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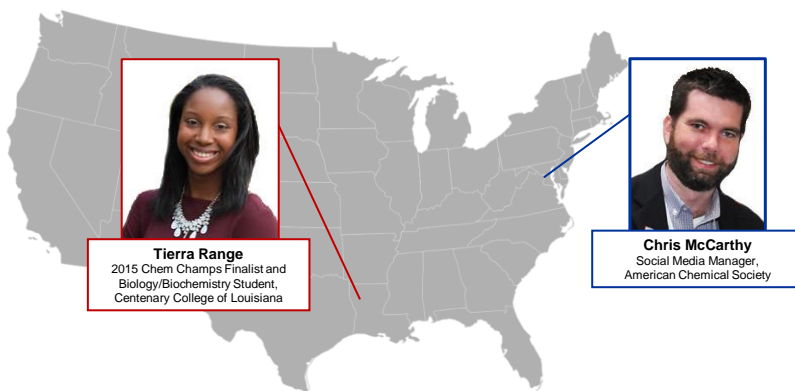
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  - Check out <http://bit.ly/chemchamps2015> and <http://bit.ly/chemchamps2014> for ideas
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# Basking in Energy: A Look Into Polymer Solar Cells



Tierra Range

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# Block copolymer development for use in bulkheterojunction photovoltaics



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## Solar Cells



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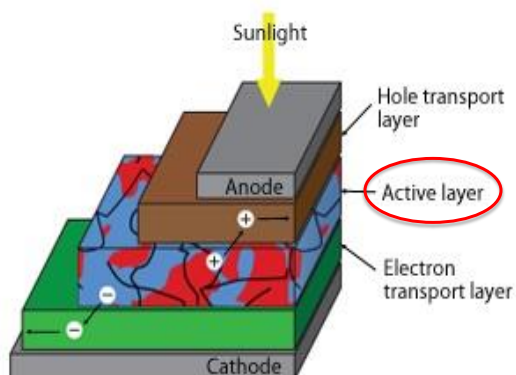


# Organic Solar Cells

- **Three Types:**
  - dye-sensitized
  - hybrid architectures
  - bulkheterojunction

- **Bulkheterojunction polymer solar cell active layer:**

- an electron-rich donor material
- an electron-deficient acceptor material

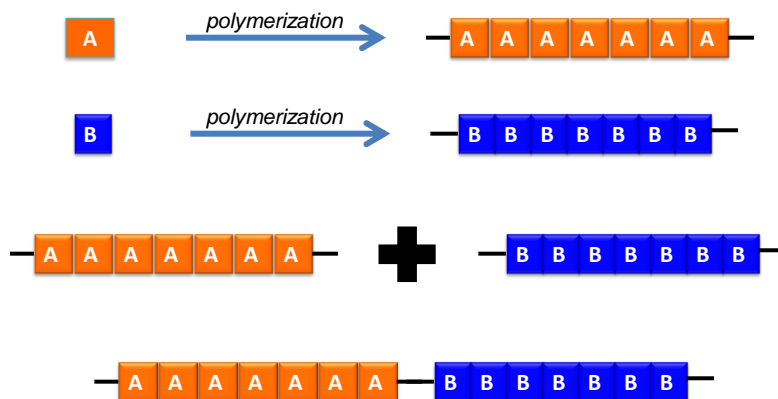


<http://www.nature.com/am/journal/2011/201102/full/am201151a.html>



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# Block Copolymer Formation



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# Block Copolymer to Be Created

## – Donor Block (“Block A”)

- Polyfluorene
- Polythiophene



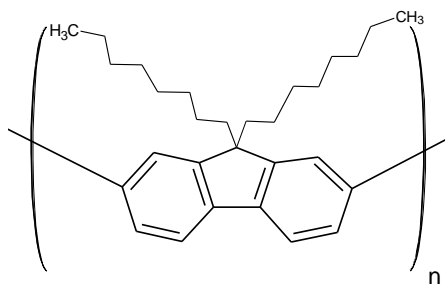
## – Acceptor Block (“Block B”)

- Polybenzotriazole



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## Why Polyfluorene?



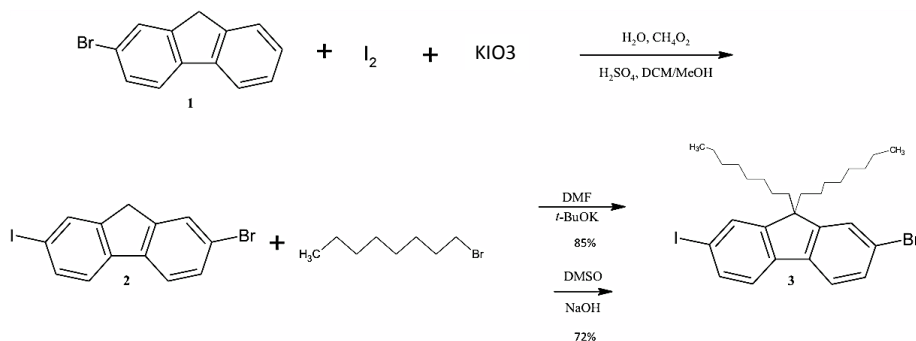
Polyfluorene

- Good donor molecule
- Has not been synthesized more than once before in literature
- Challenging synthesis



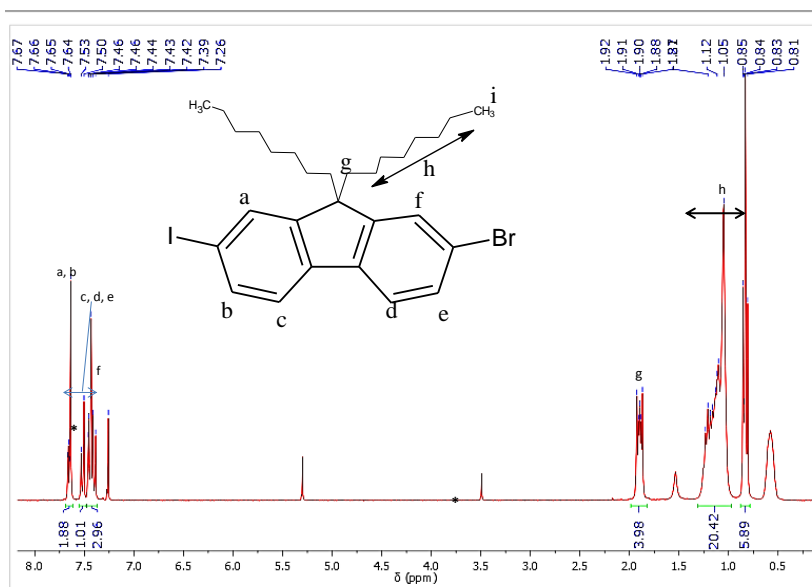
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# Synthesis of Polyfluorene



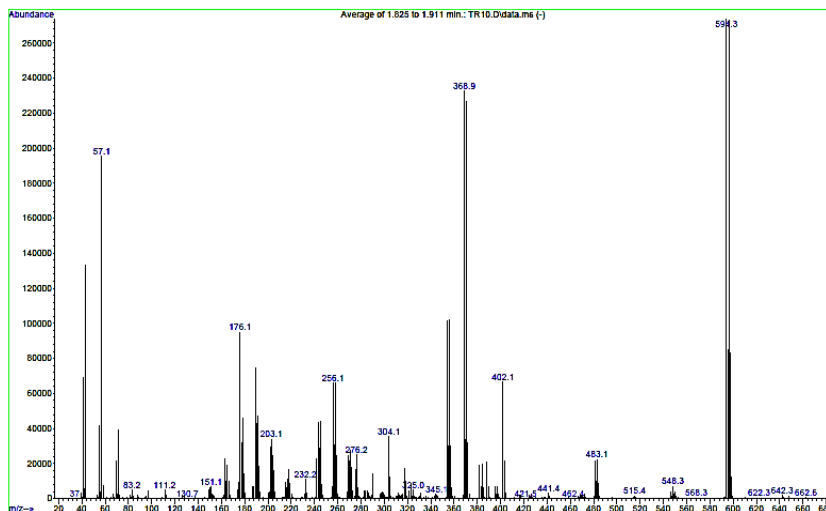
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## <sup>1</sup>H NMR Analysis Confirms Synthesis of 3



20

## Mass Spectroscopy Analysis Confirms Synthesis of 3



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### Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



**What was the biggest problem with performing the grignard metathesis reaction?**

- Problems with the nickel catalyst
- Lack of materials in the lab
- Humidity
- Reproducibility

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## Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT

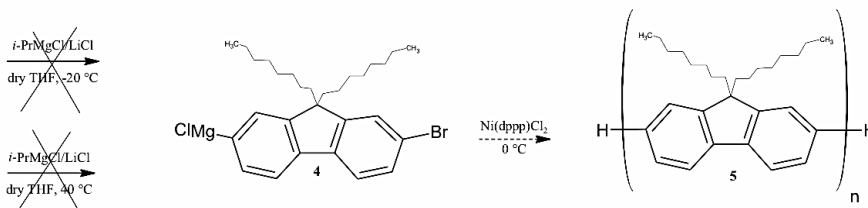


**What was the biggest problem with performing the grignard metathesis reaction?**

- Problems with the nickel catalyst
- Lack of materials in the lab
- **Humidity**
- Reproducibility

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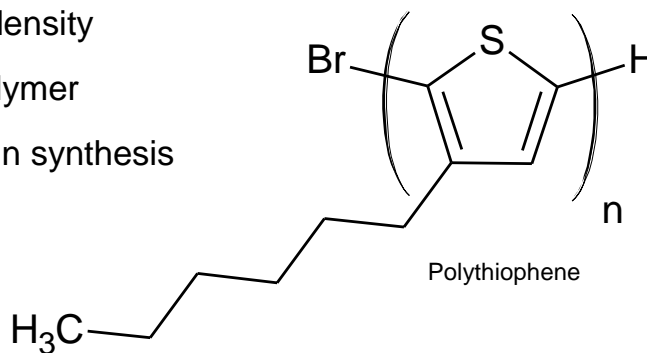
## Grignard Metathesis Chain-Growth Polymerization for Polyfluorenes



24

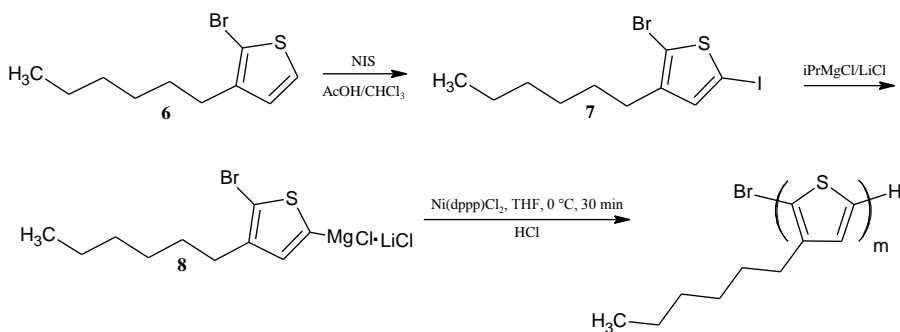
## Why Polythiophene?

- Good donor molecule in block copolymers
- High electron density
- Well known polymer
- More success in synthesis



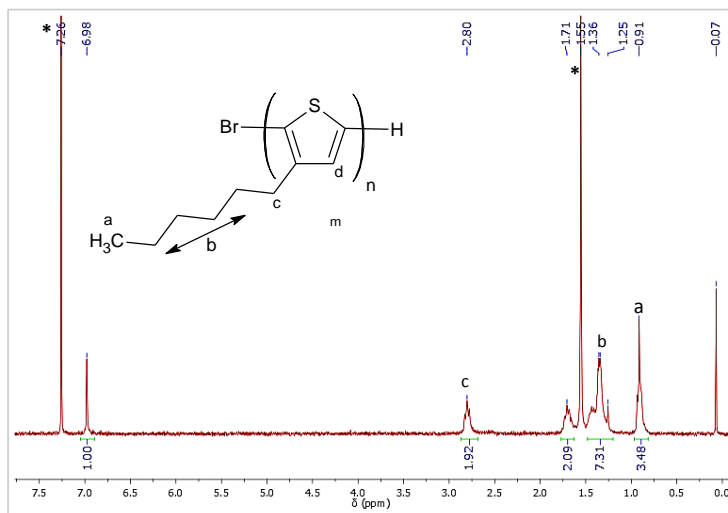
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## Polythiophene Synthesis



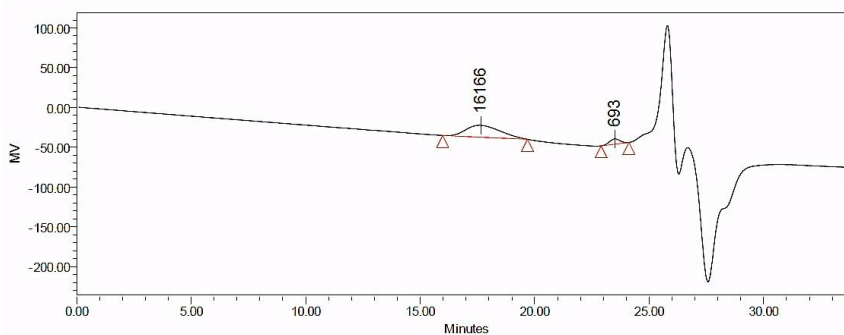
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## $^1\text{H}$ NMR Confirms Synthesis of 9



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## GPC Analysis Confirms Synthesis of 9

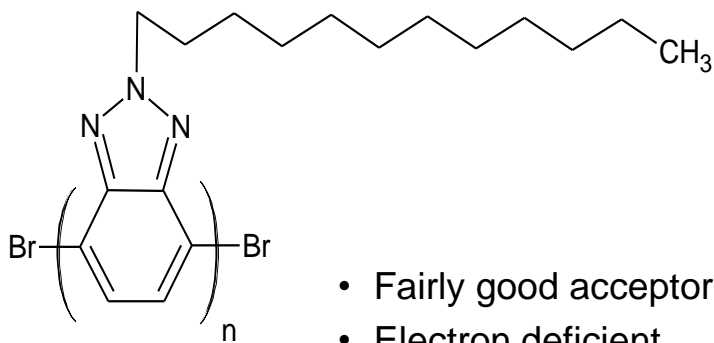


$M_n^a$ (g/mol)	$MW^b$ (g/mol)	PDI <sup>c</sup>	Degree of Polymerization <sup>d</sup>
≈14,000	15554	1.11	~84



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## Why Polybenzotriazole?



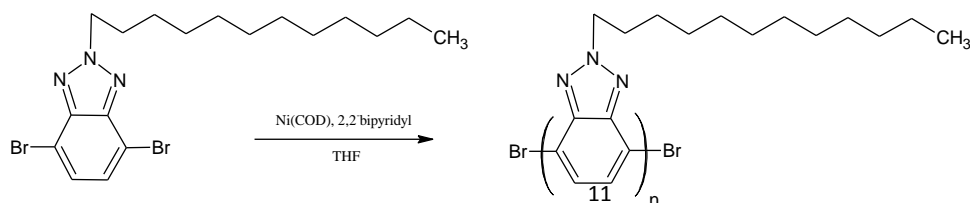
Benzotriazole

- Fairly good acceptor molecule
- Electron deficient
- High solubility



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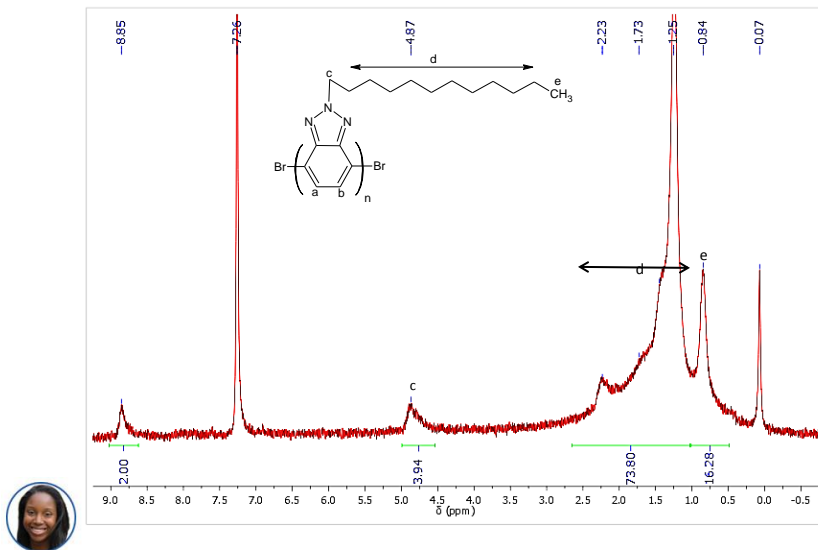
## Polybenzotriazole Synthesis



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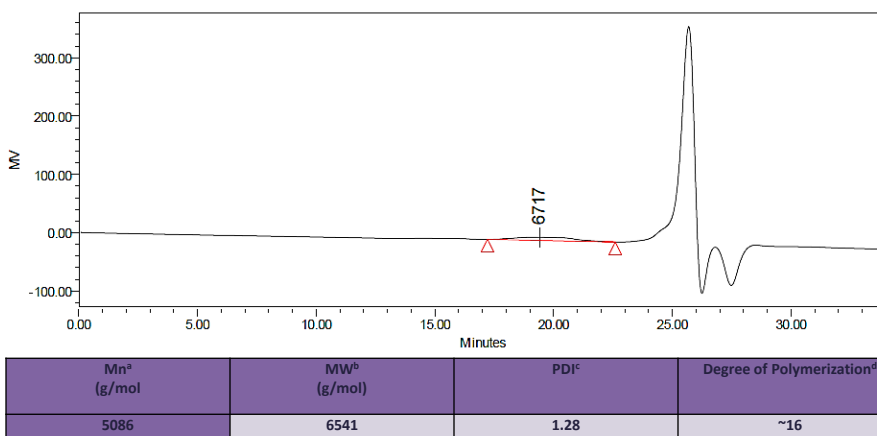


# <sup>1</sup>H NMR Analysis of Polybenzotriazole 11



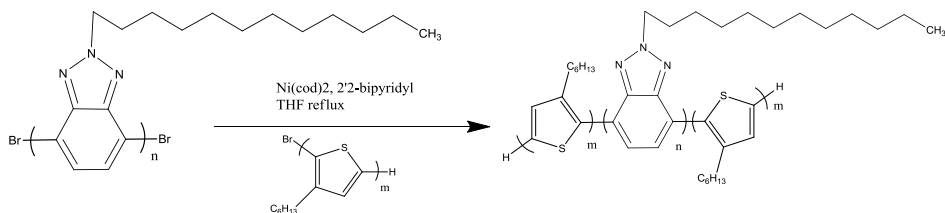
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# GPC Analysis of Polybenzotriazole 11



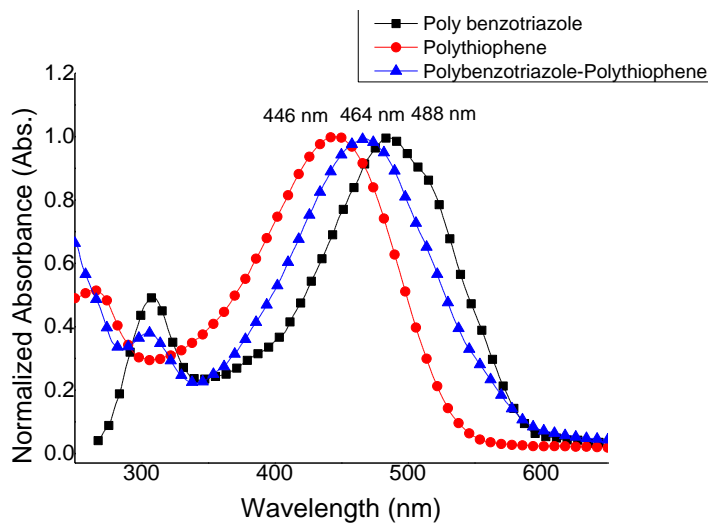
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## Development of Block Copolymer

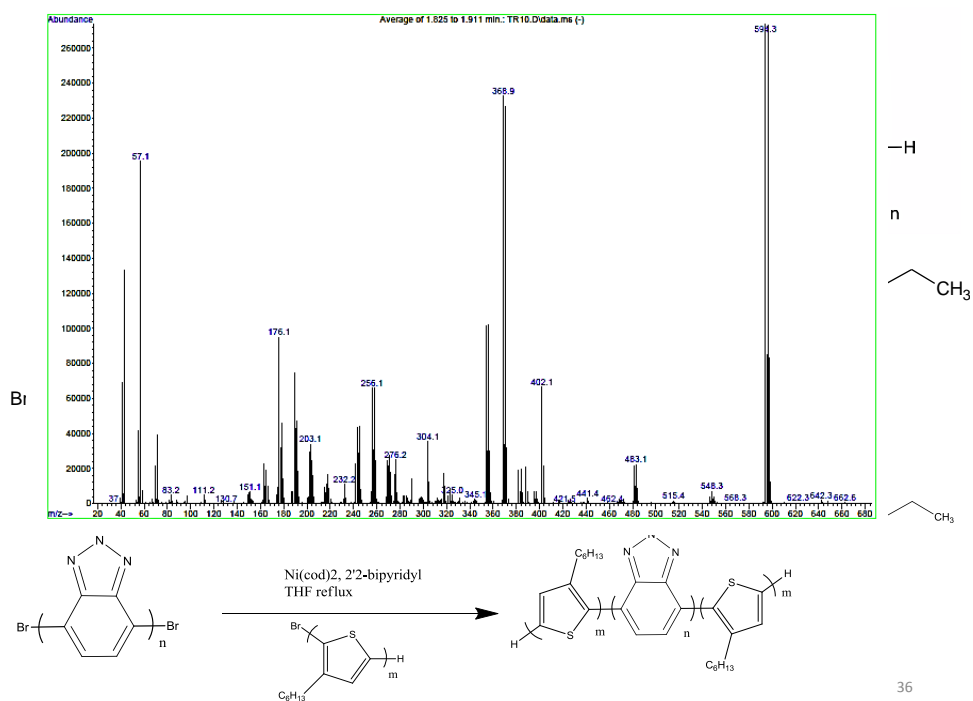
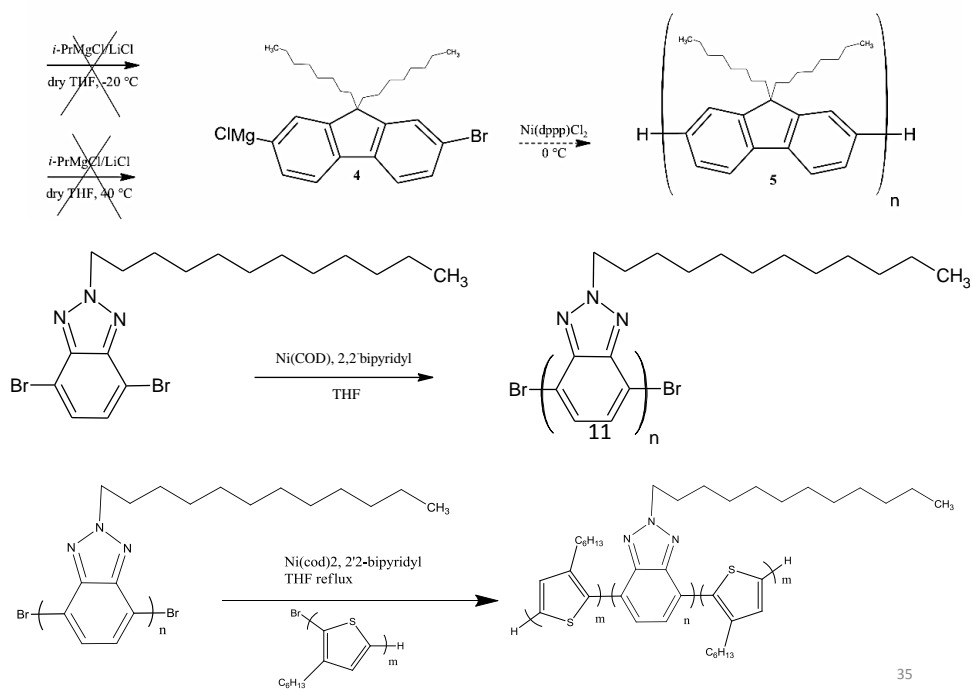


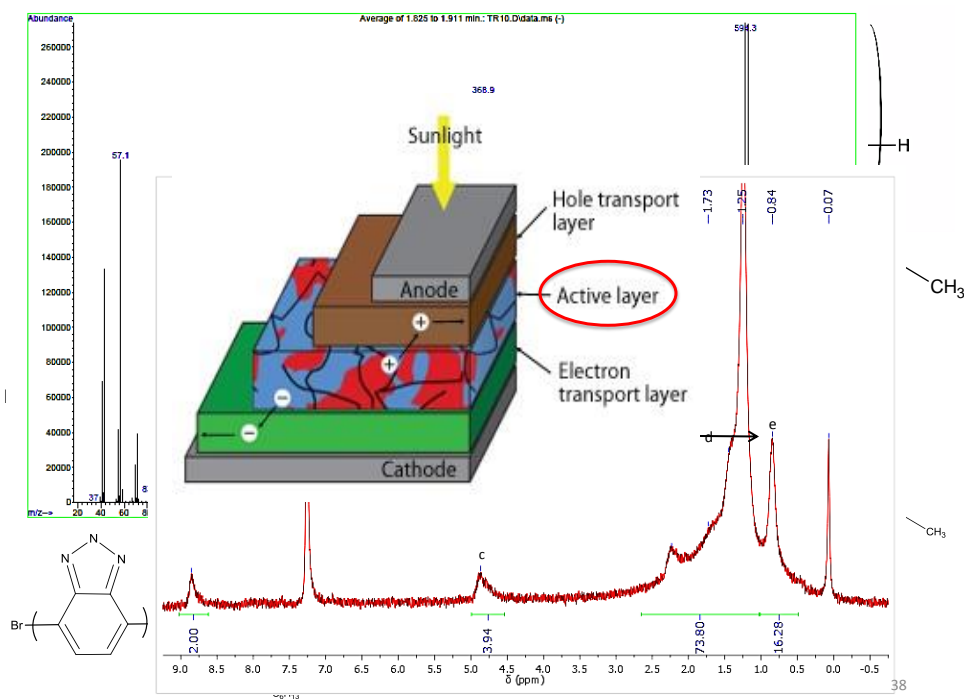
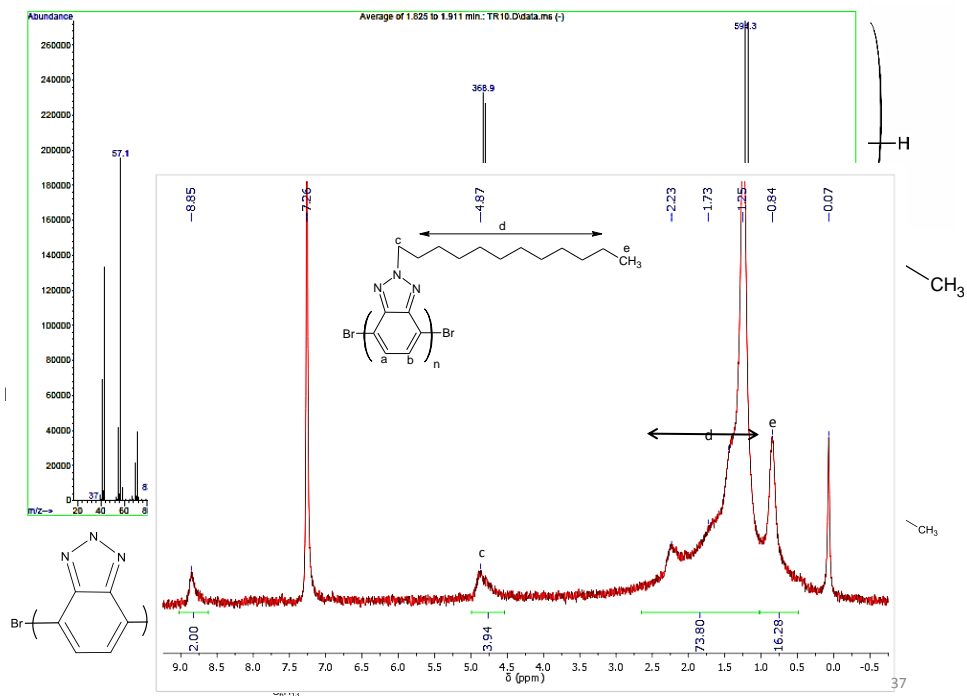
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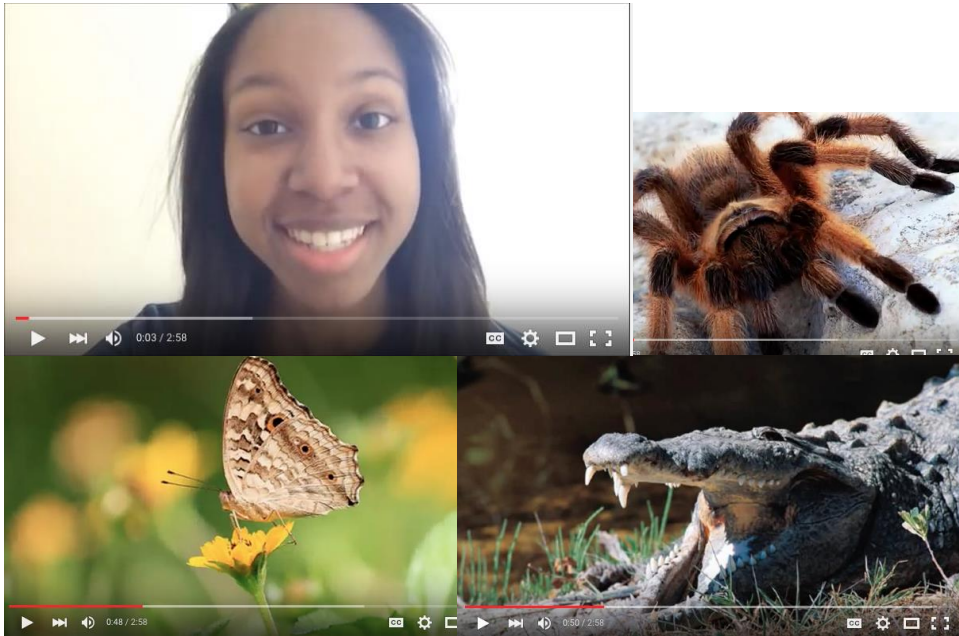
## UV/Vis absorption of polybenzotriazole, polythiophene, and their physical mixing in THF



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## Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



**Which general feeling below best describes the majority of people's attitudes towards chemistry or learning chemistry?**

- Enjoyment
- Neutral
- Disgust
- Confusion

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## Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT

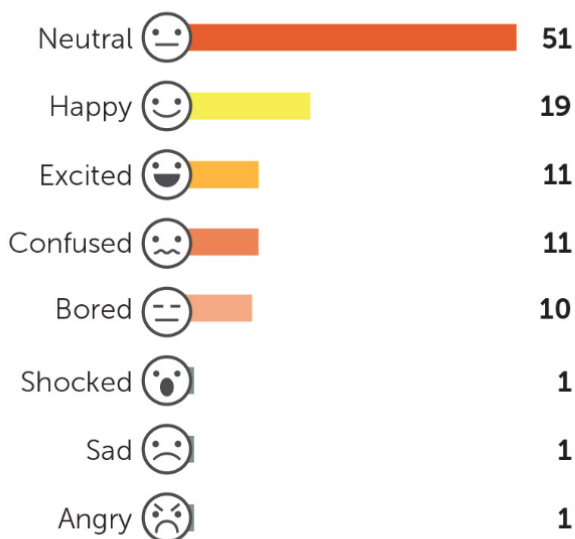


**Which general feeling below best describes the majority of people's attitudes towards chemistry or learning chemistry?**

- Enjoyment
- **Neutral**
- Disgust
- Confusion

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Figure 2.1: Feelings towards chemistry (%)

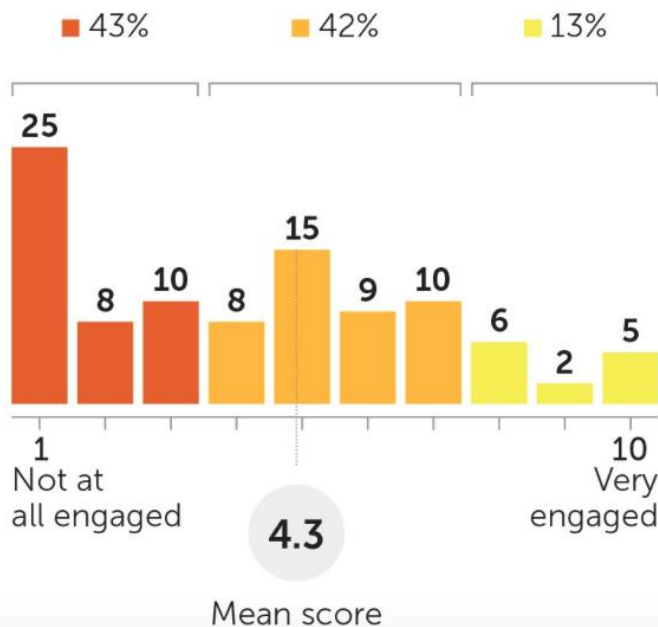


Q.4B Which of the following describes how you feel about chemistry? Base: All respondents (2,104 UK adults 16+) Multi-coded

<http://www.rsc.org/globalassets/04-campaigning-outreach/campaigning/public-attitudes-to-chemistry/public-attitudes-to-chemistry-research-report.pdf?id=8495>

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Figure 2.2: Engagement/interest in chemistry (%)



<http://www.rsc.org/globalassets/04-campaigning-outreach/campaigning/public-attitudes-to-chemistry/public-attitudes-to-chemistry-research-report.pdf?id=8495>

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## Science Communication Checklist

- Remember your audience
- Find a way to connect
- Keep them engaged



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## Science Communication Checklist



Remember your audience

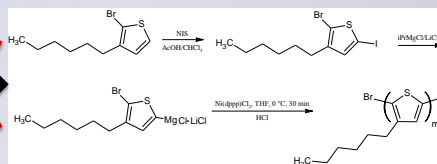


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## Science Communication Checklist



Remember your audience



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## Science Communication Checklist

✓ Remember your audience



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## Science Communication Checklist

✓ Remember your audience



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## Science Communication Checklist

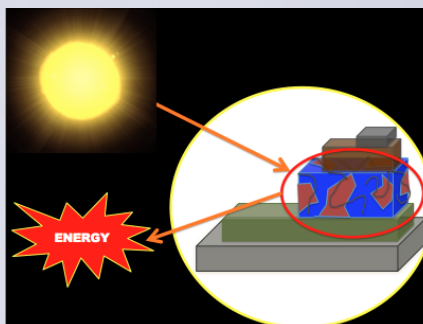
✓ Remember your audience



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## Science Communication Checklist

✓ Find a way to connect



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## Science Communication Checklist

✓ Keep them engaged



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## Science Communication Checklist

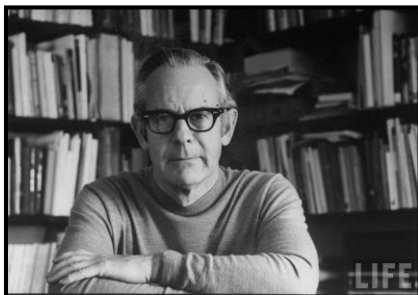
✓ Remember your audience

✓ Find a way to connect

✓ Keep them engaged

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# Food for Thought



“Communication leads to community, that is, to understanding, ...and mutual valuing.”

– Rollo May

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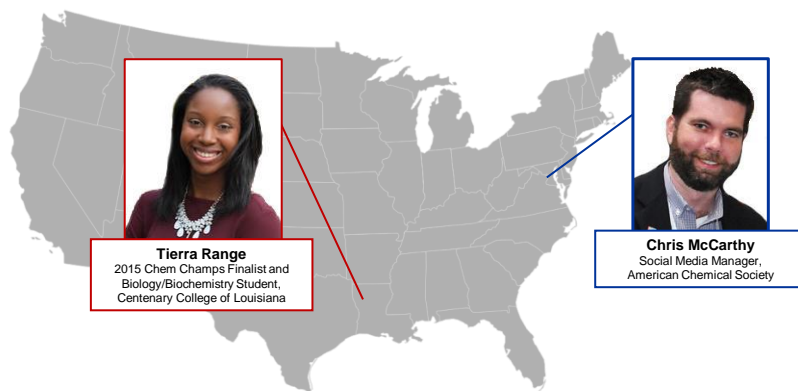


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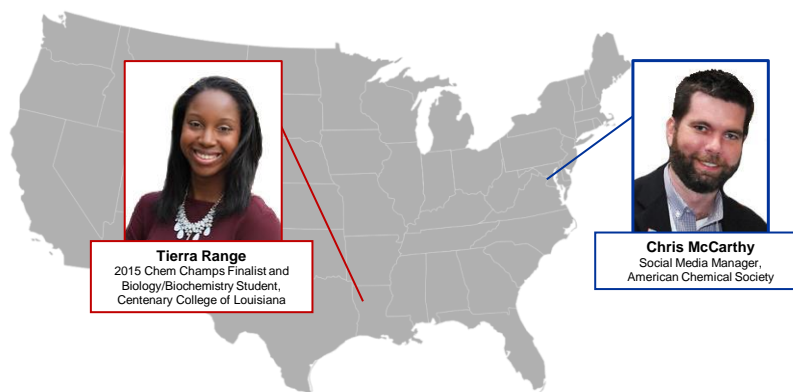
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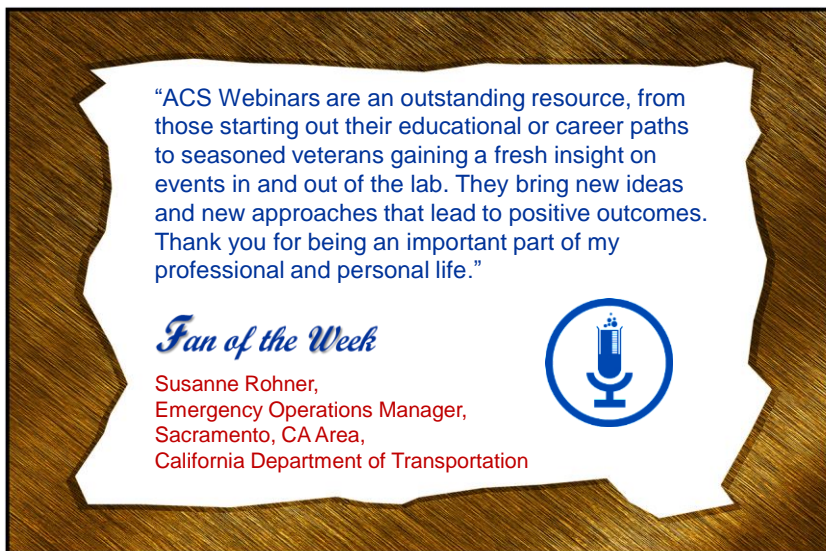
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