No	Name	Affiliation	Department	Positions	Title	Abstract:	Provide
1	Wei-Chang Lo	Academia Sinica	Institute of Physics	Postdoc	Three-Dimensional Traction Force Microscopy by Machine Learning	Traction force microscopy (TFM) is an important tool to measure the force transmitted between the cell and the external microenvironment. However, calculating the stress from the displacement of markers is a challenging task because it is an ill-posed inverse problem. Most of the TFM experiments to date thus are performed on a two-dimensional flat geometry, which is usually solved by incorporating the theory of linear elasticity with regularization. Nonetheless, neural network-based machine learning has been shown to be a promising alternative for solving such inverse problems. Here, we propose a workflow to perform three-dimensional TFM by a machine learning based approach, which combines physics-informed neural network and the finite element method to solve the equations of elasticity. Specifically, the implementation of the training dataset and the boundary conditions associated with the three-dimensional TFM setup are clarified in this proposal.	1
2	Yan-Hsien Chen	Academia Sinica	Institute of Atomic and Molecular S	Master degree student	Enhanced 3D Nanoparticle Tracking with Spiral Phase Interferometric Scattering Microscopy (SP-iSCAT)	Interferometric Scattering (iSCAT) microscopy is a highly sensitive technique that measures the linear scattering signals of individual nanoparticles through image-based interferometric detection. However, the application of iSCAT to 3D particle tracking has been limited by the oscillation of the signal-to-noise ratio (SNR) when particles move along the axial direction. In this work, we introduce a strategy to overcome this limitation by evenly distributing the phase of a particle's scattered field using a spiral phase mask at the back pupil plane. Our approach, termed "spiral phase iSCAT microscopy (SP-iSCAT)," maintains a consistent SNR as particles move, thus enhancing the accuracy of particle localization in 3D. We evaluate the performance of SP-iSCAT through numerical simulations, benchmarking the theoretical limits. Additionally, we experimentally demonstrate high-precision, ultrahigh-speed 3D tracking of freely diffusing nanoparticles in water. We successfully measure the diffusion trajectories of particles as small as 20 nm in diameter at a high speed of 20,000 frames per second. The capability of accurate tracking of small particles by SP-iSCAT allows for precise quantification of hydrodynamic particle sizes at the single-particle level. Furthermore, SP-iSCAT provides quantitative measurements of the amplitude of the scattered signal, enabling the determination of particle polarizability. This combination of information allows for the direct assessment of particle size and mass density of individual nanoparticles in solution, opening the door to the investigation of biological nanoparticles in complex systems, such as cell vesicles and virus particles.	1
3	Bo-Kuan Wu	Academia Sinica	Institute of Atomic and Molecular S	RA	Enhancing Interferometric Scattering Microscopy by Optimizing Light Coherence for Superior Nanoparticle Tracking and Mass Detection	Optical interference microscopy is a valuable tool for label-free visualization of biological cells. Recent advances in interferometric scattering (iSCAT) microscopy have enabled the observation of nanoscopic objects and cellular structures by detecting their linear scattering light through interference. While the importance of stable and strong illumination photon flux for reducing photon noise is well recognized, the impact of light coherence has been largely overlooked. Higher spatial and temporal coherence facilitates sustained interference, enhancing high-contrast detection of nanoscopic objects. However, excessive coherence can introduce noise, such as speckles and fringes, which may reduce spatial resolution in complex three-dimensional samples like biological cells. Optimizing illumination coherence is thus crucial for high-performance iSCAT microscopy. In this work, we optimized the coherence properties of the light source for iSCAT imaging, targeting applications in interferometric nanoparticle tracking analysis (iNTA) and mass photometry. By carefully selecting parameters of spatiotemporal coherence, we improved signal sensitivity and minimized background noise. These adjustments enabled us to accurately track nanoparticles and detect individual biomolecules, leveraging the single-molecule sensitivity of iSCAT. This technique also benefits from minimal sample preparation, requiring only small sample volumes, which is advantageous for both iNTA and mass detection applications. Additionally, our system facilitating the observation of rapid cell dynamics at the nanoscale. This enhancement allows for the visualization of key cellular processes and interactions, contributing to a deeper understanding of biological functions. In summary, optimizing light coherence in iSCAT microscopy significantly advances its application in nanoparticle tracking and mass detection, while also supporting high-resolution imaging of cellular dynamics with minimal sample preparation.	1
4	Lizhen Huang	Nanyang Technological University	School of Chemistry, Chemical Engineering and Biotechnology	RA	3D Distortion Calibration for Expansion Microscopy using Patterned Nanopillar Arrays	Expansion microscopy (ExM) provides a unique high-resolution solution for biological imaging that physically increases the dimension of biological samples to bypass the constraints of the light diffraction limit and avoid the requirement for sophisticated optical set-up. However, the expansion process may introduce physical distortions in the gel, compromising the accuracy for the 3D visualization of nanometer-scale cellular structures. Here, we present our efforts in applying vertically aligned nanopillar arrays in conjunction with ExM to achieve distortion calibration in 3D. Specifically, we fabricate ordered arrays of nanopillars with known coordinates along the x, y, and z axes. By referencing to the known coordinates of these nanopillars, we were able to accurately calibrate cellular protein positions in 3D. Furthermore, with nanopillar array-enabled 3D calibration, we located proteins involving in podosome rosettes—clusters of individual podosomes critical for cell migration and bone degradation, whose structural organization is lack of study. Using nanopillar array-enabled 3D calibration, we significantly improved the accuracy of podosome protein localization in 3D, enhancing our understanding of the podosome rosette's intricate organization. Our work provides a new solution to a robust 3D distortion calibration method for ExM, increasing the accuracy and reliability of nanoscale imaging for detailed cellular structures in 3D.	1
5	CHONG SIAN KANG	Nanyang Technological University, Singapore	CCEB	Master degree student	Curvuatre-Facilitated Membrane Intercalation of Conjugated Oligoelectrolytes (COEs)	Conjugated oligoelectrolytes (COEs) are fluorescent, amphiphilic molecules that can spontaneously integrate with lipid bilayer membranes. Due to their adjustable molecular lengths and charged groups, COEs exhibit selective antimicrobial capabilities by impacting lipid bilayers of varying compositions. However, the mechanism underlying COE-membrane interactions and their influence on membrane deformability at the nanoscale remains poorly understood. This study introduced a nanostructure-supported lipid bilayer platform to investigate the intercalation behavior of a series of COEs with varying molecular designs into synthetic membranes. Intriguingly, our results revealed a significant preference of these COEs for highly curved membrane regions that can be tuned by the length and charges of the molecular design. These findings elucidate the membrane geometry as a new angle to interpretate COE-membrane interactions and underscore the critical role of molecular design in developing effective antimicrobial strategies.	1
6	NA QIN	Nanyang Technological University	School of Chemistry, Chemical Engineering and Biotechnology	PhD Student	Differentiation Of Thyroid Cancer Phenotypes Through Subnuclear Deformation Patterns On Nanopillar Arrays	Thyroid cancer is one of the most prevalent cancers in the world. The presence of nuclear anomalies, such as subnuclear folds and grooves, is a vital feature of thyroid cancer biopsies for diagnostic purposes. However, the accuracy and categorization of thyroid cancer are reliant on the pathologist' s experience and a significant portion of cases yield inconclusive results. Therefore, there is a need for the technologies that provide quantitative and robust readouts to differentiate thyroid cancer malignancy. In this study, we utilized nanopillar arrays to guide the nuclear morphology aberrations into ordered and quantifiable nanoscale patterns. These patterns effectively distinguish different phenotypes of thyroid cancer cells. In-depth examination of these nanoscale deformations via expansion microscopy reveals differential spatial arrangement of lamin proteins on nanopillars. Additionally, the nanopillar-guided deformation patterns are correlated to cancer metastatic behaviour, such as migration, adhesion. We envision that this nanopillar-based platform will act as an effective tool in quantifying the nuclear irregularities, improving the diagnosis of thyroid cancer.	1
7	Chi-Shuo Chen	National Tsing Hua University	Dept of Biomedical Engineering and Environmental Sciences,	Professor	The Broadcast of Mechano-Signaling in Glioma Spheroid: Physical Contacts with Microglia Alter the Rheological Characteristics of Glioma Collectives	Cell mechanics serve essential roles in tissue development and cancer progression; cells can sense the mechanical properties of the microenvironment and modulate their physiological functions accordingly. Cellular force signals propagated between cells, however, the influences of cellular force on the mechanical alteration of cell collectives in 3-dimension remains largely underexplored. Considering the critical roles of microglia in glioma progression, using a soft-indentation approach, we studied the impacts of microglia on the mechanical properties of the glioma spheroid (GS) about 300~400 μm in diameter. A few microglia (O(102) cells) attached to the periphery of glioma spheroid (O(104) cells) can modulate the ensemble rheological characteristics of glioma spheroid; no rheological difference was observed was observed in the absence of glioma vitality. In addition to a 2-fold stiffness increase (with about 15% microglia attaching), the results of relaxation measurement suggested that microglia can regulate the viscoelasticity of glioma collectives. By applying the generalized Maxwell model with effective configuration of one elastic element and two Maxwell material constituents in parallel, Showed the alteration of viscoelastic characteristics in glioma collectives . We further identified the integrity of actin filaments, myosin contractility, and GX43 on the cell membrane are required for signaling the contacts of microglia at periphery to the other cells in the spheroid; the results suggested the importance of intra/intercellular forces in the rheological regulation of 3D multicellular organization. In summary, we showed that the microglia contacts (MgC) of a few microglia are sufficient to alter the mechanical properties of the glioma collective, and the cellular forces interconnect the propagation of a signal from the local microglia. Considering the mechanical properties of the tumor microenvironment are critical in therapeutic resistance and cancer metastasis, our findings highlight the critical roles of physical forces in cell collectives and provide an alternative perspective for the regulations of microglia to glioma.	1

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8	Bo-Kai Wang	Academia Sinica	Institute of Biomedical Sciences	Postdoc	Centrosome Migration and Apical Membrane Formation in Polarized Epithelial Cells	Polarization is crucial for the proper functioning of epithelial cells. Early polarization features include the trafficking and enrichment of polarity molecules to form the apical membrane (AM) or cell-cell junctions, as well as the apical positioning of the centrosome. However, the dependencies among polarity molecules, AM formation, and centrosome positioning remain poorly understood. In conventional Matrigel-cultured epithelial cells, de novo polarization can occur when a single cell divides. At the exit of mitosis, centrosomes move to the location where the apical membrane will form, raising the question of the role of the centrosome in epithelial polarization. We perturb centrosomes and polarity regulators in Matrigel-cultured cells and also manipulate polarity direction in non-conventional culture to examine the relationship between polarity features. Surprisingly, the centrosome is not essential for AM formation but promotes formation efficiency. The polarity regulator Par3, rather than the trafficking of AM components, affects centrosome positioning. In non-conventional cultures, the centrosome migration is opposite to that of the AM direction, and Par3 exhibits a different pattern from Matrigel culture. Taken together, our work shows that polarity indicated by centrosome position is not universal and elucidates the upstream-downstream relationship between centrosome positioning and other polarization features, providing insights into epithelial polarization.	0
9	Yen Chiu	National Central Universi	Department of Physics	Master degree student	Interaction between multi-size bacteria among swarming dynamics	Unlike swimming in a 3D environment, swarming in micro-organisms is a collective behavior exhibited by rod-like bacteria driven by flagella on a semi-solid. It has been accepted that bacterial swarming is governed by short-range volume exclusion and long-range hydrodynamic interaction. Before the swarming state, the cell body elongates to adapt to the habitat change. Previous studies have mainly focused on the distribution of velocity and vorticity or the characteristic scales of swarming bacteria. The role of the aspect ratios of bacteria in the swarming behavior remains open. In this work, we experimentally investigate the above issue using a single strain of Vibrio alginolyticus with multi-aspect ratios during the expansion of the monolayer colony. We observe that the length of the bacteria has a wide range of heterogeneity, and different aspect ratios of bacteria play distinct roles in the formation of the swarming clusters and the swarming dynamics. Furthermore, interactions between aspect ratios benefit the efficiency of cell migration.	1
10	Chia-Hsuan Tsou	NDHU	Physics	Undergrad	Interaction of Nanodiamond-drug complex treatment and P-glycoprotein in multiple cancer cell lines to overcome drug resistance	Nanodiamond (ND) has been demonstrated with exceptional biocompatibility and low cytotoxicity across various cell lines, establishing it as a reliable and safe platform for use as a nanocarrier in biological and medical applications. In this study, ND-HSA-DOX was formed by conjugating human serum albumin (HSA) and doxorubicin (DOX) with ND. ND can deliver drugs to tumour microenvironments, while HSA prevents the composite from aggregating. In our previous work, we used human alveolar basal epithelial cells (A549) and human normal lung fibroblast cells (HFL1) to develop three types of 3D co-culture models: "single type of cancerous cell," "mixed co-culture," and "core-shell co-culture" multicellular tumour spheroids (MCTS). Compared to 2D models, 3D MCTS are closer to real human conditions and better mimic the microenvironment in vivo. The cytotoxic effects of ND, pure DOX, and the ND-HSA-DOX complex were assessed in three types of 3D MCTS models via a growth inhibition assay. Our results show that ND-HSA-DOX has better cancer-inhibiting efficacy compared to the pure drug DOX in 3D co-culture MCTS. The crucial gene MDR1 (Multi-drug resistance) is known for causing drug resistance, leading to the efflux of drugs by P-gp (P-glycoprotein). P-gp is an ATP-binding cassette (ABC) transporter on the cell membrane that acts as an efflux pump to regulate potentially harmful substances within the cell. In this work, we used pure DOX and ND-HSA-DOX in 2D models of A549 cells to verify the characteristics of P-gp and compare its interactions with different treatments.	1
11	Hannah Katrina Co	Academia Sinica	Institute of Molecular Biology	PhD Student	Emergence of large-scale cell death via trigger waves of ferroptosis	Large-scale cell death is commonly observed during organismal development and human pathologies. These cell death events extend over great distances to eliminate large populations of cells, raising the question of how cell death can be coordinated in space and time. One mechanism that enables long-range signal transmission is trigger waves, but how it might be utilized for death events in cell populations remains elusive. Here, we demonstrate that ferroptosis, an iron and lipid peroxidation-dependent form of cell death, can propagate across human cells over long distances (≥ 5 mm) at constant speeds (~ 5.5 μm/min) via trigger waves of reactive oxygen species (ROS). Chemical and genetic perturbations indicate a primary role of ROS feedback loops (Fenton reaction, NADPH oxidase signaling, and glutathione synthesis) in controlling the progression of ferroptotic trigger waves. We show that introducing ferroptotic stress via suppression of cystine uptake activates these ROS feedback loops, converting cellular redox systems from being monostable to bistable, thereby priming cell populations to become bistable media over which ROS propagate. Furthermore, we demonstrate that ferroptosis and its propagation accompanies the massive, yet spatially-restricted, cell death events during muscle remodeling of the embryonic avian limb, substantiating its utility as a tissue-sculpting strategy during embryogenesis. Our findings highlight the role of ferroptosis in coordinating global cell death events, providing a paradigm for investigating large-scale cell death in embryonic development and human pathologies.	1
12	Po Yu Chen	National Cheng Kung University	Institute of Basic Medical Science	PhD Student	Discoidin domain receptor 1 promotes focal adhesion maturation and suppresses podosome formation through integrin β1 activation triggered by matrix rigidity	Fibrosis results from the imbalance of collagen homeostasis, including collagen fiber organization and collagen degradation. Discoidin domain receptor 1 (DDR1) is a collagen receptors that is upregulated in unilateral ureteral obstruction (UUO)-induced renal fibrosis. We found that TGF-β1, a pro-fibrotic cytokine, induced the upregulation of DDR1 and myofiborblast activation in NRK49F cells. Although knockdown of DDR1 did not reduce TGF-β1-induced myofibroblast activation, it markedly enhanced podosome formation, a component for ECM degradation, through the inhibition of integrin β1 activation. Interestingly, softening the matrix stiffness decreased DDR1 expression, which negatively correlated with podosome formation. Finally, the functional assay for collagen degradation and collagen alignment revealed strong matrix degradation ability and poor collagen aggregation in DDR1-siliencing cells. In summary, we demonstrated that there is a mutually exclusive effect between stress fiber and podosome formation, and DDR1 plays a crucial role in promoting stress fiber formation and inhibiting podosome formation through the integrin β1 activation triggered by mechanical stimuli. The findings from this study illustrate that mechanical stimuli regulate collagen receptors to modulate collagen homeostasis, which provides evidence to further understand fibrosis process.	1
13	Aoi Otsuka	Graduate Institute for Advanced Studies, SOKENDAI	Department of Genetics, School of Life Science	PhD Student	Chromatin organization and behavior in HRAS-transformed mouse fibroblasts	In higher eukaryotic cells, a string of nucleosomes, where long genomic DNA is wrapped around core histones, are rather irregularly folded into a number of condensed chromatin domains, which have been revealed by super-resolution imaging and Hi-C technologies. Inside these domains, nucleosomes fluctuate and locally behave like a liquid. The behavior of chromatin may be highly related to DNA transaction activities such as transcription and repair, which are often upregulated in cancer cells. To investigate chromatin behavior in cancer cells and compare those of cancer and non-cancer cells, we focused on oncogenic-HRAS (Gly12Val)-transformed mouse fibroblasts CIRAS-3 cells and their parental 10T1/2 cells. CIRAS-3 cells are tumorigenic and highly metastatic. First, we found that HRAS-induced transformation altered not only chromosome structure, but also nuclear morphology in the cell. Using single-nucleosome imaging/tracking in live cells, we demonstrated that nucleosomes are locally more constrained in CIRAS-3 cells than in 10T1/2 cells. Consistently, heterochromatin marked with H3K27me3 was upregulated in CIRAS-3 cells. Finally, Hi-C analysis showed enriched interactions of the B-B compartment in CIRAS-3 cells, which likely represents transcriptionally inactive chromatin. Increased heterochromatin may play an important role in cell migration, as they have been reported to increase during metastasis. Our study also suggests that single-nucleosome imaging provides new insights into how local chromatin is structured in living cells.	1
14	Miao Xinwen	Nanyang Technological University	School of Chemistry, Chemical Engineering and Biotechnology	Postdoc	Nanoscale Saddle Curvature Guide Chikungunya Virus Replication Complex Assembly via Nonstructural Protein 1	The replication of many detrimental RNA viruses, including SARS-COV-1 and -2, DENV, and HCV, are found to take place in nanoscale curved membrane compartments in host cells. This process is controlled by a few non-structural viral proteins (nsPs). However, the molecular mechanism of how nsPs assemble around the curved membrane to form viral replication complexes is largely unclear. It is mainly due to the technical challenges to probe the interaction between nsPs and the curved membrane which is often below the diffraction limit of light. In this study, we designed and fabricated a series of nanostructure arrays to generate pre-defined membrane curvatures both on the plasma membrane of live cells and on supported lipid bilayer in vitro and investigate the impact of viral nsPs curvature sensitivity on the assembly of the Chikungunya Virus (CHIKV) replication complex. Our results demonstrate that nsP1 is preferential accumulate and stabilize around nanoscale saddle curved sites. The cell membrane can facilitate the local enrichment of nsPs in a curvature-dependent way, which contributes to CHIKV replication.	1

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15	Karen G. Rosal	Academia Sinica	Institute of Physics	Postdoc	Role of Apical Actin-Myosin Network in Regulating Tight Junctions in MDCK Cells	Role of Apical Actin-Myosin Network in Regulating Tight Junctions in MDCK Cells Karen G. Rosal1, Chia-hsuan Lu2, Fu-Lai Wen1, Shawn Ching-Chung Hsueh3, Wen-hsiu Wu4, Yu-Fang Lin5, Mathieu Prouveur6, Thomas Boudier7, Keng-hui Lin1, 8 1. Institute of Physics, Academia Sinica, Taipei, Taiwan 2. Department of Computer Science and Information Engineering, National Taiwan University, Taipei, Taiwan 3. Department of Physics, University of British Columbia, Vancouver, Canada 4. Department of Physics, National Tsing-hua University, Hsinchu, Taiwan 5. Department of Electrical Engineering, National Taiwan University, Taipei, Taiwan 6. Department of Applied Mathematics, Mines ParisTech, Paris, France 7. Sorbonne University, Paris, France	1
16	Yu-Jung Su	Academia Sinica	Physics	RA	Negative Curvature Induce Cellular Responses on Cell-cycle Arrest and Adipogenesis	Yu-Jung Su1 (蘇昱蓉), You-Hsuan Liu1,2 (劉又萱), Bor-Lin Huang1 (黃柏霖), Karen G. Rosal1 (羅凱倫) and Keng-Hui Lin1 (林耿慧) 1. Institute of Physics, Academia, Sinica, Taipei, Taiwan 2. Genome and Systems Biology Degree Program, National Taiwan University, Taipei, Taiwan Abstract: Cells grown in 3D environment often exhibit different morphological and epigenic response from cells grown on traditional 2D culture. Previously, our lab demonstrated that spherical microwells serve as good approximation for 3D culture. However, the throughput of microwells in earlier study was low, only 10 ~ 10 microwells were generated for each chip. In this study, we created O(100 ~ 100) microwells on a 22*22 mm2 coverglass and cultured human mesenchymal stem cells (hMSCs) in the large array. This new chip generates enough cells for flow cytometry and RNA-seq analysis. We found hMSCs in small microwells do no proceed normal cell cycle and higher cytoplasmic retention of yes associated protein (YAP) in cells in small microwells (60 mm) compared with cells in 100-mm microwells. We also found that hMSCs prefer adipogenic differentiation in spherical microwells. Transcriptomic analysis show that differentiation-related genes are up-	1
17	Jen-Hao Cheng	Academia Sinica	Institute of Molecular Biology	PhD Student	Self-organized cellular patterns orient cell death trigger wave	Collective cell behavior generates a multitude of cellular patterns that exhibits specialized cell alignments, densities and macroscopic structures through cell self-organization. The formation of these cellular patterns serves as a foundation for morphogenesis and development. Despite the ubiquity of cellular patterns in tissues, how it may impact the homeostasis of the entire cell population in the face of stress remain unexplored. Here, we showed that the emergent cellular patterns can prime cells for differential sensitivity to ferroptosis, an iron and lipid peroxidation-dependent form of cell death. Ferroptosis induced large-scale cell death has been shown to propagate without spatial limitation as trigger waves, threatening the viability of the whole cell population. However, in the presence of self-organized cellular patterns, cell death propagation is oriented in direction and speed by the spatial arrangements of cells, resulting in distinct spatial distributions of dead and surviving cells. The wave initiates in areas of cellular misalignment and lower cell density, particularly at sites of specific cellular patterns known as topological defects. Once initiated, the wave travels rapidly along aligned cells, but decelerates when encountering cells oriented against its path or when passing through high density regions. We further discovered this phenomenon is attributed to the polarized distribution of oxidizable lipids in the membrane of individual cells. Our findings show self-organized cellular patterns in a cell population direct propagation of large-scale ferroptotic cell death, featuring how collective cellular behavior in tissues and organs influences vulnerability to ferroptosis.	1
18	Samuel Herianto	Academia Sinica	Chemistry	PhD Student	Reconstitution of phage shock protein A (PspA) synthesis and polymerization using a cell-free system and liposomes	Phage shock protein A (PspA) is a membrane-associated protein that is believed to play a critical role in bacterial membrane fusion, yet, its mechanism is less understood. In this study, we reconstituted the cell-free PspA synthesis within liposomes and observed its phenotypic effects on membranes. This process is highly critical for the development of a self-sustained artificial cell model with cell-like properties induced by self-synthesized proteins that are generated from its genetic level. In this study, we successfully designed multiple plasmids of pspA and translated them to PspA using cell-free protein synthesis (containing in-vitro transcription and translation molecules extracted from E. coli) in both bulk and liposomes. In particular, PspA contains 5 α-helices (α1-α5); and here, the process of synthesis of each truncated α-helix was also successfully demonstrated. Moreover, cell-free synthesis of PspA (full-length, α1, α12, α123, and α1234) in a bulk system revealed aggregation and oligomerization (self-assembly) and formed μm sized filament-like structures, highlighting the critical role of α1 on polymerization and filament formation. Interestingly, when encapsulated within liposomes, these proteins induced the shape change in the liposomal membrane to be more elongated. In Cryo-EM analysis, these proteins are capable of binding with membranes, creating rapture (hole-like structure), and deforming liposomes into several shapes, such as tubule membranes, elongated membranes, internal budding, and endocytosis (fission). This result implies that PspA (mainly through α1) may somehow remodel the membranes through interactions and further induce deformation. Overall, we highlight that α1 plays vital roles in PspA aggregation/polymerization, membrane interaction, rapture, fission, and shape deformation. We assume that these phenotypes may be the intermediate process of membrane fusion.	1
19	Cheng-Yu Chang	NDHU	Physics	Undergrad	Evaluation of Nanodiamond-Polycaprolactone composite for antibacterial activity against Escherichia coli	Nanodiamonds (NDs) are promising material for various biological purposes. In this study, detonation method produced Nanodiamonds with an average size of 5 nm had been certificated the antibacterial properties. We combined NDs with 3D printing material Polycaprolactone (PCL) to create an antibacterial composite. Raman spectroscopy played a pivotal role in characterizing ND-PCL, verifying the combination of ND and PCL was successful. Furthermore, Raman mapping images of ND-PCL were obtained to confirm the uniform distribution of ND throughout the composite. After sample preparation, we subsequently investigated the antibacterial effect of ND-PCL against gram-negative bacteria Escherichia coli (E. coli). UV-visible spectroscopy was employed to observe the interaction between ND-PCL and E. coli after 24 hrs incubation. Bacterial viability was monitored by measuring optical densities of E. coli at 600 nm in nutritious liquid Luria–Bertani medium for 24 hrs incubation. The outcome demonstrated the biocompatibility of PCL, and the antibacterial effect was attributed to ND. By comparing the results between pure ND and ND-PCL, we certified the combination didn’ t reduce the antibacterial effect of ND. This study elucidated an application for ND in forming an antibacterial composite with 3D-printing materials, we hoped the continued research and development can explore potential of ND composite and utilize in medicine application.	1
20	Ting-Jui Ben Chang	NTU	Department of Electrical Engineering	PhD Student	Multiplexed Nancoscoy via Buffer-exchanged Single-molecule Localization Microscopy	Understanding cellular functions in all their complexity can greatly benefit from spatially mapping of the diverse molecules within a cell using multi-target single-molecule localization microscopy (SMLM). Current developments primarily rely on fluorescent spectrum, lifetime, or cyclic staining, necessitating complex optical configurations, fluorophore identifications, or labeling designs. Consequently, there remains a need for a simple imaging platform. Here, we introduce buffer-exchanged STORM (beSTORM), a method that distinguishes between single molecules regardless of their spectral properties by leveraging their responsive blinking behaviors influenced by buffer conditions. Through simple buffer exchanges, beSTORM achieves spectrum-unlimited dual or four-target SMLM imaging with minimal crosstalk (<1%). Integration with expansion microscopy (ExM) extends its capability to resolve up to six proteins at the molecular level within a single emission color, free from chromatic aberration. beSTORM's simplicity and compatibility offer a versatile platform for seamless integration with other techniques, promising advancements in highly multiplexed nanoscopy for exploring complex biological systems with nanoscale precision.	1
21	Zhi-Yu Peng	NDHU	Physics	Undergrad	Inhibition of melanin production using nanodiamond conjugate berberine	TBA.	1