Managing a Research Program

Following a research project through the scientific process

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Scientific Method
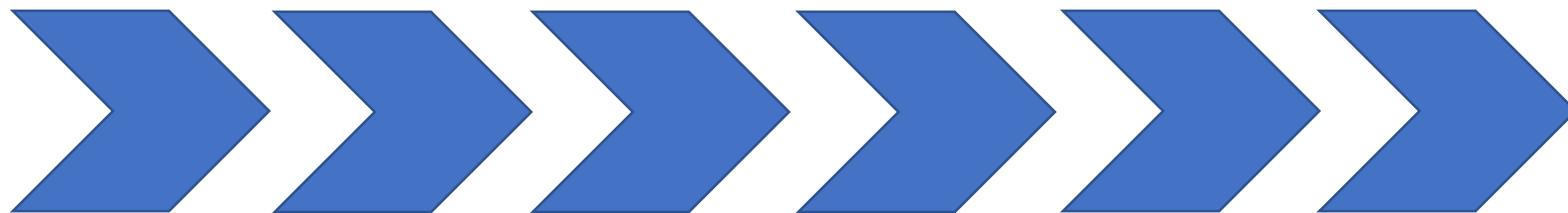
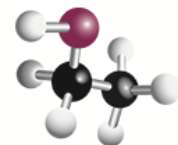**Question** **Research** **Hypothesis** **Experiment** **Analyze** **Conclude**

Question
Research
Hypothesis
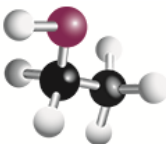## Experiment
Analyze
Conclude

- **What do we want to know?**
  - Define Scope
    - Breadth of the project
    - Research project vs. program
  - Define Objective
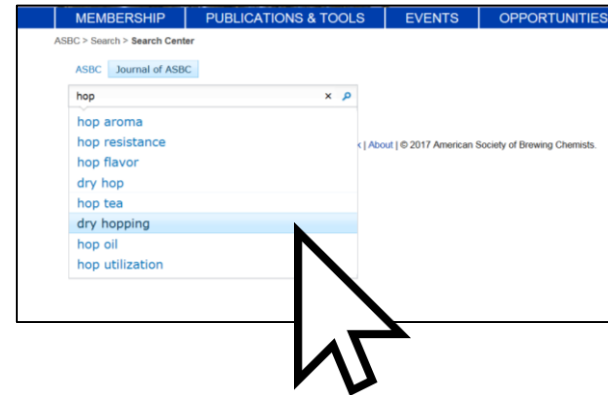   - Goals or benefit to achieve or accomplish

- **Why do we want to know it?**
  - Provide Background
    - Context to support the research question

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Question

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- **What can we find out?**
  - Externally
    - Relevant literature search
  - Internally
    - Project background
    - Past experience
    - Observational studies
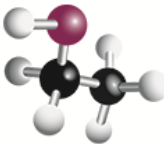
- **Predict what will happen.**
  - Review Knowns

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- **How to test the hypothesis:**

  - Consider the Result
    - What measurements will help answer the objective?
  - Resources and Materials needed
    - Analytical instruments and tools
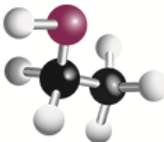   - Individuals or groups that will be pulled upon

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Brewhouse

Cellar

Filtration

In-process analysis

In-process observations

Packaging

Sensory tests

Outside laboratory tests

R&D/Raw Materials analytical tests
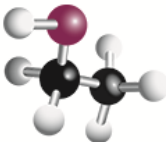
Local QA analytical tests

- Resources and Materials needed (cont.)
  - Teamwork
  - Work with area expertise

- Set Priority

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| Brewery	Sierra Nevada Brewing Co. Production Study Request Form	Assigned project number
Brand		**Date initiated:**
Requested by		**Category**
Will the project be managed by the brewery?	**If yes, who from the brewery will be managing the project?**	**Assigned R&D liaison (if leader is not from R&D)**
Does the project require immediate attention and why?		
Assigned folder for project documentation:		

TITLE

OBJECTIVES
(Goals or benefits that you want to achieve or accomplish)

BACKGROUND

EXPERIMENTAL DESIGN & DECRIPTION
(Procedures and requested support for executing the project to achieve the objectives)

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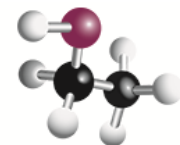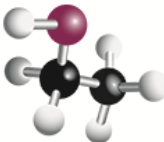
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- Experimental Design Principles
  - Importance of the **Control**
    - No treatment
    - Necessary benchmark
  - Randomize influential factors for **Test(s)**
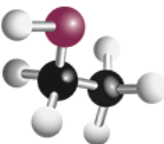
Question

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- Good Practices
  - Consistent ingredients
    - Specify lots/batches
  - Consistent equipment
    - Multiple brewhouses
  - Consistent processes
  - Consider volume
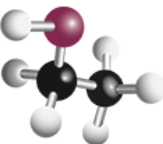 - Splitting batches
  - Specials to the filler

- Methodology:
  - Sampling
  - Measurements
  - Testing procedures
    - ASBC MOA
    - Internal SOPs
  - Replications
  - Stability/Aging

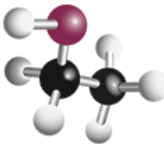Question

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Sensory Experimental Design

| Testing Questions	Types of Tests Available
Is the test different than the control?	Bench test, Triangle test, Paired Comparison
How is the test different than the control?	QDA, Profile
Quality Control - Are there any defects?	Release Go/No-Go, True to Type, QDA, Profile
Does the beer match the expectations of the style?	Release Go/No-Go
Are we able to differentiate our beer brands?	Triangle test, Matching Lexicon, QDA, Profile, PCA
Is the test typical of the brand profile?	True to Type, Profile
What is the impact of time?	Consecutive Triangle tests, consecutive Profiles, Age Ranking and Rating, PCA
Which one is the most liked?	Consumer Preference, Hedonic Scaling
Is the new flavor improved?	Consumer Preference, Hedonic Scaling

• Control and Test(s) Brews

- If it goes according to plan…this happens in a blink of an eye…or at least within a few brews.
- Fastest part **IF** there was adequate communication and information provided
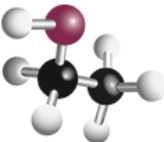
Question
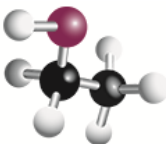## Research
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- ## Analyze Test
  - First ensure that the experiment went according to plan
  - Review brewing specs of test and control
  - Prior to analyzing the additional analytical requests
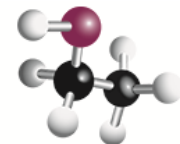
- ## Then Analyze Results

Question

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- **What have we learned?**
  - Communicate again!
  - Share findings
    - Recap emails
    - Technical or business reports
    - Research group presentations
  - Relevance to the company
    - Information can be very motivating
    - Helps with support the next time

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- **Follow up studies!**
  - Typically the results of one question creates more or new questions.

Questions

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