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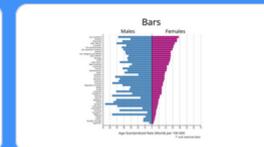
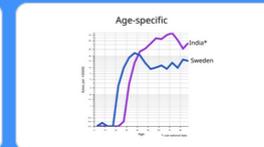
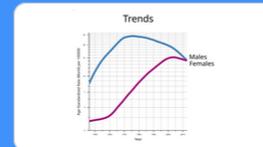
Occupational Cancer and Carcinogens

Clinic of occupational medicine and toxicology JFM in Martin,
CU in Bratislava

Oto Osina, MD, assoc. prof., PhD.

CANCER OVER TIME

Explore changing trends in cancer incidence and mortality over the course of half a century in 60 countries



CANCER TODAY

CANCER OVER TIME

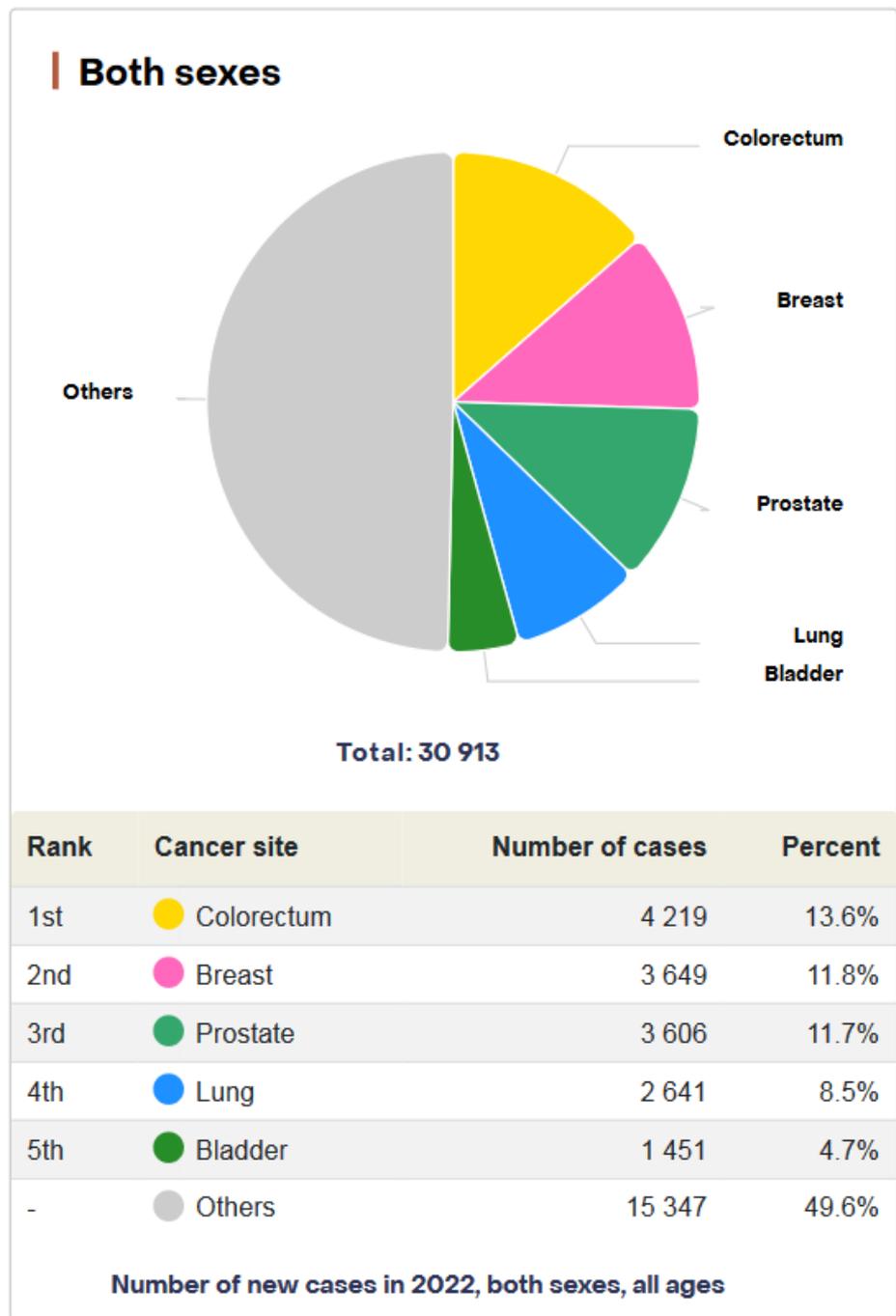
CANCER TOMORROW

CANCER CAUSES

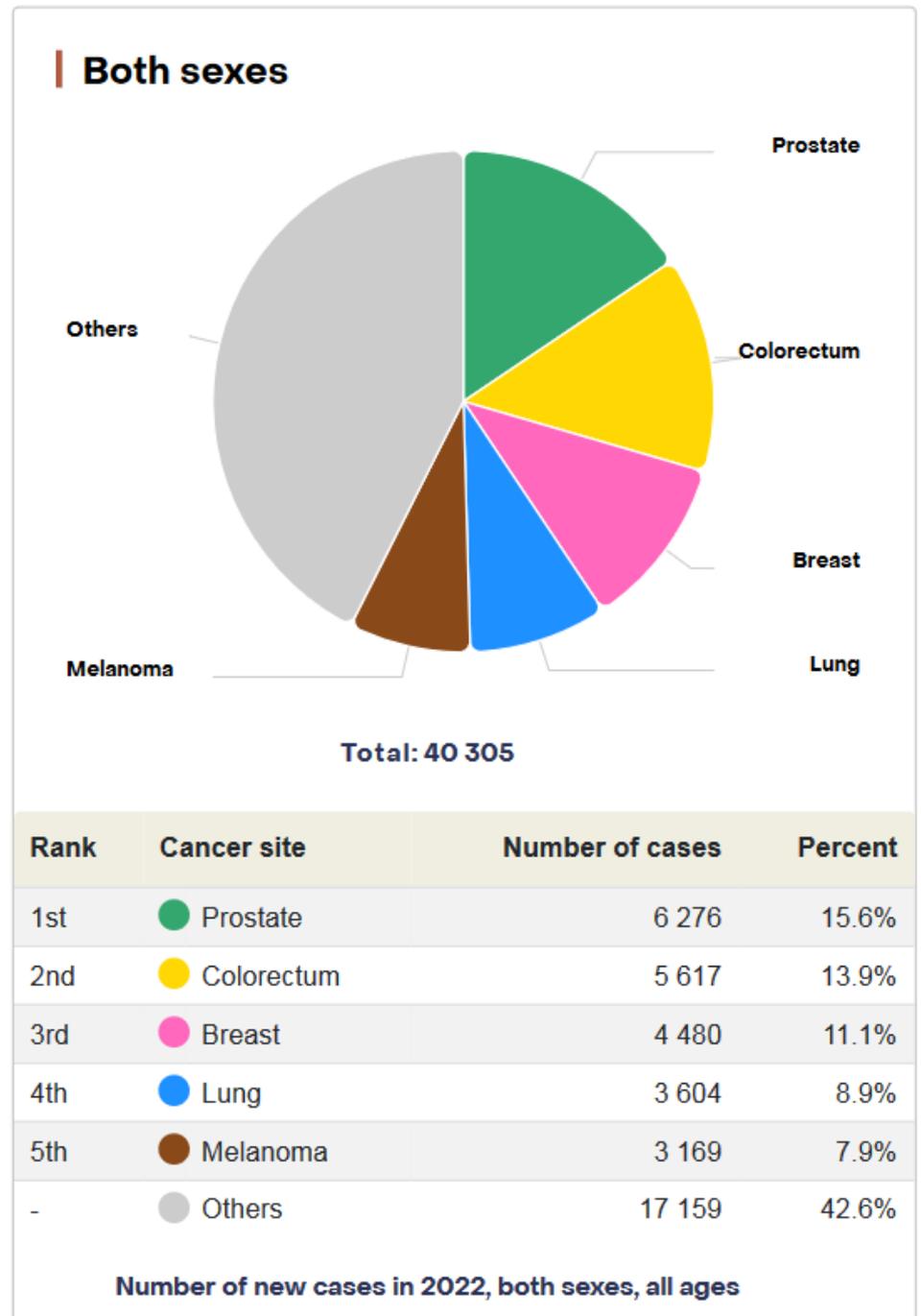
CANCER SURVIVAL

CANCER @CSU

Estimated Number of new cases of cancer in Slovakia - 2022



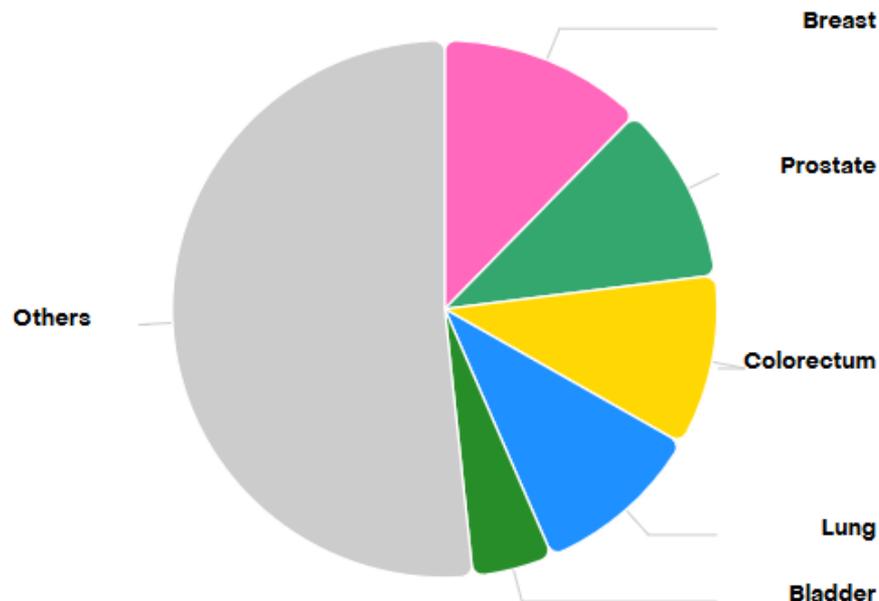
Estimated Number of new cases of cancer in Norway - 2022



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Estimated Number of new cases of cancer in Germany - 2022

Both sexes



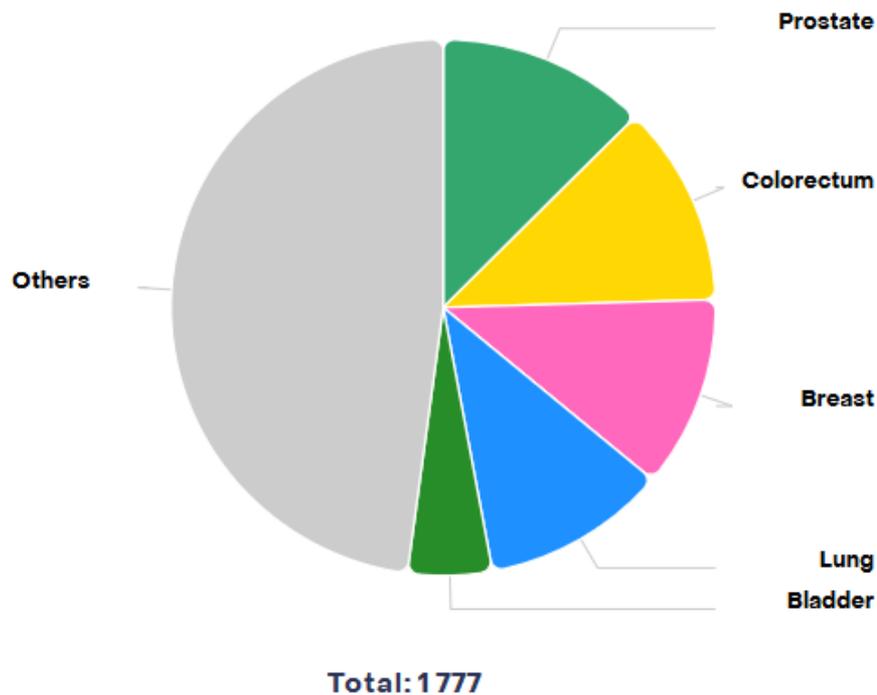
Total: 605 805

Rank	Cancer site	Number of cases	Percent
1st	● Breast	74 016	12.2%
2nd	● Prostate	65 269	10.8%
3rd	● Colorectum	62 544	10.3%
4th	● Lung	62 025	10.2%
5th	● Bladder	29 035	4.8%
-	● Others	312 916	51.7%

Number of new cases in 2022, both sexes, all ages

Estimated Number of new cases of cancer in Iceland - 2022

Both sexes



©<https://gco.iarc.fr/today/fact-sheets-populations>

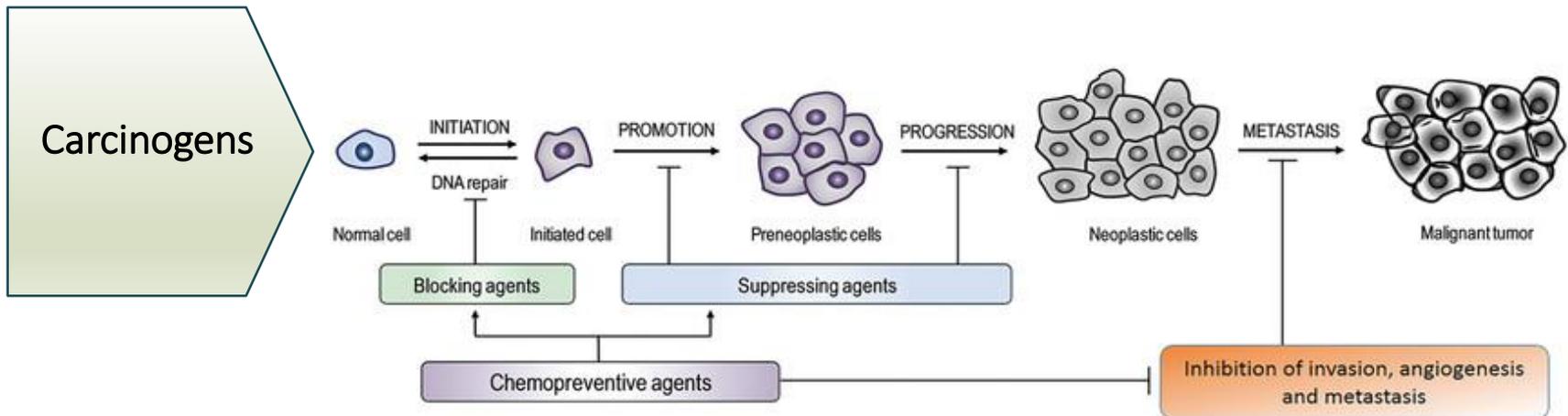
Occupational carcinomas

Carcinogenesis – complicated and prolonged process

Occupational cancer arise from single abnormal cell, which DNA is changed by exposure to carcinogenic chemicals, radiation or other agents from work environment

Development of tumor depend on variety factors:

- Ability of the cell to repair the damage
- Presence of other endogenous and exogenous agents that can support or inhibit tumor development
- Effectivity of immune system



https://www.researchgate.net/figure/Carcinogenesis-phases-initiation-promotion-progression-and-metastasis-A-Initiation_fig2_279304092

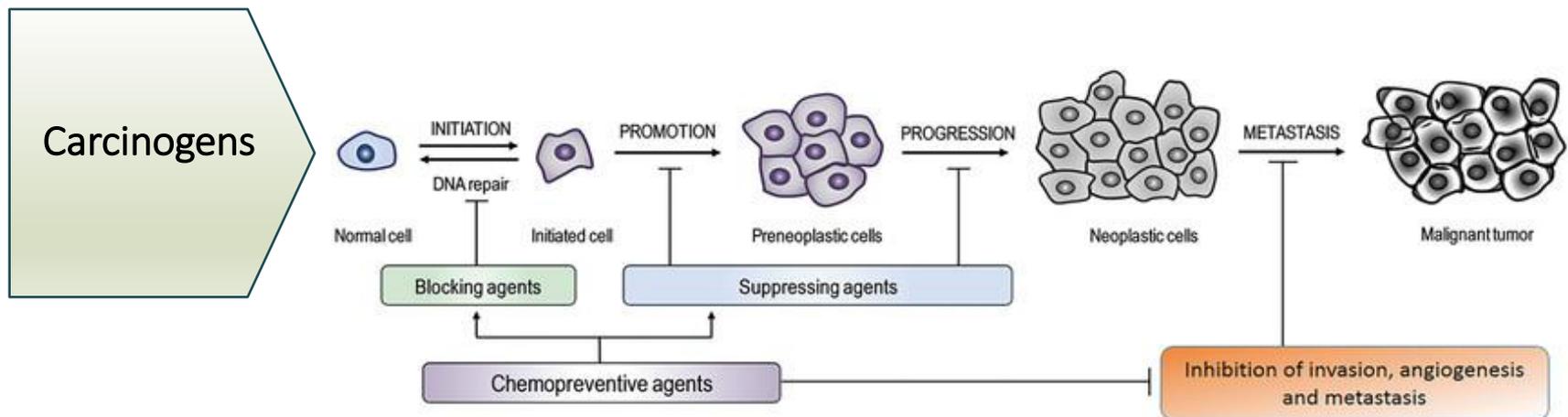
Occupational carcinomas

Cancer development has 2 stages

- **Initiation** – is developing of the genetic change inside healthy cell after influence known carcinogen – initiator

Initiators

- **Physical factors** – ionizing, UV radiation,
 - **Chemical factors** – carcinogenic metals, asbestos, silica, pesticides ...
 - **Biological factors** – viruses, bacteria, molds, mycotoxins ...
- **Promotion** – more steps reactions of carcinogenic substances which are not carcinogens (promoters – hormones, Growth Factors - proteins which can promote cell division), but after initiation they facilitate carcinogenic process



https://www.researchgate.net/figure/Carcinogenesis-phases-initiation-promotion-progression-and-metastasis-A-Initiation_fig2_279304092

Occupational carcinogens

- ❖ Based on analysis of animal and epidemiological study the **IARC** (International Agency for Research on Cancer) issued list of chemical and industrial processes connected with development of human cancer

Group 1 Human carcinogens

This category - there is sufficient evidence of carcinogenicity in humans

Group 2A Probable carcinogens - the agent has 2 of the following evaluations

- *Limited evidence of carcinogenicity in humans*
- *Sufficient evidence of carcinogenicity in experimental animals*
- *Strong evidence that the agent exhibits key characteristics of carcinogens*

Group 2B Possibly carcinogens - the agent has 1 of the following evaluations

- *Limited evidence of carcinogenicity in humans*
- *Sufficient evidence of carcinogenicity in experimental animals*
- *Strong evidence that the agent exhibits key characteristics of carcinogens*

Group 3 No classifiable as carcinogens

- *Evidence suggesting lack of carcinogenicity in humans and experimental animals*

Group 4 Probably not carcinogens

Occupational carcinogens IARC group 1

<u>Chemical carcinogens</u>	<u>Localisation of cancer</u>
4 - Aminobiphenyl	Urinary bladder
Arsenic and his compounds	Lung, skin, liver
Asbestos	Lung, pleura, throat, GIT, peritoneum, kidney
Benzene	Leukemias (CML)
Benzidine	Urinary bladder
Beryllium and his compounds	Lung
Bis(chloromethyl)ether	Lung
Cadmium and his compounds	Lung

Occupational carcinogens IARC group 1

<u>Chemical and physical carcinogens</u>	<u>Localisation of cancer</u>
Chromium (VI) compounds	Lung, paranasal sinuses
Dioxin	Sarcoma
Ethylene oxide	Leukemia
Gamma radiation	Leukemia, skin cancer, Lung ...
Mustard gas (Sulfur mustard)	Lung
2-Naphthylamine	Urinary bladder
Nickel compounds	Lung, paranasal cavity
Radium	Bones
Vinyl chloride	Liver, brain, lung

Occupational carcinogens IARC group 1

<u>Biological carcinogens</u>	<u>Localisation of cancer</u>
Epstein – Barr virus	Nasopharyngeal carcinoma,
Hepatitis B virus (chronic infection with)	Hepatocellular carcinoma
Hepatitis C virus (chronic infection with)	Hepatocellular carcinoma
Human immunodeficiency virus (type 1)	Kaposi's sarcoma
Human papillomavirus (types 16, 18)	Cancers of the cervix, vulva, vagina, and anus in women, anus and penis in men

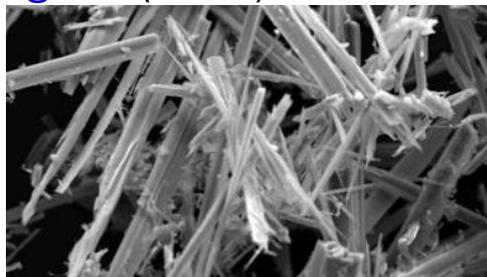
Confirmed occupational cancers

<u>Condition</u>	<u>Industry/Occupation</u>
Hepatic hemangiosarcoma	Vinyl chloride polymerization
Lung cancer	Asbestos industries, Arsenic, Mustard gas, Coal gasification, Underground exposure to radon
Mesothelioma	Asbestos industries and the users
Skin cancer	Arsenic, Farming (UV radiation),
Leukemias	Exposure to benzene, Radiologist
Bladder cancer	Rubber and dye workers
Cancer of the nasal cavity and sinuses	Woodworkers, Nickel smelting and refining, Radium chemists
Laryngeal carcinoma	Asbestos industries and utilizers

Lung cancer

- Most important **general factor is smoking** (active and passive)
- **Professional carcinogens** (IARC)

- Asbestos

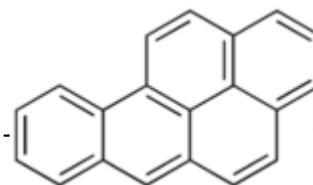


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© https://www.odpady-portal.sk/files/Dokument/Azbest_RTVS.jpg

- Silica
- Arsenic and his compounds
- Mustard gas
- Beryllium
- Cadmium
- Nickel
- Radon
- Polycyclic aromatic hydrocarbons (PAHs)
- Ionizing radiation



Benzopyrene

Lung cancer

Pathology

- Histological finding of professional and non – professional lung cancer is same (Spinocellular Ca 30 – 40 %, Small cell Ca 25 – 30 %, Adenocarcinoma 30 – 40 %)

Types

- Small Cell Lung Cancer (SCLC)

Fast growth

Considerable tendency to metastasize

Good sensitivity on chemotherapy and radiotherapy

The main type in smokers

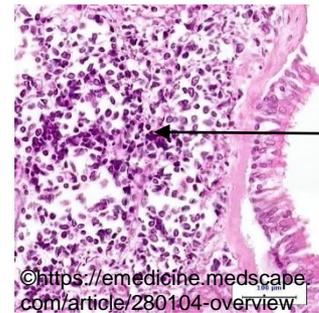
- Non Small Cell Lung Cancer (NSCLC)

Lower tendency to metastasize

Lower sensitivity on chemotherapy and radiotherapy

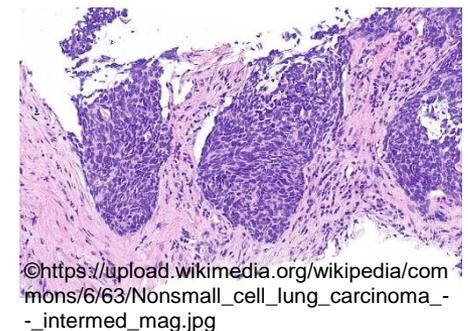
Spinocellular carcinoma – smokers

Adenocarcinoma – non smokers



Small cell lung carcinoma

Normal ciliated respiratory epithelium



©https://upload.wikimedia.org/wikipedia/commons/6/63/Nonsmall_cell_lung_carcinoma_-_intermed_mag.jpg

Lung cancer

Clinical findings

- Manifestation **after exposure 15 - 20** years, significant concern have a smoking
- Metastases to – lymphatic nodes, liver, bones, kidney, brain
- **Symptoms** – Long- time cough, Hemoptysis, Dyspnea, Chest pain, Stridor, Repeated bronchopneumonies, Sweating, Pleural exudates
Total symptom of malignity – lost of weight, cachectisation, fatigue, lassitude, anorexia
- **Diagnostic**
 - History of cough without effect on therapy
 - subfebrile or higher temperature
 - Physical examination - often negative,
 - Laboratory and other exam. - increase in FW, CRP
 - X-ray of the lungs, CT, fibrobronchoscopy, biopsy

Asbestos induced mesothelioma

Tumor – originated from mesothelial cells lining the pleura space or peritoneum

Types of mesothelioma

- pleural 70%,
- peritoneal 20%,
- pericardial and testicular 10%

Death from respiratory failure occurs within months

Diffuse malignant mesothelioma

- Arise from pluripotential mesenchymal cell
- Is a diffuse lesion, spreads widely in the pleura space
- Is associated with extensive pleural effusion
- Grow directly to thoracic structures

Asbestos induced mesothelioma

Symptoms of pleural mesothelioma

- From beginning the symptoms absent or are minimal
- Persistent gnawing **chest wall pain** on the involved side, which may radiate to the shoulder and arm
- **Persistent dry cough** – hemoptysis, wheezing, hoarseness
- **Dyspnea** on exertion
- **Pleural exudates**
- **Total symptoms of malignity** – lost of weight, cachectisation, fatigue, anemia, lassitude
- Some patients have repeated **subfebrilias**

Asbestos induced mesothelioma

Findings on physical examination

Physical finding vary with the stage of disease

- Percussion is dull on reduced over affected side
- Auscultation
 - Pleural friction murmur
 - Pleural effusion – vesicular, weak, absent

Advanced sings

- Arthralgias, enlargement of supraclavicular or axillary nodes

Chest x-ray (CT is most sensitive)

- Unilateral pleural effusion
- Thick tumor lining on the chest wall

Biopsy- histological findings of tumor

Treatment – surgical resection, radiatiation, chemotherapy – unsatisfactory

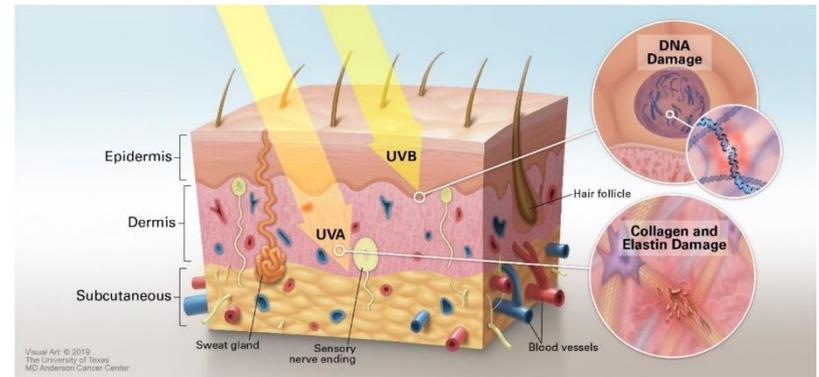
Skin cancer

Main risk for population and workers is ultraviolet radiation (UV)

In industry the skin cancer can develop after exposition of UV, ionizing radiation, polycyclic aromatic hydrocarbons, arsenic ...

Histological types

- malignant melanomas,
- basal cell epitheliomas,
- squamous cell carcinomas,
- ceratoacanthomas



Clinical findings

Nodular or nodulo-ulcerative lesion on the skin of the neck and head

Lesion is usually painless

Malignant melanomas quickly metastasize

Basal cell epitheliomas metastasize rarely, but can invade widely and deeply

Treatment - Large excision, irradiation

Other occupational cancers

Leukemia's (CML) – exposure to ionizing radiation and benzene

Symptoms – weakness, anorexia, fever, weight loss, frequent infections, easy bleeding and bruising, pain of bones or joints

Physical findings – pallor, hepatosplenomegaly, lymph node enlargement

Laboratory findings – leukocytosis, immature white cells in peripheral blood and bone marrow, anemia, thrombocytopenia

Hepatic angiosarcoma – exposure to vinylchloride

Symptoms – abdominal pain in right upper quadrant, weight loss, anorexia

Physical findings – hepatomegaly

Diagnosis – USG, CT, liver biopsy

Other types of lung cancer – exposure to radon gas, chlormethyl ether, ionizing radiation

Symptoms – cough, hemoptysis, dyspnea, weight loss

X-ray findings – hilar or mediastinal adenopathy, atelectasis

Diagnosis – bronchoscopic biopsy, cytology, CT