AIR QUALITY, OXIDATIVE STRESS, and VASCULAR HEALTH

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When mortality from all causes was considered, or when deaths due to cardiovascular and respiratory diseases were grouped together, the effects of air pollution were consistent and the association was robust.
Six Cities Study and Beyond

“Air pollution kills.”

Since then, a steady stream of studies has grown into a river of reports that collectively have swelled the banks of this initial association and have further specified that ischemic heart disease is the single-most abundant cause of morbidity related to air pollution.

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JUST SAY NO

MOLECULE OF THE YEAR
Free radicals *in vivo*:
Endothelium mediated vasodilation and NO bioavailability

L-Arginine → eNOS → Citrulline

Endothelium

NO → ONOO⁻
O₂⁻

NO

sGCi → sGCa → cGMP → RELAXATION

Smooth muscle cell

GTP
Doppler ultrasonography:

Rest

Exercise

Donato et al. AJP 2010
Evidence of NO-mediated vasodilation during handgrip exercise

Wray et al., AJP H 2011
For similar flow/shear, arm blood vessel reactivity during exercise is altered with age.

Donato et al. AJP 2010
The effect of oral antioxidants on arm vessel reactivity during exercise in the old

AO cocktail: Vitamin C (1,000 mg); Vitamin E (600 I.U.); Alpha-lipoic acid (600mg)

Donato et al. AJP 2010
Nitrosative and Oxidative Stress: Sources and Implications

Peroxynitrite is a potent oxidant, which damages many tissues and organs by nitration of the tyrosine residues of proteins, and it enhances the late response of inflammation.
Chronic exposure to each 10 µg/m3 PM2.5 increase is associated with a 4 to 6% increase in CVD deaths, which translates to 800 000 deaths annually in the world (according to the World Health Organization), making PM exposure the 13th leading cause of CVD

What constituent of inhaled PM2.5 is responsible for the association?

What is the mechanism by which inhaled PM2.5 can specifically affect cardiovascular disease risk?
Mechanism of PM2.5 induction of vascular inflammation/dysfunction.

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Conundrum: Physical activity – Air Quality – CVD

“What fits your busy schedule better, exercising one hour a day or being dead 24 hours a day?”
Utah Vascular Research Laboratory

UVRL.org

National Institute of Health
American Lung Association
American Heart Association
Parker B. Francis Foundation
Stein Institute For Aging Research
Tobacco Related Disease Research Program
Association Francaise contre les Myopathies
Office of Rural Health VAMC
Rehabilitation Research and Design VAMC