UNIVERSITÀ DEGLI STUDI DI BRESCIA

I SEMINARI DEL DIPARTIMENTO DI MEDICINA MOLECOLARE E TRASLAZIONALE

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Redesign Nature: Self-assembly of Nucleic Acids in Material Science, Molecular Computing, and Synthetic Biology

Nucleic acids DNA and RNA are capable of self-assembling into secondary structures following Watson-Crick base-pairing rules. Commonly, they are found in cells as double helices further condensed into chromatin (DNA), as protein-associated complexes (ribosomes), or as functional structures for translating genes into proteins (tRNA). The self-assembly process was used in recent years to design structures at the nanoscale, while strand-displacement and dynamic motifs allowed the reconfiguration of such nanostructures in a mechanical-like fashion.[1,2] These architectures were decorated with metal nanoparticles, proteins, and fluorophore-quencher pairs to generate: Optically active chiroplasmonic nanostructures,[3,4] programmed catalytic functions, and finely regulated dynamic nano-devices. The programmability of DNA was also used to generate dynamic junctions in hybrid nanomaterials comprising carbon nanotubes.[5] Recently, hybrid RNA- DNA triplexes were used to design logic gates for molecular computing,[6] and control transcription in a synthetic biology system.[7]

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3. Cecconello, A. et al. DNA Scaffolds for the Dictated Assembly of Left-/Right-Handed Plasmonic Au NP Helices with Programmed Chiro-Optical Properties. J. Am. Chem. Soc. 138, (2016).
4. Cecconello, A. et al. Chiroplasmonic DNA Scaffolded “Fusilli” Nanostructures. Nano Lett. 24, 5944–5951 (2024).
5. Amoroso, G. et al. DNA-Powered Stimuli-Responsive Single-Walled Carbon Nanotube Junctions. Chem. Mater. 31, (2019).
6. Rilievo, G. et al. Integration of DNA–RNA-triplex-based regulation of transcription into molecular logic gates. FEBS Lett. 597, (2023).
7. Cecconello, A., Magro, M., Vianello, F. & Simmel, F. C. Rational design of hybrid DNA–RNA triplex structures as modulators of transcriptional activity in vitro. Nucleic Acids Res. 1, 13–14 (2022).

Martedì 4 giugno 2024, Ore 14:00, aula A

Ospite: Prof.ssa Alessandra Gianoncelli