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This paper examines the complicated issues of friendship and community in the digital age through the lens of sports fandom. QPR NYC, a New York City based organization founded to bring together fans of second division English soccer club Queens Park Rangers, meet weekly at a pub in midtown Manhattan to watch their team in action. They also maintain a lively dialog via Facebook Messenger in which approximately 15 members of the group keep in near daily contact. In the thread, started in 2017, members discuss subjects ranging from the obvious like soccer, to non-sports topics such as music, design, politics, family and food.

None of the members of QPR NYC knew each other outside of their affiliation with the club, yet most would count the friendships they have made, and maintain largely online, as both real and meaningful. Are QPR NYC an outlier or proof that friendships can not only be maintained through digital mediation but, with a little help from sports fan culture, can be birthed by it?
Post-Transcriptional Circadian Regulation of Cell Cycle by Core Clock Protein
FREQUENCY in Neurospora crassa

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Most research into the mechanisms of circadian regulation on output has focused on transcriptional activation by the positive arm of the transcriptional/translational negative feedback loop. However, recent work has established a vast array of circadian oscillating proteins in which the corresponding mRNA is not rhythmic. Because of this discrepancy, we hypothesized that a substantial amount of circadian regulation on output is accomplished post-transcriptionally via a negative arm mechanism. In the model organism Neurospora crassa, the negative arm is comprised of FREQUENCY (FRQ), Frequency Interacting RNA Helicase, and Casein Kinase 1. Of these, FRQ has been computationally and experimentally shown to be an intrinsically disordered protein (IDP). Aside from lacking a single, predetermined, three-dimensional structure, IDPs play key roles in signaling and regulation due to their transient but highly specific interacting partners. This makes FRQ a prime candidate for post-transcriptional circadian regulation beyond the established core clock.

The aim of this study is to characterize protein complexes centered around FRQ that change over the circadian day to determine potentially negative arm-regulated proteins. To this end, Neurospora samples where purified through co-immunoprecipitation before protein identification through liquid chromatography mass spectrometry. These results show that FRQ has time-specific interactions with proteins involved in cell cycling and metabolism, as well as a variety of other functions. One specific protein found to be interacting with FRQ is of particular interest: Cell Division Control Protein 2 (CDC28). The CDC28 homolog in humans, Cyclin-dependent Kinase 1 (CDK1), acts as a checkpoint in the cell cycle and specific phosphorylation events on CDKs can activate or halt cell cycle progression, a process under circadian timing in Neurospora. This leads us to hypothesize that time-specific FRQ/CDC28 interaction leads to the temporal phosphorylation of CDC28 and the oscillation of the cell cycle, establishing the extensive interactome of FRQ and by extension circadian regulation through post-transcriptional mechanisms.
True Darkfield Schlieren Visualization with a Levitated-Bead Light Block

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Schlieren imaging is a technique for visualizing gradients of refractive index. In a typical schlieren setup, an experiment is placed into a collimated beam of light, called the “visualization region”, produced by a point source and a lens or mirror. Another mirror or lens is used to focus the collimated beam onto a beam block (e.g., a knife edge). Rays that encounter a refractive index change in the visualization region are diverted from their parallel path. The result is a brightfield intensity map based on the first spatial derivative of refractive index. However, a brightfield arrangement leads to poorer spatial resolution, signal-to-noise ratios, and limits-of-detection due to higher background. Darkfield schlieren would overcome many of these limitations. Beam stops that result in darkfield images have been constructed from colored filters and painted on glass substrates. However, these options cause chromatic aberration that negatively impact spatial resolution. To address these issues, we describe a darkfield schlieren setup that uses an acoustically levitated bead as a beam stop to improve sensitivity and maintain image fidelity. Schlieren images with little-to-no background were obtained and had improved spatial resolution compared to conventional brightfield schlieren visualization.

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The light-driven water oxidation occurs in the photosynthetic protein, photosystem II (PSII), where a cuboidal Mn₄CaO₅ cluster catalyzes the conversion of water to dioxygen (2H₂O → O₂ + 4H⁺ + 4e⁻). This is one of the most energetically demanding reactions in nature that sustains life on earth. The development of bio-inspired artificial catalysts for water oxidation is key to the development of solar fuel technology. Moreover, the study of artificial catalysts also provides insight on the role of catalytic intermediates and important mechanistic aspects of the water oxidation in nature. The Mn₄CaO₅ cluster of PSII is comprised of di-μ-oxo dimanganese units that bind water as the substrate. In this work, we describe a series of synthetic mixed-valent dimanganese complexes that mimic the structure and function of the Mn₄CaO₅ cluster. We characterize the complexes by X-ray crystallography, UV-Vis spectroscopy, mass spectrometry, EPR spectroscopy and FT-IR spectroscopy.
My research aims at obtaining optimal location of warehouses that send relief to the disaster impacted population, such that it is cost-effective and that helps alleviate the suffering of the people in need. I search for a solution that minimizes total social costs, which include the costs of transportation and fixed facility costs, as well as the cost of suffering. The cost of suffering is the deprivation cost based on the time a person has been left without a critical relief. To understand better this concept, let’s consider two warehouses located in the coastal areas of an island that has been impacted by a hurricane. After the hurricane, people in the central region were very hard to reach due to infrastructure damage. Although for logisticians the location of these warehouses is convenient because they can deliver faster, yet in the central region people will take longer to get relief. This solution reduces the cost of transportation but increases the cost of suffering due to the extended time these people are left without relief. Thus, I develop a model that provides a better solution that benefits both logisticians and the population in need.
Mechanical mismatch of tumor and vessel-like constraint leads to emboli growth
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Tumor emboli pose a significant clinical problem as they are associated with a poor prognosis. These secondary tumors are found within blood and lymphatic vasculature, lodged within these vessels. Current in vitro models study the tumors themselves but have not examined how tumor emboli interact with the vessels, specifically the geometry of the vessels. There lies a mechanical interplay between the growth of the tumor emboli and the constraint provided by the vessel that has not been understood. Here we examined the growth and morphology of tumor emboli grown under a vessel-like constraint and show how the stiffness of the constraint can encourage differences in overall shape of the tumors. We further elucidated how the shape of a tumor emboli is derived from a mechanical mismatch between the tumor itself and its constraint.
Mixed-Reality Fitness Platforms and the Outsourcing of Proprioception

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As market enthusiasm for virtual and augmented reality experiences begin to reach beyond the space of gaming, entertainment, and industrial simulation, new mixed-reality health and fitness technologies have begun augmenting traditional workout gear with digital interfaces that not only track biometric data (as with the FitBit) but serve the user simulated workout environments, virtual instructors, and even tactile feedback. Following conversations within the discipline of platform studies that investigate the position and perceptions of the sensory body in practice with emerging media technologies, this talk will consider how a new generation of networked fitness gear is reshaping not only the social space of the workout but, perhaps more significantly, the user’s sensory relationship with their own body. At-home workout platforms like Peloton rely on audiovisual media to simulate the group cycling experience, while the Mirror simulates one-on-one aerobics instruction by digitally superimposing a live teacher on the user’s reflection. Wearable platforms like the Nadi X yoga pants go a step further, using integrated sensors and haptic feedback to suggest positional corrections. This turn in the datafication of health marks what I call the “outsourcing of proprioception,” replacing interior bodily awareness with exterior modes of mediation.
Characterizing the interaction trinity between herpes virus, neuron cell surface and tau
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Though approximately 6 million people in the US are affected by Alzheimer’s disease (AD), a neurodegenerative disease characterized by amyloid-beta senile plaques and neurofibrillary tangles of abnormally phosphorylated tau (Ab-pTau), AD’s causative mechanism remains unknown. Since 2017, virologists have shown strong evidence connecting herpes simplex virus type 1 (HSV-1) to AD pathology, including: a high re-activation rate of latent HSV-1 in the hippocampi of AD patients, increased susceptibility of neurons in AD brains to infection by HSV-1, and uptake of AD-relevant ab-pTau by HSV-1 infected cells.

These observations are possibly connected via neuron cell surface receptors, called heparan sulfate (HS) proteoglycans. Previous literature showed that Ab-pTau uptake as well as HSV-1 viral entry via cell surface receptor glycoprotein D-1 (gD-1) was dependent upon sulfation of the 3-OH position on HS. We investigated the interaction between HSV-1 gD-1, HS, and tau to ascertain if these interactions promote tau proliferation. We determined the type, location and strength of binding between HS: gD-1 and tau: gD-1 using surface plasmon resonance and hydrogen-deuterium exchange mass spectrometry using gD-1 variants. These results have profound implications for drug discovery for AD, such as targeted disruption of HS: tau interactions via carbon-dot drug delivery.
Designing Adaptations to the Anthropocene: Rural Perspectives Abstract
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Rural, food-producing communities are at the frontlines of the escalating climate crisis. Unprecedented threads to the livelihoods of farms, farmers, local communities and ecosystems become increasingly evident. Economic crises, post-industrial decline, aging infrastructures, and the industrialization and globalization of the agricultural market converge with and further exacerbate the crisis. This constitutes an unprecedented threat — and a new urgency for rural communities to adapt.

Today, adaptation approaches in rural communities are largely constrained to maintaining agricultural productivity. This problematically reduces rural communities to be seen primarily in terms of agricultural industries. It renders invisible, and potentially obsolete, the increasingly hidden and at times surprising diversity of rural communities. Arguing that adaptation must transcend this insular economic-perspective, this talk foregrounds key pitfalls of sector-specific adaptation approaches and formulates opportunities for adaptation that is ecosystems- and community-centered, equitable and sustainable.
Mechanical Characterization of Neurofibromatosis Type 1 Spheroids
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Neurofibromatosis type 1 (NF1) is an autosomal dominant disease that affects roughly 1 in 2000 people. One of the hallmarks of NF1 is the growth of various kinds of tumors both benign and malignant. This research focuses on mechanically characterizing the mechanics of specifically plexiform neurofibromas (PNFs). PNFs are a benign tumor that form on nerve junctions, which can cause many problems for the patients. In addition, PNFs also carry the potential to transition into malignant peripheral nerve sheath tumors (MPNSTs), which are one of the deadliest types of tumors. It has previously been demonstrated that on a single cell level mechanics are altered in NF1 and the gene product of NF1 is crucial for many mechanical pathways in the cell. We are now interested in characterizing the cells on a larger scale focusing on a tumor spheroid model. By using techniques such as parallel plate indentation and atomic force microscopy we can determine the mechanical properties of these tumor models at a milli and nano scale. These stiffnesses can help inform future research and modeling done for NF1 as a disease and are a steppingstone towards determining the cause of transition from a benign to malignant tumor.
Application of Huang-Rhys Theory to Classify Quantum Emitters in 2D Nanomaterials

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Recently, 2D materials including hexagonal boron nitride (hBN) and transition metal dichalcogenides (TMDs) are being used as great platforms for electronic and optoelectronic applications. These materials host defects which have the potential to generate non-interacting photons called single photon emitters (SPEs). Potential defects in these 2D materials were determined by optimizing the parameters including emission energies, formation energies, structural changes, electronic wavefunctions, and reaction energy barriers. One potential origin found from this optimization process includes mobile single oxygen atoms getting trapped under tensile strain in plane with tungsten (W) in tungsten diselenide (WSe2) to form SPEs. In addition, adding layers to monolayer hBN and forming bulk hBN tends to narrow the PL lineshape peak, which indicates the possibility of single antibunched photons with a singular emission energy. Lastly, since the calculation of the PL spectra is computationally expensive due to phonon calculations in the generating function approach, so we estimate the electronic transition from the Franck-Condon Overlap Integral from the electronic wavefunctions to ultimately measure the degree of SPE from the single quantity, the Huang-Rhys (HR) factor.