

CHEMISTRY SEMINAR

Triazenyl Furans: An Emerging Species of Diels–Alder Diene

By Dat Dam, Chemistry '25

11:30 am

Thursday, October 5, 2023

Science Center Room 300

Abstract:

The Diels–Alder (DA) reaction is one of the most common reactions in Organic Chemistry because it has several reactivity advantages. Due to having a fairly straightforward mechanism, in addition to the ability to couple together two molecules, the DA reaction is a very effective and efficient way to synthesize substituted cyclohexenes, which can be further reacted to form aromatic compounds. Over the past summer, the Newton Group at the University of Georgia has worked with triazenyl furans to explore its DA reactivity as an emerging diene. Results have shown that furans substituted with the triazene group at both positions are promising dienes in DA reactions that can act as an alternative approach to the synthesis of several aromatic molecules (Fig. 1). For the triazenyl furans where the triazene group is substituted at the second carbon from the oxygen, they can undergo two consecutive DA reactions thanks to the “convenient” positions of the pi bonds. In other words, said species of furans have demonstrated Diene–Transmissive reactivity (Fig. 2). At the end of the summer, the Newton Group was working to optimize many reactions that involved the triazenyl furans to get better yields, as well as finding the appropriate conditions to synthesize more complex molecules that contain the cinnoline framework in their structure.

Concept:

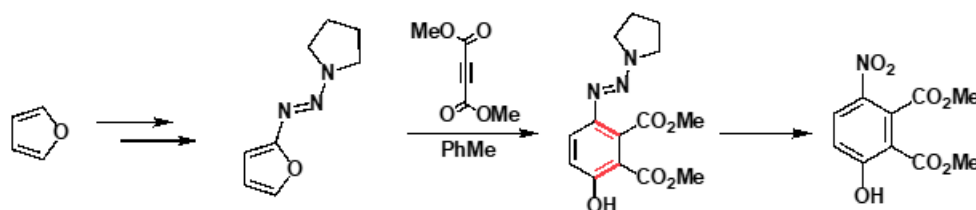
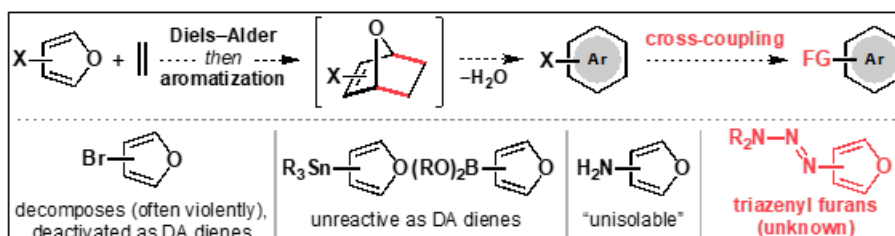


Fig. 1

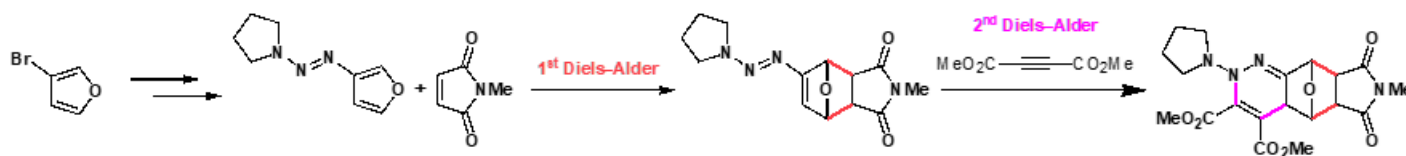


Fig. 2

CHEMISTRY SEMINAR

pH-induced Gold Nanorod Assembly Using Polyelectrolyte Coatings

By Hana Konno, Chemistry '26

11:30 am

Thursday, October 5, 2023

Science Center Room 300

Abstract:

Gold nanorods have unique optical properties that are not observed in other forms of gold. We can utilize these properties by controlling the assembly and the orientation of nanoparticles. Several techniques, ranging from scaffolds to small molecules, have been developed to assemble gold nanorods. The ongoing research within this field has numerous potential applications which include the development of sophisticated biosensors, cancer therapy, and solar cells that would utilize the optical properties of gold nanorods. Here we show that poly-L-lysine (PLL) electrostatically coated onto gold nanorods using a layer-by-layer coating technique can undergo pH-induced structural changes which drives nanorod assembly. When the pH of the solution with PLL-coated rods is raised above the critical pH of 10.5, the polymer transitions from a random coil structure to an alpha helical structure, therefore altering the intermolecular forces in between adjacent nanorods which proceed to come together. TEM and SEM images taken before and after pH 10.4 of the gold nanorod solution help visualize increased nanorod assembly when the pH was changed, which supported our initial spectroscopic findings. Our results demonstrate that using this approach is a feasible way to control nanorod assembly in a relatively short amount of time. We anticipate that this technique will be further explored, potentially with other combinations of polymer coatings that may have higher success at driving assembly.

CHEMISTRY SEMINAR

Biomolecular Condensates: How Do Cells Avoid Getting Soupy?

By Vy Tran, Chemistry '25

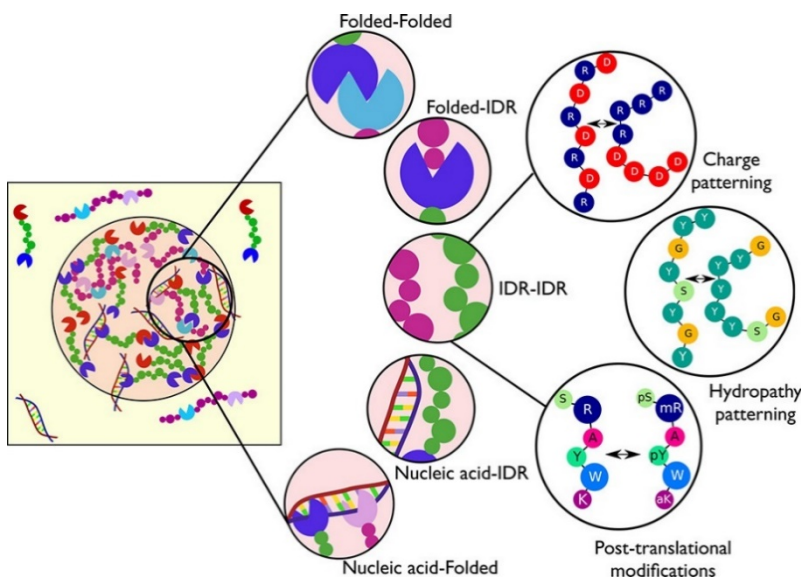
11:30 am

Thursday, October 5, 2023

Science Center Room 300

Abstract:

Biochemical processes in cells occur in a highly coordinated manner with careful spatiotemporal control. Membranes provide a physical barrier that separates processes inside several organelles from the cytoplasm. However, membranes are not the only barrier utilized in biological systems, and membraneless organelles, such as nucleoli, Cajal bodies, and stress granules, employ a different strategy. These organelles, which are multicomponent, non-stoichiometric intracellular compartments, are biomolecular condensates. Lacking a membrane, they are physically separated from their surrounding environment by liquid – liquid phase separation. This separation allows them to concentrate hundreds or thousands of different proteins and nucleic acids and create a distinctive environment from the surroundings. The phase separation process is driven largely by phase-separating proteins (scaffold proteins), whose intrinsically disordered domains (IDRs) have been shown to play an important role in the process. The question that arises is the role of the protein sequence, including amino acid composition and primary sequence in driving phase separation. To investigate this relationship, the effect of sequence shuffling of LAF-1 protein, an intrinsically disordered protein, on phase separation was examined. It was found that the presence of a short conserved domain, charge patterning, and arginine–tyrosine interactions determine the phase separation behavior of the protein. In another study, hydrogen bonds and aromatic stacking established by modular repeats are shown to determine phase separation behavior of the intrinsically disordered histidine-rich squid beak proteins. Overall, these studies show that the amino acid composition and primary sequence of phase-separating proteins is important in driving phase separation.



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Molecular determinants of phase separation underlying the formation of biomolecular condensates.