Advisory Group recommendations on priorities for the IARC Monographs

An Advisory Group of 29 scientists from 18 countries met in March, 2019, to recommend priorities for the International Agency for Research on Cancer (IARC) Monographs programme during 2020–24. IARC periodically convenes such advisory groups to ensure that the Monographs evaluations reflect the current state of scientific evidence relevant to carcinogenicity.[1] A detailed report of the Advisory Group will be published subsequently.[2]

The Advisory Group assessed the response to a public call for nominations and considered more than 170 unique candidate agents, including the recommended priorities remaining from a similar Advisory Group meeting convened in 2014.[3] The expertise of the Advisory Group covered multiple disciplines, and the members appraised, on an individual nomination basis, the evidence according to human exposure (including any evidence of exposure in low-income and medium-income countries), cancer epidemiology, cancer bioassays in experimental animals, and carcinogen mechanisms, in line with the evaluation methodology recently refined in the Preamble to the IARC Monographs.[1] A complementary approach assessed all nominations using a chemoinformatics, text mining, and chemical similarity analysis workflow;[4] this approach helped to reveal coverage and gaps in the extent of evidence across data streams, supporting decisions on individual agents and groups of chemically related nominations. The Advisory Group deliberated on all nominated agents both by evidence stream (ie, exposure, human cancer, cancer bioassay, and carcinogen mechanisms) and by type of agent (eg, metals, fibres, chemicals, biological agents, and complex mixtures) to inform development of priority recommendations.

The Advisory Group recommended a broad range of agents with high (table 1), medium, or low (table 2) priority for evaluation. Priority was assigned on the basis of evidence

	Rationale
Agents not previously evaluated by IARC Monographs	
Haloacetic acids (and other disinfection byproducts)	Relevant human cancer, bioassay, and mechanistic evidence
Metalworking fluids	Relevant human cancer and bioassay evidence
Cannabis smoking, fertility treatment, glucocorticoids, *Salmonella typhi*, sedentary behaviour*, tetracyclines and other photosensitising drugs	Relevant human cancer and mechanistic evidence
Cupferron, gasoline oxygenated additives, gentian violet, glycidamide, malachite green and leucomalachite green, oxymetholone, pentabromodiphenyl ethers, vinclozolin	Relevant bioassay and mechanistic evidence
Breast implants, dietary salt intake*, neonatal phototherapy*, poor oral hygiene*	Relevant human cancer evidence
Aspartame	Relevant bioassay evidence
Arecoline, carbon disulphide, electronic nicotine delivery systems and nicotine*, human cytomegalovirus, parabens	Relevant mechanistic evidence
Agents previously evaluated by IARC Monographs†	
Automotive gasoline (leaded and unleaded), carbaryl, malaria	New human cancer, bioassay, and mechanistic evidence to warrant re-evaluation of the classification
Acrylamide*, acrylonitrile, some anthracyclines, coal dust, combustion of biomass, domestic talc products, firefighting exposure, metallic nickel, some pyrethroids (ie, permethrin, cypermethrin, deltamethrin)	New human cancer and mechanistic evidence to warrant re-evaluation of the classification
Aniline, acrolein, methyl eugenol and isoeugenol*, multi-walled carbon nanotubes*, non-ionising radiation (radiofrequency)*, some perfluorinated compounds (eg, perfluorooctanoic acid)	New bioassay and mechanistic evidence to warrant re-evaluation of the classification
Ostrogen:oestradiol and oestrogen-progestogens‡, hydrochlorothiazide, Merkel cell polyomavirus, perchloroethylene, very hot foods and beverages	New human cancer evidence to warrant re-evaluation of the classification
1,1,1-trichloroethane, weapons-grade alloy (tungsten, nickel, and cobalt)	New bioassay evidence to warrant re-evaluation of the classification
Acetaldehyde, bisphenol A*, cobalt and cobalt compounds, crotonaldehyde, cyclopeptide cyanotoxins, fumonisin B_1, inorganic lead compounds, isoprene, o-anisidine	New mechanistic evidence to warrant re-evaluation of the classification

Evidence of human exposure was identified for all agents. *Advised to conduct in latter half of 5-year period. †See current International Agency for Research on Cancer (IARC) list of classifications, volumes 1–123. ‡Group 1 carcinogen; new evidence of cancer in humans indicates possible causal associations for additional tumour sites (see Section 3 of Preamble to the IARC Monographs[1]).

Table 1: **Agents recommended for evaluation by the IARC Monographs with high priority**

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For more on the **IARC Monographs** see http://monographs.iarc.fr/

Upcoming meetings
June 4–11, 2019, volume 124: Shift work that involves circadian disruption
Nov 5–11, 2019, volume 125: Some industrial chemicals
March 24–31, 2020, volume 126: Opium

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Declaration of interests
All advisory group members declare no competing interests

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Declaration of interests
All representatives declare no competing interests

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MCT received personal fees from ICF Incorporated, LLC, outside this work. All other secretariat declare no competing interests.

For the **Preamble to the IARC Monographs** see https://monographs.iarc.fr/wp-content/uploads/2019/01/Preamble-2019.pdf

For **IARC declarations of interests** see https://monographs.iarc.fr/wp-content/uploads/2018/07/priorities-doi.pdf

For the **IARC list of classifications, volumes 1–123** see https://monographs.iarc.fr/list-of-classifications-volumes/

	Previous evaluation status
Medium priority agents	
2,3-butanedione (diacetyl), alachlor, biphenyl, chlorinated paraffins, chlorpyrifos, c.i. direct blue 218, diphenylamine, hydrazobenzene, indole-3-carbinol, mancozeb, nanomaterials (eg, titanium dioxide or nanosilica), nitrogen dioxide, *o*-benzyl-p-chlorophenol, ozone, pendimethalin, sleep, styrene-acrylonitrile trimer, terbufos, tris(chloropropyl)phosphate	Agents not previously evaluated by the IARC Monographs
Aflatoxins†, anthracene, antimony trioxide, atrazine, bromate compounds, dimethyl hydrogen phosphite, furan, *N*-methylolacrylamide, *p*-nitrotoluene, *Schistosoma mansoni*, tris(2-chloroethyl) phosphate, tobacco smoking (including second hand)†	Agents previously evaluated by the IARC Monographs*
Low priority agents	
2-hydroxy-4-methoxybenzophenone, aluminium, androstenedione, butyl methacrylate, cinidon ethyl, dysbiotic microbiota, fonofos, furmecyclox, isoflavones, isophorone, laboratory work and occupation as a chemist, methanol, S-ethyl-*N*,*N*,-dipropylthiocarbamate, semiconductor manufacturing, Sucralose	Agents not previously evaluated by the IARC Monographs
1,1-dimethylhydrazine, benzophenone-1, carbon black, catechol, chlordecone, cumene, dichloromethane, hepatitis D virus, human papillomavirus (beta [cutaneous] and some alpha [mucosal] types), *Opisthorchis felineus*, outdoor air pollution†, pyrrolizidine alkaloids, selenium and selenium compounds	Agents previously evaluated by the IARC Monographs*

Evidence of human exposure was identified for all agents. *See current International Agency for Research on Cancer (IARC) list of classifications, volumes 1–123. †Group 1 carcinogen; new evidence of cancer in humans indicates possible causal associations for additional tumour sites (see Section 3 of Preamble to the IARC Monographs[1]).

Table 2: **Agents recommended for evaluation by the IARC Monographs with medium and low priority**

of human exposure and the extent of available evidence for evaluating carcinogenicity (ie, the availability of relevant human cancer, experimental animal bioassay, or mechanistic evidence to support a new or updated evaluation according to the Preamble to the IARC Monographs[1]). Any of the three evidence streams could alone support prioritisation of agents with no previous evaluation. For previously evaluated agents, the Advisory Group considered the basis of the previous classification, as well as the potential impact of the newly available evidence during integration across streams (see table 4 in Preamble to the IARC Monographs[1]). Agents without evidence of human exposure or evidence for evaluating carcinogenicity were not recommended for further consideration. The Advisory Group recognised that agents related to the identified priorities might also warrant evaluation. Furthermore, additional agents might merit consideration if new relevant evidence indicating an emerging carcinogenic hazard (eg, from cancer epidemiology studies, cancer bioassays, or studies on key characteristics of carcinogens) becomes available in the next 5 years. In line with the interim standard operating procedure adopted by the IARC Governing Council,[5] IARC will consider this advice when selecting agents for future Monograph evaluations according to the Preamble to the IARC Monographs.[1]

The views expressed are those of the authors and do not necessarily represent the decisions, policy, or views of their respective institutions.

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All authors declare no competing interests.

1 International Agency for Research on Cancer. Preamble to the IARC Monographs. 2019. https://monographs.iarc.fr/wp-content/uploads/2019/01/Preamble-2019.pdf (accessed April 16, 2019).
2 International Agency for Research on Cancer. Report of the Advisory Group to Recommend Priorities for IARC Monographs during 2020–2024; 25–27 March, 2019. Lyon: Monographs on the Evaluation of Carcinogenic Risks to Humans, in press.
3 Straif K, Loomis D, Guyton K, et al. Future priorities for the IARC Monographs. *Lancet Oncol* 2014; **15:** 683–84.
4 Guha N, Guyton KZ, Loomis D, Barupal DK. Prioritizing chemicals for risk assessment using chemoinformatics: examples from the IARC Monographs on pesticides. *Environ Health Perspect* 2016; **124:** 1823–29.
5 International Agency for Research on Cancer. Sixtieth Session of the IARC Governing Council, GC/60/13. 2018. http://governance.iarc.fr/GC/GC60/En/Docs/GC60_13_CoordinationWHO.pdf (accessed April 12, 2019).