So You Think You Can Innovate?

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Tools that Enhance Idea Generation
Tool 1: Finding the Right Question

- Right time and place

Example: Cervical cancer as an STI - needed PCR to identify HPV
Tool 1: Finding the Right Question

- Big questions
  Example: Jeremy Morris, father of physical activity: “What about social class alters CVD risk?”
Tool 2: Observation

• Normal observation becomes complacent
• Normal observation is biased by expectations
Tool 2: Observation

- Marshall and Warren win Novel Prize for discovery of *H. pylori*
Tool 3: Analogy

• Kekule: Structure of benzene as a snake seizing its own tail
• Bell: Electromagnetic vibration as human voice
• Jenner: Cowpox protection as smallpox protection
Tool 4: Juggling Opposites
Deduction and Induction

• Induction: Mendel observed thousands of pea crosses
• Deduction: Einstein moved from axioms to theorems
Tool 4: Deduction and Induction

• Innovation combines induction and deduction
• Eg: Darwin observed beak size variability in finches. Through a leap of logic he inferred that some beaks out-competed others in a given environment
Tool 5: Change Your Point of View

- Darwin imagined himself as a plant
- Einstein imagined traveling at the speed of light
- Montessori imagined herself as a child
Tool 5: Change Your Point of View

- Imagine yourself as a teenager in West Texas deciding whether or not to keep an unintended pregnancy.
Tool 6: Broadening Your Perspective

• Ancel Keys: Father of the Mediterranean Diet
• Expanded his research network to create the first international comparisons of heart disease: Japan, Greece, Finland
Tool 6: Broadening Your Perspective

- How can we provide more nutritious foods in America’s lunchrooms?
- How do we get America to eat better?
Tool 7: Reversal

- Serendipity: a “happy accident”
- Alexander Fleming: father of antibiotics
- Joseph Goldberger: presence of infection vs. absence of nutrient as the cause of pellagra
Tool 7: Reversal

- Medicine: Presence of disease
- Public Health: Absence of disease

- Implications for obliviousness to absence
  - Hard to get people excited
  - Hard to get compliance
Tool 8: Reorganization and Rearrangement

- Functional fixedness: a particular object implies a particular use
- Candle experiment: attach the candle to the wall
  - Candle
  - Book of matches
  - Box of thumbtacks
Tool 8: Reorganization and Rearrangement

- Combining disciplines
- Nanoparticle engineers and pharmacologists to create new systems for drug delivery
Tool 8: Reorganization and Rearrangement

• How might you design a neonatal incubator for developing, resource-poor settings?
Tool 9: Brainstorming Group

DARPA: Red Balloons

Challenge: Ten 8 foot high, fixed bright red weather balloons at random locations around the U.S. $40,000 to the first person or team to find all 10 balloons.
Tool 9: Power of Groups

- “C” Factor
- Groups performance on wide range of intelligence tasks
- Not strongly correlated with individual intelligence
- Correlated with social sensitivity (e.g., inclusiveness) of group

Woolley, Science 2010
Tool 9: Brainstorming Group

- Generates > 100 ideas/hour
- Divergent thinking first
- Convergent thinking next
Harmonizing

- Idea Generation and the Scientific Method
Define the problem
Gather information
Separate raw inputs from frames
Generate alternative, original ideas
Converge on most useful insights/hypothesis
Develop action plan to test hypothesis
Death: scary, sober, mysterious

Approach with awe, fear

Few people have advance directives
Thinking Outside the Box

- Death and taxes
  - Tax form for advanced directives
Summary

Innovative thinking can be taught

Key is thinking outside frames

Tools include:

- Alternative framing and metaphors
- Kenner observation
- Awareness of cognitive biases
- Analogy
- Expansion
- Reversal
- PO
- Etc
INNOVATION
How to Produce Creative and Useful Scientific Ideas
GENERATION
ROBERTA NESS, MD, MPH

CREATIVITY IN THE SCIENCES
A Workbook Companion to Innovation Generation
MICHAEL L. GOODMAN, AISHA S. DICKERSON, AND ROBERTA B. NESS

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