

Importance Must be Salient for Heaviness to Increase Impressions of Importance

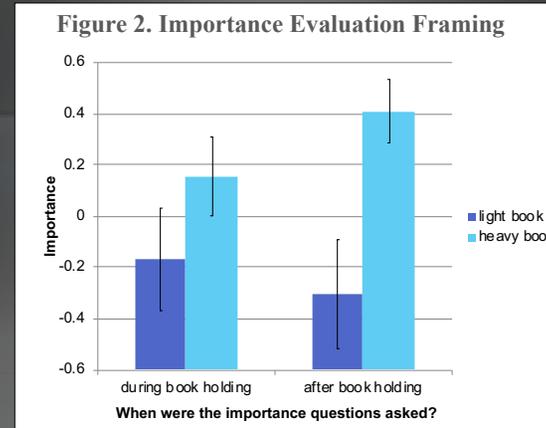
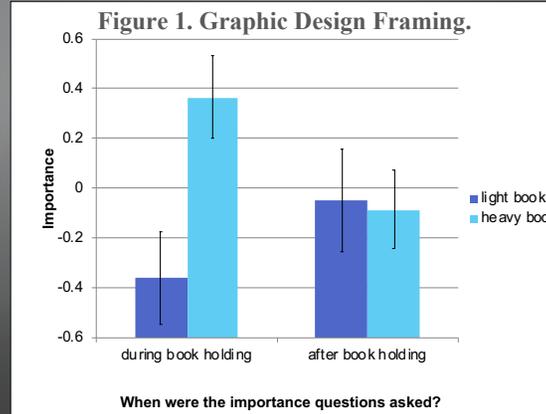
Jenna Manske, Isabel Saville, David Hauser, Phoebe Ellsworth



ABSTRACT

Recently, there has been an emphasis on the study of how the preconscious and subconscious embodiment of metaphors influence perception of various aspects of the world. Many of these studies have been conducted in order to understand how the metaphor affects perception, yet few have addressed the circumstances under which the metaphors influence has the greatest prevalence. Previous studies indicate that the incidental heaviness of an object affects people's impressions of its importance. As many metaphors imply, heaviness begets importance, yet the mechanisms driving these effects are not well known. In this study, the question under investigation is whether weight automatically affects importance, or if incidental heaviness requires the combination of contextual cues and physical perception to make salient its relevance to importance. Ninety participants, surveyed as part of either a visual evaluation task or an importance assessment task, evaluated the importance of either a heavy or control book while holding it or after returning it. When the task was framed as a visual assessment, only participants in possession of the book while evaluating were affected by the book's weight; however, when the task was framed as an importance evaluation, all participants judged the heavier book as more important than light book. Thus, contextual cues in combination with haptic cues elicit the weight effect.

- Many metaphors imply that heavy things are important (e.g., "These are heavy issues we are dealing with").
- Participants feeling heaviness rank job candidates as better and see social issues as more important. (Ackerman et al, 2010; Jostmann et al, 2009).
- Yet the cognitive mechanisms driving these weight effects are not well known. While prior research assumes that weight automatically triggers thoughts of importance (via scaffolding; Williams, Huang, & Bargh 2009), these studies also make importance a salient aspect of the task either by introducing the task as an importance evaluation or by having participants evaluate importance while simultaneously feeling heaviness sensations.
- In this study, we question whether heaviness automatically signals importance or if heaviness only bears upon importance when contextual cues make salient its relevance to importance.
- In the current study, all participants evaluated the importance of a normal or heavy book either while holding it or after returning it. Prior research has shown that the salience of importance matters; participants judge heavy books as more important (than light books) only when they hold the book while judging it and not when they previously held and returned it before judging it.
- For some participants in the current study, the task was framed as a visual design evaluation, giving no context cues for importance. These participants should be affected by weight only when they evaluated the book's importance while holding the book and not after they returned it, replicating prior salience effects.
- For other participants, the task was framed as an importance evaluation task, making importance a salient aspect of the task from the beginning. If weight effects depend upon contextual cues that make salient its relevance to importance, then these participants should be affected by weight regardless of when they evaluated the book's importance.



DISCUSSION

- Our hypothesis was proven: contextual cues are necessary for haptic sensations of heaviness to increase perceptions of importance. If importance is not salient, heaviness does not beget importance.
- Future research could potentially sample children to see when these effects coincide with developmental milestones or could assess how applicable heaviness is within the marketing and valuation of products.
- In a more basic sense, the current research sheds light upon the foundations of human thought and perception. Heaviness does not automatically activate importance (as is often assumed), but human reasoning is highly sensitive to context and perceptions of situations, which factor into our judgments and behavior. Because of that, heaviness only affects importance if importance is relevant and cued within a situation.

METHOD

- 90 participants (39 female, age range 18 – 28) were approached on at public areas on the University of Michigan college campus for a study about a book (*Dogboy* by Eva Hornung). Some were asked to participate in an assessment of the book's graphic design (i.e. the readability of the font) while others were asked to participate in an evaluation of the book's value and marketability (task framing randomly assigned).
- Researchers then handed the book to the participant. The book was either normal copy or one that contained concealed weights making it considerably heavier (book weight randomly assigned).
- Researchers asked participants four demographics questions and four book-related questions. Question order was manipulated; some participants received the book-related questions first (followed by demographics) while others received demographic questions first (followed by book-related questions; question order randomly assigned).
- Crucially, after the first four questions, researchers asked for the book back before asking the remainder of the questions. This established that participants either considered the importance of the book while feeling it's heft (*importance during book holding condition*) or considered it's importance after feeling it's heft (*importance after book holding condition*).
- The four demographics questions asked about participants' age, major, year at university, and political orientation. The four book-related questions asked participants how interested they were in reading the book (1 = not at all interested, 10 = very interested), how much they'd be willing to pay for a print copy of the book (free response), how likely the book was to appear on the New York Times' list of most influential and important books of the year (1 = not at all likely, 10 = extremely likely, and whether they'd read the book before (all said no).
- After answering all questions, participants were thanked, debriefed, and offered a piece of candy for their participation.

- Responses to the three importance-related questions were averaged together into importance index.
- Are weight effects dependent upon importance being salient? Yes – manipulating the salience of importance (via question order) moderated the effects. As shown in figure 1, when the task was framed as graphic design evaluation, the effect of weight depended upon question order, $F(1, 82) = 4.37, p = .040, r = .22$ for simple two way interaction. When participants were holding the book, those who held heavy books judged them to be more important than those who held light books, $t(82) = 2.83, p = .006, r = .30, 95\% \text{ CI } [0.214, 1.243]$ for the simple simple effect. However, when participants returned the book before assessing its importance, they did not believe the heavy book to be more important than the light book, $t(82) = 0.14, p = .892$ for the simple simple effect.
- Furthermore, as shown in figure 2, when the task was framed as an importance evaluation, making importance salient at the beginning of the task, the effect of question order was eliminated, $F(1, 82) = 1.11, p = .296$ for the simple interaction. Participants judged heavy books as more important than light books, regardless of question order, $F(1, 40) = 9.37, p = .004, r = .44, 95\% \text{ CI } [0.153, 0.745]$ for the simple main effect. This created an overall 3 way interaction of weight, question order, and task framing, $F(1, 82) = 4.91, p = .029, \eta_p^2 = .06, 95\% \text{ CI } [0.026, 0.474]$.
- Thus, weight effects on judgments of importance depend upon importance being salient at the time heaviness is felt. If importance is not already on the mind, heaviness doesn't affect it.



ABC Brains: Linking Early Childhood Experience to Neural Activity and Obesity

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INTRODUCTION

- Since the 1970s, obesity rates in children have more than tripled (Ogden & Carroll, 2014).
- Today, about one in five school-aged children (ages 6-19) has obesity (Ogden et al., 2016).
- Numerous studies have depicted the potentially irreversible damage caused by early-life exposure to obesity (Look et al., 2013; Moschen et al., 2013; Canello et al., 2013)
- Studies utilizing fMRI have illustrated that differences in neural responses in reward and motivation brain regions are implicated in obesity (Rothenmund et al, 2007; Tang, Fellows, Small, & Dagher, 2012; Boswell & Kober, 2015).
- No previous research has examined these neural response differences in children from low socioeconomic statuses (SES), who are at elevated risk for obesity development (Rogers et al., 2015).
- The current study utilizes an fMRI food reward paradigm to examine differences in neural responses to food images for children living in poverty

HYPOTHESES

- Food images would be more effective at activating motivation and reward brain regions when compared to control fixation crosses.
- High-calorie foods (relative to low-calorie foods) would illicit even greater activation of reward and motivation brain regions
- Children with higher (relative to lower) BMI z-scores would exhibit greater activation of these neural systems in response to food images, especially high-calorie food images.

METHOD

Sample

Participant characteristic (n = 35)	Mean ± SD or percentage
Age (years)	10.4 ± 0.8
Sex (%)	
Male (n = 18)	51.4%
Female (n = 17)	48.6%
Race/Ethnicity (%)	
White, non-Hispanic	45.3%
Black, non-Hispanic	11.3%
Biracial, non-Hispanic	18.9%
Hispanic, any race	20.8%
Unreported	3.7%
Income-to-needs ratio	0.99 ± 0.67
BMI z-score	1.1 ± 1.1

fMRI Food Reward Task

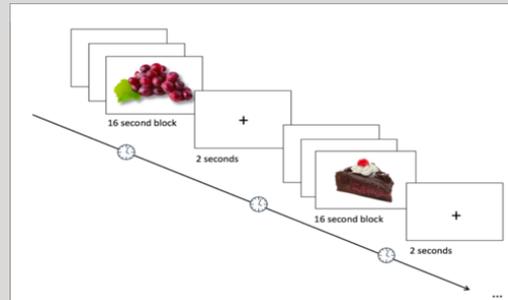


Figure 1. Food task fMRI block image design

•Instructions: "You are going to be having dinner after you leave here today. We are interested in what kinds of foods you most want to eat. In this task, you'll see pictures of foods. Please think about how much you WANT to eat each food that you see."

METHOD (cont.)

fMRI Analyses

- fMRI activation maps were generated for each participant and used to test group-level hypotheses. Hypotheses were tested within the general linear model of SPM12 (Wellcome Department of Imaging Neuroscience, 2014) using a whole brain analysis and with multiple comparisons corrected using the native FWE correction at $p < .05$

Association with BMIZ

- Parameters for all significant group-level contrasts were extracted, and the association with BMIZ was investigated using correlation matrixes in SPSS 24 (IBM Corp., 2016).

RESULTS

- Food images (compared to controls) did not result in greater activation of classic reward and motivation brain regions (i.e. dorsal striatum).
- High-calorie food images did not elicit greater activation of classic reward and motivation brain regions.
- BMIZ was not correlated with greater activation in reward and motivation brain regions in response to food images (including high-calorie foods)

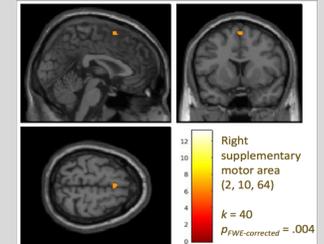


Figure 2. Brain activation map of the right supplementary motor area for food versus fixation

DISCUSSION

- Our hypotheses regarding food's effectiveness (especially high-calorie food's effectiveness) at engaging reward and motivation brain centers were not supported
- Our results did begin to inform the obesity research field about this at-risk and under-represented population of children who are living in poverty
- Future research is necessary to understand the neurobiological factors contributing to obesity risk in early childhood for low SES children

QUESTIONS?

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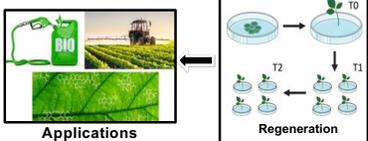
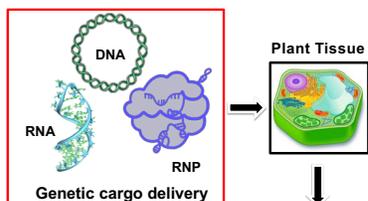
Development and Characterization of Gold Nanoparticles for Plant Genetic Engineering

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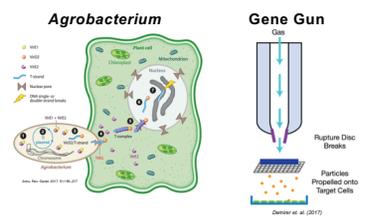
¹University of Michigan Department of Chemical Engineering, ²UC Berkeley Department of Chemical Engineering

Motivation

Plant genetic engineering is poised to fortify several key industries



Existing plant transformation methods lack practical applicability, have a narrow host range, are toxic, and inefficient



Research Objectives

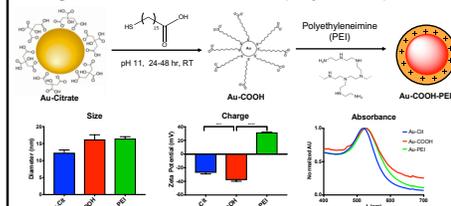
- Design biocompatible vehicles capable of efficient transport into plant cells of mature leaves
- Tune physicochemical properties of carriers to screen for optimal formulations
- Integrate nanoplatforms into model plant systems to gauge gene silencing and expression efficiency

Methods and Results

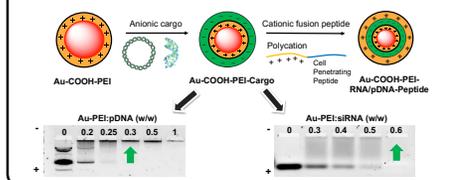
Nanoparticle Synthesis and Characterization

Approach 1: Electrostatic layer-by-layer siRNA and pDNA nanocarrier assembly

Carboxylation of AuNPs to obtain a stable negative surface for cationic polymer deposition

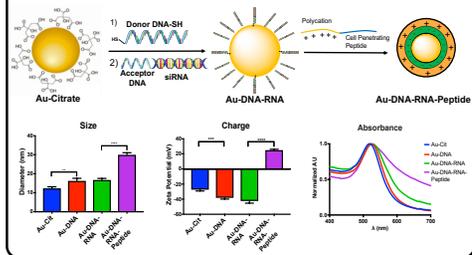


Successful loading of siRNA and pDNA onto engineered cationic nanoparticles

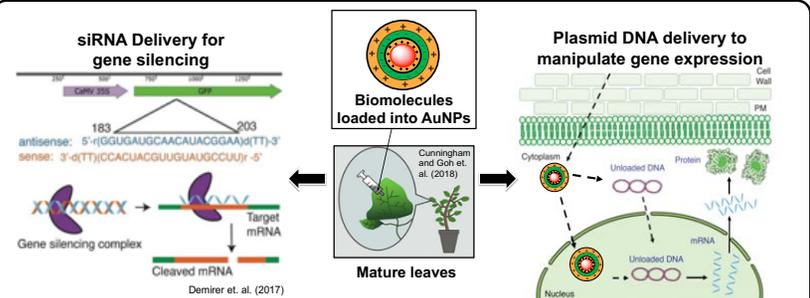


Approach 2: siRNA conjugation to AuNPs via complementary base pair hybridization

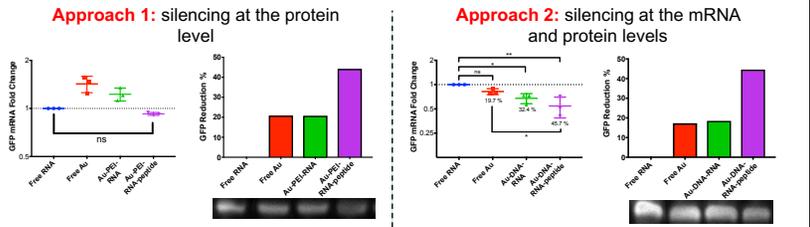
Thiolated Donor DNA attachment to AuNPs and hybridization to GFP siRNA



Administration of Nanoparticles to Mature Leaves



Preliminary results show GFP silencing in transgenic *Nicotiana benthamiana* leaves and conflicting results between mRNA and GFP levels



Approach 1: preliminary confocal imaging results show modest levels of GFP expression in wild-type *Nicotiana benthamiana* leaves



Conclusions and Future Work

We developed two nanoplatforms for the delivery of siRNA and pDNA to intact leaves. The following work must be conducted in the future:

- Repetition of all experiments with biological replicates to conclusively confirm or deny preliminary results
- Determination of critical AuNP toxicity concentrations to evaluate system scalability
- Evaluation of AuNP internalization into plant cells to gauge the platform's passive cell wall traversal capability
- Delivery of sgRNA to Cas9-expressing plants for precise plant genetic engineering

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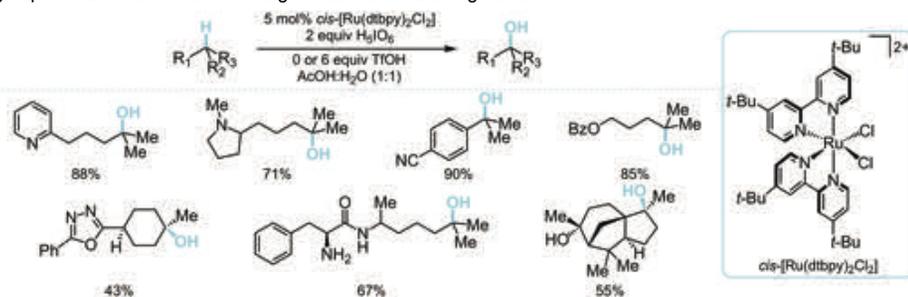
Electrocatalytic Bis(bipyridine)ruthenium Hydroxylation of Tertiary and Benzylic C–H Bonds

Sara N. Alekhtar,[§] Sophia G. Robinson,[§] James B. C. Mack,[‡] J. Du Bois,[‡] Matthew S. Sigman[§]

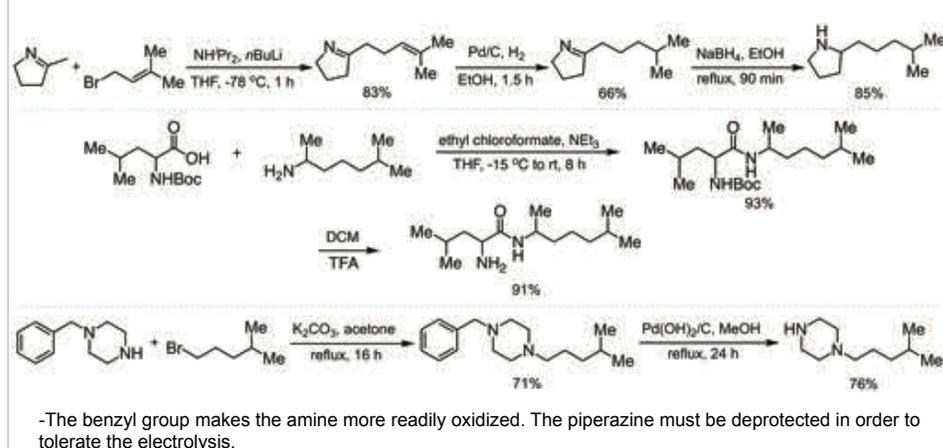
[‡]Stanford University, [§]University of Utah

Ruthenium Catalyzed C–H Hydroxylation of Amines

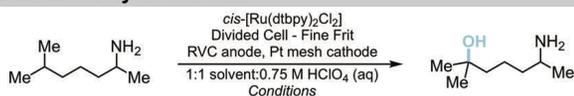
Abstract: The Sigman and Du Bois labs recently reported a methodology that employs a bis(bipyridine)Ru catalyst operating in acidic water to achieve oxidation of tertiary and benzylic C–H bonds in the presence of basic amines. The published method requires a stoichiometric amount of periodic acid to generate and turnover the active catalyst species. Efforts toward the development of an electrocatalytic method for generating the active catalyst in solution are disclosed. Performing the reaction electrocatalytically eliminates the need for periodic acid. Furthermore, the absence of periodic acid opens the possibility for broadening the functional group tolerance as well as reducing the amount of waste generated.



Substrate Syntheses



Bulk Electrolysis Screens

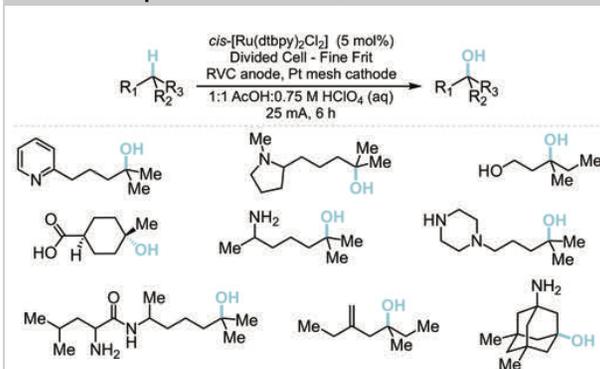


Entry	Oxidant	Time	Variations ^a	NMR Yield ^b
1	H ₂ O ₆	4 h	—	75%
2	10 mA	14 h	0 mol%	—
3	10 mA	14 h	—	51%
4	20 mA	5 h	—	38%
5	25 mA	6 h	—	69%
6	25 mA	2 h	—	33%
7	30 mA	6 h	—	42%
8	40 mA	6 h	—	33%
9	25 mA	6 h	0.09 M	39%
10	25 mA	6 h	0.12 M	30%
11	25 mA	6 h	2.5 mol%	48%
12	25 mA	6 h	MeCN ^c	15%

^astandard conditions: c = 0.06 M, solvent = AcOH, cat = 5 mol%;

^bNMR standard = 4-nitrotoluene; ^celectrolyte = 0.1 M TBABF₄

Potential Scope/Future Directions



-This method should be able to tolerate both free amines and free alcohols, as well as terminal olefins.

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Acknowledgements



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Any opinions, findings or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF



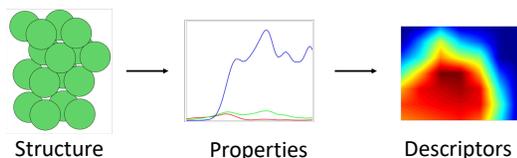
Background & Motivation

Importance of Catalysis



- 90% of all chemical and fuel production¹
- 30% of U.S. Gross National Income^{1,2}
- \$4.5 trillion/year in U.S. products²
- \$1 spent is \$1000 earned²

Studying Catalysis with Computational Methods



- Ideal catalysts are highly active, selective, and stable
- Predictions from computation drastically reduce the number of possibilities that must be tried experimentally
- Even with computation, the sample space is too large to examine by brute-force methods
- Using descriptors allows us to screen new catalyst candidates efficiently

Problem Statement

Computational methods currently used to study catalysis require specialized software packages and high-performance computing resources, making them less accessible for students and beginning researchers.

Objectives

1. Create a tool on nanoHUB that can calculate properties of interest to catalysis.
2. Make the tool versatile for use in both research and education.

Methods & Approach

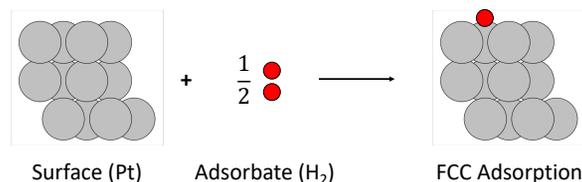
Generating Structures



Density Functional Theory



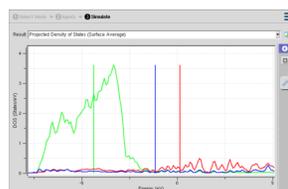
Calculating Adsorption Energy



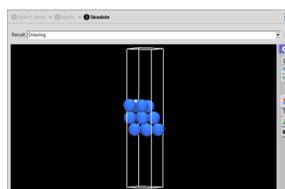
$$\Delta E_H = E_{surf+H} - E_{surf} - \frac{1}{2} E_{H_2}$$

Results & Analysis

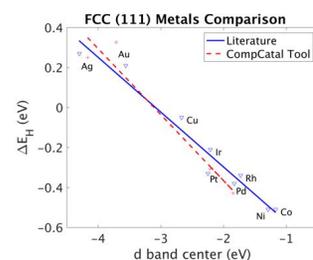
Projected Density of States



Structure Viewer



Calculating Catalytic Properties



- d band center is important for predicting catalytic properties
- Results from nanoHUB tool match closely with literature values^{3,4}

Results & Analysis (cont.)

Usability in Education and Research

Basic Inputs (Education):

- Surface
- Adsorbate
- Adsorbate position
- Distance from surface
- Energy of surface
- Energy of adsorbate

Advanced Inputs (Research):

- All basic inputs
- Lattice parameter
- Miller indices
- Supercell dimensions
- Number of layers
- Vacuum thickness

Conclusions

- Tool is able to calculate adsorption energy and d band center with comparable accuracy to literature values
- Basic and Advanced modes of operation enable use of the tool in both research and educational settings
- Tool removes the barriers to studying catalysis (specialized software and high-performance computing resources no longer required)

Try out the tool for yourself!
<https://nanohub.org/tools/compccatal>



Future Work

- Perform additional benchmarking to test accuracy with other adsorbates and metals
- Access Rappture tool through Jupyter notebook for improved visualization capabilities

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SYNTHETIC HYDROGEL CULTURE SEQUESTERS EXTRACELLULAR MATRIX PROTEINS AND PROMOTES FIBROBLAST PROLIFERATION AND OVARIAN FOLLICLE GROWTH

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ABSTRACT

The extracellular matrix (ECM) significantly contributes to the microenvironment of cells and tissues by acting as a physical scaffolding, offering adhesion sites and initiating crucial biochemical and biomechanical cues required for tissue differentiation, morphogenesis, and homeostasis. The ECM is made up of many cell-secreted proteoglycans, polysaccharides, and proteins such as collagens, fibronectin, and laminins that self-assemble to form dense networks. Three-dimensional culture provides a biomimetic platform for studying the role of ECM in cellular processes in a facile manner, but current synthetic hydrogels are unable to facilitate ECM deposition and remodeling. In this study, we designed a poly(ethylene glycol) vinyl sulfone (PEG-VS) system and functionalized with ECM-sequestering peptides to promote ECM retention. Preliminary studies used fibroblasts, as they are robust cells which secrete a variety of ECM proteins, to investigate proliferation, ECM deposition, and spreading.

We further investigated the effects of this matrix on ovarian follicle survival and growth for preserving fertility in women facing gonadotoxic anti-cancer treatments. The ovarian follicle is composed of an oocyte surrounded by layers of hormone-secreting granulosa and theca cells that are separated by a basement membrane that mediates the diffusion of intermediates. The basement membrane consists of multiple cell-secreted molecules, including the aforementioned ECM components. Allowing for the follicle to secrete and assemble its basement membrane results in higher survival, growth, and maturation rates.

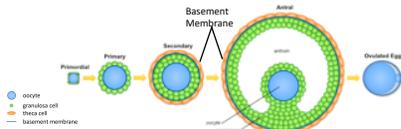


Figure 1. Schematic of follicle development.

MATERIALS AND METHODS

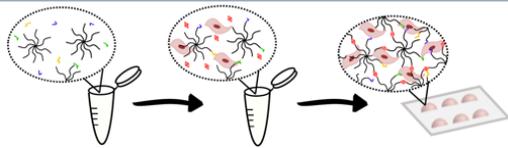


Figure 2. Peptide is reacted with PEG-VS via Michael-type addition. Mouse Embryonic Fibroblasts (MEFs) are suspended in PEG-peptide precursors mixed with a MMP-sensitive peptide crosslinker at a concentration of 10^6 cells/mL. $10\mu\text{L}$ PEG beads are formed on a glass slide and undergo gelation at 37°C for 7 minutes.

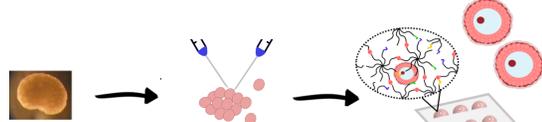


Figure 3. Mouse ovaries were removed from pre-pubertal pups, 12-14 days old. Secondary ovarian follicles are mechanically isolated and individually encapsulated in PEG with peptides.

ECM-SEQUESTERING PEG MATRIX

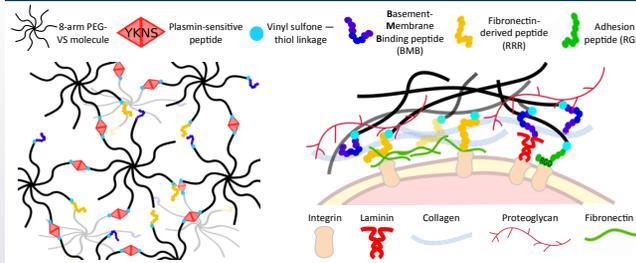


Figure 4. 8-arm poly(ethylene glycol)-vinyl sulfone (PEG-VS) molecules are functionalized with ECM-sequestering peptides and crosslinked via Michael-type addition chemistry of cysteine-terminated peptides containing plasmin-sensitive moieties. RGD is a common cell adhesion motif, RRR has been shown to bind fibronectin, and BMB binds laminin and collagen IV.

[1] Martino, M. M. *Science*. 2014; 343(6173): 885-888. [2] Cook, C. D. *Integrative Biology*. 2017; 9(4): 271-289.

FIBRONECTIN-SEQUESTERING MATRIX PROMOTES NETWORK FORMATION

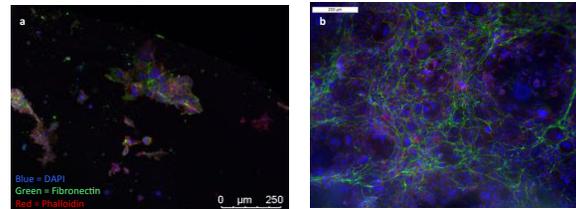


Figure 5. MEFs encapsulated in PEG with (a) cysteine (control), scale bar = $250\mu\text{m}$ and (b) RRR, scale bar = $200\mu\text{m}$. MEFs in PEG-RRR exhibited increased network formation and fibronectin deposition.

DUAL PEPTIDE PEG INCREASES ECM DEPOSITION

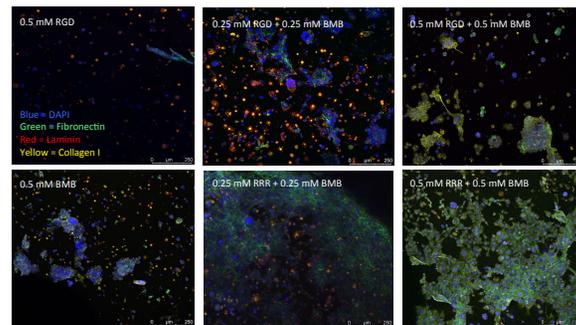


Figure 6. Confocal imaging shows that increasing total concentration of modification, particularly the combination of BMB and RRR, increases ECM protein deposition and retention when compared to RGD and BMB individually, leading to increased network formation. Scale bars = $250\mu\text{m}$.

ECM-SEQUESTERING PEPTIDES IN FOLLICLE CULTURE

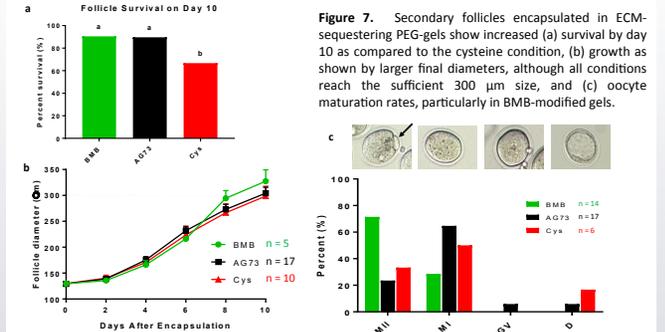


Figure 7. Secondary follicles encapsulated in ECM-sequestering PEG-gels show increased (a) survival by day 10 as compared to the cysteine condition, (b) growth as shown by larger final diameters, although all conditions reach the sufficient $300\mu\text{m}$ size, and (c) oocyte maturation rates, particularly in BMB-modified gels.

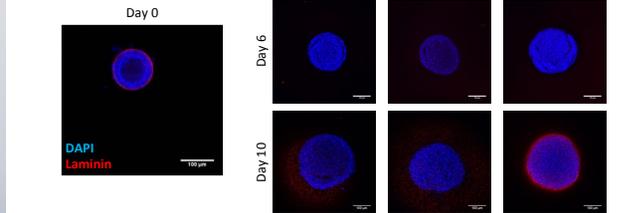


Figure 8. Follicles cultured in all gels show a loss of ECM by day 6, but follicles encapsulated in BMB-modified gels are able to rebuild their basement membrane by day 10. Scale bars = $100\mu\text{m}$.

CONCLUSIONS

- Culture of MEFs in ECM-retaining PEG hydrogels enhances network formation.
- Incorporation of RRR along with BMB at a total concentration of 1mM of modification leads to improved culturing conditions.
- ECM-sequestering peptides facilitate basement membrane deposition, significantly improve survival, and lead to improved oocyte maturation.
- Future directions:
 - Quantitative analysis of ECM deposition via photon counting.
 - Co-encapsulation of ovarian stromal cells with secondary follicles in ECM-sequestering PEG.

ACKNOWLEDGMENTS

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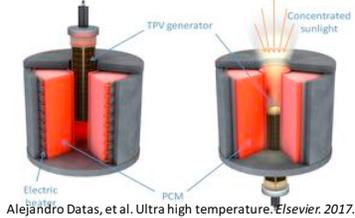
Impact of heterogeneous surface absorption on thin-film thermophotovoltaic performance

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Background

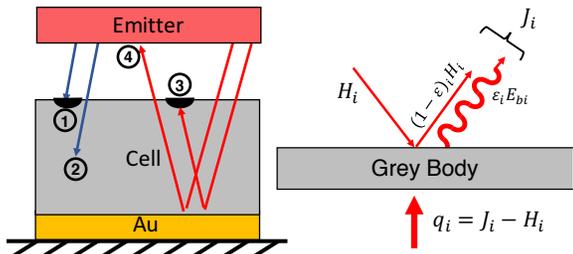
- Thermophotovoltaic (TPV) generators are a promising technology for applications in solar thermal energy conversion and grid-scale electrical storage systems.
- Large efficiency gaps are observed between cell-based laboratory experiments and practical TPV modules.
- The extent of this performance drop-off is an important consideration when designing realistic TPV cells that are both highly-efficient and robust.



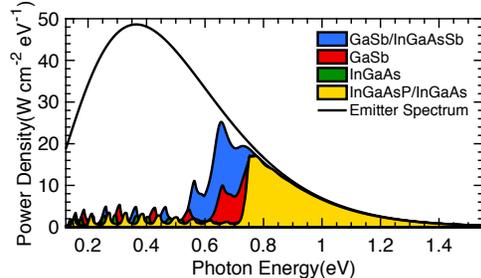
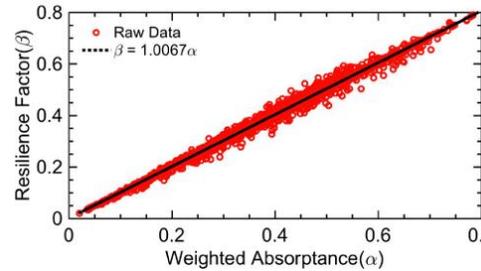
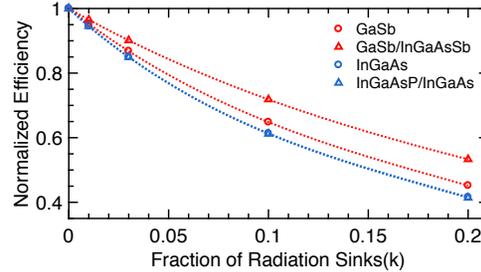
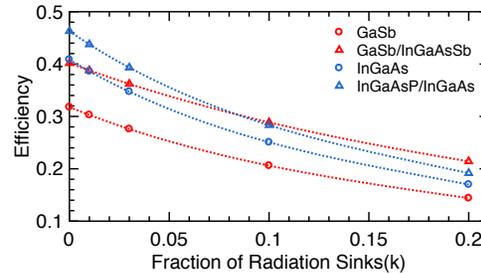
Alejandro Datas, et al. Ultra high temperature. Elsevier. 2017.

Methods

- Single- and dual-junction TPV cells are modeled at fraction of radiation sinks (k) ranging from 0 to 20%.
- The PV materials considered include: GaSb, GaSb/InGaAsSb, InGaAs, InGaAsP/InGaAs
- Heat transfer between the cell, emitter, and radiation sinks is captured by a spectral network of three diffuse surfaces.
- Spectral properties are modeled using the Transfer Matrix Method for multilayered structures.



Results and Discussion



- Absolute efficiencies for GaSb-based and InGaAs-based systems are determined at an emitter temperature of 1500K and a view factor of .9 across the k range.

- Normalization allows for consistent comparison of performance drop across devices and can be approximated by:

$$\eta^* = \frac{(1-k)\beta}{(1-k)\beta + k}$$
- The GaSb-system is more robust to radiation sinks.

- Performance-drop can be quantified by Resilience Factor β which is shown to be strongly correlated to the weighted absorption of the device (α).

- α can be interpreted as the spectral overlap between the blackbody emission spectrum of the emitter and the absorbance of the cell.
- While the addition of low band-gap InGaAsSb increases α , high-band gap InGaAsP has negligible impact on α or β of InGaAs

Conclusion

- Quantifying the impact of radiation sinks using simple descriptors can help predict the performance of TPV modules using readily-accessible, yet idealized, lab measurements.
- The key descriptor of device robustness, quantified by Resilience Factor β , is the weighted absorbance of the cell (by the emitted spectrum).
- InGaAs-based devices achieve greater efficiencies at ideal conditions ($k = 0$), but are less robust than GaSb-based devices.
- Lowering the effective band-gap of the device, by the addition of low-band gap active layers ($< .7$ eV) is optimal for maximizing above band-gap absorption and robustness, while maintaining or improving efficiency.

Future Directions

- Growth and performance analysis of GaSb/InGaAsSb and InGaAsP/InGaAs thin-film devices via epitaxial lift-off.
- Techno-economic analysis of realistic single- and dual-junction thin-film TPV devices.

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- Vinod Raman, et al. Performance drop-off due to Heterogeneous Surface Absorption in Thermophotovoltaic Devices. *In preparation*. 2018.