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Commentary

How Corporate Influence Continues to Undermine the Public's Health

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Objectivity requires the minimization and control of potential biases in the design and interpretation of scientific studies conducted to investigate linkages between exposures and outcomes. Unless the objectivity of science can be assured, the ability of science to advance knowledge in the pursuit of truth will be undermined. While several types of bias are typically controlled at the design stage of a scientific study, the role of influence from any of a number of sources, and with different motivations and intent, is only more recently being recognized for its role in derailing science. This negative influence not only affects the course of science in advancing knowledge, but also in delaying the ability of science to inform policy to prevent ill-effects and achieve justice for potential harms arising from delays caused through the casting of doubt about evidence. The greatest bias of this type comes from those with a vested interest in the outcome, most typically financially driven. To exemplify the problem in occupational and environmental health, we organized a scientific session at the Ramazzini Days in November 2018 entitled *Corporate Influence Threatens the Public Health*; the abstracts of the papers presented in this session appear also in this issue.

Framing the issue

Health and prosperity rely on independent scientific investigation and discovery for their progress. To advance science and knowledge, the ability of scientists to conduct research and share information is paramount, particularly if the public interest is to be protected.

The public interest is best protected without interference or censorship by any powerful entity having a vested interest in maintaining the *status quo* and/or serving special interests that are not congruent with the public interest. Interference and/or censorship demean and undermine the public policy process as well as our democratic institutions.

Scientific research in occupational and environmental health provides input to governmental decision-making and regulatory processes. Without access to the best available science, those in the regulatory domain will be unable to make informed, rational decisions based on evidence, thus placing public health, safety, and the environment at risk.

To what use can science be put to influence policy? The pursuit of truth in the public interest is one use, a positive use; the pursuit of special interests that manipulate science and misuse it, contrary to the public interest, is another use, a negative use. It is on the negative uses that we focus in this commentary.

Moving to action in the public interest

To examine the current status of these issues as framed above, in regard to occupational and environmental health, the Collegium Ramazzini in November 2018 convened a panel of six scientists entitled *Corporate Influence Threatens the Public Health* to draw attention to the undermining of scientific integrity by the myriad effects of corporate influence. These effects include:

- the infiltration of editorial boards of peer-reviewed (and therefore presumed credible) scientific journals by those often in the pay of industry with the consequent publication of mostly poorly-designed research studies that produce biased results that mislead readers, foment uncertainty, and derail the advancement of knowledge;
- interference by those often in the pay of industry with the independent activities of WHO/IARC and other public health-related agencies;

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- construction of roadblocks by those often in the pay of industry for much-needed government regulation of hazardous agents widely present in the workplace and the environment, agents such as pesticides and polyfluoroalkyl substances (PFAS); and
- the promulgation of "causation" criteria by those often in the pay of industry that lack foundation and effectively block workers' access to legal remedies for occupational illness and premature death.

The six panelists covered a broad range of case studies to illustrate some of the key issues related to the undermining of public health on an international scale. Their abstracts can be found elsewhere in this volume.

Empirical evidence as a basis for arresting the worsening trend

The example of perfluoriated alkylate substances (PFASs) nicely reveals how severe adverse health effects due to global contamination with such agents have been repeatedly denied in scientific journals, creating doubt resulting in the absence of restrictive regulations (1).

Mandrioli draws attention to financial conflict-of-interest (fCOI) which systematically biases research and the publication process (2, 3) and Bero underscores that bias in research is a serious problem that concerns researchers, consumers, policy-makers, as well as other users of evidence (4).

Misconduct and malfeasance are not new in science. Broad and Wade (5) provide numerous examples over the centuries where scientists betrayed the truth and engaged in fraud and deceit. In the career lifetimes of several of the panelists, a review of the literature on malfeasance - through the self-interested manipulation of methods in epidemiology and related sciences foundational to interpreting evidence - begins with Epstein's seminal contribution. In his book *The Politics of Cancer* (6), Epstein describes influences impacting decision-making relating specifically to cancer in all of its aspects (causation, treatment and prevention) providing evidence for the lacklustre progress in both cancer morbidity and mortality.

A few years later, Clayson and Halpern (7) noted that "Industry's offensive against the regulation of health and safety hazards uses academics to downplay or deny the seriousness of the hazards..." as the means to serving their own special interests.

To counteract influence in epidemiology, the need for ethics in epidemiology was first brought to attention by Soskolne (8, 9). Self-regulation within the professions is deemed more desirable than government involvement to better ensure that professional conduct is in support of the public interest.

Downplaying and denying hazards are two well-known mechanisms for the subversion and ambushing of science. These actions undermine the health policy-maker's role by fomenting uncertainty. Policy-makers are less able to formulate policy in the presence of uncertainty. The motivation of those self-interested in maintaining the *status quo* is to delay policy change, thus permitting them to continue with business-as-usual.

Several texts, book chapters and peer reviewed articles have been written that address these mechanisms. Many of these are case studies, bringing to life examples of malfeasance in science and policy. Selected texts since Epstein's work in 1978, include those by Davis (10-12), Michaels (13), McCulloch and Tweedale (14), Oreskes and Conway (15), Cranor (16), Friedman and Friedman (17), others Soskolne (18, 19), Baur et al. (20, 21) and, most recently, that edited by Walker (22). The latter examines the role and mechanisms by which corporate manipulation and vested interests wreak devastation in Public Health.

Equipped with the methods of epidemiology, epidemiologists – as applied health scientists – can work for good or evil. In the latter case, they introduce bias in subtle and influential ways. How does this process unfold?

In practice, applied health scientists, studying diseases where they arise, can discover a finding that does not support the *status quo*, running contrary to the interests of a powerful stakeholder. In such instances, the epidemiologist must be prepared to face the "Four D's," which are applied with the intent of avoiding rational policy action. The scientist can be confronted with:

- **D**eny – denial that the findings could be correct
- **D**elay – in that more research will be called for
- **D**ivide – in that commissioned work will result in biased findings
- **D**iscredit – if the scientist persists, he/she will be discredited.

This paradigm (i.e. the "Four D's") has been applied in the case of many substances, including, tobacco, asbestos, and climate change. Its application has resulted in vast numbers of preventable cases of morbidity and premature mortality (23). Only after consuming vast resources, through the persistence of scientists working in the public interest, has public policy ultimately been able to be invoked to better serve the public interest.

Classical techniques that skew results: from biased methods to junk science

By referring to the "late lessons from early warnings" on hazards posed by endocrine-disrupting substances [EDSs] Gee (24) draws attention to the high risk of false negative experimental [animal laboratory] and observational studies; a false positive case study could not be identified.

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Underlying reasons include bias in methods such as not taking into consideration multi-causality, thresholds, timing of those mixtures which characterize the exposures, and impacts of such substances.

Following, extracted from Cranor (16) and Soskolne (25), is a Table that concisely brings together the broad range of techniques that are selectively manipulated to bias the body of evidence away from the pursuit of truth and in service of what are often moneyed interests, contrary to the public interest. These techniques generate 'junk science', the latter produced usually through funding provided by powerful interests. The latter is used to infiltrate the literature such that, in court proceedings, doubt will work in favour of the defendant and make it unlikely that policy change will ensue.

The asbestos and silica examples from India illustrate one strategy that is used to undermine and intimidate researchers who promote scientific conclusions that are perceived as unwelcome by the industry concerned (26). At the same time, appreciation of the hazards and risks of these minerals among the community is growing as shown by the latest WHO statistics (27).

The private sector also uses support from researchers who are willing to promote skepticism and exert negative influence on colleagues who speak for improved control of toxic releases. As illustrated by the case on conflicts of interest, this problem is probably widespread and difficult to examine due to the lack of transparency.

In most industrialized countries, the private sector carries out or sponsors more research than do public institutions. Industrial research is crucial to generate new technologies and better usage of resources. However, the cases included in this article illustrate that this extensive research may also be counter to the financial interests of the industry, e.g., when studies find that currently used technologies carry risks to public health that ought to result in discontinuation of the technology. When such information is kept secret, the possible adverse effects may accumulate and become severe.

The glyphosate case (28) illustrates how a financial interest can interfere with regulatory processes.

The U.S. situation (29) shows how the policy development for protection of public health against toxic chemicals may be affected by libertarian standpoints that favor lesser

Techniques used to undermine both science and policy

The standard techniques that mal-intended scientists use to foment uncertainty about cause-and-effect include:

- Statistically under-powered studies
- Inadequate follow-up methods
- Inadequate follow-up time
- Contaminated controls, and a broad range of degree and types of exposure among the presumed exposed group
- Ignoring known synergies among components of the mixture of chemicals to which people are exposed
- Inadequate laboratory practices that systematically under-estimate exposures
- Inappropriate analytical methods for calculations
- Unbalanced discussion
- Selective disclosure of competing interests
- Linear-reductionist quantitative methods without post-normal qualitative approaches to complement them

Classical arguments used to delay action in support of maintaining the *status quo* include classical techniques used to skew research results:

- Making a biased or selective interpretation
- Ignoring mechanistic information for inferring effects
- Exaggerating differences between human and toxicology studies, the insistence being on separating effects seen in animals from effects in humans, or the converse as is convenient
- Ignoring the fact that molecular structures predict hazard potential

Classical techniques employed that skew and delay policy, and also create an unhelpful division among scientists:

- The insistence on first demonstrating effects in local populations of exposed people despite demonstrated effects in humans elsewhere
- The failure to make explicit the implicit value judgements that go into deciding appropriate standards of evidence for drawing policy-relevant conclusions (viz. by the researcher suppressing dominant interests and values that may skew the results)

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regulation without taking into account the costs to public health. Wagner et al. (30) most recently discuss these movements as creating "science wars".

The examples presented by the panelists illustrate the need for proper, effective, and sustainable steps that will allow better transparency, collaboration, and expansion of environmental health research and responsible decision-making (31).

An ideal way forward

While the experiences recounted by each of the panelists may not be representative of global tendencies in applying scientific information to protect public health, they do underscore the need for action if the public interest is to be protected.

We recommend that the evidence assembled by this panel be used to translate science into prudent policies that also incentivize the industrial production of useful safe chemicals in sufficient amounts while minimizing risks to the environment and human health. These are aspects that are usually externalized and disregarded.

The case studies indicate that this ideal is far from being reached. Further, the examples presented illustrate that the policy debate has been extended to involve research and researchers, not openly, but often disguised as public information and research support rather than interference.

As stated by Markowitz and Rosner (32): "… as a society we cannot entrust those with self-interest to be the judge and jury of what is and what is not a danger. … , that can only lead to compromised science, a questionable decision-making process, and a potentially polluted world."

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