

## Young Career Focus: Dr. Ori Gidron (The Hebrew University of Jerusalem, Israel)

**Background and Purpose.** SYNFORM regularly meets young up-and-coming researchers who are performing exceptionally well in the arena of organic chemistry and related fields of research, in order to introduce them to the readership. This Young Career Focus presents Dr. Ori Gidron (The Hebrew University of Jerusalem, Israel).

### Biographical Sketch



Dr. O. Gidron

**Ori Gidron** received his M.Sc. in chemistry from the Weizmann Institute of Science (Israel) in 2007 under the supervision of Professor M. van der Boom. He then joined the group of Professor M. Bendikov at the Weizmann Institute of Science and received his Ph.D. in 2012, for which he was awarded the Dov-Elad Prize for Excellence in Chemical Research. In June 2013, he accepted a Marie Curie (IEF) Postdoctoral Fellowship to work in the group of Professor F. Diederich at ETH Zurich (Switzerland) on supramolecular assemblies of carbon-rich materials. In 2015, he became an assistant professor at the Hebrew University of Jerusalem (Israel). In 2019, he received an ERC Starting Grant for his research on the topic of helically locked  $\pi$ -conjugated materials. His main interests are chiral organic semiconductors, curved aromatic systems, and furan-containing materials for organic electronics.

### INTERVIEW

**SYNFORM** *What is the focus of your current research activity?*

**Dr. O. Gidron** Our research activity aims to synthesize and study new functional  $\pi$ -conjugated materials for applications in organic electronics. In that context, our current main project studies how twisting aromatic molecules affects their properties. The performance of organic electronic materials is strongly dependent on their conformation. Twisting these materials out of planarity induces chirality and generates new electronic, magnetic, optical, and chiroptical properties. Materials possessing valuable new properties are desired for application in non-linear optical devices, spin filters, chiroptical devices and magneto-optical devices. However, the effect of twisting is poorly understood, and twisting is often achieved at the expense of  $\pi$ -conjugation, resulting in inferior device performance. We have recently introduced helically locked twisted acenes, which allow us to systematically study the effect of twisting on various electronic, optical, chiroptical, and magnetic material properties.<sup>1</sup>

**SYNFORM** *When did you get interested in synthesis?*

**Dr. O. Gidron** Growing up, one of the most influential books on my career was “*The Periodic Table*” by Primo Levi. The love for chemistry portrayed in his book influenced my career path and convinced me to start my undergraduate studies in chemistry. My fascination with organic synthesis began during my bachelor studies, where I was first exposed to the power of synthetic organic chemistry from the story of the discovery of conducting polymers. It amazed me that synthetic organic chemists have the power to engineer the color and conductivity of organic materials by synthetic modification. In addition, I found great satisfaction in synthetic labo-

ratory work, in general, and particularly in obtaining a new molecule that was never previously synthesized.

**SYNFORM** What do you think about the modern role and prospects of organic synthesis?

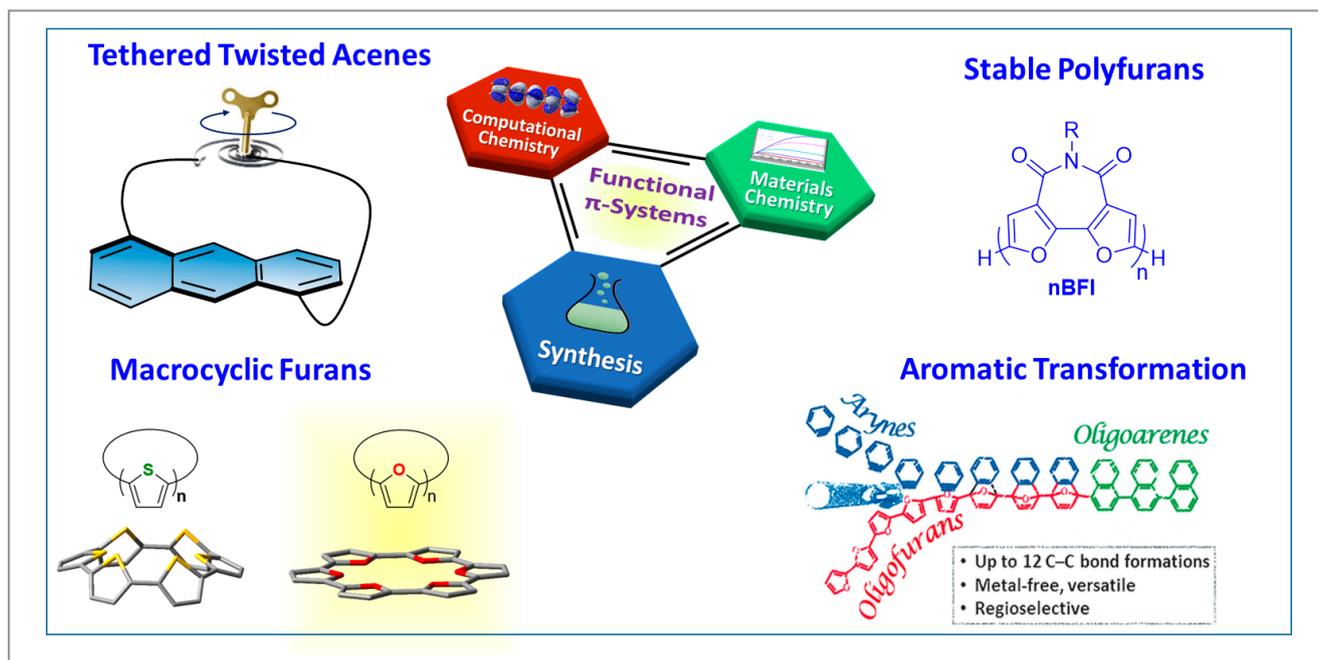
**Dr. O. Gidron** Synthetic organic chemistry is more relevant today than ever, with new synthetic methodologies enabling breakthroughs, such as the recent synthesis of the first carbon nanobelts, or synthetic supramolecular assemblies that constitute molecular machines. As new applications emerge for electronic, optical, and spintronic devices comprising organic molecules, the development of new methodologies to obtain these targets is crucial. The introduction of automated processes, such as automated flash chromatography and the emergence of flow chemistry, have already greatly improved efficiency, enabling chemists to focus on more complex synthetic challenges. In addition to classical synthetic methods, the recent introduction of on-surface synthesis and STM characterization techniques enable the synthesis of large graphene nanoribbons and other carbon allotropes that were previously inaccessible, mostly because of their low solubility and low yields.

**SYNFORM** Could you tell us more about your group's areas of research and your aims?

**Dr. O. Gidron** Our group focuses on the development of new functional  $\pi$ -conjugated materials for organic electronics, and on understanding the relationship between structure (planarity, different heteroatoms, etc.) and material properties. For this purpose, we combine computational chemistry, organic synthesis, and materials characterization techniques.

In addition to the abovementioned study of helically locked twisted acenes, we also focus on three other major projects (Figure 1):

(i) *The development of conducting polymers with strong emission in the visible and near infrared (NIR) spectral region:* Although many conjugated polymers display strong emission in the visible spectral range, obtaining such emission in the NIR spectral region is a significant challenge. While oligo- and polyfurans emit considerably stronger fluorescence than their thiophene analogues, they are yet to display fluorescence in the NIR. In addition, oligofurans suffer from low stability, which limits their application. We have recently developed a new building unit, the bifuranimide, which is significantly more stable than its furan analogues. Oligomers and polymers containing bifuranimide display strong fluorescence from the blue to red spectral region.<sup>2</sup>



**Figure 1** Main projects currently being studied in the Gidron group. Reprinted with permission from references 1a and 3, copyright (2018) American Chemical Society, and from reference 4, copyright (2017) Wiley-VCH.

(ii) *Investigation of new macrocyclic systems.* We are investigating new oligofuran-based macrocyclic systems for organic electronics. In a computational study, we found that replacing thiophene with furan should significantly decrease the strain energies for small macrocycles. Calculations indicate that the macrocyclic ring should show a low ionization potential, small reorganization energies, and small HOMO–LUMO gaps, rendering them excellent candidates for organic semiconductors.<sup>3</sup>

(iii) *Development of new methodologies for the synthesis of conjugated backbones.* Although conjugated oligomers such as oligophenylenes are important active materials in organic electronics, their synthesis can be challenging. We recently introduced a regioselective transformation of oligofurans to oligoarenes using multiple Diels–Alder cycloadditions.<sup>4</sup>

**SYNFORM** *What is your most important scientific achievement to date and why?*

**Dr. O. Gidron** Our introduction of the first helically locked twisted acenes is our most important scientific achievement to date. It is also the starting point toward achieving our next goal, namely, synthesizing intrinsically chiral and conjugated organic materials with tunable twist. We hope to embed our materials in conducting polymers and study the effect of helicity on performance. In this way, our goal is to obtain a better understanding of the conformational factors that govern the Chiral Induced Spin Selectivity (CISS) effect, and the performance of magneto-optical materials among other effects.



## REFERENCES

- (1) (a) A. Bedi, L. J. W. Shimon, O. Gidron *J. Am. Chem. Soc.* **2018**, *140*, 8086–8090. (b) A. Bedi, O. Gidron *Chem. Eur. J.* **2019**, *25*, 3279–3285. (c) A. Bedi, R. Carmieli, O. Gidron *Chem. Commun.* **2019**, *55*, 6022–6025.
- (2) S. V. Mulay, B. Bogoslavky, I. Galanti, E. Galun, O. Gidron *J. Mater. Chem. C* **2018**, *6*, 11951–11955.
- (3) O. Dishi, O. Gidron *J. Org. Chem.* **2018**, *83*, 3119–3125.
- (4) S. Gadakh, L. J. W. Shimon, O. Gidron *Angew. Chem. Int. Ed.* **2017**, *56*, 13601–13605.