Sustainable work and the exposure to chemicals

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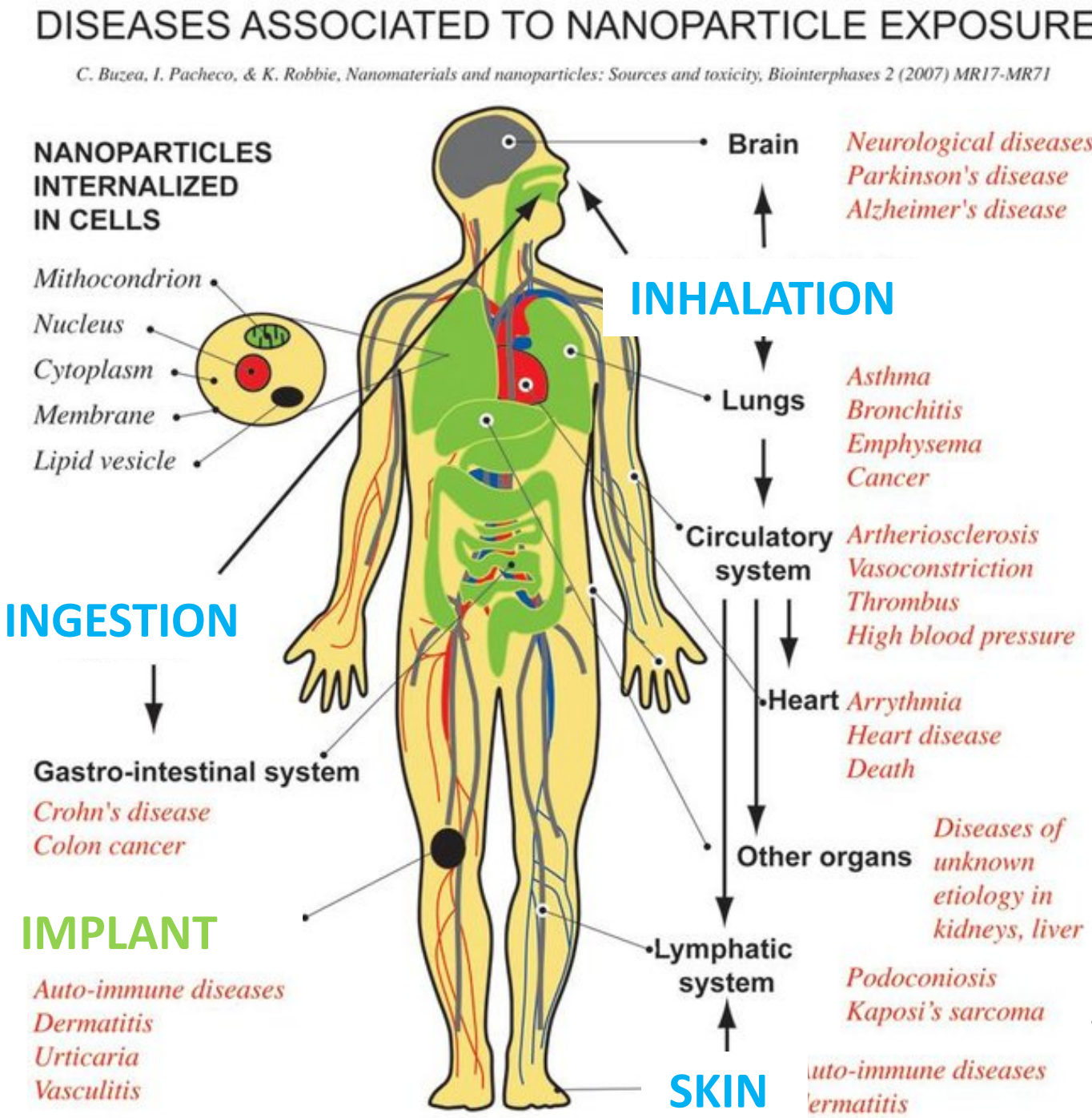
My own research:

Aerosols – airborne particles

Many work environment studies: hair dressers, cleaners, welders, asphalt workers, ..

And human chamber studies for aerosols: diesel, candle, cooking smoke, phthalates, …

Around 150 000 chemicals are registered in the world.



The three main pathways:

- inhalation
- ingestion
- skin

…and thereafter distribution in the body

…and thereafter interaction with different organs and chemical processes.

Source: Buzea et al (2007) in Nanomaterials and nanoparticles.

A deep learning neural network trained on 50,000 crystal structures of inorganic materials has acquired the ability to recognize chemical similarities and predict new materials.

New and new old chemical hazard exposure

New chemical

- **Nano particles**

New users

- **Thermosetting polymers**, eyelash extension in the beauty industry

New products

- Water based painter colors contaning **Pre**

New upgrade of the risk

- **Welding fume**

New exposure

- **Asbestos**

To summarise: there will always be new challenges/threats, and we should never forget that the "old ones" could turn up in a new context.

The exposure and health effects are unequally distributed

- A population-based survey study “Gender differences in occupational exposure patterns”
- Aged 20—64 years were randomly selected (males=1431, females=1572)
- Self-reported occupational exposure to specific dusts and **chemicals**, physical exposures and organisational factors.
- **Men** were two to four times **more likely to report exposure to dust and chemical substances**, loud noise, irregular hours, night shifts and vibrating tools.
- **Women** were 30% more likely to report repetitive tasks and working at high speed, and **more likely to report chemical exposure to disinfectants, hair dyes and textile dust.**
- **When men were compared with women with the same occupation, gender differences were subdued**. **However, males remained significantly more likely to report exposure to welding fumes, herbicides, wood dust, solvents,** tools that vibrate, irregular hours and night-shift work.
- Women remained more likely to report repetitive tasks and working at high speed, and in addition were more likely to report awkward or tiring positions compared with men with the same occupation.
- In conclusion: The study showed substantial differences in occupational exposure patterns between men and women, **even within the same occupation**. **Thus, the influence of gender should not be overlooked in occupational health research**.

Source: Eng et al, *Occupational and Environmental Medicine*. 2011, 68(12):888-894

Workers is also exposed beside the work!

Some exampels:

- Phtalates, diesel fume etc is everywhere
- PFOS (**Perfluorooctanesulfonic acid)** in dring water

Different social groups will have different exposure caused by different consumer habits and residential locations.

Collecting of big data!

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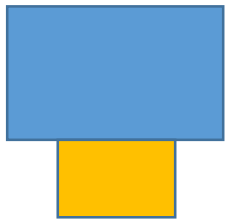

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Smart sensor
for everyone!

Toxic, Explosive, and
Volatile Organic Compounds
– All in a chip

Mobile-Phone Based Chemical Analysis - Instrumental Innovations and Smartphone Apps
Trojanowicz-M, et al. in Modern Chemistry & Applications 2017, 5:2

Big-data and machine learning techniques for toxicology and use in risk assessment

- The creation of **large toxicological databases and advances in machine-learning techniques** have empowered computational approaches in toxicology.
- A first implementation of **machine learning-based predictions** termed REACH*across* **achieved to predict the six most common acute hazards** covering about two thirds of the chemical universe.
- It demonstrates the new quality introduced by big data and modern machine-learning technologies.

Source: Thomas Luechtefeld et al, Toxicology Research 2018, 5:721

Is there opportunities for the use of computational methods to increase the efficiency to discover new chemical health threats? Or maybe, it is the only way forward to keep pace with the development of new and complex/specific chemicals?

Questions for further discussion…

How do we research?

- Do we need to **move from a dominance of "misery research"** to the risks of more action-oriented research focused on health promotion? And how does the potential for financing and scientific merit influence such development?
- Is our research sufficiently observant and **equipped / competent for future changes in chemical exposure** due to, for example, globalization and technology development?

Social awareness?

- Does research in chemical health risks **take due account of social justice, equality, gender** and the relationship between **work and spare time**?
- Are there workplaces / industries for which researchers are **not sufficiently aware**? Need more measurements and mapping at work?
- Many of the products and **chemicals we use are produced in other countries**. How should our research be influenced by this fact?

New opportunities?

- Is there a great potential for using and/or developing technologies **to collect "big data" to develop future research** into chemical health risks? Or use machine learning techniques?