

Opportunity Title: Effective markers for the detection of synthesised hazardous materials in waste products

Opportunity Reference Code: ICPD-2019-20

Organization Office of the Director of National Intelligence (ODNI)

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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 3/1/2019 6:00:00 PM Eastern Time Zone

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

Detection of an illicit laboratory through waste generated during the synthesis procedure:

- There are a range of illicit chemicals, including homemade explosives, that may be manufactured by chemistry synthesis using readily available domestic precursors. These reactions typically involve bringing together two or more chemicals that would not typically be combined during their legitimate use.
- The purpose of this research topic is to identify and characterize materials that can be added to precursor chemicals and will, when exposed to conditions typical in illicit synthesis, undergo a reaction to produce a readily detectable material. A response to this topic would seek to provide molecular markers and potential reactions to generate marker materials, which, alongside appropriate currently available detection technologies, will enable detection of illicit material due to markers in the waste stream. Careful consideration will need to be given to common reactions in legitimate household waste streams which may interfere and/or cause false-positives.

Example Approaches:

- Marker chemicals are used to detect chemical reaction progress, improve the resolution on Magnetic Resonance Imaging (MRI) scans or monitor the pH in biological cells. These chemicals may be detected through detection technology, looking for physical properties. Additionally, commercially available equipment is available that detects the vapors from illicit materials.
- There are two potential approaches:
 - Conduct a broad review of synthesis protocols for marker chemicals and identify synthesis routes that are appropriate to illicit synthesis routes.
 - Conduct a broad-spectrum review and analysis of the potential (low cost) detection technologies and the chemical or physical signatures that the detection technologies are most sensitive to.



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- Based on the review, target molecules and reaction routes that can be formed as a side product of an illicit synthesis.
- For successful materials / technology combinations the research would also consider the real-world implications of its implementation including; limits of detection, interference, false positives and operating protocols. An impact assessment on the impact of the inclusion of additional chemicals within a formulation on the legitimate use of the original chemical should also be completed.
- This research, while aimed at detection of illicit synthesis, could be conducted using inert substitutes to demonstrate a proof of concept reaction schemes.

Key Words:

Chemical synthesis; trace detection; marker reactions; environmental chemistry.

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** ([6](#) )
 - **Computer, Information, and Data Sciences** ([16](#) )
 - **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** ([5](#) )
 - **Physics** ([16](#) )
 - **Science & Engineering-related** ([1](#) )
 - **Social and Behavioral Sciences** ([28](#) )