The IARC Monographs Vol. 114
Carcinogenicity of Processed & Red Meat Consumption

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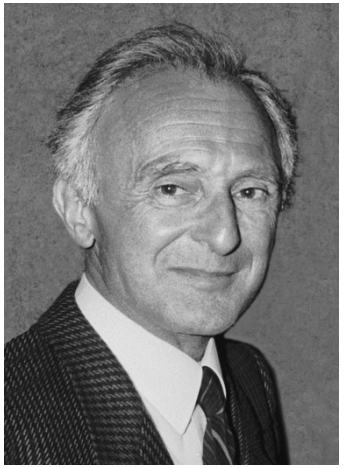
“The encyclopaedia of carcinogens”

The *IARC Monographs* evaluate

- Chemicals
- Complex mixtures
- Occupational exposures
- Physical and biological agents
- Personal habits



Lorenzo Tomatis
1929-2007

Almost 1000 agents have been evaluated

- 119 are *carcinogenic to humans* (Group 1)
- 81 are *probably carcinogenic to humans* (Group 2A)
- 292 are *possibly carcinogenic to humans* (Group 2B)

National and international health agencies use the *Monographs*

- As a source of scientific information on known or suspected carcinogens
- As scientific support for their actions to prevent exposure to known or suspected carcinogens

International Agency for Research on Cancer

World Health Organization

How are Evaluations Conducted?

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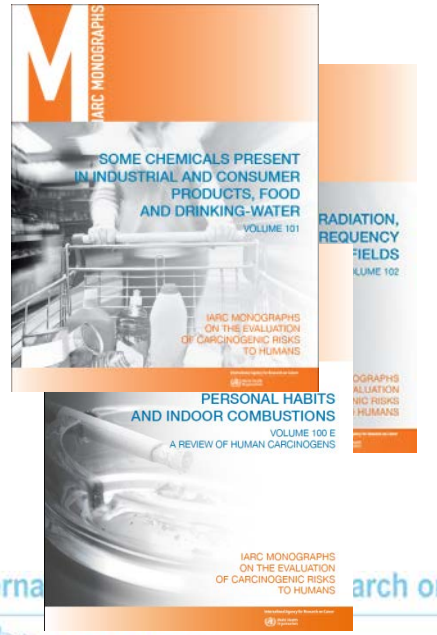

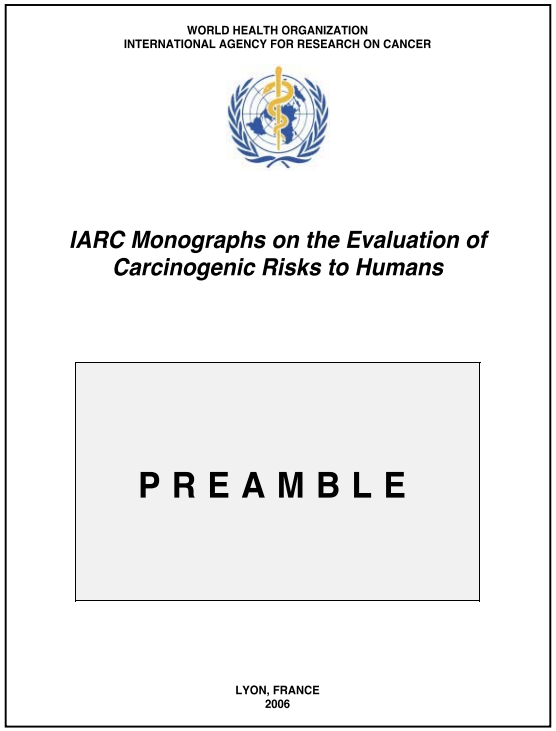

- Published guidelines for participant selection, conflict of interest & stakeholder involvement
- Criteria for data eligibility
- Guidelines for review of human, animal and mechanistic evidence
- Decision process for overall evaluations

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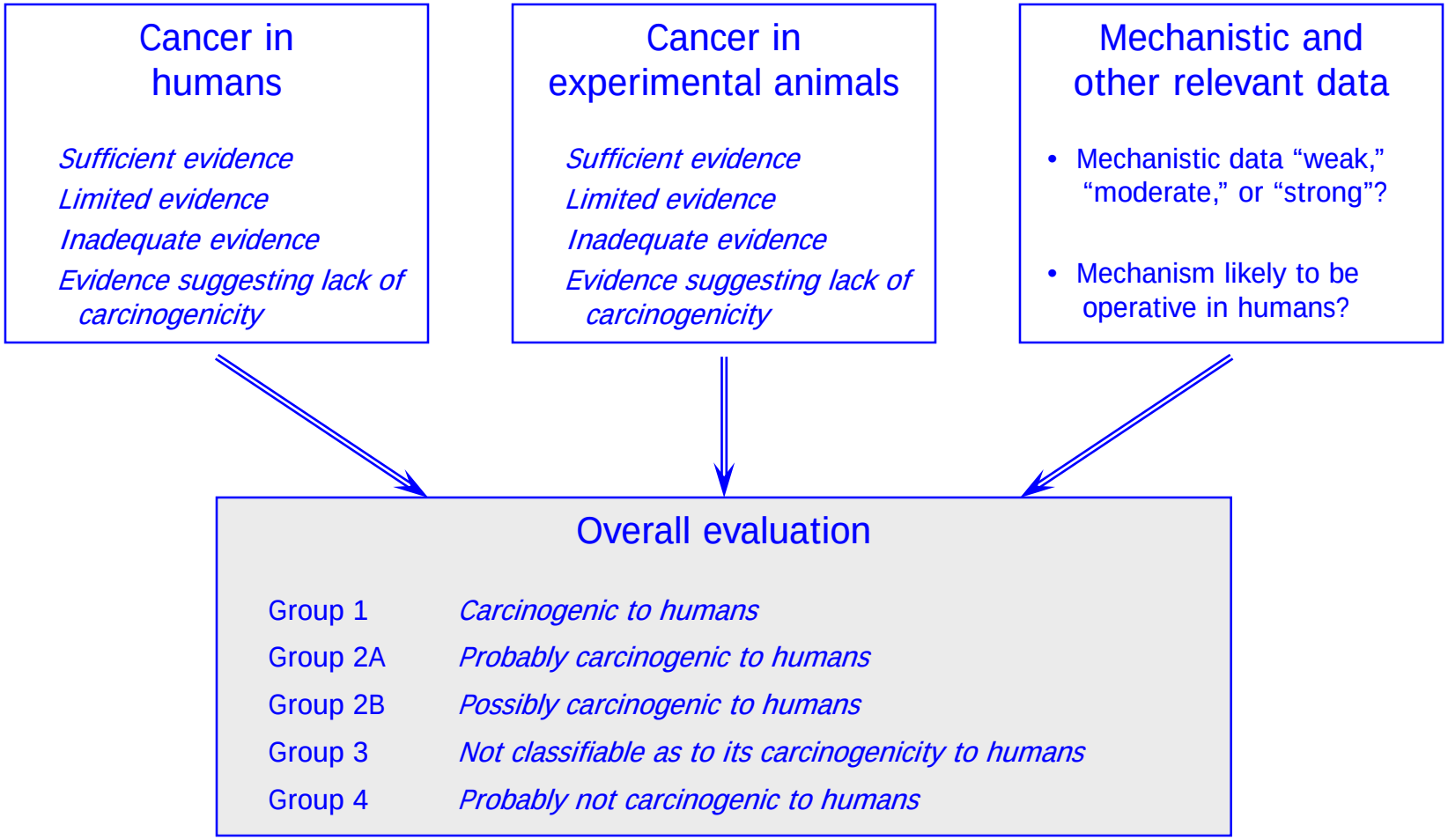
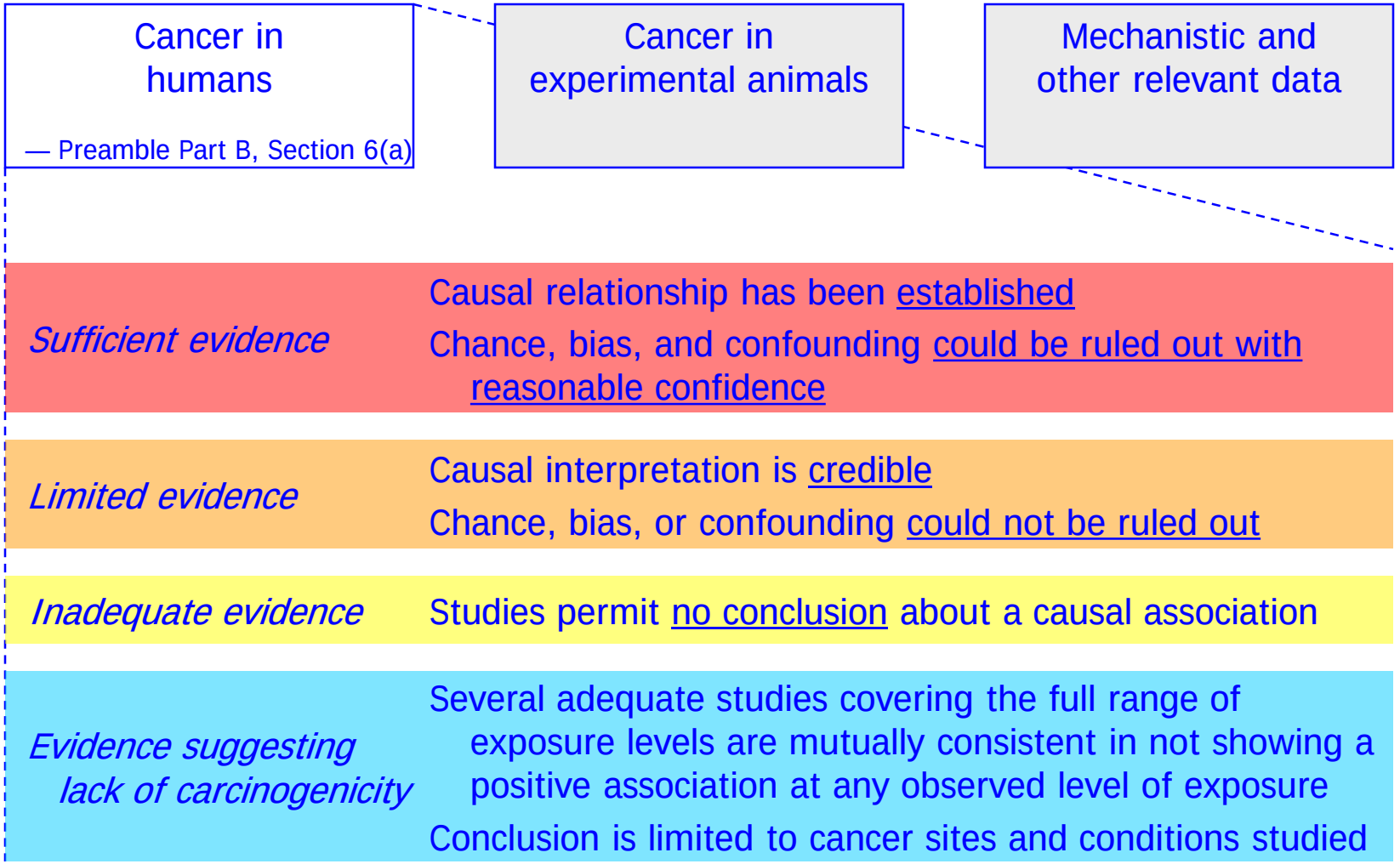
http://monographs.iarc.fr/ENG/Preamble/index.php

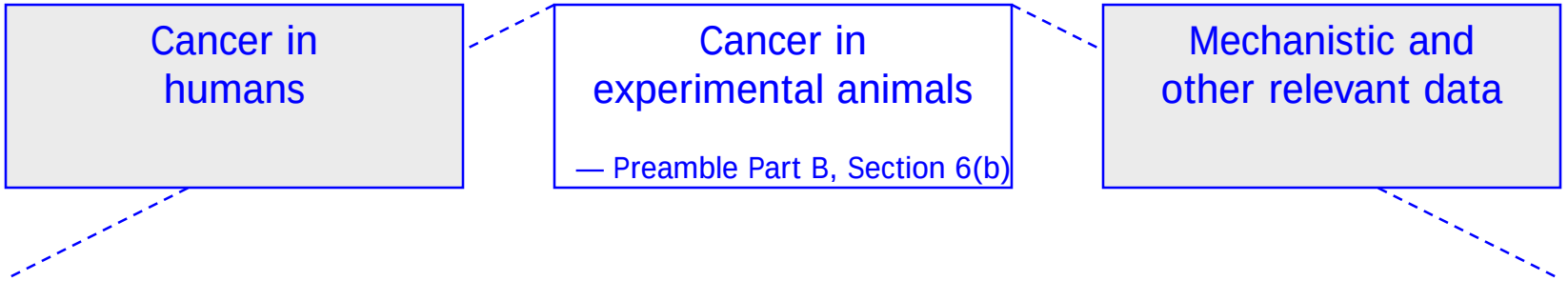
Subgroup work



Evaluating human data (Subgroup 2)



Evaluating experimental animal data (Subgroup 3)



Sufficient evidence	Causal relationship has been established through either: - Multiple positive results (2 species, studies, sexes of GLP) - Single unusual result (incidence, site/type, age, multi-site)
Limited evidence	Data suggest a carcinogenic effect but: (*e.g.*) single study, benign tumours only, promoting activity only
Inadequate evidence	Studies permit no conclusion about a carcinogenic effect
Evidence suggesting lack of carcinogenicity	Adequate studies in at least two species show that the agent is not carcinogenic Conclusion is limited to the species, tumour sites, age at exposure, and conditions and levels of exposure studied

Evaluating mechanistic and other data (Subgroup 4)

Cancer in humans	Cancer in experimental animals	Mechanistic and other relevant data — Preamble Part B, Section 6(c)

- Are the mechanistic data “weak,” “moderate,” or “strong”?

Have the mechanistic events been established? Are there consistent results in different experimental systems? Is the overall database coherent?

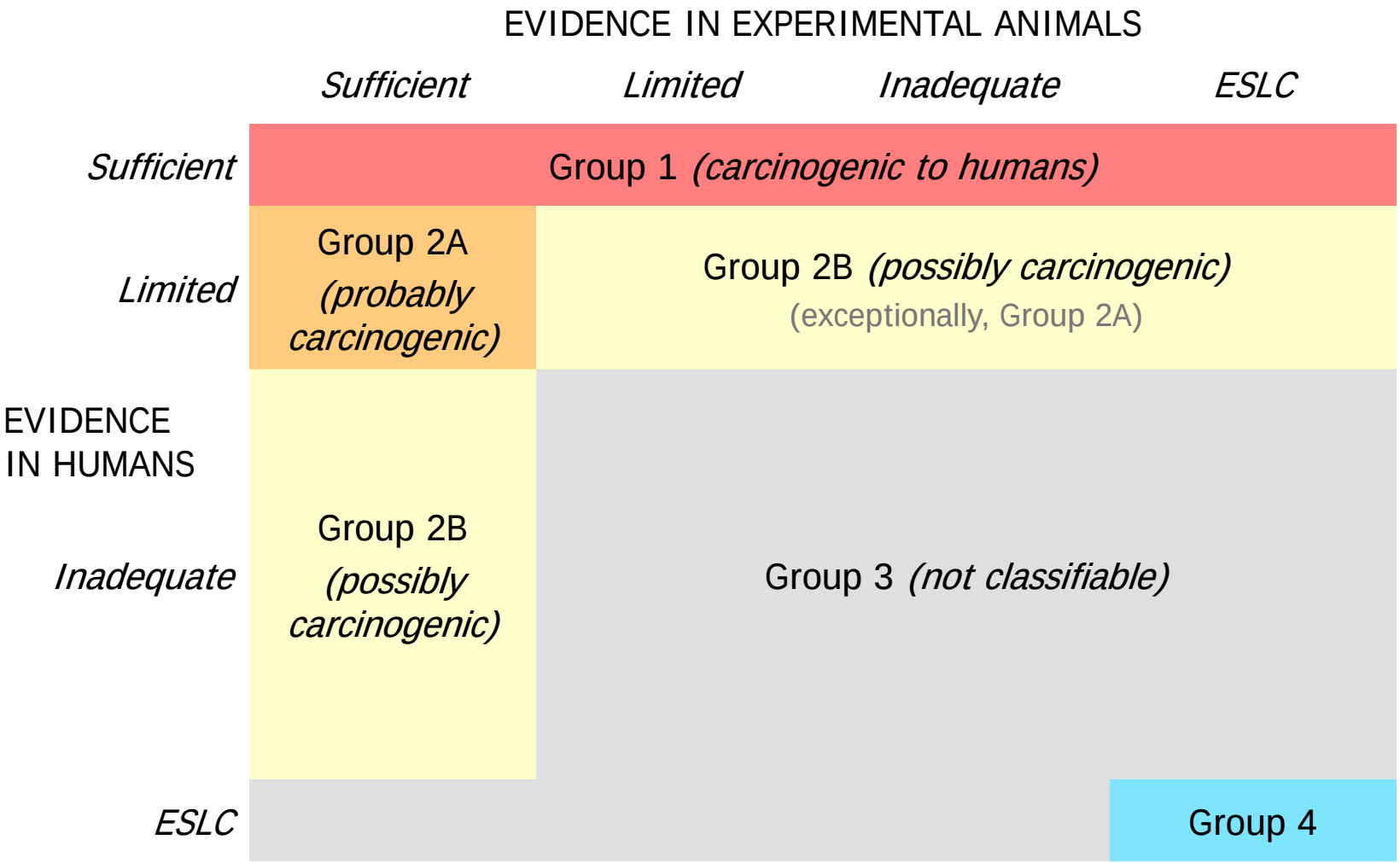
Has each mechanism been challenged experimentally? Do studies demonstrate that suppression of key mechanistic processes leads to suppression of tumour development?

- Is the mechanism likely to be operative in humans?

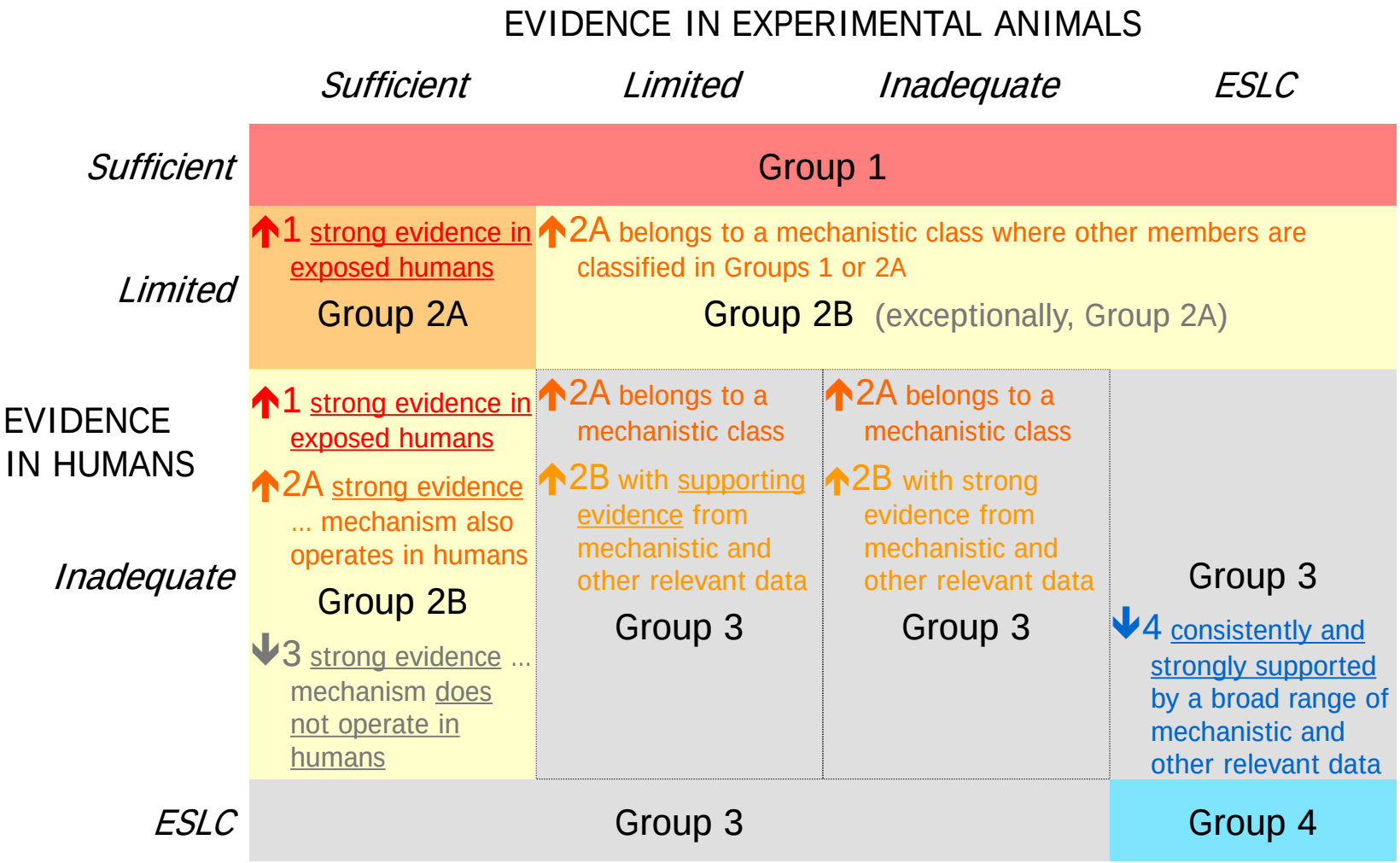
Are there alternative explanations? Could different mechanisms operate in different dose ranges, in humans and experimental animals, or in a susceptible group?

Note: an uneven level of support for different mechanisms may reflect only the resources focused on each one

The plenary sessions will combine the human and experimental evaluations



Mechanistic data can be pivotal when the human data are not conclusive



Red & processed meat: definition

Red meat

unprocessed mammalian muscle meat – e.g. beef, veal, pork, lamb – may be minced or frozen;

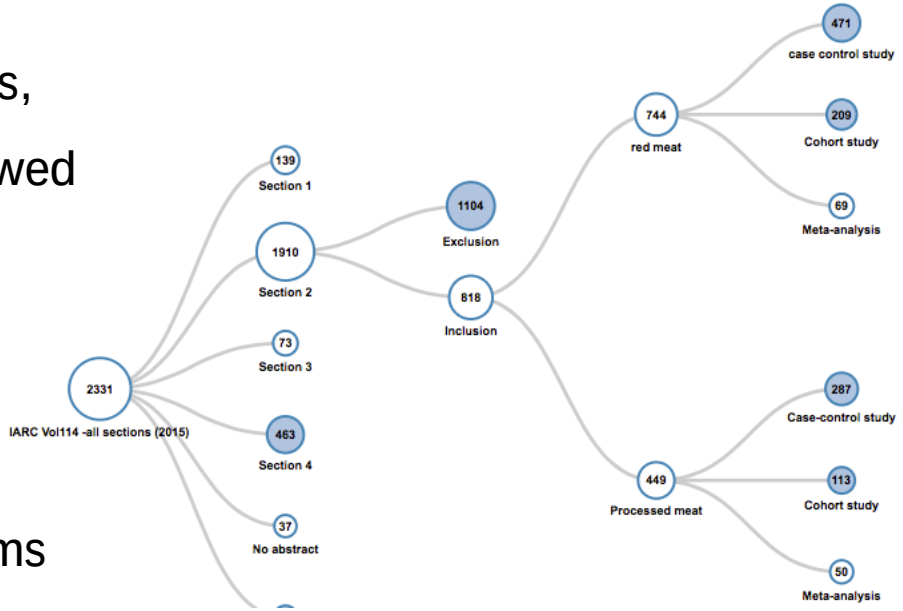
Processed meat

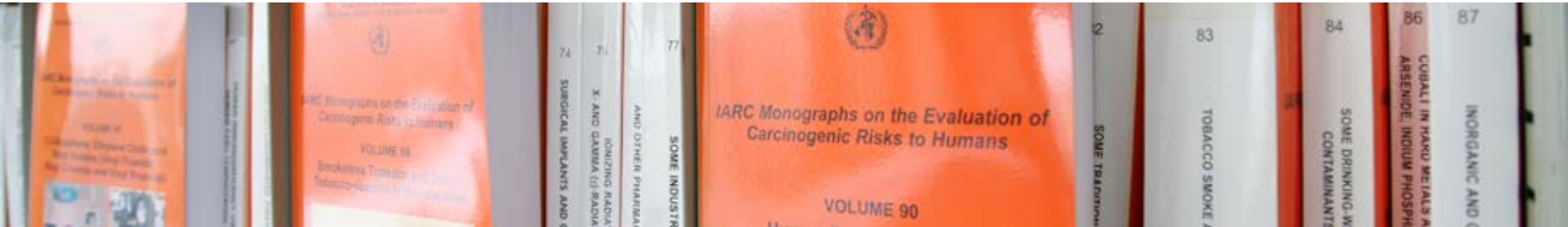
meat transformed through salting, curing, fermentation, smoking or other processes

Meat **processing** formation of carcinogenic chemicals including NOC and PAH.
Cooking production of carcinogens including HAA and PAH.
High-temperature cooking by pan-frying, grilling, or barbecuing production of highest amounts of these chemicals

The Scientific Data

- All of the publicly-available data on cancer in humans, cancer in animals, and relevant mechanisms are reviewed
- > 700 epidemiologic studies on red meat
- > 400 studies on processed meat
- > 400 studies on related mechanisms
- The largest number of epidemiologic studies concern colorectal cancer





IARC Monograph Vol114: Consumption of red meat and processed meat: colorectal cancer

- Greatest weight given to prospective cohort studies conducted in the general population.
  High-quality population-based case-control studies provided additional evidence.
- Studies judged most informative considered red meat and processed meat separately and had quantitative dietary data obtained from validated questionnaires, large sample size and control for the major potential confounders
- Processed meat positive associations in 12 of the 18 cohort studies, including studies in Europe, Japan and the USA.
  Supporting evidence from 6 of 9 informative case-control studies.
- Red meat positive associations with high versus low consumption in half of 14 cohort studies, including a cohort from 10 European countries spanning a wide range of meat consumption and other large cohorts in Sweden and Australia.
  15 informative case-control studies, 7 with positive associations for with high versus low consumption of red meat.

Conclusions on red meat and processed meat

- Meta-analysis of 10 cohort studies: Statistically significant dose-response relationship (meta-analysis of colorectal cancer in 10 cohort studies)

  Processed meat: 18% increase (95% CI 1.10-1.28) per 50 g/day
  Red meat: 17% increased risk (95% CI 1.05-1.31) per 100 g/day

- Consistent associations of colorectal cancer with consumption of processed meat across studies in different populations, which make chance, bias and confounding unlikely as explanations, "*sufficient evidence in humans for the carcinogenicity of the consumption of processed meat*".
- Red meat consumption: chance, bias and confounding could not be ruled out with the same degree of confidence, (eg no clear association was observed in some high quality studies, residual confounding from other diet and lifestyle risk difficult to exclude).
  "*limited evidence in humans for the carcinogenicity of the consumption of red meat".*
- Data for > 15 other cancers. Positive associations consumption of red meat and cancers of the pancreas and the prostate (mainly advanced prostate cancer), and processed meat and cancer of the stomach.

Cancer in experimental animals

- In rats treated with colon cancer initiators and promoted with low calcium diets containing either red meat or processed meat, there was an increase in the occurrence of colonic preneoplastic lesions in three and four studies, respectively
- There is *inadequate evidence* in experimental animals for the carcinogenicity of consumption of red meat and of processed meat.

Other relevant data on processed & red meat

- Meta-analysis: modest, statistically significant association between consumption of red meat and processed meat and adenomas (preneoplastic lesions) of the colorectum
- In humans, observational data showed associations with gene mutations relevant to carcinogenesis in tumours of the colon.
- Consuming well done cooked red meat increased bacterial mutagenicity of human urine.
- Three intervention studies in humans, changes in oxidative stress markers (either in urine, faeces or blood) associated with consumption of red meat or processed meat.

Strong mechanistic evidence for carcinogenicity of red meat and moderate for processed meat. These mechanistic data primarily apply to the digestive tract.

Overall Evaluations

- *Cancer in humans*

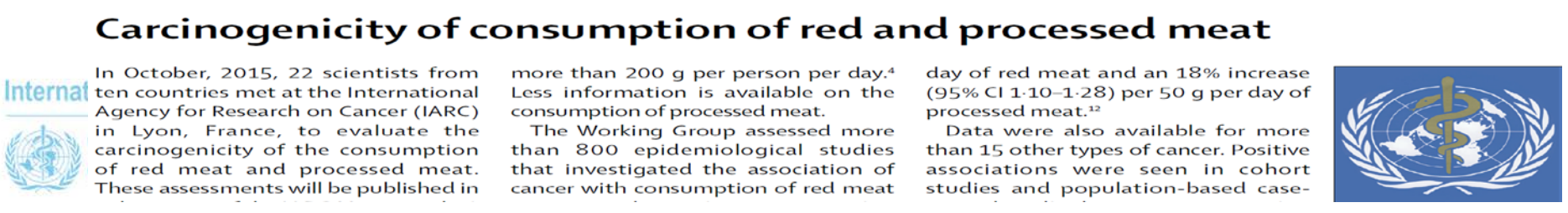
  Processed meat: *sufficient evidence* for colorectal cancer. Also positive association with stomach cancer.

  Red meat: limited evidence for colorectal cancer and strong mechanistic evidence. Also positive association with pancreatic and prostate cancer.

- *Inadequate evidence* in experimental animals
- Strong mechanistic evidence

Consumption of processed meat: "*carcinogenic to humans*" (Group 1)

Consumption of red meat: "*probably carcinogenic to humans*" (Group 2A)



Carcinogenicity of consumption of red and processed meat

In October, 2015, 22 scientists from ten countries met at the International Agency for Research on Cancer (IARC) in Lyon, France, to evaluate the carcinogenicity of the consumption of red meat and processed meat. These assessments will be published in

more than 200 g per person per day.[4] Less information is available on the consumption of processed meat.

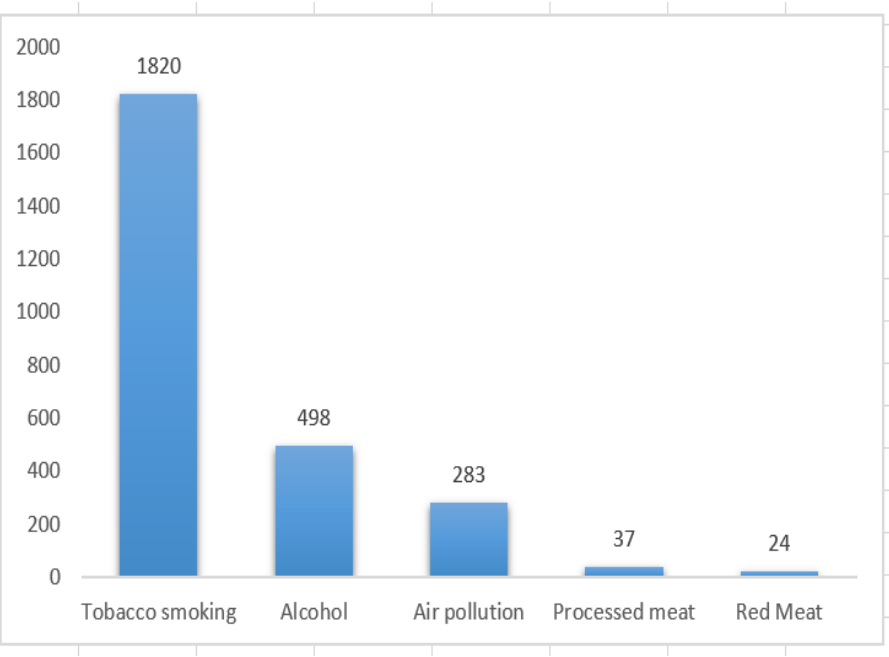
The Working Group assessed more than 800 epidemiological studies that investigated the association of cancer with consumption of red meat

day of red meat and an 18% increase (95% CI 1·10–1·28) per 50 g per day of processed meat.[12]

Data were also available for more than 15 other types of cancer. Positive associations were seen in cohort studies and population-based case-

Deaths attributable to red & processed meat

Number of attributable cancer deaths (in thousands) :



- Worldwide consumption
  red meat < 5% to up to 100%
  processed meat <2% to 65%
- Among consumers
  avge intake 50–100 g/pers/day
  high consumption > 200 g/pers/day red meat or processed meat

Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013

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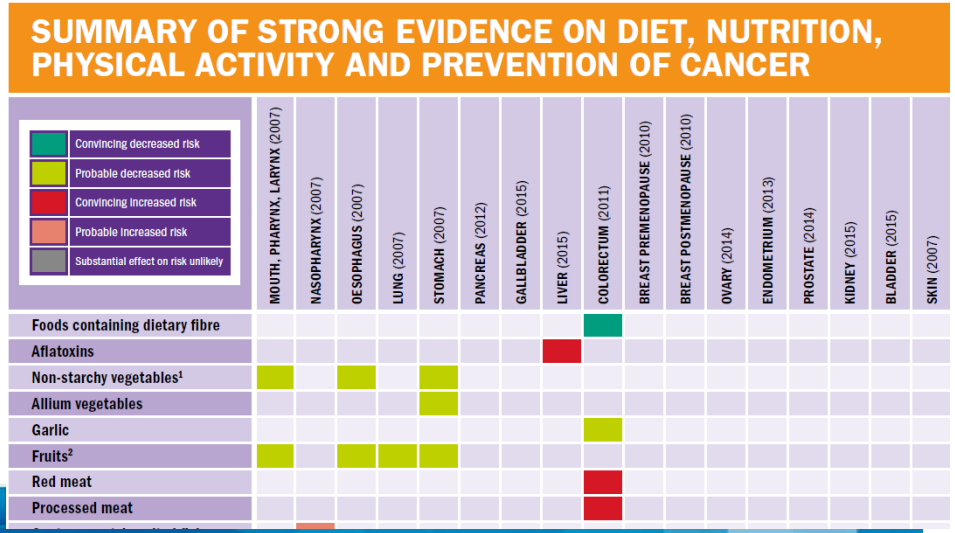
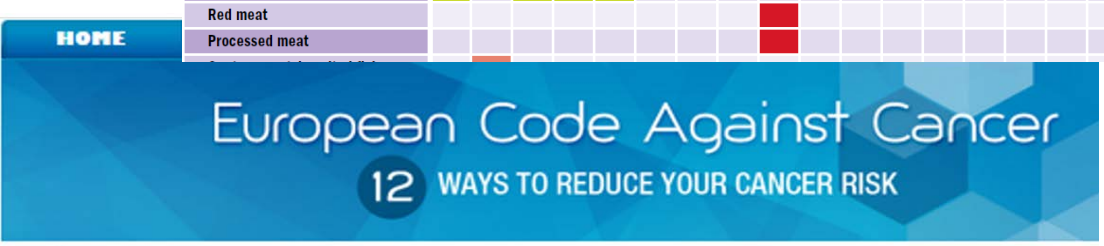
Putting the evaluation in context

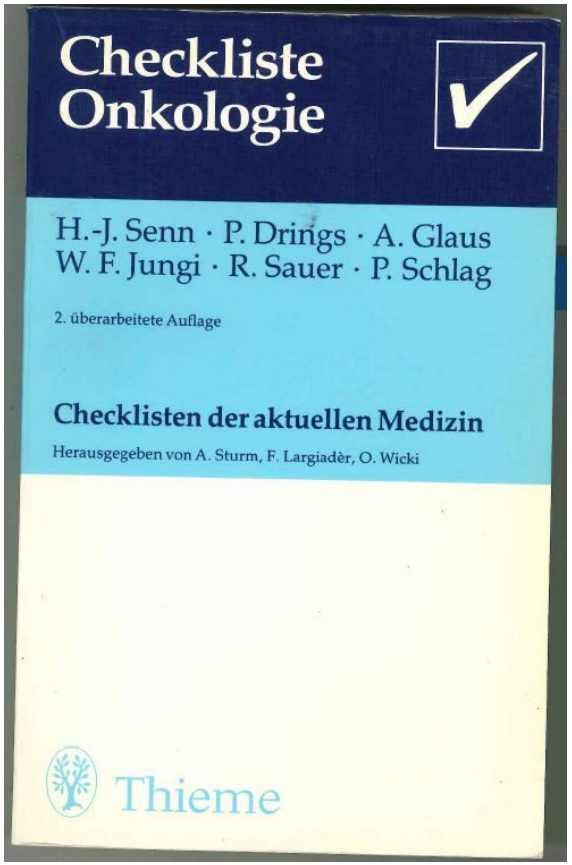
WCRF Continous Update Project





You are here: **Home**

1. Do not smoke. Do not use any form of tobacco.
2. Make your home smoke-free. Support smoke-free policies in your workplace.
3. Take action to be a healthy body weight.
4. Be physically active in everyday life. Limit the time you spend sitting.
5. Have a healthy diet:
   - Eat plenty of whole grains, pulses, vegetables and fruits.
   - Limit high-calorie foods (foods high in sugar or fat) and avoid sugary drinks.
   - Avoid processed meat; limit red meat and foods high in salt.



1988, Colon cancer
Etiology: diet rich in meat

Acknowledgements

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- **U.S. National Institute of Environmental Health Sciences (since 1992)**
- **Institut National du Cancer (INCa), France**
- **U.S. Center for Disease Control (CDC)**
- **American Cancer Society**

International Agency for Research on Cancer

World Health Organization

Thank you!