Transport Planning & Public Health
Napier University, 22nd Nov 2018

The cardiovascular effects of air pollution

Dr Mark R. Miller

Pechakucha Session
6 minutes, 6 slides (hopefully, this slide does not count!)

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Air pollution has effects all over the body

Neurodegenerative Diseases

Impaired cognition
Altered behaviour

Depression

Stem cell alterations

Liver toxicity

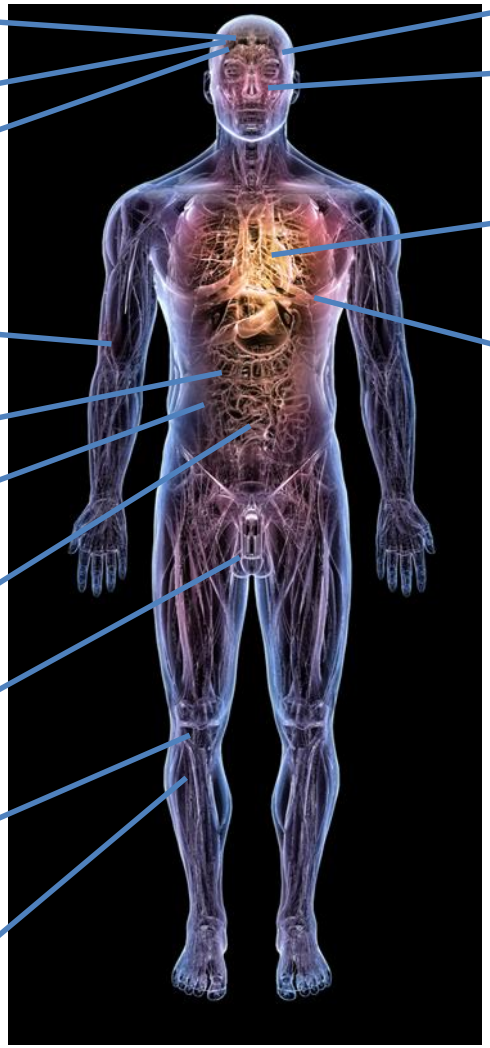
Renal Disease

Metabolic syndrome & Diabetes

Decreased Fertility

Autoimmune rheumatic diseases

Peripheral artery disease



Stroke

Olfactory deficits

Cardiovascular disease

Asthma
COPD
Respiratory infection
Lung cancer

Pre-eclampsia

Premature birth

Low birth weights

Epigenetic changes

Detrimental health effects in offspring

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Air pollution and mortality

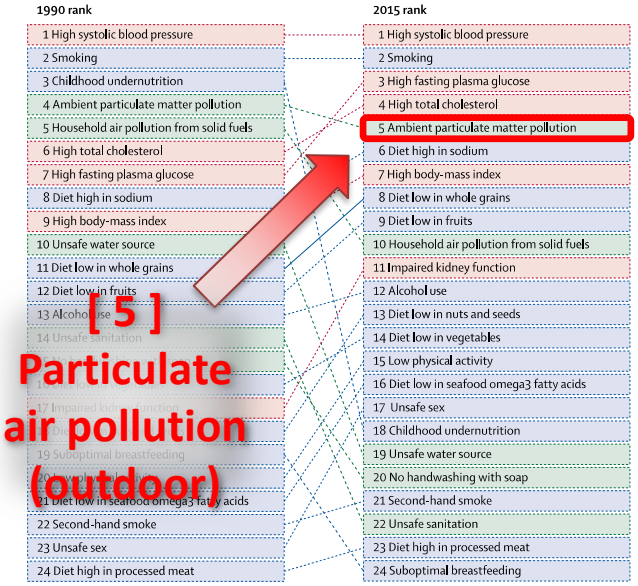
The world-wide effects of air pollution are considerable

MORTALITY: 3 - 7 million premature deaths per year

MORBIDITY: loss of more 5 million work days per year

Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015

Aaron J Cohen, M*
Lalit Dandona, Ra
Lidia Morawska, C
Theo Vos, Christo



Cardiovascular disease

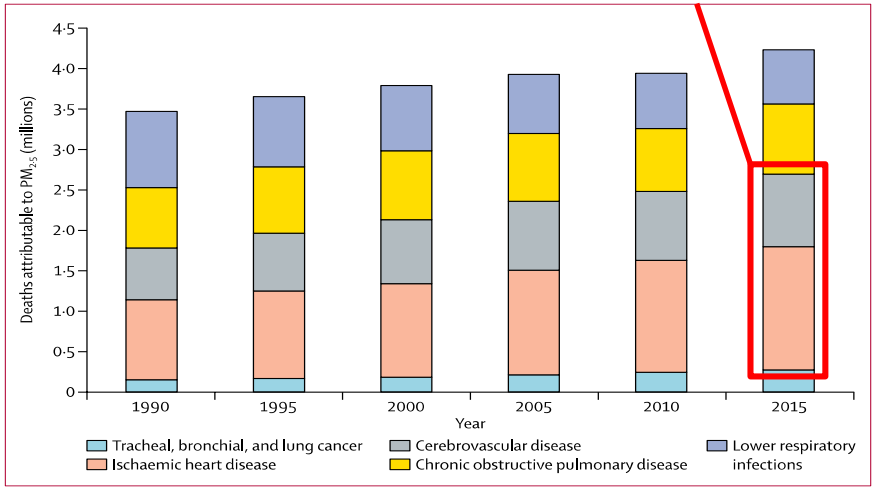


Figure 4: **Deaths attributable to ambient particulate matter pollution by year and cause**
$PM_{2.5}$=particle mass with aerodynamic diameter less than 2·5 μm.

Associations between air pollution and cardiovascular disease are strongest for the particulate matter in the air

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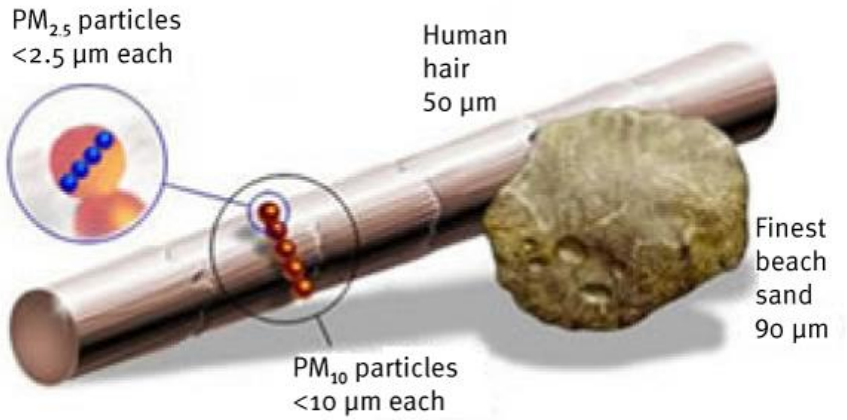
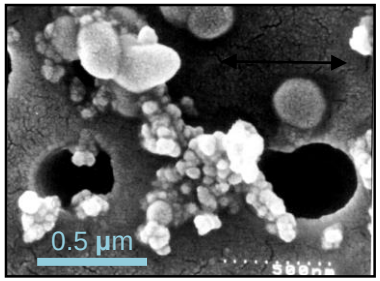
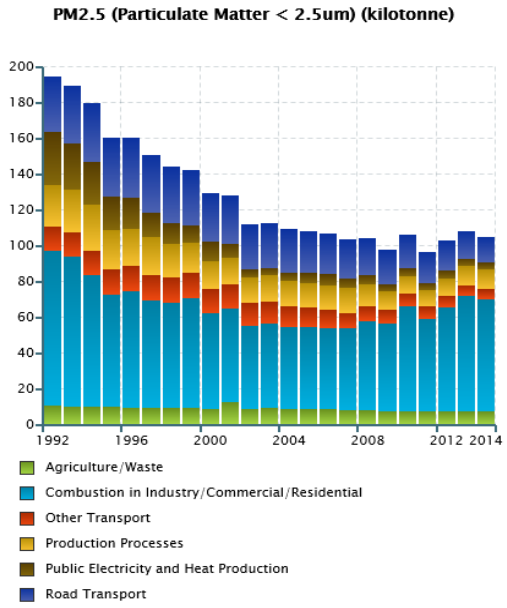
Particle size

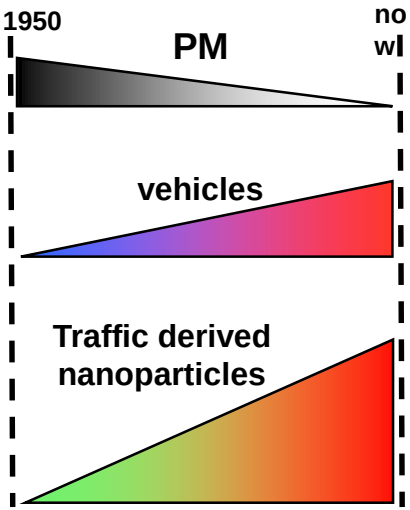




	(µm)
"Coarse" (PM_{10}):	<10.0
"Fine" ($PM_{2.5}$)	<2.5

PM_{10} is measured as the **mass** of particles with an aerodynamic diameter of 10 µm or less





"Ultrafine" ($PM_{0.1}$): <0.1

(nanoparticles, <100 nm)

Vehicle exhaust rich in nanoparticles

PM_{10} and $PM_{2.5}$ do not adequate measure ultrafine particles

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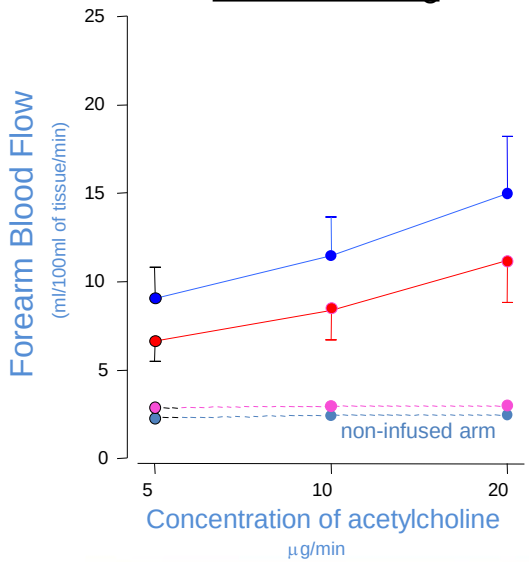
Controlled exposure to dilute diesel exhaust

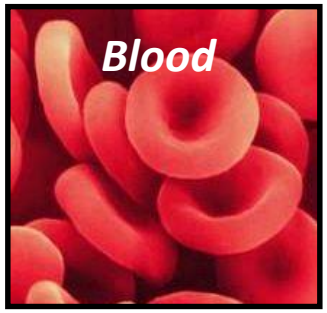
Response to a vasodilator drug

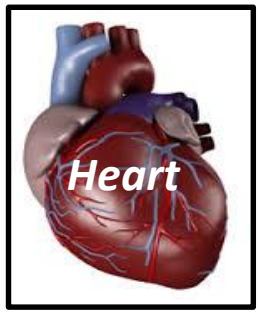


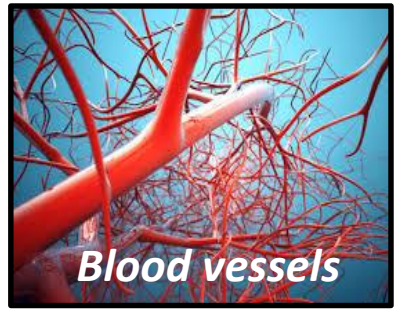
clean air

dilute diesel exhaust

- Substantial impairment in vascular function
- Rapid effect: within 2 hours
- Long-lasting impairment: > 24-h







Diesel exhaust harms the cardiovascular system in many ways

Mills et al. Circulation 2005

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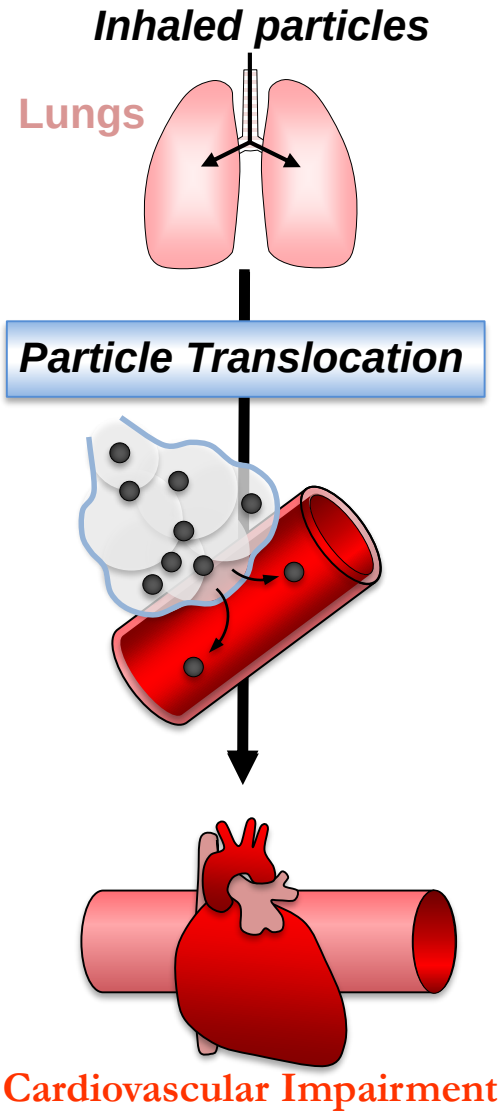
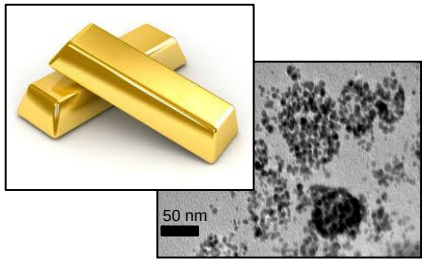
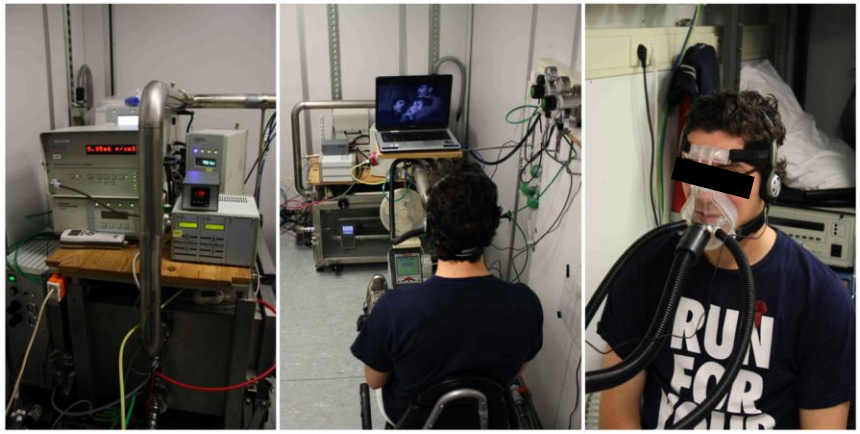
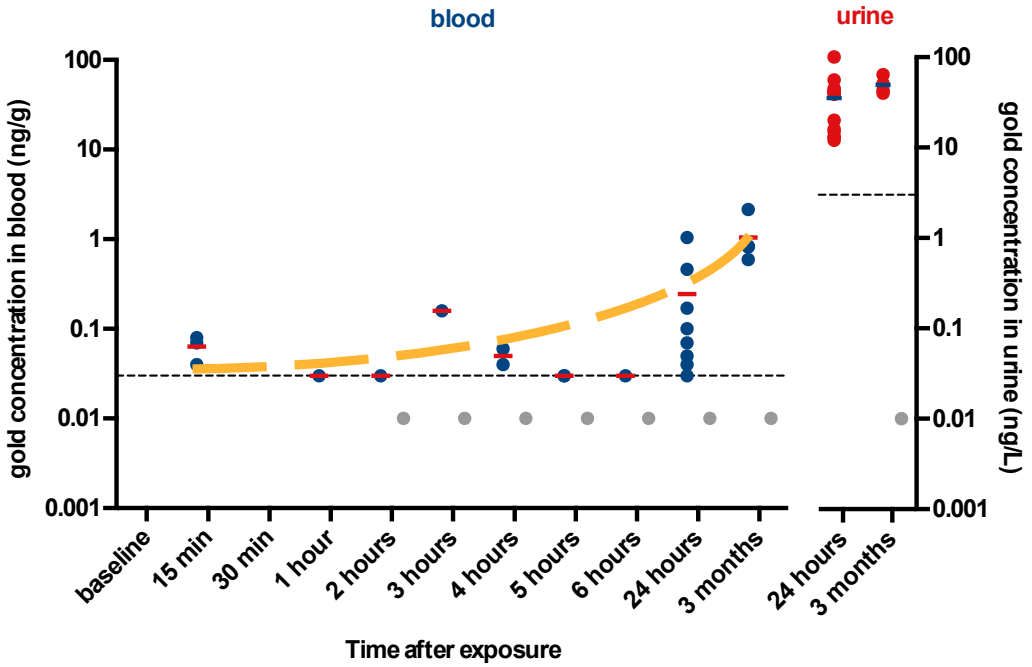
From lung to blood: “particle translocation”?









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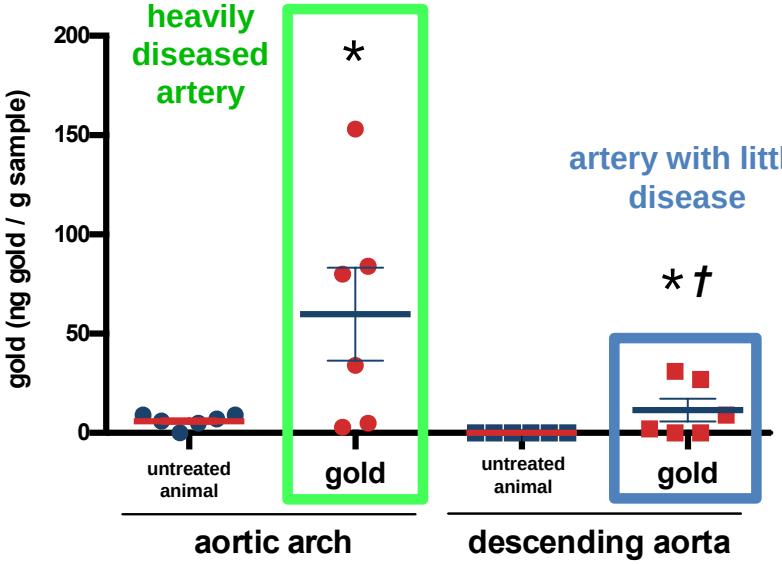
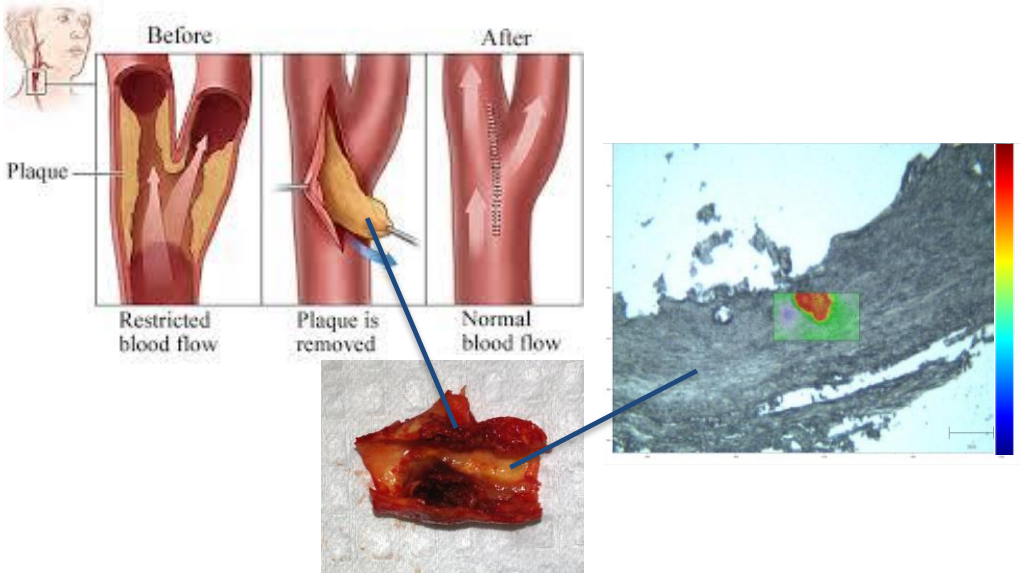
Inhaled nanoparticles accumulate at areas of vascular disease





- If diesel exhaust particles reach areas of vascular inflammation they are likely to promote cardiovascular disease and events

- **Reducing emissions from vehicles should be a major strategy to reduce the health effects of air pollution**

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Thanks!

To our workers, collaborators, funders and audience

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