-  Increase temperature has a direct effect on air pollutant in particular O₃ formation

The Greenhouse Effect

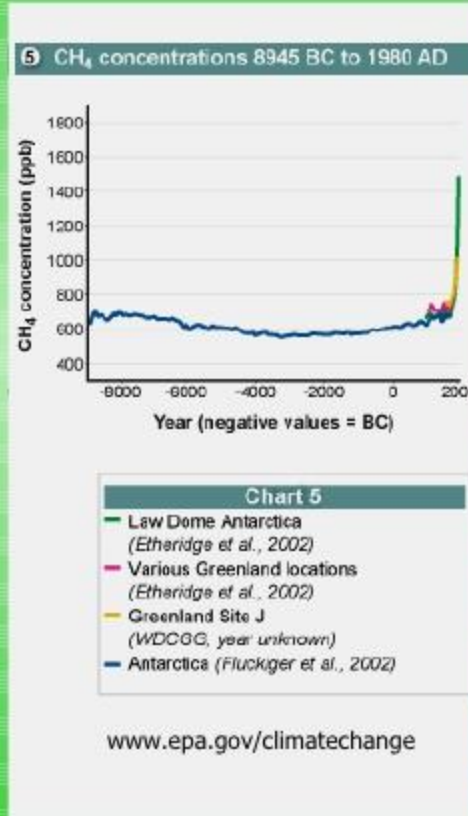
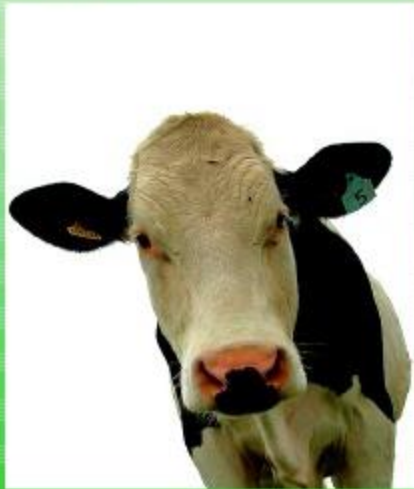




Carbon Dioxide in Earth's atmosphere has risen by about 30% since the beginning of the industrial revolution. Most of the increase is due to the combustion of fossil fuels, which releases the long-stored CO₂ back into the atmosphere.

Methane

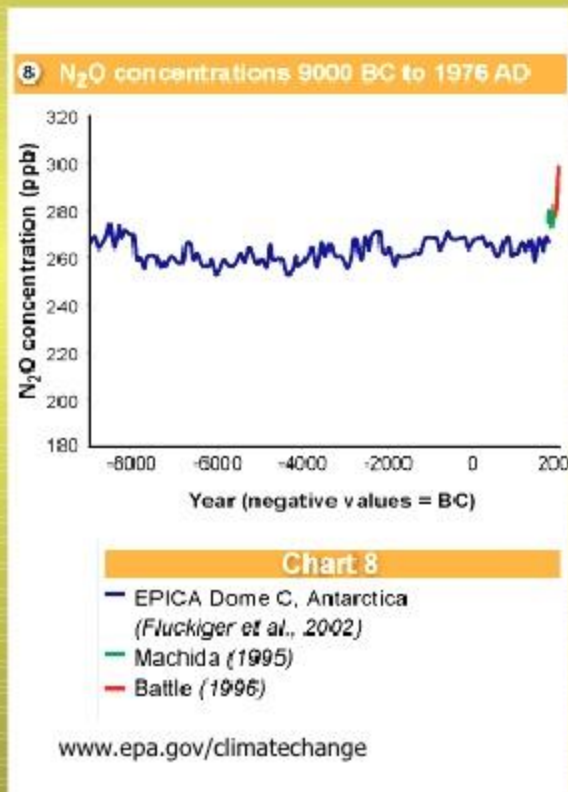
Methane is released by coal mining, landfills, and by agriculture, particularly through the digestive processes of beef and milk cows.



Nitrous Oxide

Nitrous Oxide is produced by cars, by fossil fuels used for heat and electricity, and by agriculture.

<http://www.epa.gov/nitrousoxide/scientific.html>



- Deforestation



- Coal Mining



- Burning of Fossil Fuels



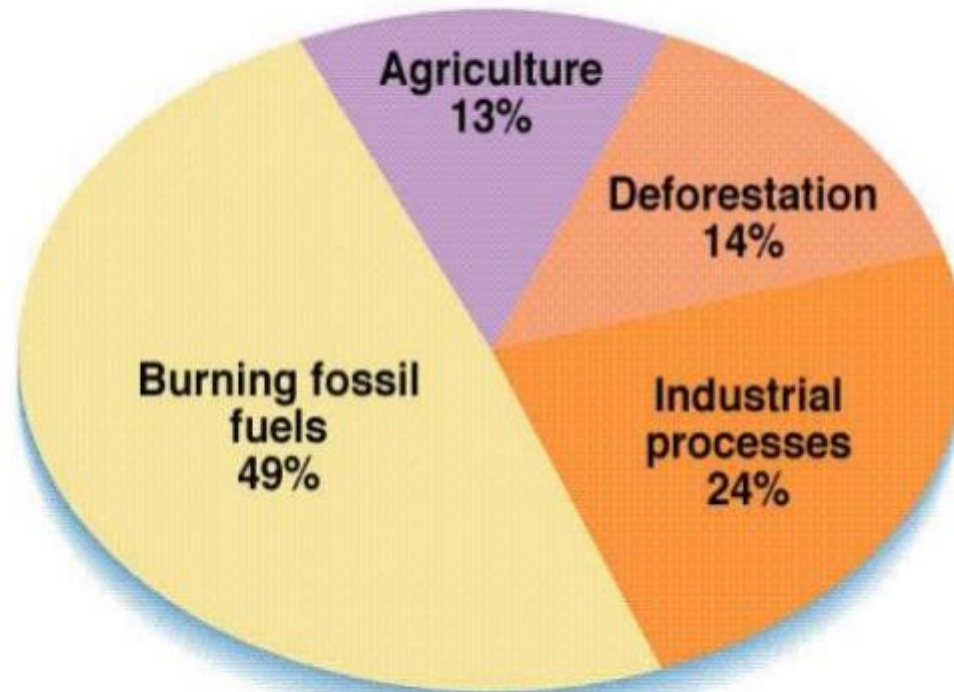
- Industrial processes



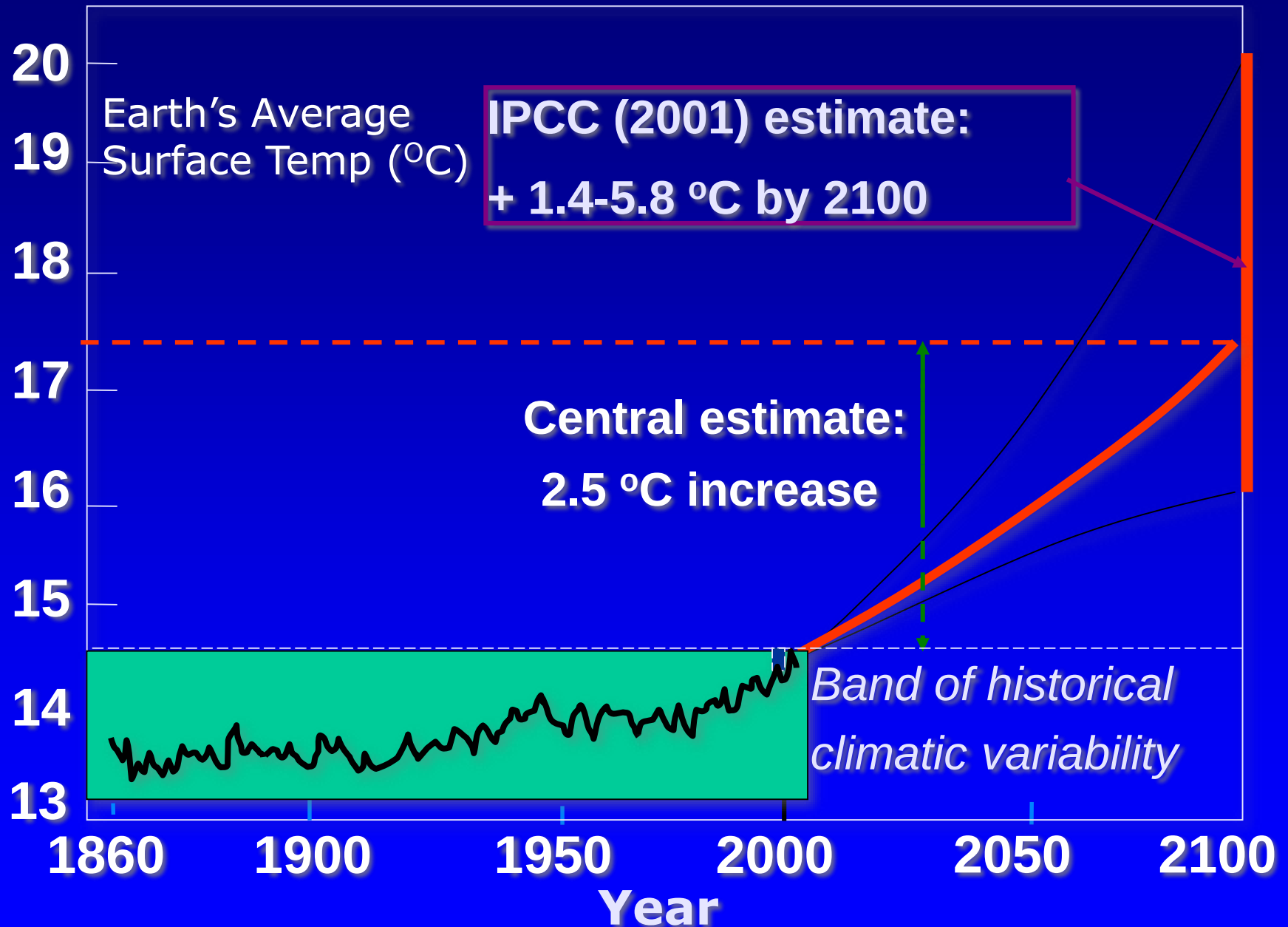
- Agriculture



Global Warming & Humans



Global change factors



EFFECTS OF CLIMATE CHANGE

RISE IN SEA LEVEL



Melting ice sheets → *Sea level rise*



HEAVY RAINFALL ACROSS THE GLOBE



Glaciers are melting away worldwide



**Agassiz Glacier,
Montana, in
1913...**

...and in 2005



**Pasterze Glacier,
Austria, in
1875...**

...and in 2004



EXTREME DROUGHT



DECLINE IN CROP PRODUCTIVITY



ECOSYSTEMS ARE CHANGING



HURRICANES



WHO estimated mortality (per million people) attributable to climate change by the year 2000

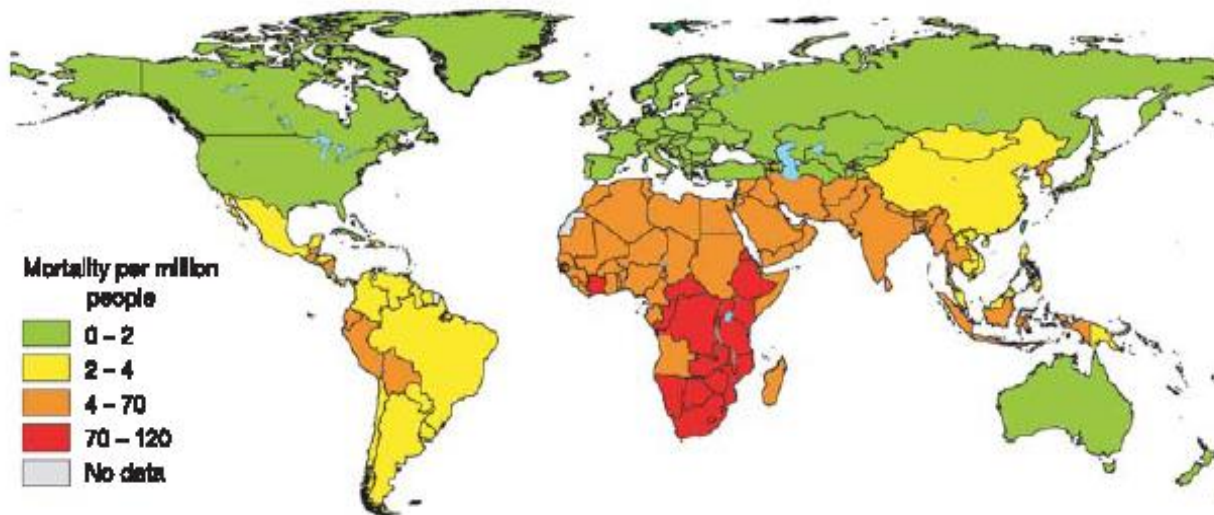


Figure 2 | WHO estimated mortality (per million people) attributable to climate change by the year 2000. The IPCC 'business as usual' greenhouse gas emissions scenario, 'IS92a' and the HadCM2 GCM of the UK Hadley Centre were used to estimate climate changes relative to 'baseline' 1961–1990 levels of greenhouse gases and associated climate conditions. Existing quantitative studies of climate–health relationships were used to estimate relative changes in a range of climate-sensitive health outcomes including: cardiovascular diseases, diarrhoea, malaria, inland and coastal

flooding, and malnutrition, for the years 2000 to 2030. This is only a partial list of potential health outcomes, and there are significant uncertainties in all of the underlying models. These estimates should therefore be considered as a conservative, approximate, estimate of the health burden of climate change. Even so, the total mortality due to anthropogenic climate change by 2000 is estimated to be at least 150,000 people per year. Details on the methodology are contained in ref. 57.

Air Pollution



Tehran, Iran, 15 November 2016. Habib Kashani, a member of Tehran's municipal council, said on Tuesday that pollution in Tehran had led to the death of 412 citizens in the past 23 days, according to the state news agency, Irna. City authorities announced that all schools would be closed on Wednesday. The concentration of ultra-fine airborne particles (known as PM2.5) reached more than 150 this week, setting a new record. These particles of less than 2.5 micrometres in diameter can penetrate the lungs and pass into the bloodstream and have been linked to increased rates of chronic bronchitis, lung cancer and heart disease. (Guardian newspaper)





هفته جهانی آلرژی

۲۲-۱۶ فروردین ۱۳۹۵

World Allergy Week

4-10 April 2016



Animal and plant life is changing



2/3 of European butterfly species studied have shifted their ranges northward by as much as 150 miles. (Parmesan, 1996; Parmesan et al., 1999)



An analysis of the distributions of British birds found that many species have moved north by an average of 18.9 km. (Thomas et al, 1999)



At Boston's Arnold Arboretum, plants are flowering eight days earlier on average than they did from 1900 to 1920. (Primack et al, 2004)

Health effects - risk factors for atopic diseases

- Genetic Predisposition
- Environmental Factors

Air Pollutants

- Gases:

- O₃,

- CO,

- NO_x,

- So_x

- Particles:

- PM2.5,

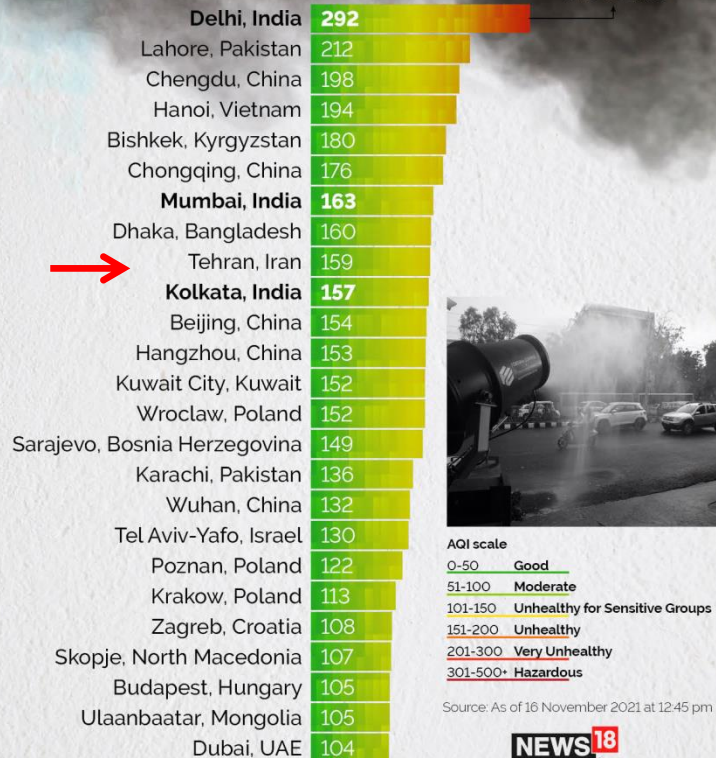
- Pb

WORLD'S MOST POLLUTED CITIES TODAY

Three Indian cities are among the ten cities with the worst air quality according to IQAir real-time data

Air Quality Index (AQI)

Worst in the world



Climate change - pollen

- $\uparrow \text{CO}_2 \rightarrow \uparrow$ plant biomass & pollen production
- $\uparrow$ temperature $\rightarrow \uparrow$ earlier flowering and longer pollen seasons for some plants
- $\uparrow$ ambient $\text{CO}_2 \rightarrow$ some plant products $\uparrow$ allergenic

Ozone levels and asthma

- Warmer air temperature →
↑ ground levels of O₃
 - O₃: pulmonary irritant → inflammation
→ pneumonia, allergic rhinitis, asthma
 - ↑ long term and short term asthma
-
- Ebi KL, Paulson JA. Climate change and child health in the United States. Curr Probl Pediatr Adolesc Health Care. 2010 Jan;40(1):2-18.
 - D'Amato G, Cecchi L, D'Amato M, Liccardi G. Urban air pollution and climate change as environmental risk factors of respiratory allergy: an update. J Investig Allergol Clin Immunol. 2010;20(2):95-102.

Climate change - ↑ exposures

- ↑ Ozone – higher ozone ground levels
- ↑ Pollen – earlier start of the season, more pollen, alternated pollen
- ↑ Common Ragweed
(*Ambrosia artemisiifolia*)
- ↑ Oak Processionary Moth
(*Thaumetopoea processionea*)
- In higher altitudes ↑ house dust mite

Climate change – changes !

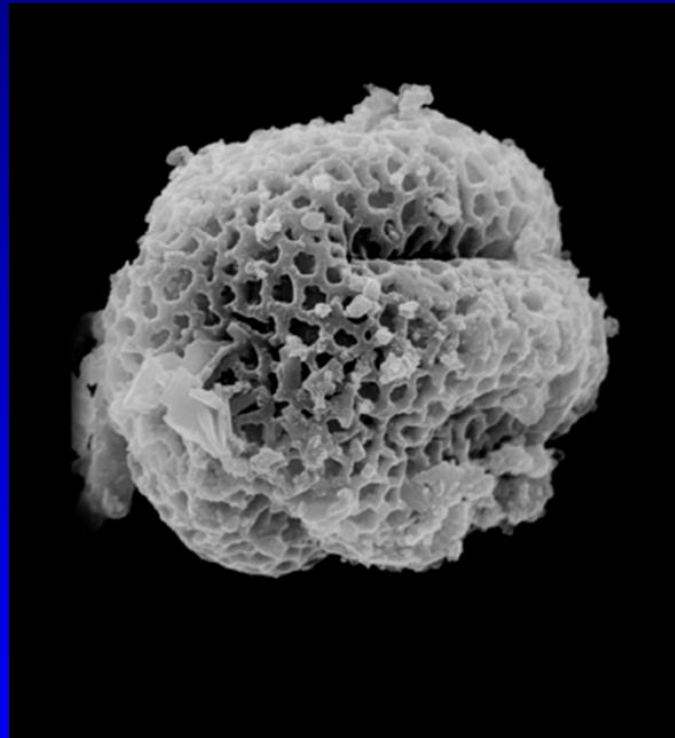
- Δ time spent indoor/outdoor
-> Δ exposure to various air pollutants
- Δ pattern of infectious diseases
- Δ different ventilation rates -> mold
- Δ behaviour e.g. outdoor sports

Health effects

- atopic diseases

- Asthma
- Allergic rhinitis / „hay fever “
- Allergic conjunctivitis
- Atopic dermatitis
- Food allergies

Fine particles and pollen



Airborne allergens bind fine particles – allergen – aerosols derive, which have an additional allergenic potential

Foto: Prof. Heidrun Behrendt/Helmholtz Zentrum München, Klinische Kooperationsgruppe Umweltdermatologie und Allergologie, aus http://www.helmholtz-muenchen.de/fileadmin/FLUGS/PDF/Themen/Allergien/Klimawandel_und_Allergien.neu.pdf

Air Pollution and Allergic Diseases

Children living near heavy roads exhibit a higher risk for atopic eczema



Erhöht das Risiko für AE



Eczema, respiratory allergies, and traffic-related air pollution in birth cohorts from small-town areas

Ursula Krämer^{a,*}, Dorothea Sugiri^a, Ulrich Ranft^a, Jean Krutmann^a, Andrea von Berg^b,
Dietrich Berdel^b, Heidrun Behrendt^c, Thomas Kuhlbusch^d, Matthias Hochadel^{e,f},
Heinz-Erich Wichmann^f, Joachim Heinrich^f

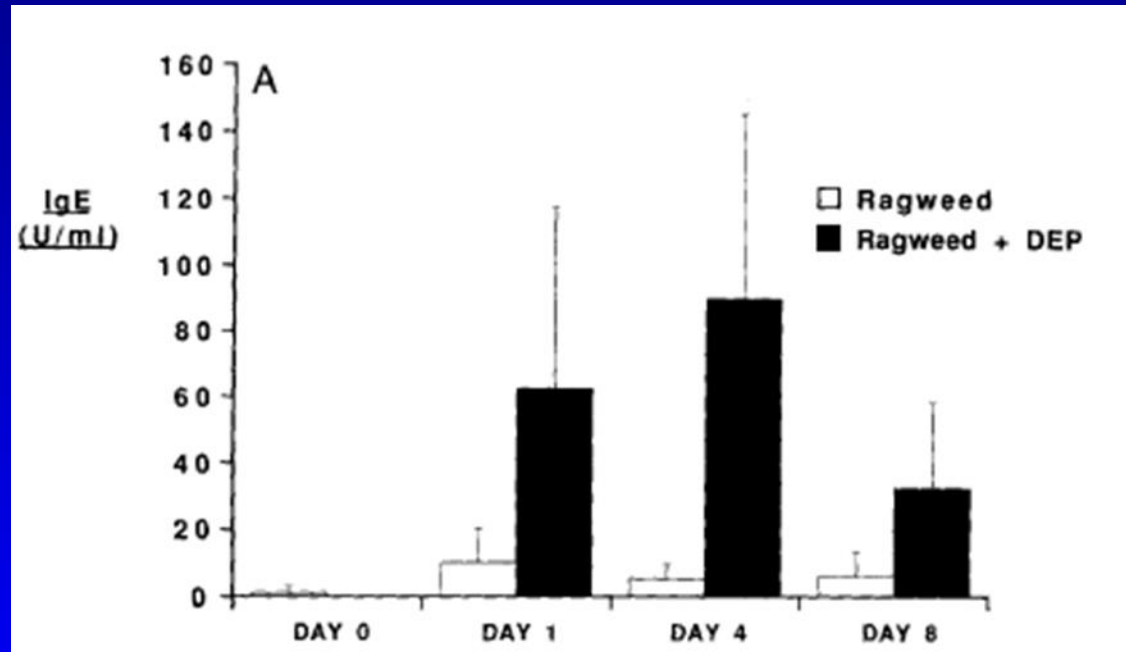
the GINIplus and LISAplus study groups

Journal of Dermatological Science 56 (2009) 99–105

Particles and asthma

- Warmer air temperature →
↑ levels of PM (particulate matter)
- PM penetrate lower airways
→ ↑ wheezing, bronchitis, LRTI,
asthma
- Esp. diesel exhaust particles (DEP)
- → interaction between DEP &
aeroallergens → ↑ ↑ ↑ IgE

Health effects – ragweed plus diesel exhaust particles

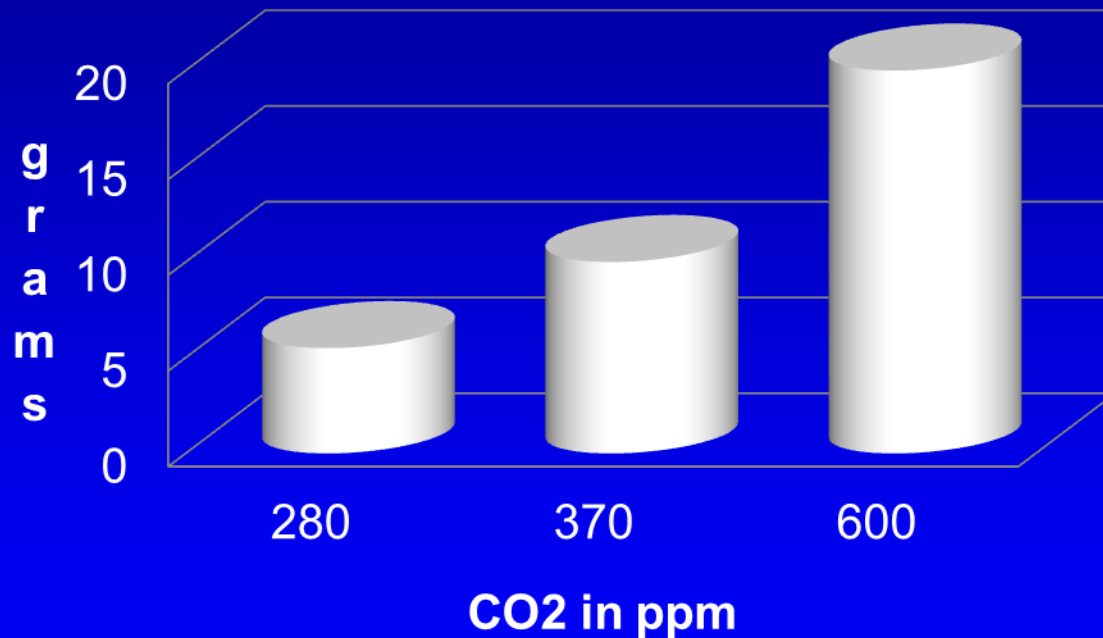


Effect of ragweed or ragweed plus DEP on IgE levels in nasal washes over time.

Diaz-Sanchez D, Tsien A, Fleming J, Saxon A. Combined diesel exhaust particulate and ragweed allergen challenge markedly enhances human in vivo nasal ragweed-specific IgE and skews cytokine production to a T helper cell 2-type pattern. *J Immunol.* 1997 Mar 1;158(5):2406-13

Increased aero-allergens

Ragweed pollen production – CO₂ levels



Pollen production in common ragweed

Ziska L, Caulfield FA. Rising CO₂ and pollen production of common ragweed (*Ambrosia artemisiifolia*), a known allergy-inducing species: implications for public health. *Aust J Plant Physiol.* 2000;27:893–8.

Increased aeroallergens, increased illness

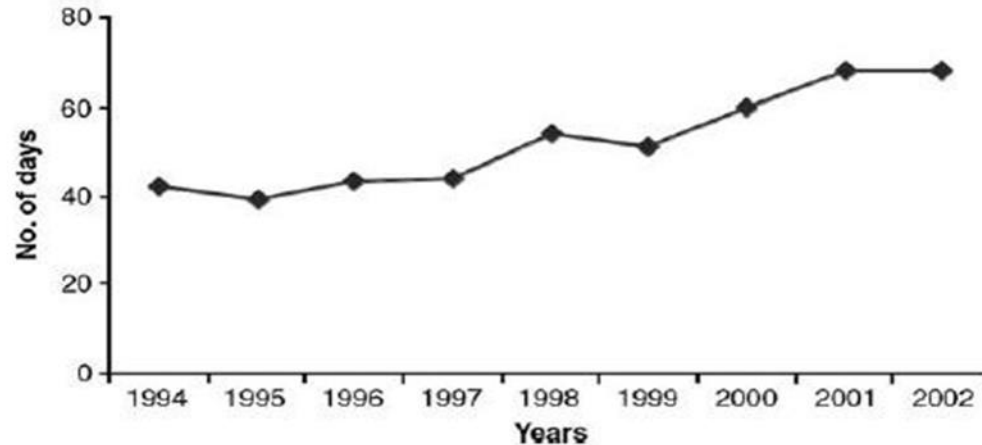


Fig. 4. Length of the *Ambrosia* pollen season for the Montreal region between 1994 and 2002.

- Length of pollen season increasing significantly
- Seeking medical consultation
 - OR 2.69 (1.32-5.52) day of high pollen counts
 - OR 2.48 (1.26-4.88) 5 days after high pollen counts

Climate Change & Allergic Airway Disease



What actions are needed?

- Training of health care professionals – new emerging diseases
- Greening the health care system

Examples of GHG-reducing strategies with health cobenefits

- Increased active transport: bicycles and walking
- Use public transport
- Eat fresh, locally grown, when possible organic food
- Eat less beef and pork, more fruits, vegetables, and whole grains
- Energy efficiency: turn it off at the power source when not in use, use energy-efficient lighting and appliances, optimize insulation

Thank you

