Green Chemistry Education Webinar Series

Green Chemistry Careers in Industry

April 12, 2016

GREEN CHEMISTRY & COMMERCE COUNCIL

Business Mainstreaming Green Chemistry

In Partnership with:

Network of Early Career Sustainable Scientists and Engineers
www.sustainablescientists.org

ACS Green Chemistry Institute®
www.acs.org/content/acs/en/greenchemistry

The Green Chemistry Commitment
TRANSFORMING CHEMISTRY EDUCATION
www.greenchemistrycommitment.org

What is the GC3?

- Cross-sectoral, B2B network of over 90 companies and other organizations
- Formed in 2005
- Collaboratively advances green chemistry across sectors and supply chains

Today's Speakers

Irene Erdelmeier

Organic and Medicinal Green Chemist, Co-founder of Tetrahedron, France

Teresa McGrath

Environmental Regulatory Toxicologist, Valspar

Jon Smieja

Environmental Chemist, Global Sustainability, Steelcase

Ground Rules

- Due to the number of participants in the webinar, all lines will be muted
- If you have a question or comment, please type it in the “Questions” box located in the control panel
- Questions will be answered at the end of the presentation

Green Chemistry Careers in Industry

Irene Erdelmeier, Ph.D.
Co-Founder Tetrahedron (France)

Green Chemistry – an SME perspective

Overview

- Education and training
- Professional experience
- About Tetrahedron (France)
- Essentials about Green Chemistry in a R&D-based company
- Skills/competences/personal qualities/job profiles

Education and Training

- **Graduation as Chemical Engineer/Synthetic Organic Chemistry (Darmstadt/Germany)**

- **Ph. D. in Synthetic Organic Chemistry (1990, Darmstadt and Freiburg, Germany) on prostaglandins /anti-inflammatory compounds**

- **Postdoc in Molecular Mechanisms of Toxicology (Paris, France, 1990-1992)**

Professional experience

1992-99:
Bioxytech

- **Developing diagnostics; pharmaceutical research**

2001-2002:
L'ORÉAL PARIS

- **Led project on active/ biological photoprotection**

2002-2009:
Expertise & Consulting

- **Contract research in synthesis and medicinal chemistry**

Increasing interest and need for Green Chemistry

1992-99:
Bioxytech

- 1998: The 12 Principles of Green Chemistry

2001-2002:
L'ORÉAL PARIS

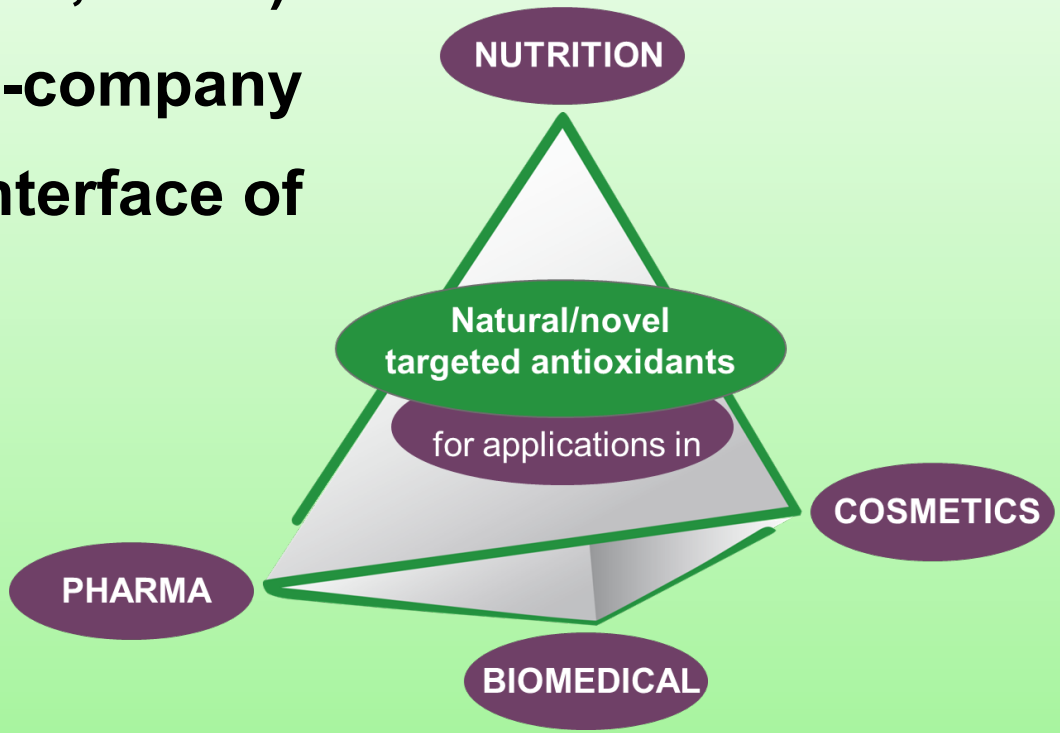
- 2001: Legislation about CMR
- Controversy about potential EDR-activity of sunscreens

2002-2009:
Expertise & Consulting

- 2007: REACH came into force
- 2008: first solvent selection guides (GSK, Pfizer)

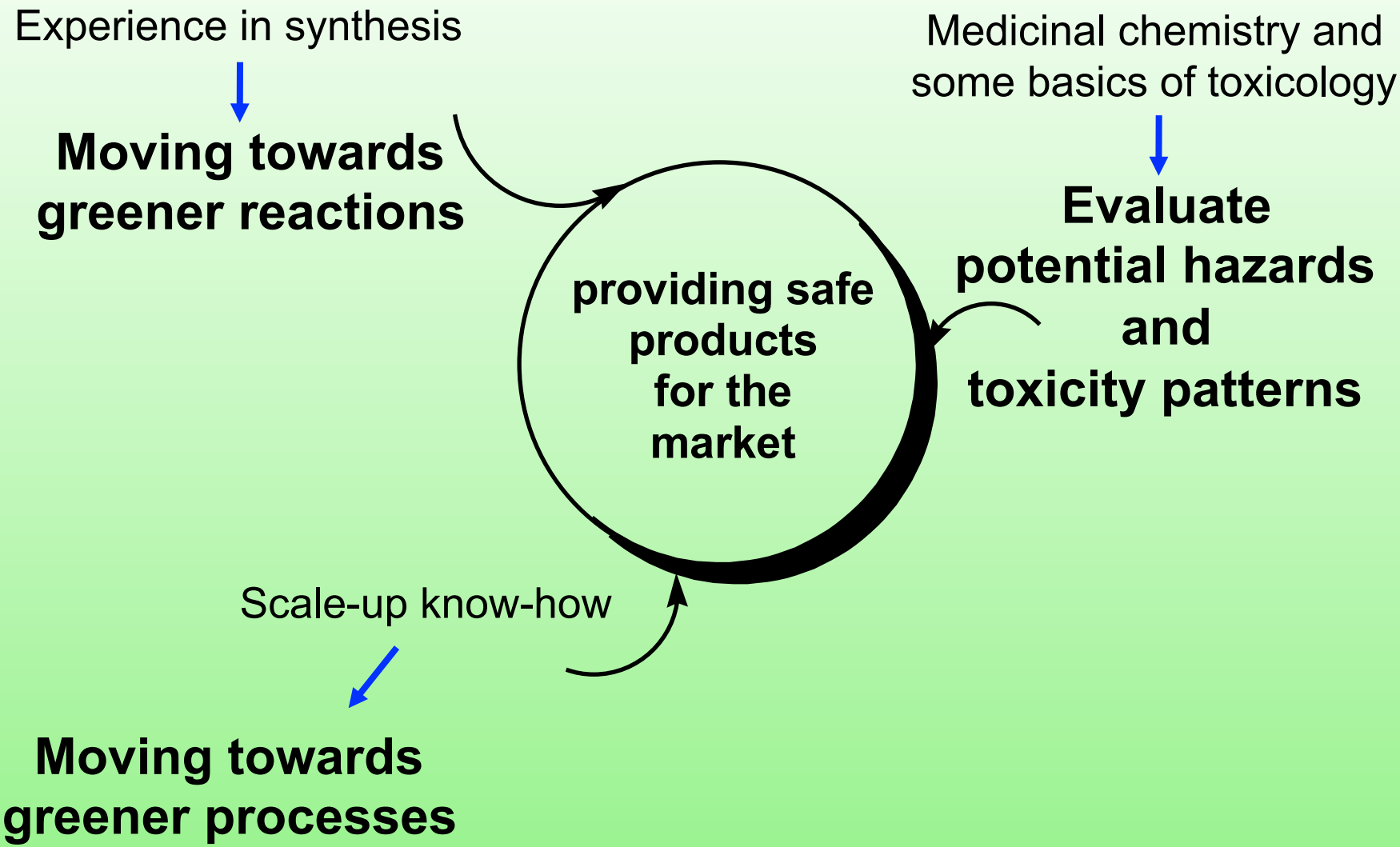
Tetrahedron (Paris)

- Start-up created in 2003 (founded with J.-C. Yadan Ph.D., and M. Moutet, Ph.D.)
- Privately held R&D-company
- Innovation at the interface of Chemistry/Biology



- Mission: provide safe and innovative, nature-inspired ingredients

Strong commitment to green chemistry



Green chemistry at Tetrahedron

Products → rare natural or nature-derived products (e.g. amino acids)

Water as process solvent – whenever possible

Chemical processes → Biomimetic processes (inspired by the biosynthesis)

Innovative isolation and purification procedures

Green Chemistry in a R&D-based company

John Warner:

The mistake people make is to think that alternatives already exist.

In my estimation, over 65 or 70 percent of the problems haven't had solutions invented yet. It's not a sourcing issue. It's not just picking a better molecule to buy.

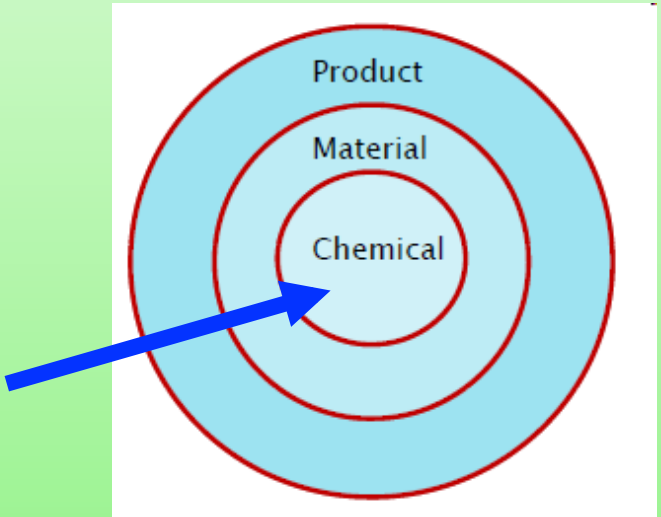
They have to be invented.

Green chemistry = Engine for growth ?!

The green chemical landscape for safe products "yet to be invented"

Products

- Safe
- Active/Highly efficient
- Biodegradable
- Functional use responds to a customers/clients need

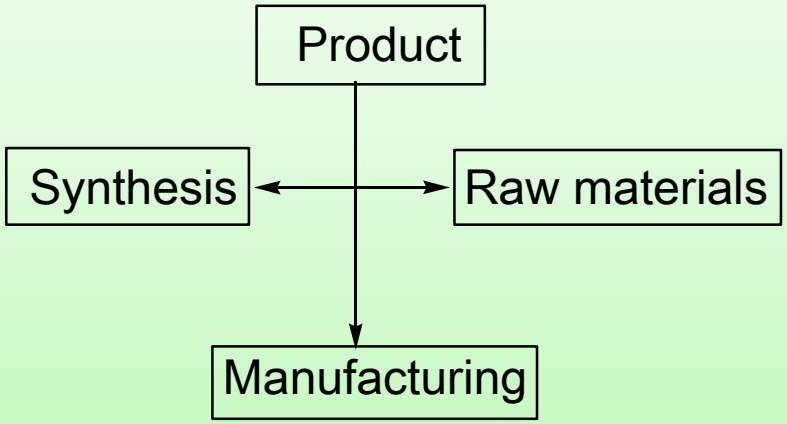


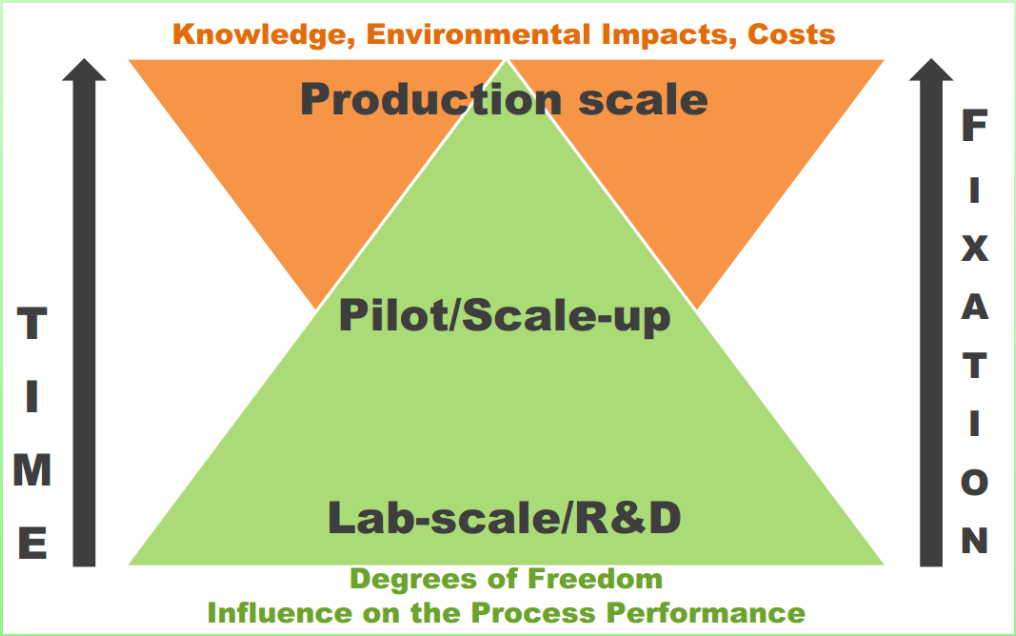
**from K. Geiser webinar 10-19-11*

Green Chemistry in the R&D phase

Chemical processes

- Safe (e.g. for workers)
- Towards sustainability in regard to:
  - Starting materials (renewables)
  - Reagents
  - Solvents
  - Isolation/purification procedure
- Economically viable

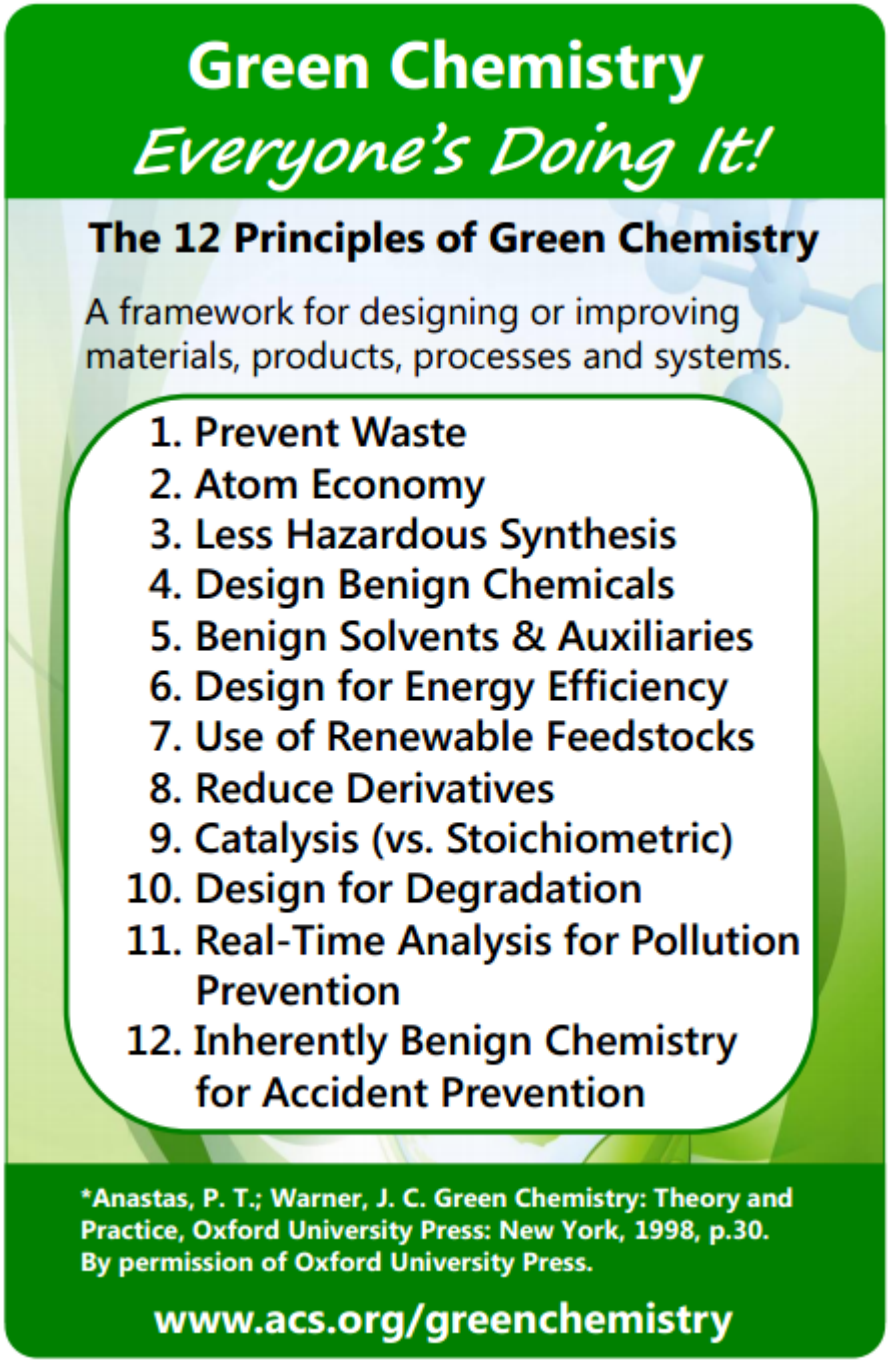




*from D. Ott, D. Kralisch et al., Sustainability and Medicinal Chemistry in Practice, in prep.

Measuring of efforts.

…. for example by checking
The 12 Principles



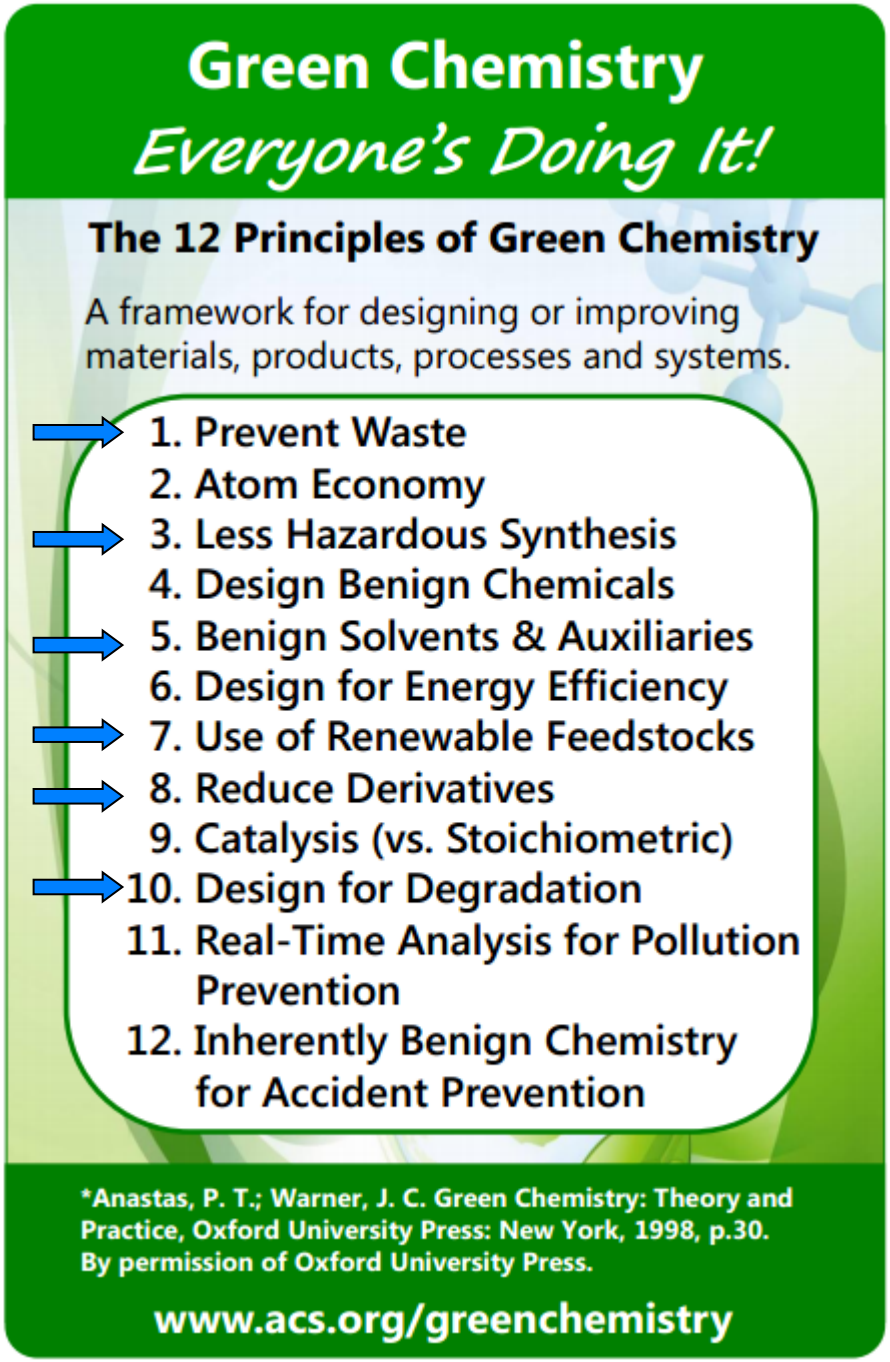
Measuring of efforts..

Waste reduction = savings

by introduction of a new technology

Quantity of saved IER **4.5 tons**

Quantity of saved solvents **22.2 tons**



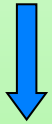
Measuring/comparing improvements – detecting hotspots – making choices

Products

- Green Screen ™
- Alternatives Assessments
- MCDA
- Absence from SVHC – Listings
- other metrics

Chemical processes

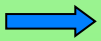
- 12 Principles of Green Chemistry
- Simple metrics: E-factor, PMI (ACS-GCI)



- Life Cycle Analysis/Life Cycle Costing

International quest for common metrics:

- European project SPIRE
- WBCSD document
- GC3 roundtable about metrics



Is there one “good yardstick”?

Skills and competences for green chemistry jobs

- sound scientific training
- understanding of chemical reactivity and mechanisms
- basic knowledge about persistence and biodegradation
- essentials of toxicology
- awareness of chemical policies and legislation (REACH)
- understanding of market needs (“new is not enough”)
- system thinking

- Material scientist
- Organic chemist
- Process Engineer
- Toxicologist
- Biologist
- Supply chain manager
- etc.

Personal qualities

- Open-minded, in particular for cross-sectorial collaborations
- Ability to communicate with other specialisms
- Adaptability
- Curious and inventive
- Rigorous - looking for truly relevant improvements

Summary

- Integration of the green chemistry approach is useful in every “classical” job for chemists
- Don’t exclude working for SME’s
- Step back and think about trends –

  the quest for safe products is in constant evolution
- Green chemistry has to be and can be sound economics
- Continuous professional education is key (and is fun)
- Networking helps (and is fun)

The search for safer products and processes is essential for protecting Human Health and the Environment

AND

a great challenge for creativity!

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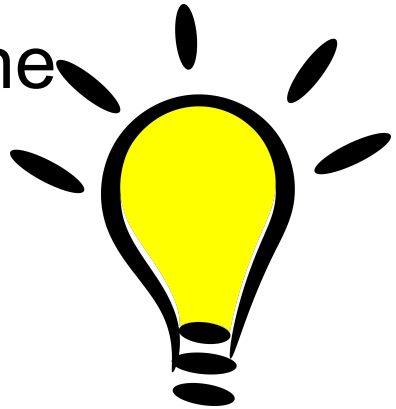
My Timeline



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1997 | 2001 | 2003 | 2004 | 2005 | 2006 | 2014 | Present

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My Ah-Ha! Moment.

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- Pollution Clean-Up vs. Pollution Prevention
- Stumbled on “Green Chemistry”
- Pursued degree in Clean Chemical Technology from University of York (UK)

Green Chemistry
Everyone's Doing It!

The 12 Principles of Green Chemistry

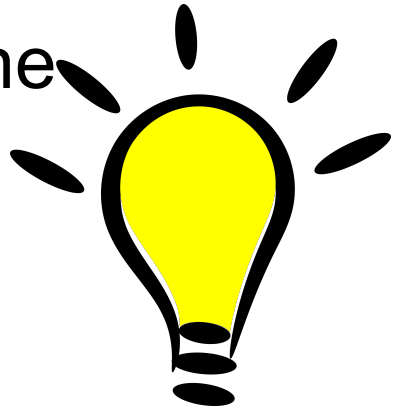
A framework for designing or improving materials, products, processes and systems.

1. Prevent Waste
2. Atom Economy
3. Less Hazardous Synthesis
4. Design Benign Chemicals
5. Benign Solvents & Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feedstocks
8. Reduce Derivatives
9. Catalysis (vs. Stoichiometric)
10. Design for Degradation
11. Real-Time Analysis for Pollution Prevention
12. Inherently Benign Chemistry for Accident Prevention

*Anastas, P. T.; Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press: New York, 1998, p.30. By permission of Oxford University Press.

www.acs.org/greenchemistry

My Timeline



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UNIVERSITY of York

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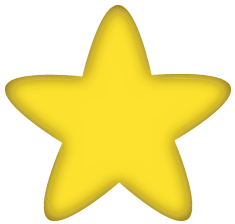

My lucky networking moment

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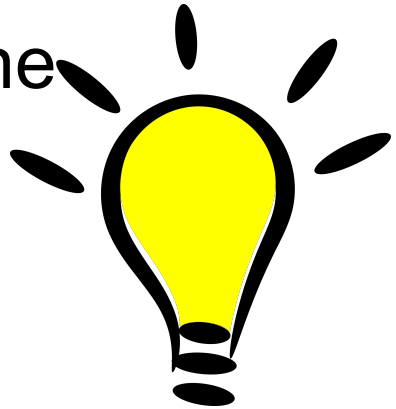
- Dr. Lauren Heine,
  - ED, Northwest Green Chemistry
  - Co-Director, Clean Production Action
  - Director of Applied Science, GreenBlue Institute

My Timeline



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HAMLINE UNIVERSITY
LITERAE · RELIGIO · LIBERTAS
SAINT PAUL · MINNESOTA
1854

UNIVERSITY of York

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Design for the Environment
U.S. EPA

NSF
NSF International

Valspar Sustainability Pillars

- People: power our success
- Community: We succeed when those around us succeed
- Innovation: focus on coatings that perform better, use safer materials, reduce emissions and minimize waste
- Operations: focus on increased efficiencies and reduced environmental impacts
- Governance: define how we operate and carry out our sustainability practices

Chemicals Management

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- Reduce the use of hazardous chemicals
  - Focus on continuous improvement
  - Use tools like Alternatives Assessment and GreenScreen to find safer alternatives
  - Empower our chemists with hazard and risk assessment tools
- Improve transparency
  - Support our customers by providing data to support
    - Health Product Declaration
    - Declare Statements
    - Environmental Product Declarations
    - Ecolabels
  - Engage stakeholders during product development process

Green Chemistry Opportunities Can be Found Anywhere!

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Example Sectors

- Government
- NGOs
- Academia
- Third party certification body
- Industry
- Retail

Example Positions

- Bench chemist
- Biologist
- Research & Development
- Regulatory/EHS
- Toxicology
- Marketing
- Sales
- Project manager
- Designer
- Architect

Advice

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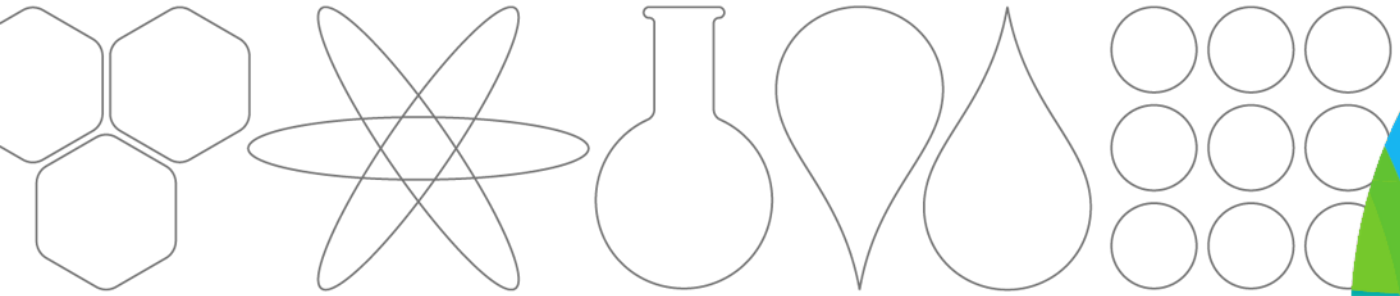
- Find your interest area and become an expert
- Network
  - Informational interviews
  - Conferences
  - Trainings
- Maintain good relationships
- Know your audience
- Look for allies everywhere

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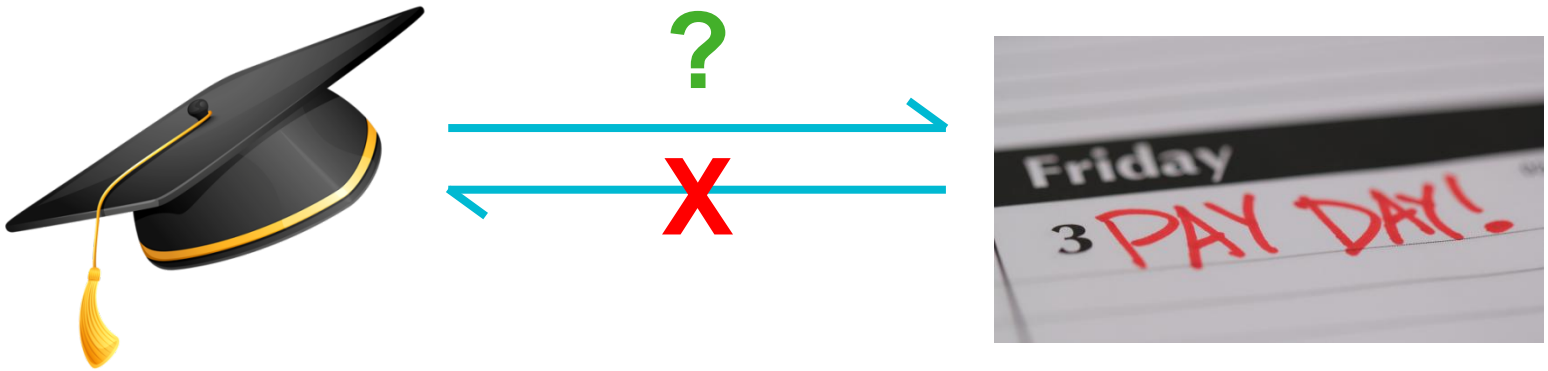
if it matters, we're on it.®

Green Chemistry Careers in Industry

Jon Smieja, PhD

Sustainable Design & Development Leader



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THE STORY OF JON

From small town farmer to small town sustainability leader… and everything in between

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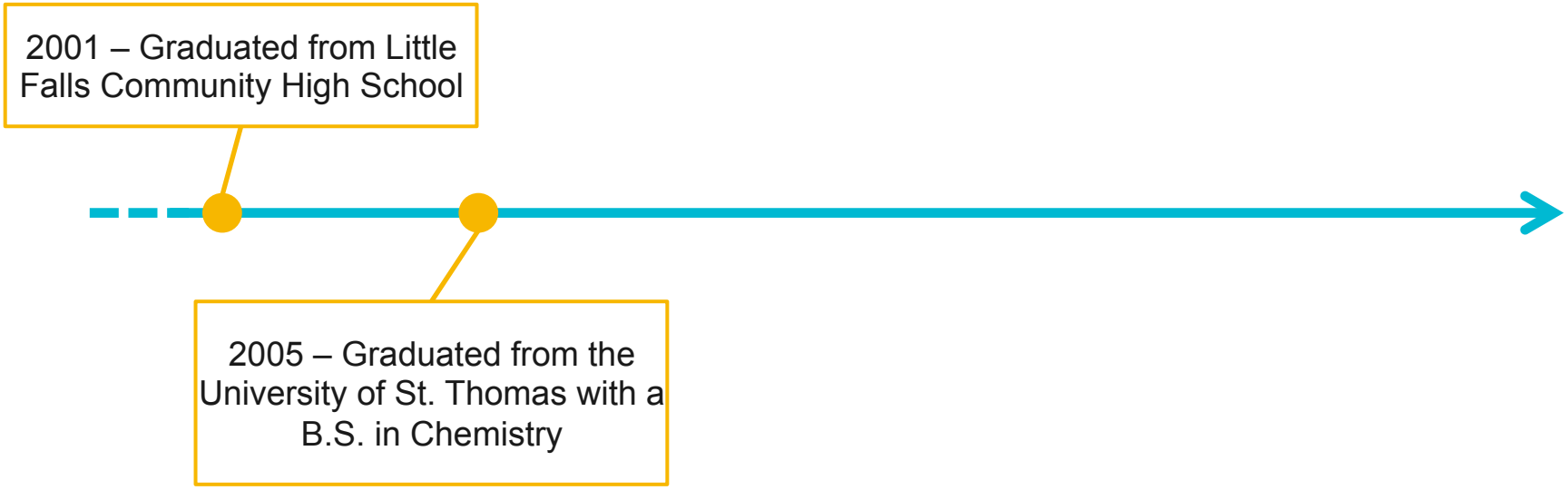

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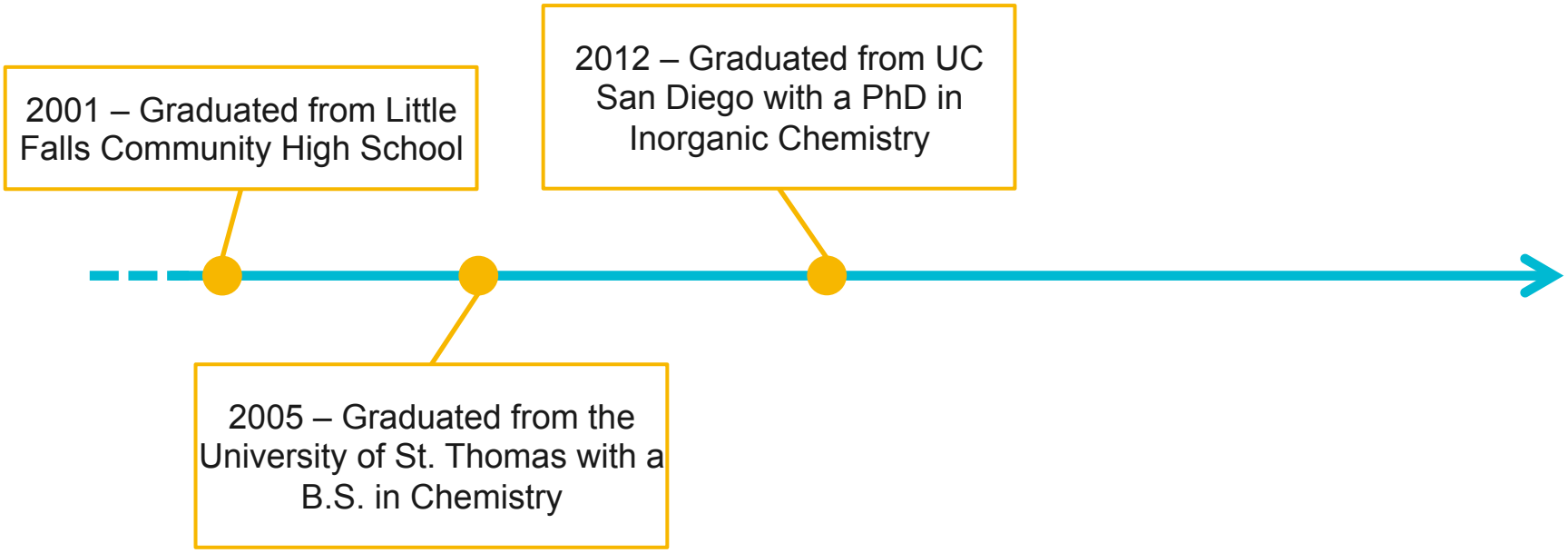

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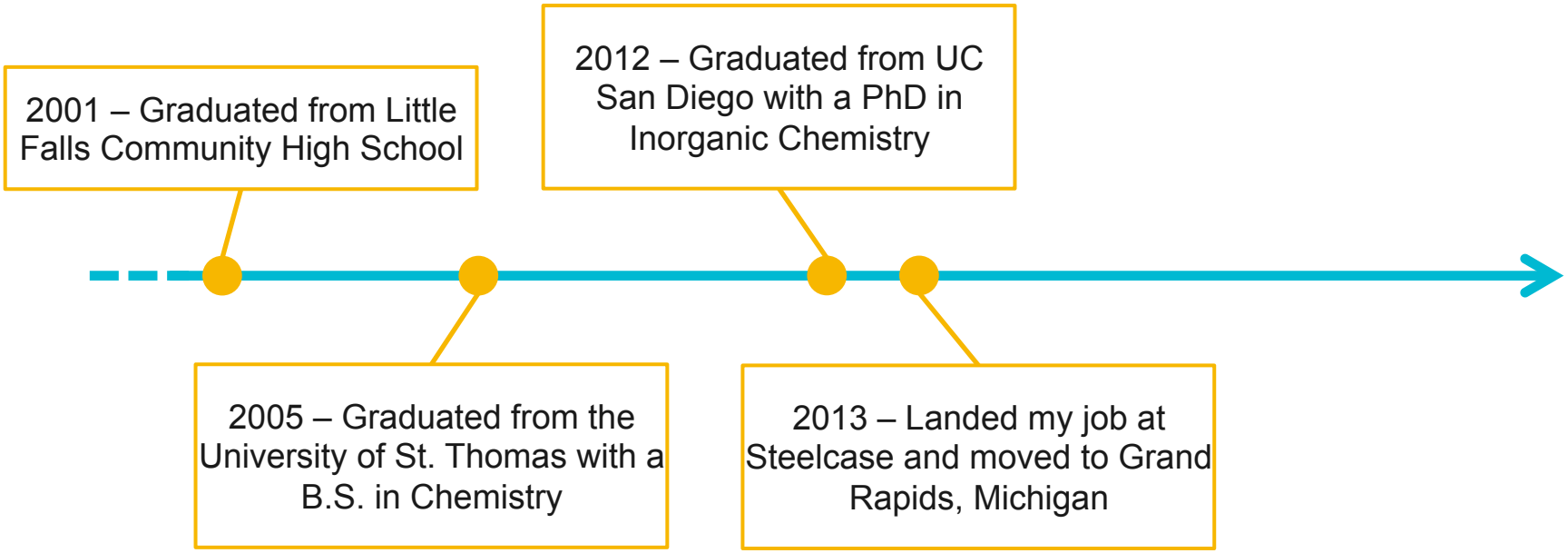

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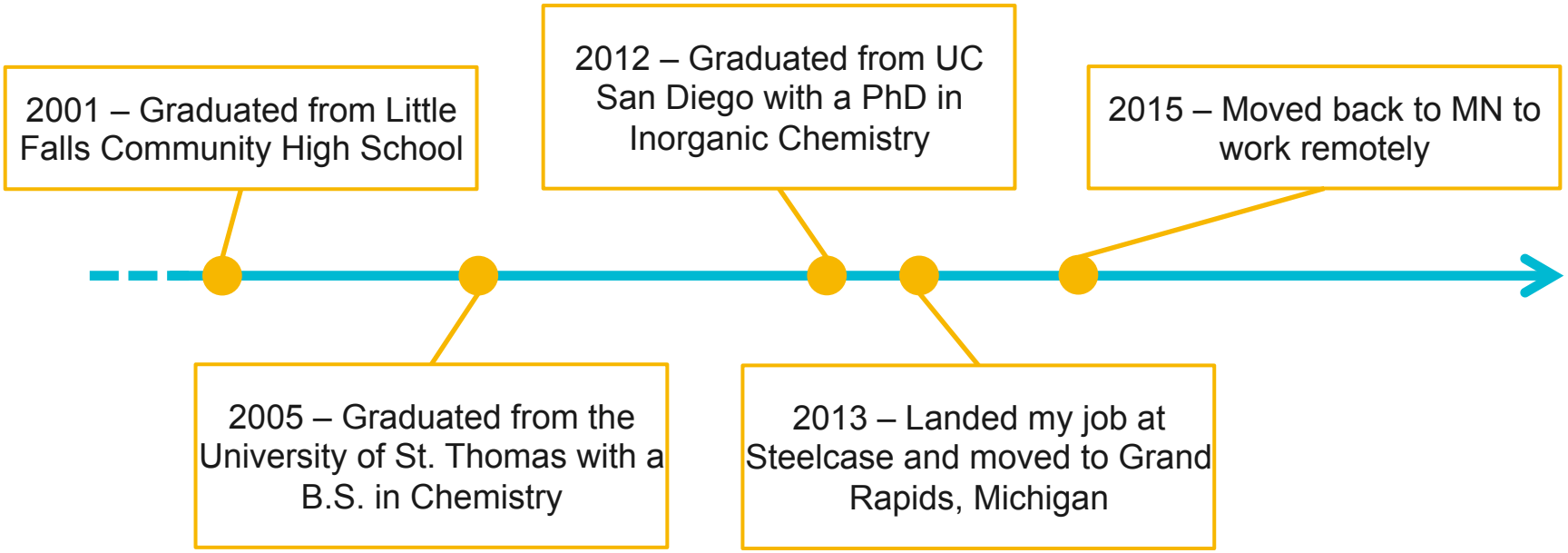

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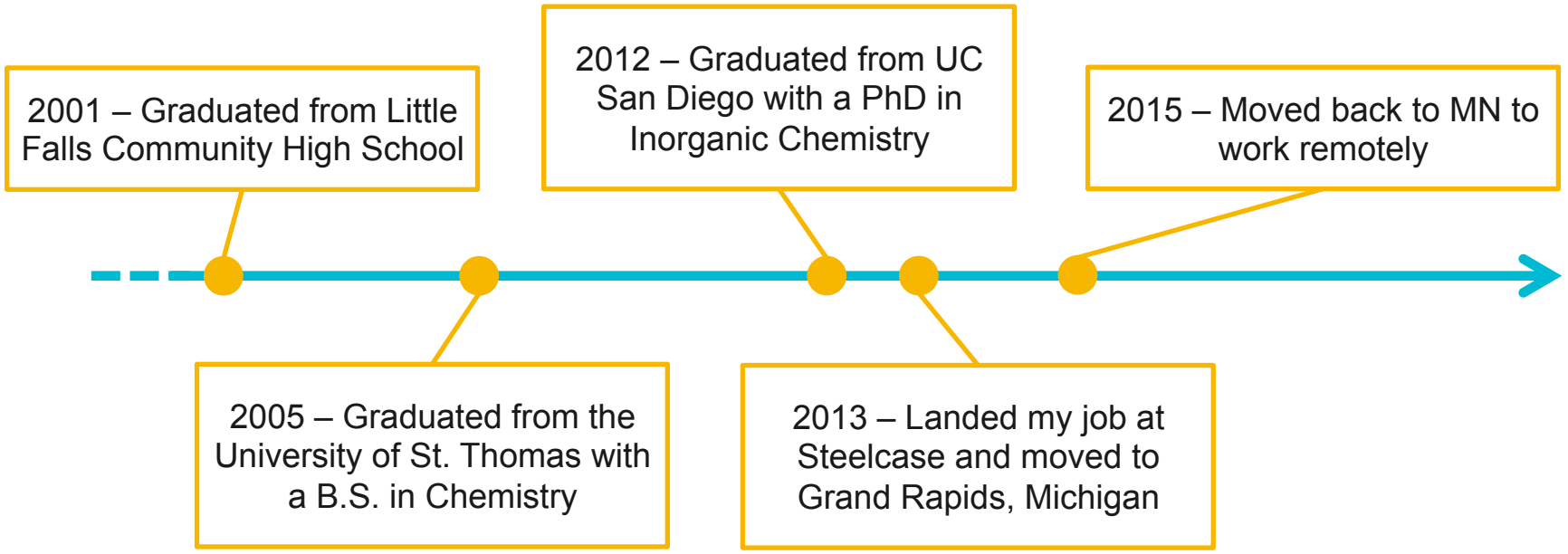

What's maybe more important than the main bullets here, though, are the spaces in between. That is where all the decisions, pain, and heartache can be found… and good stuff, don't forget about the good stuff

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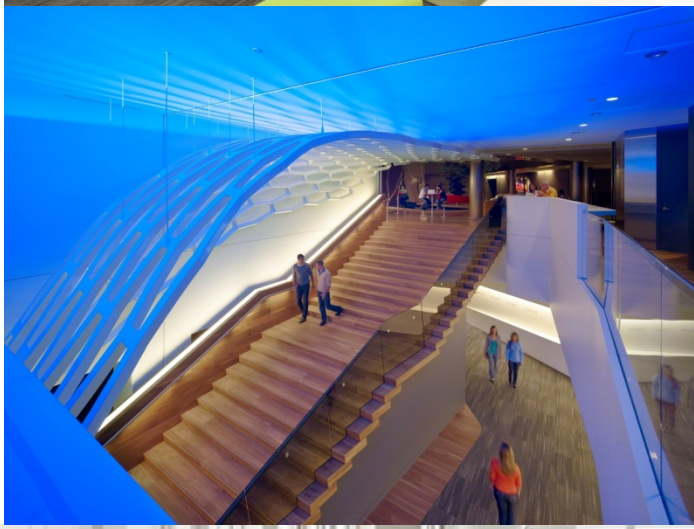
Steelcase in a nutshell (or a text box)

- Founded in 1912
- Global company with >9,000 employees
- Complete office furnishing provider

- Strong history of sustainability dating back to some of the founders of the company
- First company to certify a product to the Cradle to Cradle standard
- Been working in in earnest in the green chemistry space since 2004
- Sustainability team has 20+ members as well as many other advocates and people with direct responsibility for sustainability throughout the company



A message from the top

Steelcase is in the **people business**. While it's true we are a global leader in creating products and solutions for offices, schools, healthcare facilities and other workplaces, our larger purpose extends far beyond what we create. **Sustainability plays a vital role in achieving that goal**.

We believe **sustainability is about creating the economic, social and environmental conditions that allow people and communities to thrive**. We also believe it is an innovation lens and a pathway to ensuring our company is positioned to serve all of our stakeholders' needs well into the future.

This perspective influences everything we do – from the products we deliver to the research we conduct, the investments we make to the opportunities we explore. **Sustainability is a systems approach** to how we do business and it continues to produce results year after year.

Jim Keane
CHIEF EXECUTIVE OFFICER

Areas of focus

TOXICITY

CONSUMPTION

WASTE

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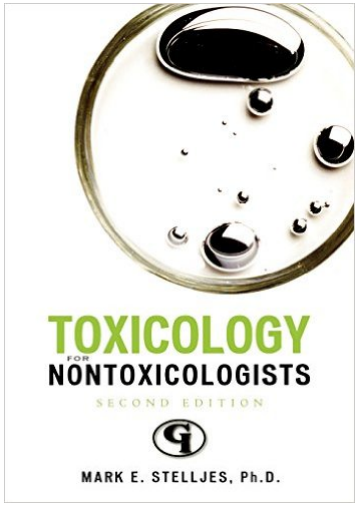
You could call it “on the job training”



GreenScreen®
Practitioner Program

HOW YOU SHOULD START OUT

Three tips for any chemist that I wish I would have known

1. Learn toxicology and green chemistry if you have the chance (become an expert)

2. Don’t avoid large corporations in your job search (for multiple reasons)

3. You still have to talk to people… sorry (networking is the most important thing)

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Thank You

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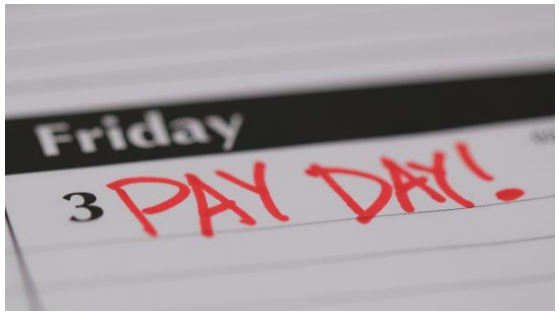

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Question & Answer

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- Questions will be answered in order as they are received.

Upcoming Events

GC3 WEBINAR

Innovating with Intent: Science & Sustainability at Eastman

April 13, 2016, 12:00 pm EDT

nesse WEBINAR

Making the Transition Towards a Sustainable Economy

April 19, 2016, 12:00 pm EDT

GC3 WEBINAR

VAUDE – Our Journey to be the Most Sustainable Outdoor Brand in Europe

April 26, 2016, 12:00 pm EDT

Thanks for joining us!

For more information about the GC3:
www.greenchemistryandcommerce.org

GC3 GREEN CHEMISTRY & COMMERCE COUNCIL
Business Mainstreaming Green Chemistry

Training possibilities (fortunately too much to list all resources..)

- **Some links to undergraduate/graduate studies**
  - Green Chemistry Academic Programs (US)
  - York undergraduate and Postgraduate Studies:
  - Strasbourg Green Chemistry Master
  - Lüneburg Leuphana Sustainability Master
  - European Doctoral Programme on Sustainable Industrial Chemistry
  - etc.

- **Some links for continous professional education:**
  - **Continuous education in Green Chemistry**
  - **UW-Online certificate program in green chemistry and chemical stewardship***

    COURSE I: SUSTAINABILITY, TOXICOLOGY & HUMAN HEALTH
    COURSE II: PRINCIPLES OF GREEN CHEMISTRY
    COURSE III: ASSESSMENT TOOLS FOR SAFER CHEMICAL DECISIONS
  - **Paper summarizing «** Green Chemistry for Postgraduates **»**

***inspired by the UC Berleley Green Chemistry certificate program, discont.**