Intentional Disinformation about Seralini et al. (2012)

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Edward Bernays would be proud. Bernays authored an aptly named book *Propaganda* in 1928, from which evolved the contemporary art of spin doctoring or what is more delicately termed 'risk communication'. This slender volume, similar in size to Machiavelli's early 1500s treatise *The Prince*, coaches practitioners on the process of manipulating public opinion.

Current approaches to discrediting Eric Seralini and colleagues for their ongoing research into possible human health impacts of genetically modified (GM) crops are a textbook application of Bernays' principles. For example, many of the outraged commentators whose remarkably similar views simultaneously hit the press mere nanoseconds after the latest Seralini paper, perform the role of 'third party authorities' in the vernacular of Bernays. A 'third party' is a respected person, such as a leading member of the community, whose views on a controversial subject are accepted simply because of their position. Most of the academic and institutional commentators participating in the attack on Seralini's work have never conducted original research into the health effects of GM crops[1]. Nonetheless, the authority of their titles accords the aura of impartial purveyors of sound, scientific reason.

However, the unacknowledged industry linkages of oft-cited GM advocates challenge their credibility. Diels et al. (2011) documented the impact of biotech industry involvement on the outcomes of research published in peer-reviewed journals. Based on an analysis of 94 objectively selected papers, they concluded

> "... the existence of either financial or professional conflict of interest was associated to study outcomes that cast genetically modified products in a favorable light ($p=0.005$). While financial conflict of interest alone did not correlate with research results ... a strong association was found between author affiliation to industry (professional conflict of interest) and study outcome ($p<0.001$)."

The utility of third party pronouncements and related strategies, such as using multiple sources to make the same allegations in a variety of venues, has been well established against other scientists asking inconvenient questions about GM crops. Examples include Shiv Chopra and Margaret Hayden (Health Canada), Ignacio Chapela (University of California, Berkeley), Irina Ermakova (Russian Academy of Sciences), Arpad Pusztai and Susan Bardosc (Rowett Research Institute, Scotland), Andres Carrasco (University of Buenos Aires, Medical School, Argentina), and Don Huber (Purdue University).

Careers are destroyed. Funding becomes unattainable. Papers are rejected. Physical safety is threatened. So what is the unambiguous message to any scientist contemplating research into the health or environmental impact of GM crops? Don't go there. The entirely foreseeable and self-serving result is that a preponderance of the limited information available on GM safety is

[1] In the interests of free disclosure, neither have I, but then I am not presuming to question the methodology, statistics, or interpretation of the study

funded by and even authored by the biotech industry, with the expected outcome (see Diels et al., 2011).

Red Herring Arguments. A red herring is defined as an argument which distracts an audience by introducing an irrelevancy, or in this case, a fallacy. An example of the red herrings used by GM proponents against Seralini et al. (2012) is presented below.

Red Herring Argument	Factual Rebuttal	Thus…..?
Tom Saunders, Head of Diabetes & Nutritional Sciences Division, Kings College, London UK : "This strain of rat is very prone to mammary tumors particularly when food intake is not restricted"	The Sprague-Dawley rats used by Seralini et al. (2012) were used in most industry studies (e.g. Hammond et al., 1996, 2004, 2006; MacKenzie et al., 2007). In these and other industry studies (e.g. Malley et al. 2007) feed intake was consistently free choice – unrestricted.	If there are concerns with this breed of rat or method of feeding, would they not invalidate industry-conducted as well as independently-funded research? The key point is that industry studies ran only 90 days. The tumors found by Seralini et al. (2012) occurred *after* 90 days – underscoring the need for longer term testing for chronic exposure – a point which appears to have been lost in the distraction.

A significant number of red herrings have been uncritically accepted by and reported in the media, attesting more to the effectiveness of Bernays' third party authority strategy than to actual failings in the research.

Quality of Methodology/Statistics: Much of the remaining criticism focused on the quality of the methodology and statistics, including number of animals used per experimental unit in Seralini et al. (2012). For non-specialists, this can appear damning evidence of shoddy science.

In this regard, two refereed analyses of the quality of research methods in GM products may be helpful. In addition to placing the methods of Seralini et al. (2012) in context, these analyses are relevant because they assess the quality of the published research which has been interpreted to suggest the safety of GM products to date.

First, Snell et al. (2012) assessed the quality of 12 'long term' (meaning >96 days) and 12 intergenerational feeding trials on health effects of GM crops. From this review of 24 studies, of which 13 did not indicate their source of funding and 11 were funded by various national institutes, they concluded:

> "The studies reviewed here are often linked to an inadequate experimental design that has detrimental effects on statistical analysis as far as the most frequently used statistics are concerned….. The experimental protocol currently used is described in the OECD Test Guideline No. 408, initially designed for assessing the toxicity of chemicals (OECD,

1998). It recommends populations of at least 10 animals per sex and per group, with 3 doses of the test substance and a control group[2]. **Six out of the 24 studies examined here used an appropriate number of experimental animals**: three long-term studies (Daleprane et al., 2009a, 2010; Sissener et al., 2009) and three multigenerational studies (Brake et al., 2003; Flachowsky et al., 2007; Haryu et al., 2009)." (emphasis added)

They continued:

" Furthermore, **seventeen out of the twenty-four studies examined did not use isogenic lines for the control diet (or more precisely did not state they used isogenic lines**)….."[3] (emphasis added)

They concluded:

"In summary, the major insufficiencies not only include **lack of use of near isogenic lines but also statistical power underestimation, absence of repetitions … over-interpretation of differences, which are often within the normal range of variation, and poor toxicological interpretation of the data**." (emphasis added)

It is noteworthy that the criticisms of design/methods/statistics identified by Snell et al. (2012) for most of the GM long-term and multi-generational trials published to date do not appear to have raised the concern of those leveling the same criticisms at Seralini et al. (2012).

Second, questionable experimental designs/statistical methods in industry-affiliated GM research were also identified in an earlier analysis of studies purporting to assess rBST impacts on dairy cattle. As reported by Dohoo et al. (2003a and b):

"….while many studies of rBST have been carried out, most of the studies had small or moderate sample sizes (less than 100 cows). **While studies of this size were adequate to evaluate some of the major production effects of rBST, they had insufficient power to detect either beneficial or harmful health effects associated with the use of the drug.**...The consequence of insufficient power in individual studies may be that a number of studies each report no significant effect on an outcome of interest, even though a real effect may exist...." (emphasis added)

When they subjected 53 studies (drawn from 60 refereed papers plus an additional 26 Monsanto studies submitted to regulators) to a meta-analysis, they found statistically significant adverse impacts of rBST on several parameters, including risk of clinical mastitis, cystic ovaries, culling, lameness, and non-pregnancy. The meta-analysis approach revealed impacts which were obscured by the design/methods of the many industry-funded studies published in the refereed literature.

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[2] N.B. Seralini et al. (2012) used 10 animals per sex per group, and 3 doses plus a control

[3] N.B. Seralini et al. (2012) stated "The varieties of maize used in this study were the R-tolerant NK603 (Monsanto Corp. USA) and its nearest isogenic non-transgenic control…. Grown under similar normal conditions, in the same location, spaced at a sufficient distance to avoid cross contamination…confirmed by qPCR analysis of DNA samples"

In sum, the source, type, timing, and caliber of the public criticism of Seralini et al. (2012) – a study which identified possible risks from GM products - contrasts notably with the singular absence of public criticism of studies concluding 'no risk'.

1. If the criticisms of Seralini et al. (2012) are valid, and as a non-specialist I can only defer to the refereed review analyses cited above, then the same criticisms must be leveled at most of the long-term and multigenerational information available to date.
2. If the criticisms of Seralini et al. (2012) are not valid, then what is the purpose of mounting such an aggressive campaign, by those with little or no record of conducting comparable research themselves?

Such a conundrum leaves little, evidence-based confidence in the safety of GM products – a reality which should be acknowledged and rectified by government regulators and funders of research into GM safety.

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Dohoo I.R., K. Leslie, L. DesCôteaux, A. Fredeen, P. Dowling, A. Preston, W. Shewfelt. 2003a**.** A meta-analysis review of the effects of recombinant bovine somatotropin 1. Methodology and effects on production. Can J Vet Res 67:241-251

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Hammond et al. 1996. The feeding value of soybeans fed to rats, chickens, catfish and dairy cattle is not altered by genetic incorporation of glyphosate tolerance. J. Nutr 126:717-272

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MacKenzie and 12 others. 2007. Thirteen week feeding study with transgenic maize grain containing event DAS-Ø15Ø7-1 in Sprague–Dawley rats. Food Chem Toxicol 45:551–562

Malley and 14 others. 2007. Subchronic feeding study of DAS-59122-7 maize grain in Sprague-Dawley rats. Food Chem Toxicol 45:1277–1292

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Sissener, N.H., M. Sanden, A.M. Bakke, A. Krogdahl, G.-I. Hemre. . 2009. A long term trial with Atlantic salmon (*Salmo salar* L.) fed genetically modified soy; focusing general health and performance before, during and after the parr−smolt transformation. Aquaculture 294:108−117

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