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Paul Royster

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Foxes Propose New Guidelines for Henhouse Design: Comments on NISO's Proposed Open Access Metadata Standards

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Author's Note:

This commentary is in response to: NISO RP-22-201x, *Open Access Metadata and Indicators* (draft for comment), which is available at: http://www.niso.org/apps/group_public/document.php?document_id=12047

NISO is the National Information Standards Organization, a non-profit industry organization whose mission statement reads: "NISO fosters the development and maintenance of standards that facilitate the creation, persistent management, and effective interchange of information so that it can be trusted for use in research and learning."

Their recently-issued proposed guidelines for new metadata fields to be attached to scholarly works purport to address and clarify issues of access and re-licensing surrounding the electronic distribution of journal articles. Briefly, they propose to add two fields to the standard metadata: one called "free to read" to identify documents that may be accessed without restriction or registration, and a second called "license_ref" to point users to a uniform resource identifier (URI) that will purportedly explain the re-use terms that apply to the document in question.

The draft proposal is not long—18 pages—and is thankfully plain-language and not overly technical. NISO is to be complimented for that.

The first problem with the proposal, though, and in many ways the root of the subsequent ones, is the composition of the 16-member working or advisory group. It is overwhelmingly made up of publishers, publishing consultants, and publisher associations. There is a single representative of an American library (Indiana University), two from British libraries (Wellcome Library and University of Birmingham Library), and one from a British library association (JISC). The representative of the American library organization (SPARC) is actually the owner of a publishing consulting company (ScholarNext). There is no one to represent the interests of the potential users, the faculty authors, or the institutional disseminators of the content.

In fact, the group contains 75% representatives of publishers and publishing services, many of whom have opposed, misrepresented, and sought to limit legitimate fair use of published materials. The publishers include American Chemical Society, Reed Elsevier, Public Library of Science, International Association of STM Publishers, and Social Science Research Network; publisher services companies include Copyright Clearance Center, Creative



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Commons, CrossRef, Ex Libris, Inc., EDItEUR, and Kennisland. They have been offered a seat at the table while the writers and researchers who create and use scholarship have not. This has the appearance of a self-interested cabal setting up standards that further entrench their control over content on which they have managed to secure a near monopoly.

Propagation of the standards lends an unearned aura of credibility, legitimacy, and authority to untested publisher claims of ownership or proprietorship. It also threatens to marginalize non-commercial and non-traditional publishers or disseminators of scholarly content. The guidelines are targeted at a relatively narrow (but profitable) band of communication, where content purportedly owned or licensed by large publishers is furnished to libraries and faculty, conceived only as passive recipients. Adoption of the proposed practices would only further normalize the institutionalized theft of intellectual property from the creators and originators of knowledge, who remain subject to the predatory and monopolistic practices of the majority of these guideline writers.

“free to read”

While this designation makes some sense in the narrow universe of subscription, hybrid, and gold OA journals publication, it does not address the myriad of forms in which scholarly content exists online. “Free to read” is defined as “accessible to anyone with an internet connection and without registration.”

So public domain works in Google Books would not qualify (sign-in is required). Nor would pdf files from the National Academies Press website (which requires log-in for pdf’s), though their low-res non-log-in-requiring page-by-page .gif files theoretically would. What about works that can be accessed only as page images and only a page at a time, such as those in the Library of Congress’s American Memory project? These would seem to qualify *sensu stricto*, but how would the attribute be attached or applied. Works in Hathi Trust, or the Internet Archive might or might not. A 400 Mb file from the Internet Archive might be theoretically accessible to someone with dial-up access to the internet, but in practice—not so much.

“license_ref”

More disturbing is the “license_ref” attribute, purporting to clear up the murky waters of re-use rights. Publishers frequently misunderstand, misstate, or misrepresent the rights they hold over academic materials. Springer, for example, labels articles authored by US government employees as “Copyright US Government,” which is an impossibility and an absurdity. Elsevier and others frequently publish without a copyright statement other than “Published by Elsevier”; this is purportedly done when some or all coauthors have declined or failed to sign the copyright transfer agreement. Many publishers commonly place a copyright ownership statement on materials that are public domain (see Figures 1–8, Appendix). In practice, copyright statements are routinely placed by copy-editors who have little or no understanding of copyright law or knowledge of the specific transfer agreements. It is also common practice for copyright to be settled on or remain with the author(s), while all publication, dissemination, and re-use rights are held by the publisher. Copyright transfer agreements are frequently 10 or more pages of single-spaced fine print. The “license_ref” attribute will do little to sort out this mess, and it will, in fact, lend greater credence and assumed authority to mistaken, misguided, or fraudulent claims of ownership.

A further complication to the “license_ref” attribute is that the re-use rights granted by various publishers differ so widely in what is granted to various classes of users and for various versions of material. With some publishers, a work may or may not be disseminated by the institution based on whether that institution has a policy mandating accessible dissemination. For ACS, the institution must have a mandate; for Elsevier, it must not—and both these publishers are represented in the working group.

Moreover, while most commercial publishers have declared policies regarding accessible re-use of materials they have published, many scholarly societies, university presses, and smaller publishers have not. Certainly, this is an inconvenience to repository managers and authors seeking to provide access to their materials, but the adoption of the proposed NISO standard will do little to address this issue.

Yet another complication is the frequent discrepancy between the stated policies of publishers regarding reuse and the actual rights granted or transferred by contract. Several publishers have issued re-use and author posting policies that flatly contradict the terms of their standard author agreements, in all cases claiming controls over re-use licenses that have no legal or contractual basis.

Further, the idea that an attribute referring to a licensing URI will persist over the long term or point to the same content over time is either innocent or absurd. To believe that the era of publisher acquisition and consolidation is ended is naïve; and online resources, even uniquely identified ones, often do not persist beyond the next website redesign or revision or software update. Today's URI is next year's Error 404.

Frankly, the publishers need to put their house in order before presuming to prescribe new metadata standards that will perpetuate their uneven and self-serving administration of the rights they have wrested from the academic laboring class. Enshrining their sometimes questionable claims in dedicated metadata fields would be good business practice for them, but not for those who want to see scholarly communication conducted on more equitable and fairly competitive terms.

A further issue is that these proposed metadata standards raise the bar for small-scale, start-up, and occasional publishing efforts—such as those from university libraries, departments, centers, or student organizations. Not all publishers have the expertise or the infrastructure to comply with the standards and practices recommended by NISO. This appears to be yet another occasion where the promotion of "open access" has become the sheep's clothing under whose guise non-standard, non-commercial, and innovative publishing models are pushed beyond the pale of acceptability or feasibility. The standards proposed here are another example of an existing monopolistic profit-based cabal of large commercial publishers (and their sometimes unwitting allies) asserting control over the language and practice of academic discourse.

I urge the NISO organization to re-think its objectives, means, and priorities here, and to open up the discussion to those stakeholders whose interests were ignored or suppressed.

Paul Royster serves on the JLSC editorial board. The opinions expressed here are those of the author, and do not necessarily reflect JLSC's position.

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APPENDIX

Figure 1. Journal of the American Water Resources Association

Note that the American Water Research Association both claims to own the copyright to this article and simultaneously admits that it is in the public domain.



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ESTIMATION OF EVAPOTRANSPIRATION ACROSS THE CONTERMINOUS UNITED STATES USING A REGRESSION WITH CLIMATE AND LAND-COVER DATA¹

Ward E. Sanford and David L. Selnick²

ABSTRACT: Evapotranspiration (ET) is an important quantity for water resource managers to know because it often represents the largest sink for precipitation (P) arriving at the land surface. In order to estimate actual ET across the conterminous United States (U.S.) in this study, a water-balance method was combined with a climate and land-cover regression equation. Precipitation and streamflow records were compiled for 838 watersheds for 1971-2000 across the U.S. to obtain long-term estimates of actual ET. A regression equation was developed that related the ratio ET/P to climate and land-cover variables within those watersheds. Precipitation and temperatures were used from the PRISM climate dataset, and land-cover data were used from the USGS National Land Cover Dataset. Results indicate that ET can be predicted relatively well at a watershed or county scale with readily available climate variables alone, and that land-cover data can also improve those predictions. Using the climate and land-cover data at an 800-m scale and then averaging to the county scale, maps were produced showing estimates of ET and ET/P for the entire conterminous U.S. Using the regression equation, such maps could also be made for more detailed state coverages, or for other areas of the world where climate and land-cover data are plentiful.

(KEY TERMS: evapotranspiration; hydrologic cycle; precipitation; streamflow.)

Sanford, Ward E. and David L. Selnick, 2012. Estimation of Evapotranspiration Across the Conterminous United States Using a Regression with Climate and Land-Cover Data. *Journal of the American Water Resources Association* (JAWRA) 49(1): 217-230. DOI: 10.1111/jawr.12010

INTRODUCTION

Evapotranspiration (ET) is a major component of the hydrologic cycle, and as such, its quantity is of major concern to water resource planners around the world. The long-term average quantity of water available for human and ecological consumption in any region is roughly the difference between the mean annual precipitation and mean annual ET (Postel *et al.*, 1996) with the latter frequently a majority

fraction of the former. Thus, quantifying ET is critical to quantifying surface runoff to reservoirs or recharge to aquifers (Healy and Scanlon, 2010). Quantifying ET is also critical for studies of ecosystem water balances (Sun *et al.*, 2011a) and regional carbon balances (Sun *et al.*, 2011b).

In spite of the critical nature of this hydrologic component, its measurement on regional to continental scales has been problematic. Measurement of ET, although possible directly at the land surface (e.g., Stannard, 1988), is usually made either indirectly by

¹Paper No. JAWRA-11-0134-P of the *Journal of the American Water Resources Association* (JAWRA). Received December 16, 2011; accepted September 24, 2012. © 2012 American Water Resources Association. This article is a U.S. Government work and is in the public domain in the USA. Discussions are open until six months from print publication.

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Figure 2. Wetlands

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Wetlands (2013) 33:667–678
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ARTICLE



Foraging Habitat for Shorebirds in Southeastern Missouri and its Predicted Future Availability

Daniel J. Twedt

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Abstract Water management to protect agriculture in alluvial floodplains often conflicts with wildlife use of seasonal floodwater. Such is the case along the Mississippi River in southeastern Missouri where migrating shorebirds forage in shallow-flooded fields. I estimated the current availability of habitat for foraging shorebirds within the New Madrid and St. Johns Basins based on daily river elevations (1943–2009), under assumptions that shorebirds forage in open habitat with water depth <15 cm and use mudflats for 3 days after exposure. The area of shorebird foraging habitat, based on replicated 50-year random samples, averaged 975 ha per day during spring and 33 ha per day during fall. Adjustments to account for habitat quality associated with different water depths, duration of mudflat exposure, intra-seasonal availability, and state of agricultural crops, indicated the equivalent of 494 ha daily of optimal habitat during spring and 11 ha during fall. Proposed levees and pumps to protect cropland would reduce shorebird foraging habitat by 80 %: to 211 ha (108 optimal ha) per day during spring and 9 ha (<3 optimal ha) per day during fall. Alternative water management that allows natural flooding below a prescribed elevation would retain nearly all existing shorebird foraging habitat during fall and about 60 % of extant habitat during spring.

Keywords Digital elevation model · Flood control · Floodwater · Foraging, Habitat quality · Mudflat · Shorebird habitat · Temporal availability

Electronic supplementary material The online version of this article (doi:10.1007/s13157-013-0422-0) contains supplementary material, which is available to authorized users.

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Introduction

For centuries, mankind has recognized that the fertile soils of alluvial floodplains yield abundant crops. However, farming bottomlands is risky as untimely flooding may destroy planted crops. Thus, prophylactic measures, such as levees, dams, and canals, have often been undertaken to protect alluvial farmland from flooding while crops are present. Conflicts arise when wildlife or other ecological processes are adversely impacted by these flood mitigation efforts. Recognizing that long-term environmental benefits result from alluvial flooding (Bayley 1995), flood control advocates are increasingly seeking compromises that provide socio-economic benefits for agriculture yet still retain some of the benefits afforded by a natural flood regime (Poff et al. 1997).

Along these lines, I sought to evaluate the impact on wildlife habitat of different water management scenarios associated with proposed flood control along the Mississippi River in southeastern Missouri, USA. I developed and applied a robust methodology to assess the current availability of shorebird foraging habitat associated with historical variation in river elevation. This same methodology was used to predict future availability of shorebird foraging habitat under different water management scenarios that could be employed after flood control measures are implemented. This affords planners an effective method to evaluate the tradeoffs between flood control for agriculture and the resultant availability and quality of wildlife habitat.

Extensive earthen levees that confine rivers within their battures (i.e., the alluvial land between low-water stage and the levees) and other flood control measures were implemented along the Mississippi River and its tributaries after record flooding in 1937 (Stevens et al. 1975). As a result levees are now present along most of lower Mississippi River (Numally et al. 1987). In addition, a

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Figure 3. *Environmental Monitoring and Assessment*

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Environ Monit Assess (2012) 184:913–928
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Improved mapping of National Atmospheric Deposition Program wet-deposition in complex terrain using PRISM-gridded data sets

Natalie E. Latysh · Gregory Alan Wetherbee

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Abstract High-elevation regions in the United States lack detailed atmospheric wet-deposition data. The National Atmospheric Deposition Program/National Trends Network (NADP/NTN) measures and reports precipitation amounts and chemical constituent concentration and deposition data for the United States on annual isopleth maps using inverse distance weighted (IDW) interpolation methods. This interpolation for unsampled areas does not account for topographic influences. Therefore, NADP/NTN isopleth maps lack detail and potentially underestimate wet deposition in high-elevation regions. The NADP/NTN wet-deposition maps may be improved using precipitation grids generated by other networks. The Parameter-elevation Regressions on Independent Slopes Model (PRISM) produces digital grids of precipitation estimates from many precipitation-monitoring networks and incorporates influences of topographical and geo-

graphical features. Because NADP/NTN ion concentrations do not vary with elevation as much as precipitation depths, PRISM is used with unadjusted NADP/NTN data in this paper to calculate ion wet deposition in complex terrain to yield more accurate and detailed isopleth deposition maps in complex terrain. PRISM precipitation estimates generally exceed NADP/NTN precipitation estimates for coastal and mountainous regions in the western United States. NADP/NTN precipitation estimates generally exceed PRISM precipitation estimates for leeward mountainous regions in Washington, Oregon, and Nevada, where abrupt changes in precipitation depths induced by topography are not depicted by IDW interpolation. PRISM-based deposition estimates for nitrate can exceed NADP/NTN estimates by more than 100% for mountainous regions in the western United States.

Keywords PRISM · Atmospheric wet-deposition · Precipitation · National Atmospheric Deposition Program

Introduction

A lack of detailed climatic and chemical depositional data for mountainous regions in the United States complicates estimation of the effects of atmospheric deposition from anthropogenic and

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Figure 4. Aquatic Toxicology

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Comparative responses to endocrine disrupting compounds in early life stages of Atlantic salmon, *Salmo salar*



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ABSTRACT

Atlantic salmon (*Salmo salar*) are endangered anadromous fish that may be exposed to feminizing endocrine disrupting compounds (EDCs) during early development, potentially altering physiological capacities, survival and fitness. To assess differential life stage sensitivity to common EDCs, we carried out short-term (4 day) exposures using three doses each of 17 α -ethinylestradiol (EE2), 17 β -estradiol (E2), and nonylphenol (NP) on four early life stages; embryos, yolk-sac larvae, feeding fry and 1 year old smolts. Differential response was compared using vitellogenin (Vtg, a precursor egg protein) gene transcription. Smolts were also examined for impacts on plasma Vtg, cortisol, thyroid hormones (T_4/T_3) and hepatosomatic index (HSI). Compound-related mortality was not observed in any life stage, but Vtg mRNA was elevated in a dose-dependent manner in yolk-sac larvae, fry and smolts but not in embryos. The estrogens EE2 and E2 were consistently stronger inducers of Vtg than NP. Embryos responded significantly to the highest concentration of EE2 only, while older life stages responded to the highest doses of all three compounds, as well as intermediate doses of EE2 and E2. Maximal transcription was greater for fry among the three earliest life stages, suggesting fry may be the most responsive life stage in early development. Smolt plasma Vtg was also significantly increased, and this response was observed at lower doses of each compound than was detected by gene transcription suggesting plasma Vtg is a more sensitive indicator at this life stage. HSI was increased at the highest doses of EE2 and E2, and plasma T_3 was decreased at the highest dose of EE2. Our results indicate that all life stages are potentially sensitive to endocrine disruption by estrogenic compounds and that physiological responses were altered over a short window of exposure, indicating the potential for these compounds to impact fish in the wild.

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1. Introduction

Environmental contaminants are potentially one of several factors that contributed to the decline of Atlantic salmon (*Salmo salar*) on the east coast of North America, and may currently play a role in poor recruitment success and restoration of this species (Fairchild et al., 1999). In particular, endocrine disrupting compounds (EDCs) are an increasing concern for wildlife, since population-level impacts of these compounds have been documented (Kidd et al., 2007; Lange et al., 2011; Blazer et al., 2012). Endocrine disrupting compounds are most often associated with municipal and industrial wastewater effluent, can feminize male fish in receiving waters (Sumpter, 2005; Desbrow et al., 1998; Blazer et al., 2007), and lead to local extinction (Kidd et al., 2007).

Two of the most prevalent estrogenic compounds in rivers and estuaries include the natural steroid, 17 β -estradiol (E2), and a synthetic estrogen, 17 α -ethinylestradiol (EE2) (Desbrow et al., 1998). Plasticizers such as 4-nonylphenol (NP) are also present in effluent, and act as weak feminizing compounds in fish (Servos et al., 2003). Routine wastewater treatment does not completely remove these compounds (Johnson and Sumpter, 2001), and fish in receiving waters exhibit histological evidence of feminization, biased sex ratios, and developmental abnormalities (Oberdorster and Cheek, 2001; Matthiessen, 2003; Bernanke and Koehler, 2009; Leet et al., 2011).

Exposure to EDCs can elicit severe and long-lasting impacts, primarily when fish are exposed early in development (Strussmann and Nakamura, 2002; Mills and Chichester, 2005). Several studies demonstrate that particular developmental stages are more vulnerable to EDCs than others. For example, Liney et al. (2005) exposed the common roach, *Rutilus rutilus*, to a gradient of wastewater effluent and found little response in adults but 100% feminization in fish exposed during the embryonic through juvenile period. Atlantic

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Figure 5. Science of the Total Environment

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Science of the Total Environment 472 (2014) 1152–1162



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A GIS-based vulnerability assessment of brine contamination to aquatic resources from oil and gas development in eastern Sheridan County, Montana

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HIGHLIGHTS

- Oil extracted from the Williston Basin is often co-produced with highly saline brine.
- We assessed potential brine contamination to aquatic resources from oil development.
- The assessment was based on oil well, geologic, and hydrologic characteristics.
- We analyzed surface and groundwater to determine the magnitude of contamination.
- The assessment did well in predicting sites with high and low levels of contamination.

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ABSTRACT

Water (brine) co-produced with oil in the Williston Basin is some of the most saline in the nation. The Prairie Pothole Region (PPR), characterized by glacial sediments and numerous wetlands, covers the northern and eastern portion of the Williston Basin. Sheridan County, Montana, lies within the PPR and has a documented history of brine contamination. Surface water and shallow groundwater in the PPR are saline and sulfate dominated while the deeper brines are much more saline and chloride dominated. A Contamination Index (CI), defined as the ratio of chloride concentration to specific conductance in a water sample, was developed by the Montana Bureau of Mines and Geology to delineate the magnitude of brine contamination in Sheridan County. Values >0.035 indicate contamination.

Recently, the U.S. Geological Survey completed a county level geographic information system (GIS)-based vulnerability assessment of brine contamination to aquatic resources in the PPR of the Williston Basin based on the age and density of oil wells, number of wetlands, and stream length per county. To validate and better define this assessment, a similar approach was applied in eastern Sheridan County at a greater level of detail (the 2.59 km² Public Land Survey System section grid) and included surficial geology. Vulnerability assessment scores were calculated for the 780 modeled sections and these scores were divided into ten equal interval bins representing similar probabilities of contamination. Two surface water and two groundwater samples were collected from the section with the greatest acreage of Federal land in each bin. Nineteen of the forty water samples, and at least one water sample from seven of the ten selected sections, had CI values indicating contamination. Additionally, CI values generally increased with increasing vulnerability assessment score, with a stronger correlation for groundwater samples ($R^2 = 0.78$) than surface water samples ($R^2 = 0.53$).

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Abbreviations: CI, Contamination Index (ratio of chloride (mg/L) to specific conductance (µS/cm)); DS, Dissolved Solids; IC, Ion Chromatography; GIS, Geographic Information System; NHD, National Hydrography Dataset; NWI, National Wetlands Inventory Dataset; PLSS, Public Land Survey System; PPR, Prairie Pothole Region; STEPPE, Science Team about Energy in Prairie Pothole Environments; SSURGO, Soil Survey Geographic Database; WPA, Waterfowl Production Area.

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1. Introduction

1.1. Background

Oil and gas production from the Williston Basin (Fig. 1) in the Northern Great Plains often produces large quantities of extremely saline co-produced water, or brine (used hereafter), with ratios of 10 barrels of brine to 1 barrel of oil not uncommon (Wanty, 1997). Superimposed over much of the northern and eastern parts of the Williston Basin is

Figure 6. Meteoritics & Planetary Science

The Meteoritical Society might be excused for its misstatement of ownership; they are, after all, concerned about events on a higher plane. But this is still an inaccurate and misleading claim.



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Particle aggregation in microgravity: Informal experiments on the International Space Station

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Abstract—We conducted experiments in space to investigate the aggregation of millimeter- and submillimeter-sized particles in microgravity, an important early step in planet formation. Particulate materials included salt (NaCl), sugar (sucrose), coffee, mica, ice, Bjurböle chondrules, ordinary and carbonaceous chondrite meteorite fragments, and acrylic and glass beads, all triply confined in clear plastic containers. Angular submillimeter particles rapidly and spontaneously formed clusters strong enough to survive turbulence in a protoplanetary nebula. Smaller particles generally aggregated more strongly and quickly than larger ones. We observed only a weak dependence of aggregation time on particle number density. We observed no strong dependence on composition. Round, smooth particles aggregated weakly or not at all. In a mixture of particle types, some phases aggregated more readily than others, creating selection effects that controlled the composition of the growing clumps. The physical process of aggregation appears to be electrostatic in nature.

INTRODUCTION

A crucial step in planet formation is the growth of solid bodies in the millimeter to meter size range: too large to condense directly from the gas phase and too small to interact strongly through mutual gravitation. The widespread existence of planets demonstrates that some growth mechanism operated in that size regime, but the process is not well understood. Whatever it was, it worked despite nebular turbulence (e.g., Weidenschilling and Cuzzi 1993; Sekiya 1998; Cuzzi et al. 2001; Weidenschilling 2010) that was probably strong enough to disrupt small-scale gravitational collapse via the Goldreich and Ward (1973) mechanism and to break dust structures held together by weak surface forces. Work on this topic (reviewed by Beckwith et al. 2000; Cuzzi and Weidenschilling 2006; Dominik et al. 2007; Blum and Wurm 2008) has included the sticking properties of ice and frost (e.g., Supulver et al. 1995, 1997; Bridges et al. 1996), silicate dust in microgravity environments (e.g., Wurm and Blum 1998; Blum and Wurm 2000; Blum et al. 2000;

Marshall and Cuzzi 2001; Wurm et al. 2001; Marshall et al. 2005; Güttler et al. 2010; Weidling et al. 2012; and references therein), and numerically modeled magnetic particles (e.g., Nuth and Wilkinson 1995; Dominik and Nübold 2002; Wang et al. 2010).

Here, we present the results of particle aggregation experiments carried out in microgravity on board the International Space Station (ISS). Despite their simplicity, these experiments illustrated the behavior of millimeter- and submillimeter-sized particles in low-density, low-viscosity gas (air) without the influence of gravity, conditions that are difficult to replicate on Earth for more than a few seconds. We found complex and often counterintuitive effects related to particle size, number density, composition, shape, and surface texture, as well as evidence that may help identify the physical mechanism that underlies the observed behavior. Because of the unsophisticated nature of the experiments it describes, this report is intended primarily to inform more formal and realistic future investigations of weightless particle aggregation.

Figure 7. *Ultrasound in Medicine & Biology*

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● Original Contribution

APPLICATION OF HIGH-INTENSITY FOCUSED ULTRASOUND TO THE STUDY OF MILD TRAUMATIC BRAIN INJURY

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Abstract—Though intrinsically of much higher frequency than open-field blast overpressures, high-intensity focused ultrasound (HIFU) pulse trains can be frequency modulated to produce a radiation pressure having a similar form. In this study, 1.5-MHz HIFU pulse trains of 1-ms duration were applied to intact skulls of mice *in vivo* and resulted in blood-brain barrier disruption and immune responses (astrocyte reactivity and microglial activation). Analyses of variance indicated that 24 h after HIFU exposure, staining density for glial fibrillary acidic protein was elevated in the parietal and temporal regions of the cerebral cortex, corpus callosum and hippocampus, and staining density for the microglial marker, ionized calcium binding adaptor molecule, was elevated 2 and 24 h after exposure in the corpus callosum and hippocampus (all statistical test results, $p < 0.05$). HIFU shows promise for the study of some bio-effect aspects of blast-related, non-impact mild traumatic brain injuries in animals. (E-mail: Joseph.McCabe@usuhs.edu) Published by Elsevier Inc. on behalf of World Federation for Ultrasound in Medicine & Biology.

Key Words: Animal models, Blast injury, Blood-brain barrier, Mouse, High-intensity focused ultrasound, Traumatic brain injury.

INTRODUCTION

Civilian and military personnel exposure to violent explosions, often from improvised explosive devices (IEDs), has burgeoned with recent world events (Aschkenasy-Steuer et al. 2005; Cernak et al. 1999; DuBose et al. 2011). In military populations, a RAND report (Tanielian and Jaycox 2008) estimated that as many as 20% (~320,000) of military personnel experienced some form of traumatic brain injury (TBI). In terms of severe TBI, a recent survey found that the majority are related to explosives (Wojcik et al. 2010), and severe blast-related traumatic brain injuries are a component of multiple injuries; a significant challenge to polytrauma care specialists (Aschkenasy-Steuer et al. 2005; DuBose

et al. 2011) and a hardship to the patient and family during rehabilitation and lifestyle adjustments (Bazarian et al. 2009; Sayer et al. 2008).

Milder forms of TBI are also a significant medical, social and economic challenge. Mild TBIs (mTBIs), in fact, constitute the majority of cases of blast-related exposures. Although nearly all individuals who sustain mTBIs eventually improve (Brown et al. 2011), residual cases persist and are likewise an ordeal for patient and caretakers and a challenge for neuropathological and imaging diagnosis, therapies, surgical reconstruction and home life adjustments (Silver et al. 2009; Tanielian and Jaycox 2008). In a sense, milder TBI has been enigmatic. The individual may have no other significant injuries, complaints may have a slower onset that is not evident as an acute manifestation and symptoms overlap and are concomitant with post-traumatic stress disorder (PTSD) diagnoses. Because of the lack of easily identifiable criteria for the critical factors related to pathophysiology, mild blast-related TBI is a significant challenge for pre-clinical researchers as well. Basic research

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Conflicts of Interest: The authors have indicated that they have no conflicts of interest regarding the content of this article.

Figure 8. Clinical Biomechanics

And finally, the publisher claims to own not only the research product of two U.S. Army doctors concerning the treatment and rehabilitation of amputees, even though they are clearly U.S. government employees, but additionally and separately, the abstract or summary of that research. I am reminded of one of my favorite characters from literature: "I'm Yertle the Turtle! Oh, marvelous me! For I am the ruler of all that I see!" I wonder what re-use rights they will allow us here in their "license_ref" attribute field, and how seriously we should treat their assertions.

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Three-dimensional joint reaction forces and moments at the low back during over-ground walking in persons with unilateral lower-extremity amputation



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ABSTRACT

Background: Abnormal mechanics of locomotion following lower-extremity amputation are associated with increases in trunk motion, which in turn may alter loads at the low back due to changes in inertial and gravitational demands on the spine and surrounding trunk musculature.

Methods: Over-ground gait data were retrospectively compiled from two groups walking at similar self-selected speeds (~1.35 m/s): 40 males with unilateral lower-extremity amputation (20 transtibial, 20 transfemoral) and 20 able-bodied male controls. Three-dimensional joint reaction forces and moments at the low back (L5/S1 spinal level) were calculated using top-down and bottom-up approaches. Peak values and the timings of these were determined and compared between and within (bilaterally) groups, and secondarily between approaches.

Findings: Peak laterally-directed joint reaction forces and lateral bend moments increased with increasing level of amputation, and were respectively 83% and 41% larger in prosthetic vs. intact stance among persons with transfemoral amputation. Peak anteriorly-directed reaction forces and extension moments were 31% and 55% larger, respectively, among persons with transtibial amputation compared to controls. Peak vertical reaction forces and axial twist moments were similar between and within groups. Peak joint reaction forces and moments were larger (3–14%), and the respective timing of these sooner (11–62 ms), from the bottom-up vs. top-down approach.

Interpretation: Increased and asymmetric peak reaction forces and moments at the low back among persons with unilateral lower-extremity amputation, particularly in the frontal plane, suggest potential mechanistic pathways through which repeated exposure to altered trunk motion and spinal loading may contribute to low-back injury risk among persons with lower-extremity amputation.

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1. Introduction

Altered and asymmetric gait and movement are common among persons with lower-extremity amputation (LEA; Sagawa et al., 2011). Such changes in the mechanics of locomotion have been associated with the development of secondary physical conditions and pain (Gailey et al., 2008). Low back pain (LBP), in particular, represents a frequent and debilitating impairment in this population that can often limit physical performance and reduce quality of life (Ehde et al., 2001; Taghipour et al., 2009). Moreover, recent and projected increases in the number of persons with LEA, resulting from traumatic injuries sustained during times of war (Reiber et al., 2010) and complications of vascular disease (Ziegler-Graham et al., 2008), further highlight the importance of understanding the underlying mechanisms linking LEA

and LBP; yet, such mechanisms are still unclear. Though most LBP remains idiopathic, physical (biomechanical) risk factors appear to play a more important role in this population.

Increased spinal loads have been identified as an important proximate cause of LBP (Kumar, 2001; McGill, 2007). Mechanical loads among tissues in/surrounding the spine are influenced by forces arising from gravity, inertia, and externally applied loads, as well as internal forces produced by ligaments and muscle contractions. Of particular interest here, the trunk (+ head and arms) accounts for nearly two thirds of total body mass (Winter, 1990), and as such even small displacements of the trunk center of mass can substantially alter muscular demands and joint reaction loads throughout the body (Gillet et al., 2003). For persons with unilateral LEA, increased and asymmetric trunk movements during locomotion have been observed (Cappozzo et al., 1982; Goujon-Pillet et al., 2008; Jaegers et al., 1995; Michaud et al., 2000; Tura et al., 2010), and which have been suggested to result from a neuromuscular/movement strategy that uses trunk weight/inertia to assist with forward progression and/or stabilizing the body.

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