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# **Biological and physical cancerogens**

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# Biological (occupational) cancerogens

- Biological agents are well known and recognised as cancerogens, most of them can also occur in occupational settings and environments – includes viruses, bacteria, fungus and parasites;
- Two main mechanisms for development have been described
- Changes in affected organs (cells) can happen at several levels:
  - changes in physiological processes at organ/tissue level
  - functional changes at cell level
  - changes at molecular level (genotoxicity in particular)

# Biological (occupational) cancerogens

- First of mechanisms:
  - Direct action of particular biological agent on target organ (cells) – e.g. Hepatitis B viruss affects hepatic tissues causing acute hepatitis, progressing to chronic form with potential for cancer cells to develop
  - Risk groups: any occupation with potential exposure (e.g. health care, social care, beauty care, agriculture etc.)

# Biological (occupational) cancerogens

- The second mechanism:
  - Effects of toxins elaborated by biological agents, some of these are extremely potent poisons
  - Risk groups: many occupational groups with potential exposures to any of these biological agents
    - Often unnoticed and unlinked with exposure at workplaces
    - Example: agriculture workers working with grain





# Biological (occupational) cancerogens

Agent	Group - IARC
Clonorchis sinensis ( <i>infection with</i> ) (liver fluke)	1
Human T-cell lymphotropic virus type I	1
Epstein-Barr virus	1
Helicobacter pylori ( <i>infection with</i> )	1
Opisthorchis viverrini ( <i>infection with</i> ) (liver fluke)	1
Schistosoma haematobium ( <i>infection with</i> ) (urinary/blood fluke)	1
Kaposi sarcoma herpesvirus	1
Human papillomavirus types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59	1
Hepatitis B virus ( <i>chronic infection with</i> )	1
Hepatitis C virus ( <i>chronic infection with</i> )	1

# Biological (occupational) cancerogens

Agent	Group - IARC
Human immunodeficiency virus type 1 ( <i>infection with</i> )	1
Human immunodeficiency virus type 2 ( <i>infection with</i> )	2B
Human papillomavirus type 68	2A
Schistosoma japonicum ( <i>infection with</i> ) (blood fluke)	2B
Human papillomavirus types 26, 53, 66, 67, 70, 73, 82	2B
Human papillomavirus types 30, 34, 69, 85, 97	2B
Human papillomavirus types 5 and 8 ( <i>in patients with epidermodysplasia verruciformis</i> )	2B
BK polyomavirus (BKV)	2B

**! The specific types of some viruses are important to note – NOT all types are listed by IARC as cancerogens**



# Biological (occupational) cancerogens

Agent	Group - IARC
<i>Ochratoxin A</i>	2B
<i>Aflatoxins (B1, B2, G1, G2, M1)</i>	1
<i>Fusarium moniliforme, toxins derived from (fumonisin B1, fumonisin B2, and fusarin C)</i>	2B
<i>Griseofulvin</i>	2B
<i>Sterigmatocystin</i>	2B
<i>Malaria (caused by infection with Plasmodium falciparum in holoendemic areas)</i>	2A

# Biological (occupational) cancerogens

- Main risk groups:
  - Some of the viruses and parasites are region specific (South-East Asia in particular) but with global travel trends this is not so much an issue (e.g. many people travel for work)
  - Some occupational groups are have more potential for eposures, e.g. health care, agriculture, food processing
  - Especially with toxins the link between exposure and symptoms are not easy to spot and more so – for occupational cancers

# Physical (occupational) cancerogens

- Some of physical cancerogens are quite well known
- Some of these are among most wide-spread cancerogones worldwide
- Ionising radiation has already been discussed...
- Another well known and evaulated (listed) factors:
  - Ultraviolet light and solar radiation
  - Hot liquids and hot surfaces
  - Radiowaves and magnetic fields?

# Physical (occupational) cancerogens

Agent	Group - IARC
Solar radiation	1
Ultraviolet radiation (wavelengths 100-400 nm, encompassing UVA, UVB, and UVC)	1
Ultraviolet-emitting tanning devices	1
Very hot beverages at above 65 °C (drinking)	2A
Magnetic fields, extremely low-frequency	2B
Radiofrequency electromagnetic fields	2B

# Ultraviolet radiation

- Both natural (solar) and man-made UV (e.g. welding, some other sources, like tanning lamps etc...)
- Specific wave-lengths linked with specific cancers, e.g. 280–315 wavelengt linked with basal cell carcinoma

# Ultraviolet radiation - effects



Basal cell carcinoma

Squamous cell carcinoma

Number on fast increase: in Latvia alone ~ 1500 new skin cancer patients yearly





# New factors – sedentary work?

A new study by scientists from the International Agency for Research on Cancer (IARC), investigated the link between levels of physical activity and risk of colorectal cancer. Using observational studies based on more than 430 000 men and women in the United Kingdom, the study showed that higher levels of physical activity were associated with lower risk of colon cancer and that higher levels of sedentary behaviour were associated with increased risk of colon cancer.

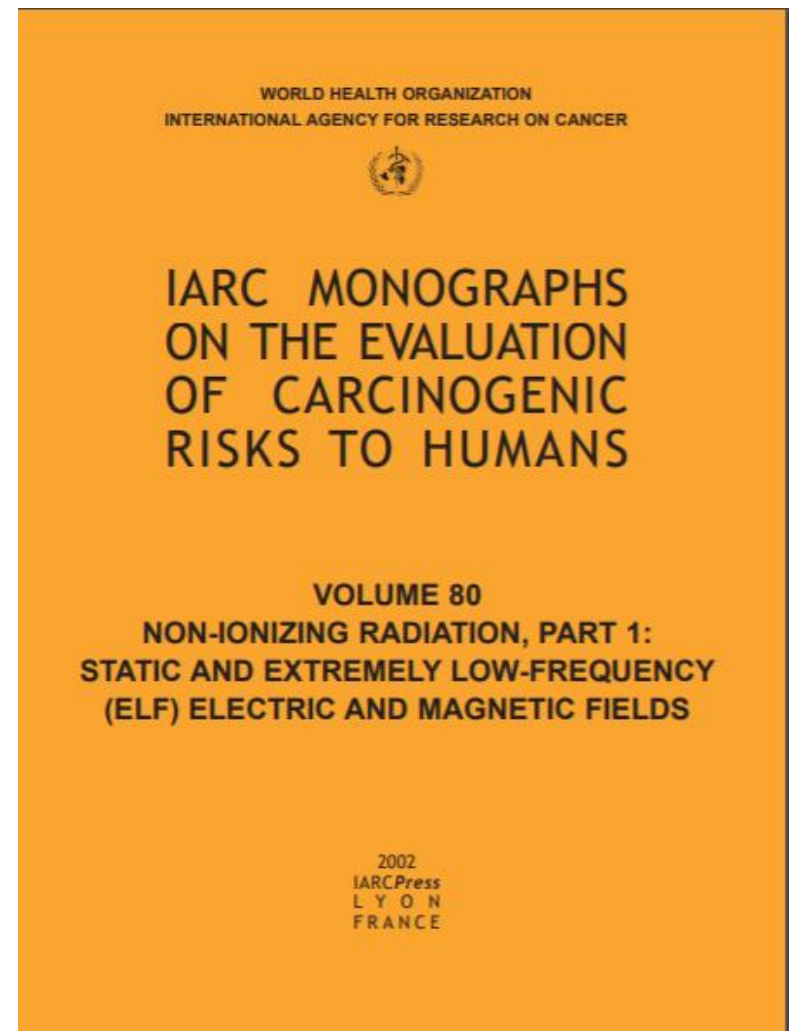
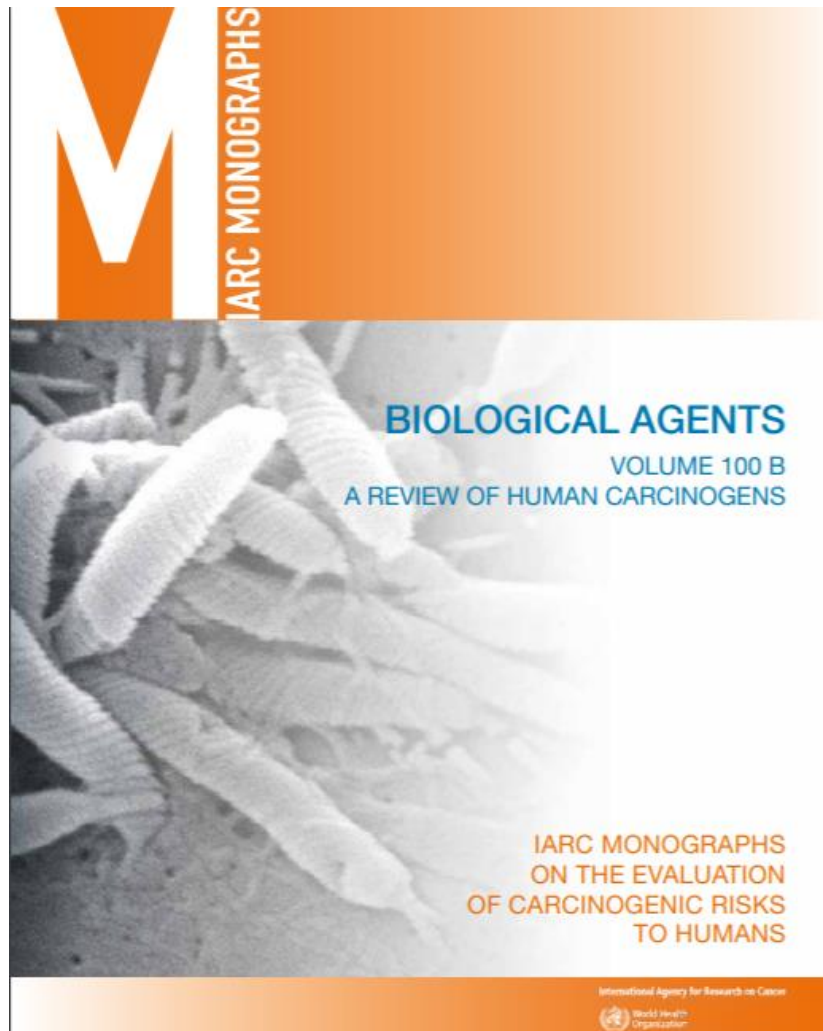
Morris JS, Bradbury KE, Cross AJ, Gunter MJ, Murphy N

Physical activity, sedentary behaviour and colorectal cancer risk in the UK Biobank

*BJC* Published online 9 March 2018;



# Further reading and references?



# Message to bring home?

- Biological and physical occupational cancerogens less wide spread than chemical factors but still – a few to consider, also in Europe
- Several of chronic infections very wide spread, many of them – with occupational origin
- Lack of knowledge among specialists and workers – «I can not see it – so it is not there...» attitude popular
- As with many occupational risks – with proper understanding effective preventive measures are possible