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Opportunity Title: Synthesis of Sequence-Controlled, Multiblock Copolymers for Information Storage Applications
Opportunity Reference Code: ICPD-2021-13

Organization Office of the Director of National Intelligence (ODNI)

Reference Code ICPD-2021-13

How to Apply **Create and release your Profile on Zintellect** – Postdoctoral applicants must create an account and complete a profile in the on-line application system. **Please note: your resume/CV may not exceed 2 pages.**

Complete your application – Enter the rest of the information required for the IC Postdoc Program Research Opportunity. The application itself contains detailed instructions for each one of these components: availability, citizenship, transcripts, dissertation abstract, publication and presentation plan, and information about your Research Advisor co-applicant.

Additional information about the IC Postdoctoral Research Fellowship Program is available on the program website located at: https://orise.orau.gov/icpostdoc/index.html.

If you have questions, send an email to ICPostdoc@orau.org. Please include the reference code for this opportunity in your email.

Application Deadline 3/3/2021 12:00:00 PM Eastern Time Zone

Description **Research Topic Description, including Problem Statement:**

Traditional storage media are unable to bridge the growing gap between information production and the ability to store data. Sequence-controlled polymers are an attractive solution because they provide orders-of-magnitude improvements in data density and the energy cost at rest, but currently cannot compete on relevant performance metrics, especially throughput and cost-of-write modalities. Molecular information storage has been dominated by biopolymers (i.e., DNA) because through decades of biotechnology development current synthesis approaches (e.g., pH sensitive phosphoramidite chemistry, photosensitive NPPOC chemistry) enable single monomer additions at relatively high accuracy that drive high data densities. These chemistries have been extended beyond the four monomer alphabet of DNA (A,C,T,G) to include a plethora of synthetic monomers, which can be employed in high-throughput, multiplexed-reaction conditions and have been successfully applied to data storage applications. These chemistries are ultimately limited because of the high cost of the monomers, toxic solvents used during synthesis, and the relative fragility of the polymers after synthesis. Recent advances in aqueous DNA synthesis have shown that information can be stored in homopolymer blocks of a block co-polymer, but information retrieval is limited to DNA sequencing instrumentation. There is a need to develop polymer synthesis chemistries that deliver high data density at low overall cost and are compatible with high-throughput, multiplexed synthesis instruments (e.g., complementary metal–oxide–semiconductor (CMOS), digital micromirror device (DMD) arrays) and a variety of sequencing instrumentation (e.g., solid state nanopores). Synthetic polymers have advantages over biological polymers in terms of bulk cost of synthesis and durability, and recent advances in controlled polymerization have demonstrated synthetic sequence-controlled polymers with high complexity/data density suitable for storage applications. Unfortunately, these chemistries (e.g., free radical, frustrated Lewis pairs) are not amenable to high throughput, multiplexed reaction conditions. This research topic will investigate novel approaches to synthesizing synthetic polymers for information storage applications that offer compelling solutions to issues associated with throughput, cost, and durability.

Example Approaches:

Design and synthesis of digitally encoded polymers that can be decoded and erased.

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https://www.nature.com/articles/ncomms8237

Relevance to the Intelligence Community:

First generation Molecular Information Storage (MIST) technology will set the Intelligence Community (IC) on a path toward continuous exponential improvements in storage capacity, saving billions of dollars in future costs while expanding a key resource to support the IC's national security mission.

Key Words: Living Polymerization, Multiblock Copolymers, Sequence Control, Full Monomer Conversion, Information Storage, Information-Containing Macromolecules, Polymers, Biopolymers, DNA

Qualifications

Postdoc Eligibility

- U.S. citizens only
- Ph.D. in a relevant field must be completed before beginning the appointment and within five years of the application deadline
- Proposal must be associated with an accredited U.S. university, college, or U.S. government laboratory
- Eligible candidates may only receive one award from the IC Postdoctoral Research Fellowship Program

Research Advisor Eligibility

- Must be an employee of an accredited U.S. university, college or U.S. government laboratory
- Are not required to be U.S. citizens

Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.
- **Discipline(s):**
  - **Chemistry and Materials Sciences** (12)
  - **Communications and Graphics Design** (2)
  - **Computer, Information, and Data Sciences** (17)
  - **Earth and Geosciences** (21)
  - **Engineering** (27)
  - **Environmental and Marine Sciences** (14)
  - **Life Health and Medical Sciences** (45)
  - **Mathematics and Statistics** (10)
  - **Other Non-Science & Engineering** (2)
  - **Physics** (16)
  - **Science & Engineering-related** (1)
  - **Social and Behavioral Sciences** (27)