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**Modelling U-shaped exposure response curves**

Essential elements such as copper and manganese may demonstrate U-shaped exposure-response relationships due to toxic responses occurring as a result of both excess and deficiency. Categorical regression methods are introduced for simultaneously fitting excess and deficiency data in the form of a single U-shaped exposure-response curve, the minimum of which occurs at the exposure level that minimizes the probability of an adverse outcome due to either excess or deficiency. The use of a severity scoring system to place diverse toxic responses on a common severity scale permits the analysis of all available exposure-response data from multiple studies expressing multiple endpoints due to both excess and deficiency. The application of these new methods is illustrated using categorical regression databases developed for both copper and manganese.

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**CRISPR without Walls: Myths and realities about the democratization of genetic technologies**

There is a revolution happening by “makers in biology.” This nascent innovation ecosystem thrives in community bio labs, which allow people of all ages to engage with biology and genomics in non-traditional settings, building on increasingly distributed and inexpensive biotechnologies. Meanwhile, one of the top science stories of 2012 was the furor about the wisdom of enhancing the transmissibility of the H5N1 influenza virus and whether do-it-yourself (DIY) biologists would cook up their own versions of the virus using information published in the academic press. Now, journalists and others are again pointing to the citizen science community amid fears about the nascent gene-editing technology CRISPR-Cas9. The DIYbio community developed codes of conduct in the summer of 2011. This culture of responsibility, the collaborative style of working, and the fact community labs are open spaces where everyone can see what’s going on reduce, if not eliminate, doomsday scenarios. This proactive culture of responsibility is an advance on the post-hoc scrambling that has often occurred within the scientific establishment. For instance, the US National Academy of Sciences began to seriously discuss the risks associated with gene drives only after experiments demonstrating the concept had been published. New governance models will be needed to establish appropriate norms for government funding and regulatory agencies, for researchers within and outside traditional laboratory settings, and for crowdfunding platforms. The DIYbio community, as stakeholders already addressing many of these questions, should play a role in a robust public dialogue about CRISPR-Cas9 and how new governance models can ensure safe, responsible scientific research. We are at a tipping point. We could help ensure safe and responsible research and build new innovation models or we could drive these emerging communities underground or out of existence.

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**Evaluating the Current Evidence for Hazard- and Risk-Based OEL Categories of Nanomaterials**

The goal of recent risk assessments of nanomaterials is to develop predictive models for occupational health decision-making based on hazard categories. Data needed for these analyses include quantitative dose and response endpoints across various types of nanomaterials, as well as physicochemical factors that may influence the toxicity (e.g., size, shape, chemical composition, solubility, surface reactivity). An ongoing NIOSH risk assessment strategy for nanomaterials involves the systematic review and development of datasets from studies in humans, animals and cell systems following exposure to nanoscale and microscale particles. Comparative potency analyses of nanomaterials to benchmark particles in tiered assays (in vitro, in vivo acute, in vivo subchronic/chronic) provide a framework for examination of endpoints of relevance to workers, including pulmonary inflammation and fibrosis, and the utilization of a broad array of experimental evidence. Challenges in these meta-analyses includes heterogeneity due to experimental design differences, limited reporting of quantitative dose-response data (especially for chronic health endpoints), few dose groups, and missing data for key parameters. Results of analyses of rodent data on acute pulmonary inflammation response to various types of nanoscale titanium dioxide, zinc oxide, and multi-walled carbon nanotubes included the identification of three nanomaterial hazard groups, which were approximately four to 200 times more potent (based on mass lung dose) than a fourth group with a microscale reference particle. Derived occupation exposure limits (OELs) based on such hazard groups may be useful for making initial exposure control decisions for nanomaterials without individual OELs. Disclaimer – The findings and conclusions in this abstract have not been formally disseminated by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy.

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**An Interactive Real-time Behavioral Game For Cyber Security**

This study describes an experiment in the form of a cyber security game with three players: attacker, defender, and user. Attacker is given 3 choices: attack the defender, attack the user or not attack anyone. The defender and user are given 2 choices, to defend either with standard or enhanced security. The outcome of the game depends on the combination of the three player’s choice of action. The likelihood of successfully defending from attacks for the defender and user may be enhanced by cooperating in making their security decisions, therefore there is an incentive to adjust one’s choices according to the other. In this game we observe whether the capability for the defender to see the user’s choice or vice versa would affect their own choice of security level. In addition, we observe if the attacker is sensitive to the level of coordination between attacker and user choices, particularly their likelihood to be deterred from making an attack. This experiment is implemented in o-tree, an online behavioral game platform that allows simultaneous interactive multiplayer games and uses online participants from Amazon Mechanical Turk.