

# *The Medical Dosimetrist as a Critical Thinker*

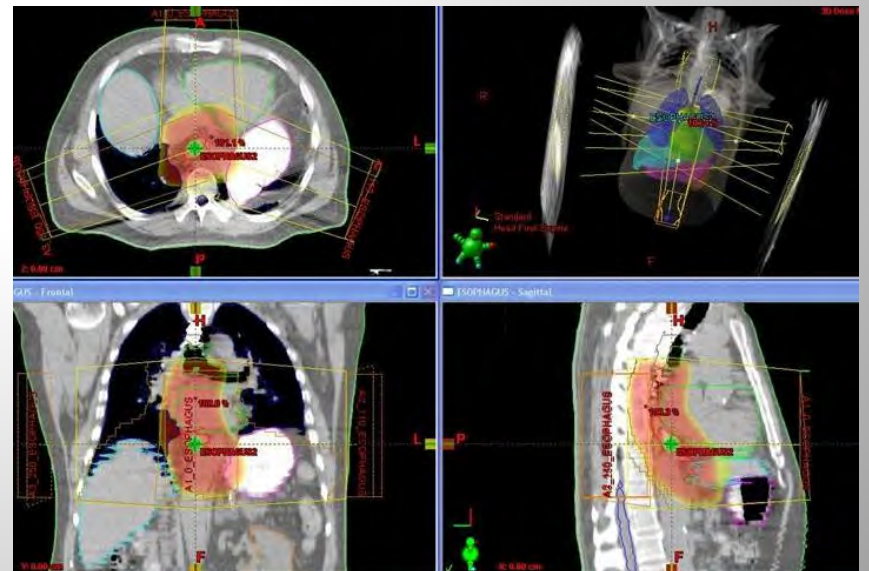
Anne W. Greener, M.S.

Chief Medical Physicist

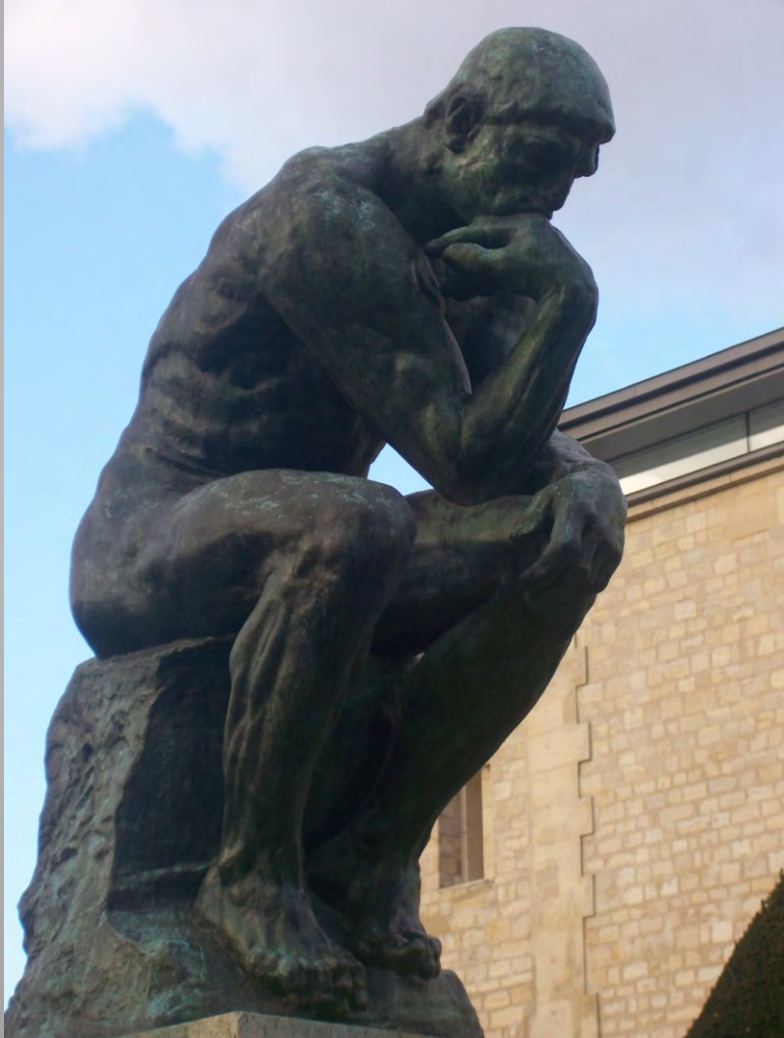
East Orange Veterans Hospital, East Orange, NJ

# *The Medical Dosimetrist*

- Member of the RT Team
- Good communicator
- Proficient in math, physics and radiation biology
- Specialized in computer modeling and treatment techniques
- Responsible for developing optimal radiation plans



# *“Critical”* *The Thinker*

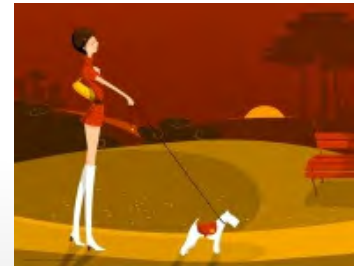
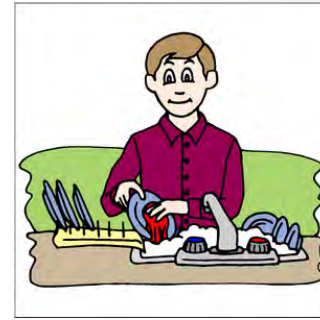


“Thinking is the hardest work there is, which is the simple reason so few engage in it.”  
Henry Ford

“To be or not to be?”  
Shakespeare

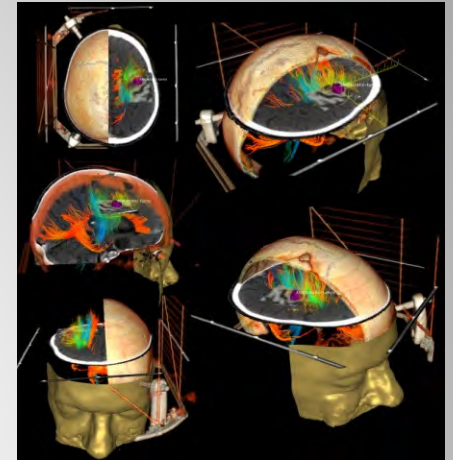
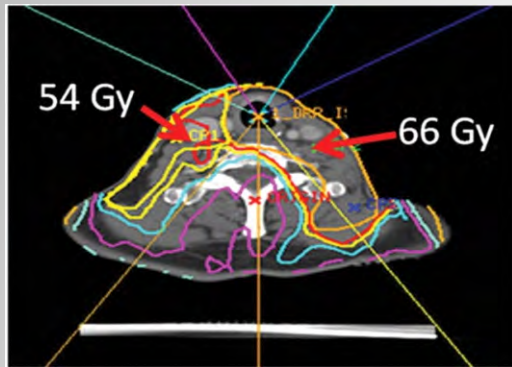
“Think left and think right and think low and think high. Oh, the thinks you can think up if only your try!”  
Dr. Seuss

# To Think???



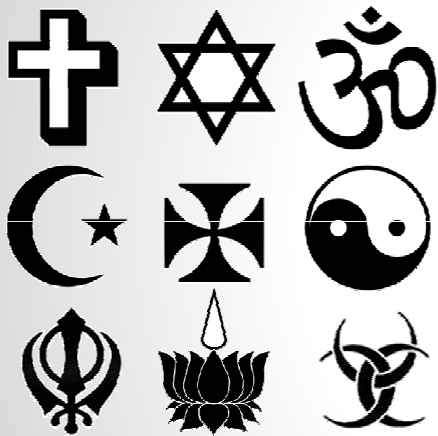
# Routine Tasks

# Unique Situations



# *Intangible Decisions*

Religion

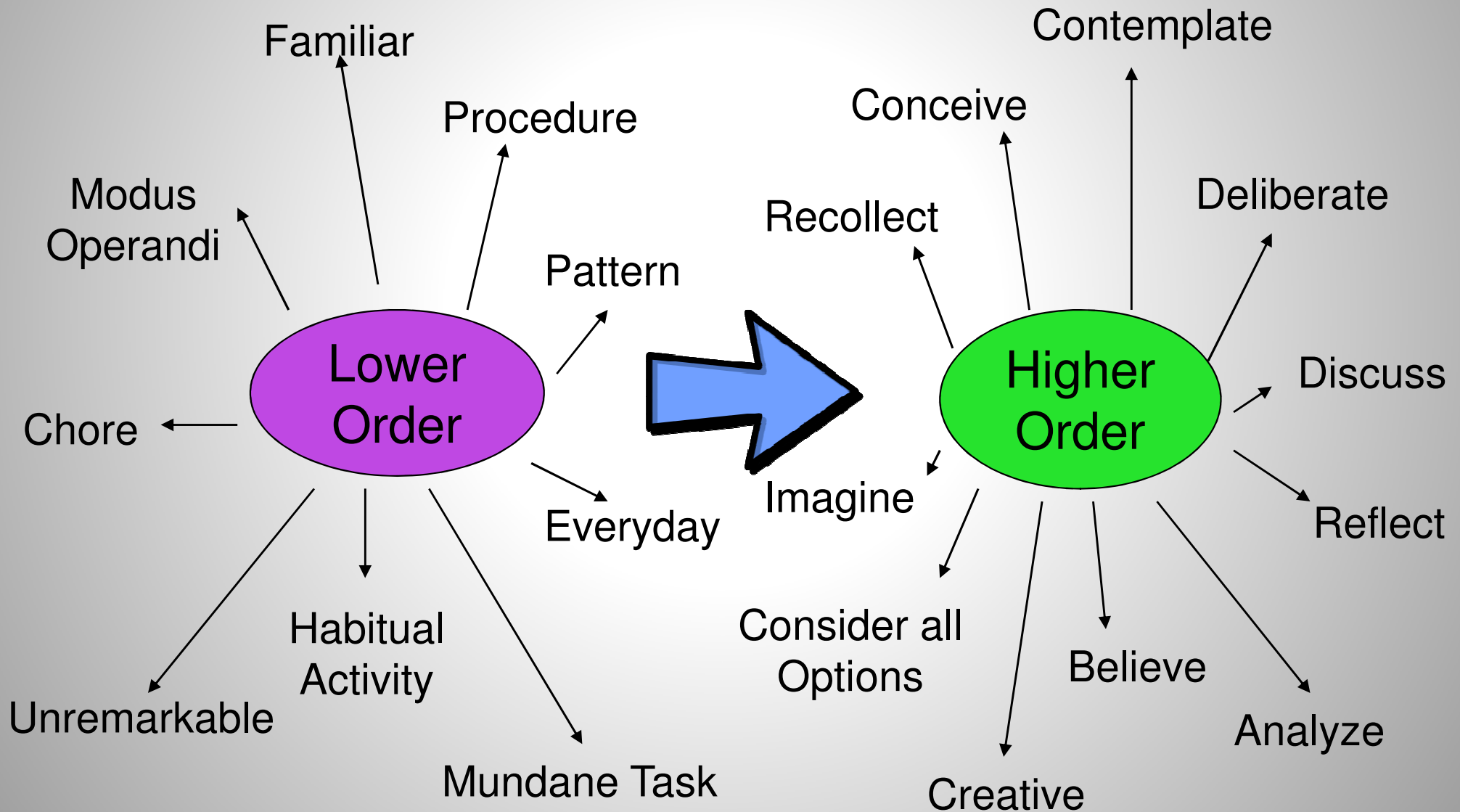


Politics

Love



# *Process of Thinking*



*Critical Thinking??*

A New Concept??

# SOCRATES



Greece  
469-399 BC

Followers:

Plato (philosopher)

Aristophanes (playwright)

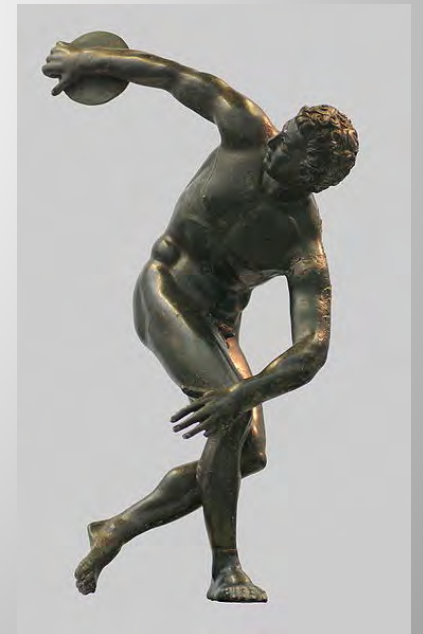
Xenophon (soldier, historian)

# *Ancient Greece*

Politics



Olympics



Philosophers

“As for me, all I know is nothing.”

“ It is not living that matters, but living  
rightly”

“True wisdom comes to each of us when  
we realize how little we understand about  
life, ourselves, and the world around us.”

Socrates

# *The Socratic Method*

Questions, Questions, and more Questions!!

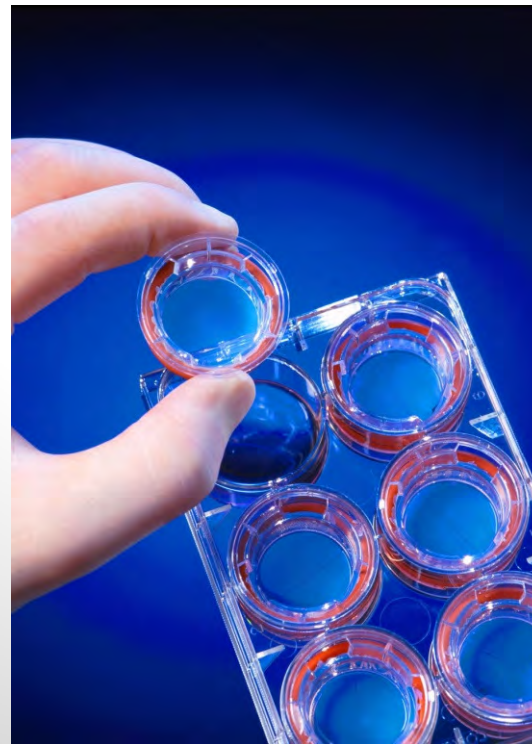
LAW



MANAGEMENT



SCIENCE



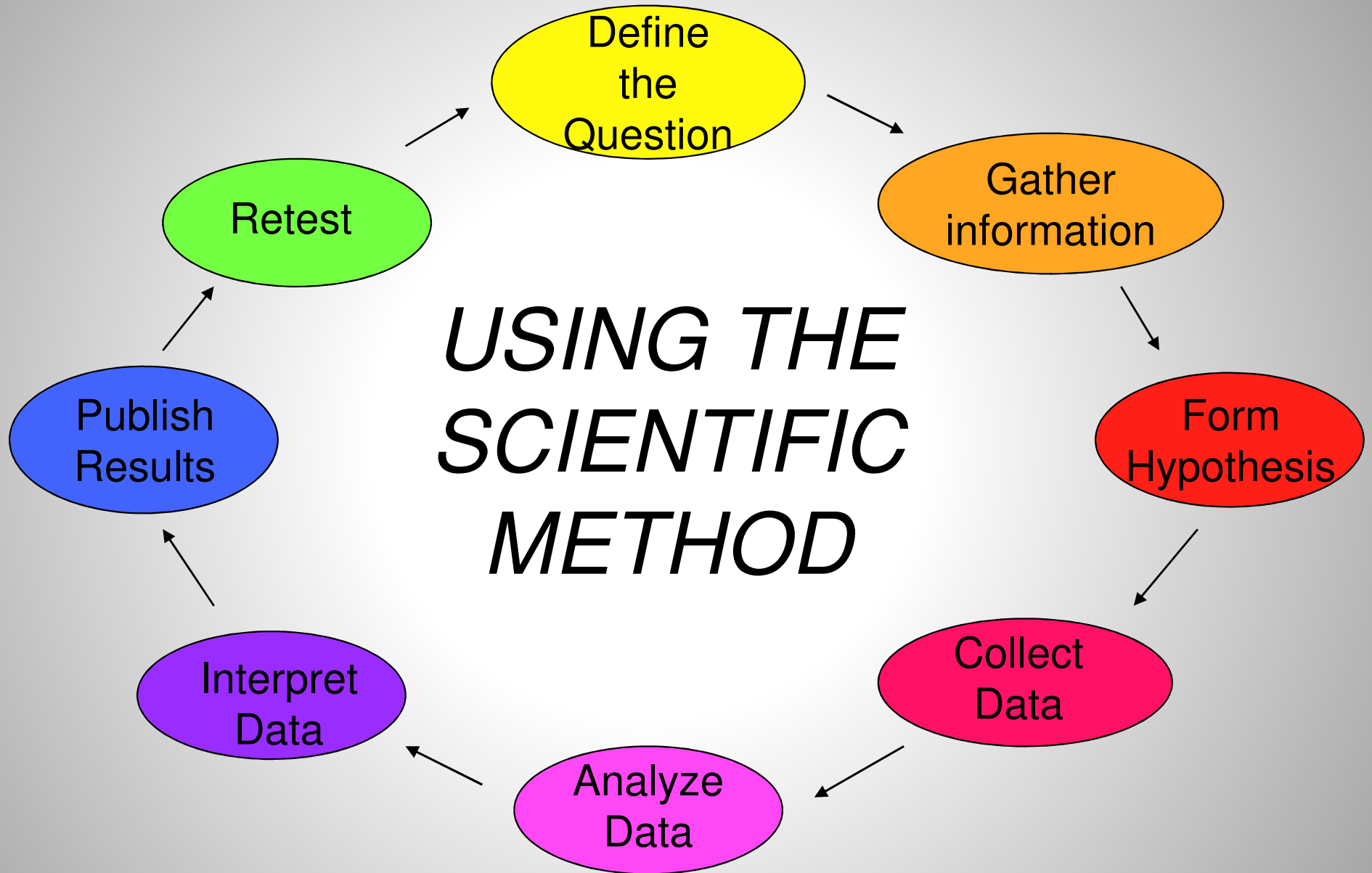
HEALTHCARE



EDUCATION



# *USING THE SCIENTIFIC METHOD*



# Health Care



Food  
Pyramid

Evidence-based  
Medicine



Magnet Therapy

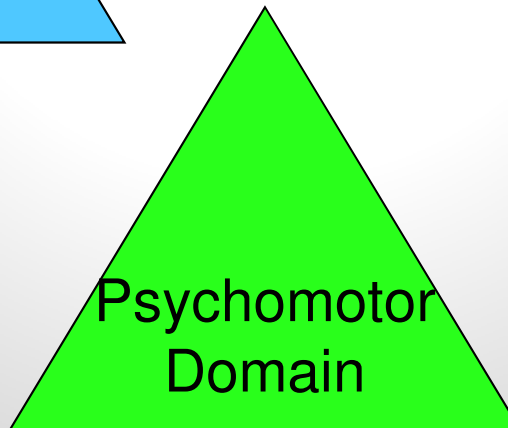
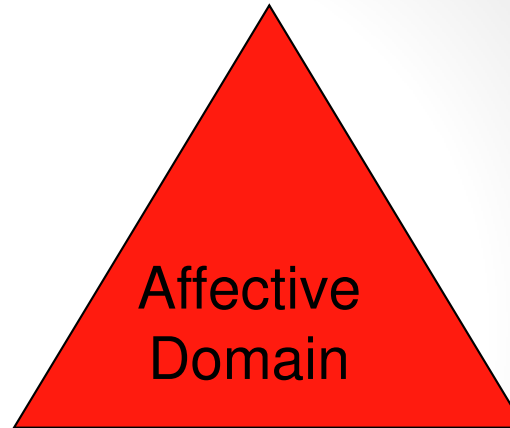
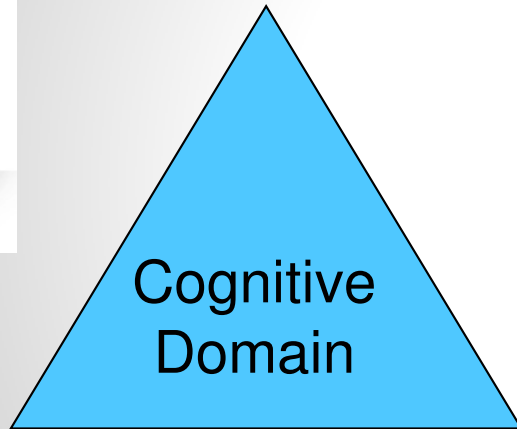
# *Constructivist Theory*

*“Knowledge is not about  
the world, but rather  
constructed of the world”*

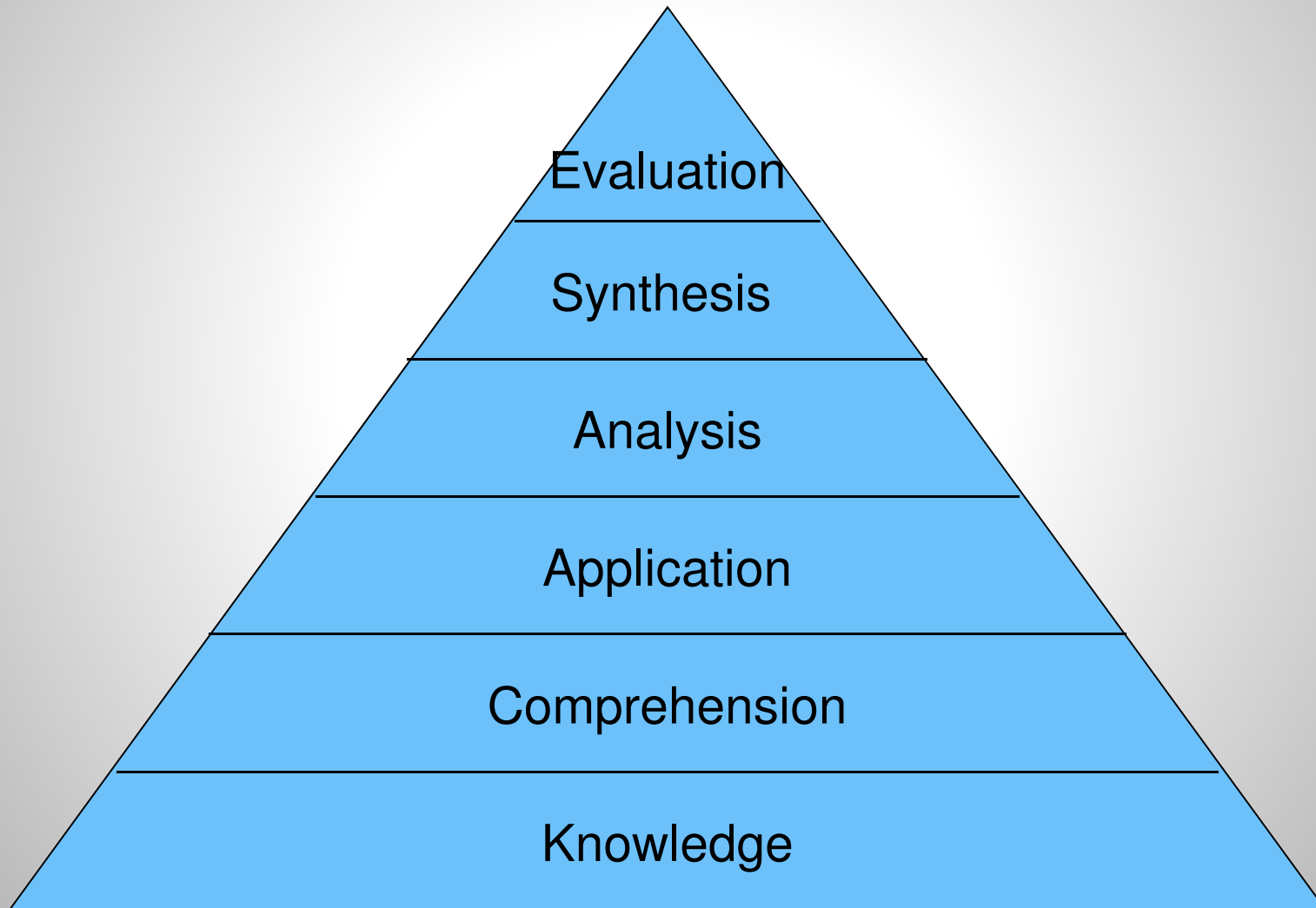
William Kilpatrick (1925)

# *Bloom's Taxonomy*

(1956)



# *Cognitive Domain*



*Critical Thinking*  
Education . . . Evaluation

# CT Assessment Tools

Tool	# of Items /Time	Professions	Reliability	Strengths and Limitations
Watson-Glaser Critical Thinking Appraisal (WGCTA)	80 passages (60 min)	Management, Education, Nursing PT, OT, RTT	Cronbach's Alpha = 0.81 R = 0.20-0.62	Measures overall CT ability
Ennis-Weir Critical Thinking Essay Test (EWCTET)	9 paragraph essay (40 min)	High School and college Students, Nursing, Social workers	IRR = 0.86, 0.82	Open-ended questions
California Critical Thinking Skills Test (CCTST)	33 items (50 min)	Educators, Medical Students, Nursing PT, AT, OT Dental Hygiene	KR = 0.77-0.84	Total score and 5 sub scale scores
California Critical Thinking Disposition Inventory (CCTDI)	75 items (20 min)	Business, Military, Students, OT, PT, Nursing Dental Hygiene		Measures Disposition toward CT - overall score and equal weight to 7 subscales
Health Sciences Reasoning Test (HSRT)	33 items (50 min)	OT, PT, Nursing, Medical Students	KR = 0.81	Measures CT ability specifically for Healthcare professionals

*Three graduate school friends, Anna, Barbara, and Carol, graduated successfully. Being in the same program, the three often worked as a team on group assignments. Anna earned the special recognition of "pass with distinction" when she graduated. Carol and Barbara, although receiving their degrees, did not earn this special honor. A fourth student in the same graduate program, Deirdre, often said that the graduate program was poorly designed and not difficult at all. Deirdre did not graduate, instead she was advised by the faculty to withdraw from the program because her work was below acceptable standards. Given this information only, it follows that*

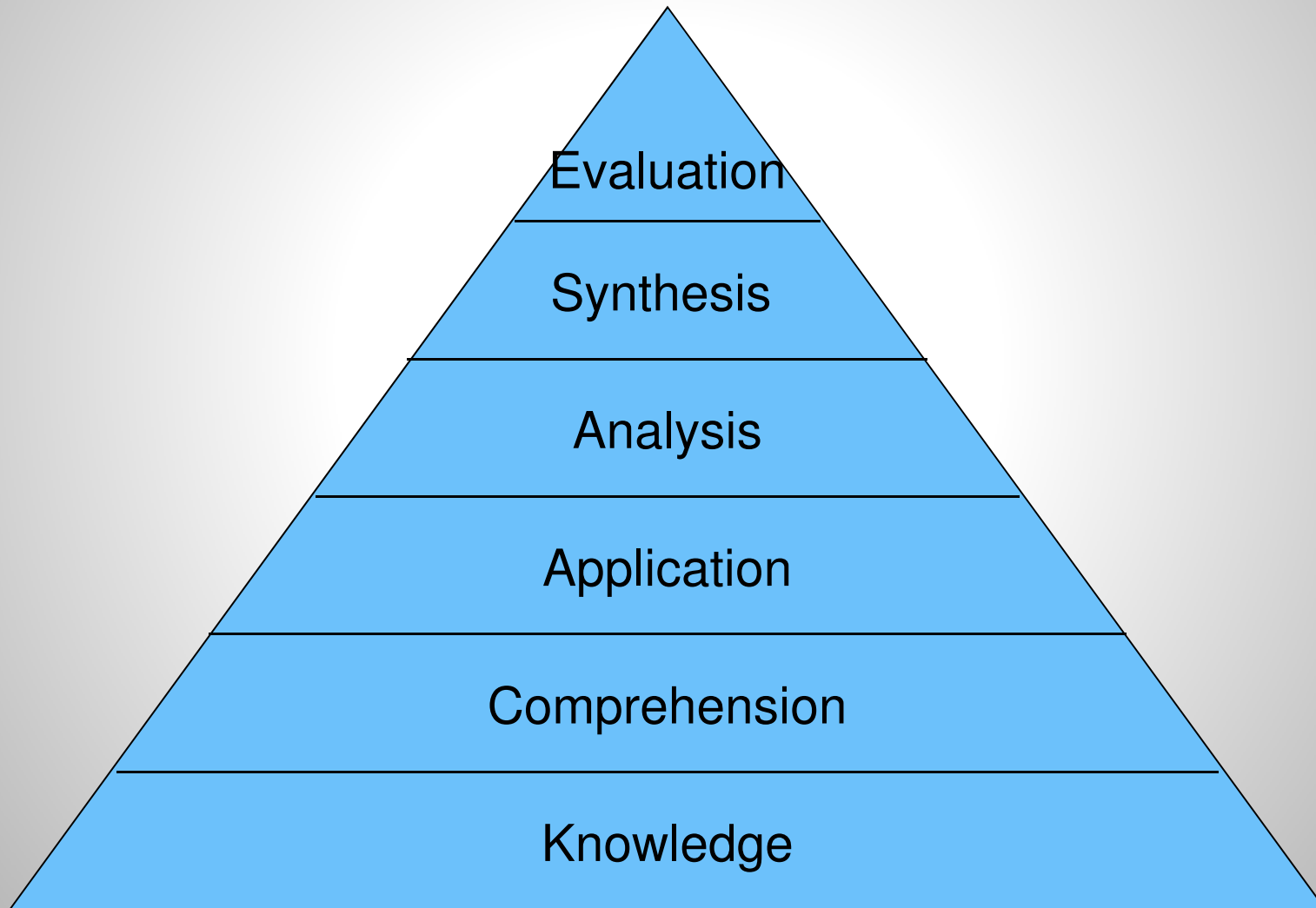
- A Carol and Barbara deserved to receive "pass with distinction" like Anna.**
- B Barbara's work in the program was superior to Carol's.**
- C Barbara was jealous of the academic success her friend, Anna, enjoyed.**
- D Deirdre's work in the program was below the quality of Carol's work.**
- E Anna, being successful, will decide to enroll in another advanced graduate program.**

*Consider the following comments about beliefs, opinions, values, and preferences. Decide whether you agree or disagree with each one. Remember that since you are being asked about your own beliefs, opinions, values, and preferences, there is no “right” or “wrong” response. The answer is whatever you say it is for you.*

- 6      Agree Strongly**
- 5      Agree**
- 4      Agree Marginally**
- 3      Disagree Marginally**
- 2      Disagree**
- 1      Disagree Strongly**

1. I hate talk-radio hosts because they shout out their views without really listening to the other side.
2. I won't let what scientists might say weaken my core beliefs.
3. I prefer jobs where the supervisor says exactly what to do, and exactly when and how to do it.
4. It's important to me to figure out what people really mean by what they say.
5. Don't kid yourself, changing your mind is a sign of weakness.
6. I always do better in jobs where I'm expected to think things out for myself.

# *Cognitive Domain*



*So What????*

# *The Medical Dosimetrist*

*The medical dosimetrist must demonstrate an understanding of topics including, but not limited to, cancer, radiation biology, radiation therapy techniques, radiation oncology physics, equipment technology, radiation safety and protection, anatomy, physiology, mathematics, and the psychosocial aspects of cancer. He or she uses **professional judgment** and **critical thinking** when performing treatment planning, recognizing and resolving equipment problems and treatment discrepancies, and recommending when treatment should be withheld until a physician can be consulted.*

AAMD, 2011

# *Scope of Practice*

*(examples)*

- Obtain and **synthesize** pertinent clinical data to facilitate the radiation oncology process.
- **Evaluate, critique, and recommend** changes to the radiation therapy process as necessary.

# *Standards of Practice*

*(examples)*

- Uses his or her **professional judgment** to recommend changes to imaging and therapeutic procedures to improve therapeutic outcome.
- **Evaluates** the patient and procedure to identify variances that may affect patient wellbeing. The evaluation process should be timely, accurate, and comprehensive.
- **Evaluates** the patient for any untoward effects, reactions, and therapeutic responses as directed by the quality assurance program, physician, or medical physicist.
- **Evaluates** the process and recognizes opportunities for future changes.
- **Evaluates** the treatment planning process.
- **Evaluates** the prescribed objective and develops plan(s) for therapeutic treatment, applying professional judgment and discretion.
- **Evaluates** performance and **recognizes opportunities for improvement.**

*What is a Critical Thinker?*

# *The Ideal Critical Thinker*

Inquisitive, well-informed, open minded, flexible, honest in facing personal biases, prudent in making judgments, orderly, willing to reconsider, diligent in seeking relevant information, focused in inquiry, self-reflective, and persistent in seeking results. (APA, 1990)

# *Critical Thinking in Health Science Professions*

- CT is like **solving a puzzle**. **Clinical reasoning is deliberation** about what is the appropriate action in a particular case, with a particular patient, at a particular time. (Mattingly, 1991)
- High order thinking occurs when a person takes new information and information stored in memory and **interrelates and/or rearranges and extends** this information to achieve a purpose or find possible answers in perplexing situations. (Lewis, Arthur & Smith, 1993)
- To promote CT, education should be **inquiry-based**. Move from reproduction of knowledge to production of knowledge. (King, 1993 and 1995)
- CT is **reflective judgment** grounded in relevant data. (Leming, 1998)
- Practitioners belief systems and CT influence clinical decisions. **Evidence based models** provide principles and guidelines for clinical practice. (Kamhi, 2011)
- CT is **applied rationality**. A set of skills that people can learn and apply in their everyday lives. (Finn, 2011)

# *What Do We Know?*

## Standardized Certification/Licensing Tests

- In most Health Science professions **certification and/or licensure** is highly recommended or mandatory to practice.  
(ASRT, 2010, NCCPA, 2010, BOCATC, 2009)
- **Standardized tests** have been utilized for assessment.  
(Linn, 2001, Geiser & Studley, 2002)

# *What Do We Know?*

## Education and Training

- Athletic Training candidates who attended an **accredited** program had higher pass rates on the NATABOC.  
(Starkey & Henderson, 1995; Williams & Hadfield, 2003)
- Athletic Training certification candidates with a **high critical thinking ability** have a greater chance of passing the certification exam. (Colt, 2007)
- Relationship between critical thinking skills of Physical Therapy students, **academic performance**, and **success** on the NPTE.  
(Vendrely, 2006)
- **Baccalaureate** Occupational Therapy students had higher critical thinking skills than those without a degree. (Lederer, 2007)
- **Graduates of degree programs** might perform better on advance practice examinations in Radiologic Technology.  
(Raymond and Washington, 2002)

*What does this mean for the  
Medical Dosimetry  
profession?*

# Medical Dosimetry Certification

Route	Educational Requirement	Medical Dosimetry Clinical Training
1	Graduate of JRCERT accredited Medical Dosimetry program of at least 18 months duration (Certificate, Baccalaureate, or Masters). Currently, 15 JRCERT accredited programs + 1 under review with a total capacity of 130 students.	
2A	B.S. (in related science)	24 months
2B	RTT	24 months
3	B.A. or A.S.	36 months

***In 2013: Routes 2 and 3 merge into one:***

***Baccalaureate in any major or RTT + 36 months clinical training***

***Proposed in 2017: One route: Baccalaureate and JRCERT graduate.***

# *Why the Change?*

## CARE Bill

Consistency, Accuracy,  
Responsibility and Excellence in  
Medical Imaging and Radiation  
Therapy Bill (H.R. 2104)  
reintroduced on June 2, 2011

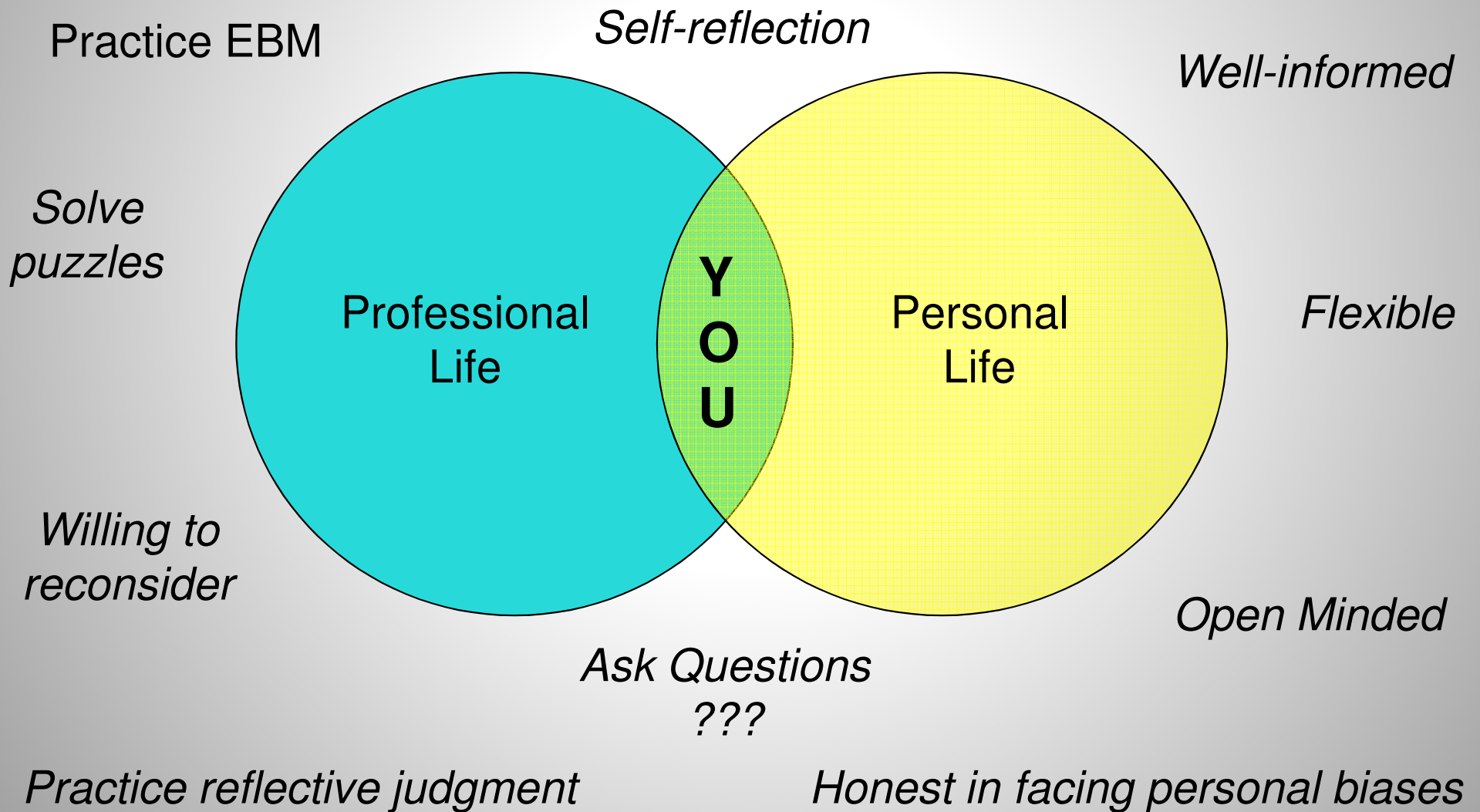


## BLS and IRS

Medical Dosimetry  
should be an  
Independent Medical  
Profession. Currently a  
subset of Radiation  
Therapist



# *Thinking Critically!*



***Thank you***

*“Learn from yesterday,  
live for today,  
hope for tomorrow.  
The important thing is not to  
stop questioning”*

Albert Einstein