

# RADIATION CROSSLINKED SHAPE MEMORY POLYMERS

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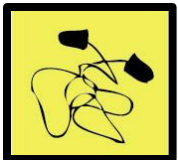
11/18/2010

“Shaping the Future”

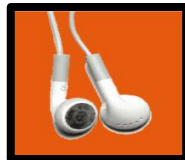
# Meet the Joneses



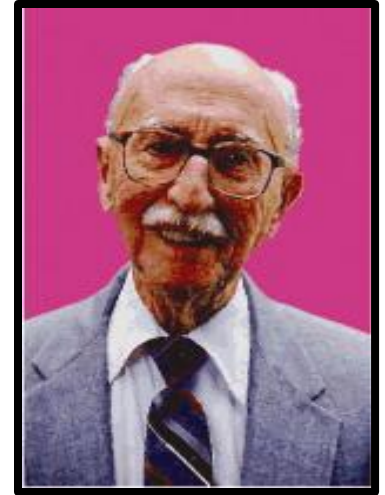
□ Sam



□ Luke



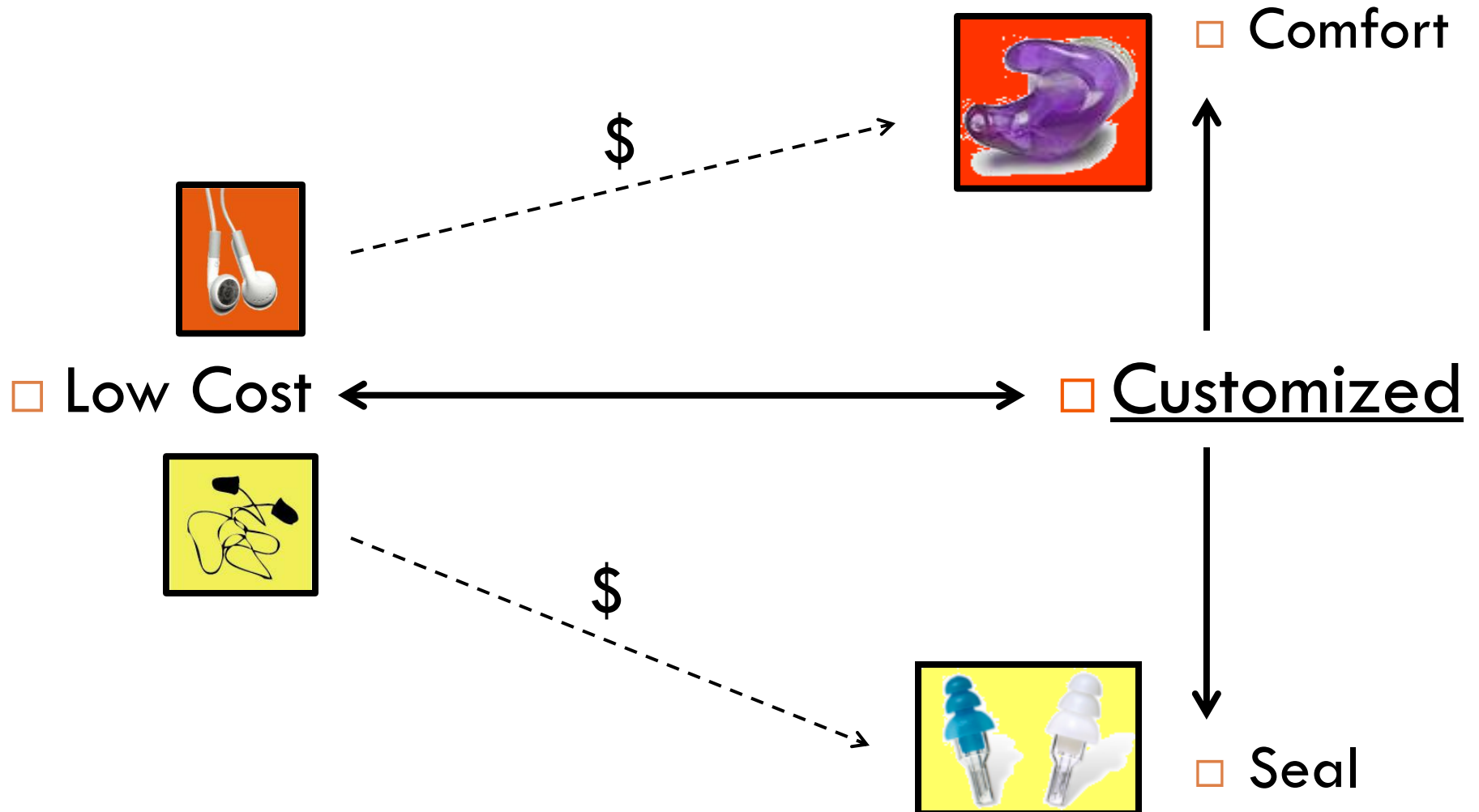
□ Margi



□ Joe



# The Pain: Nothing Fits



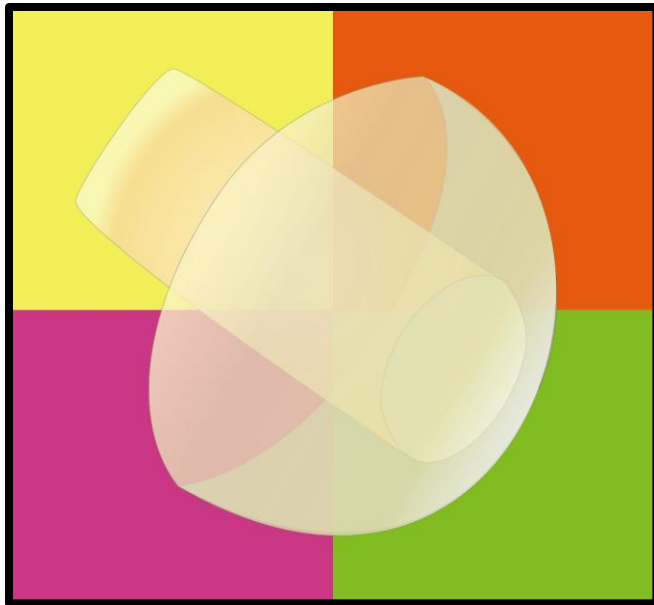
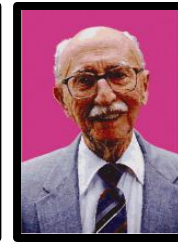
# The Technology



- Shape Memory Polymers
  - Do not melt
  - Cross link
  - Recover shape
  
- We can optimize properties
  - Set critical temp (when to seal)
  - Tune recoverable force (comfort)

**Sam's GI Joe melts**

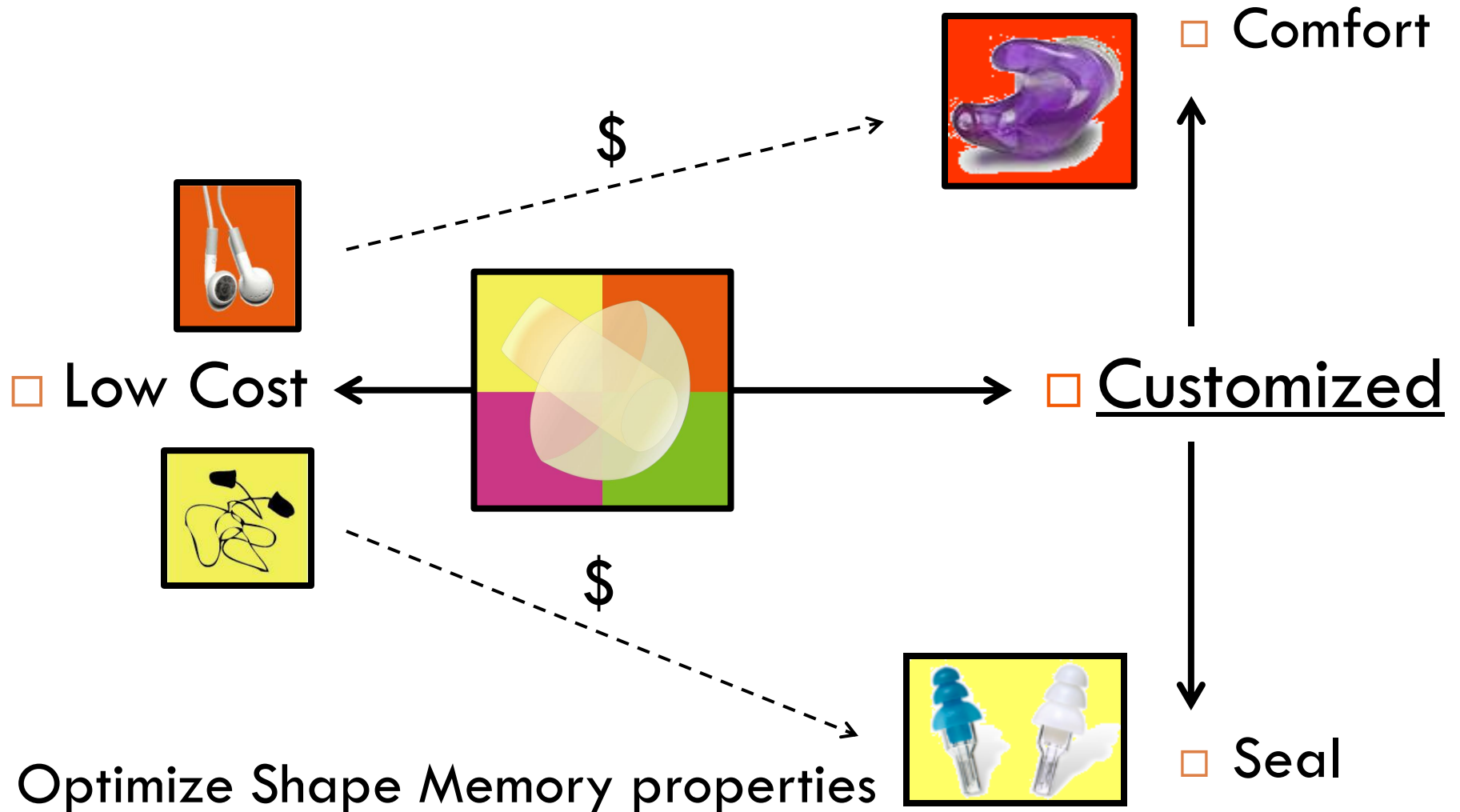
# Syzygy of Ideas



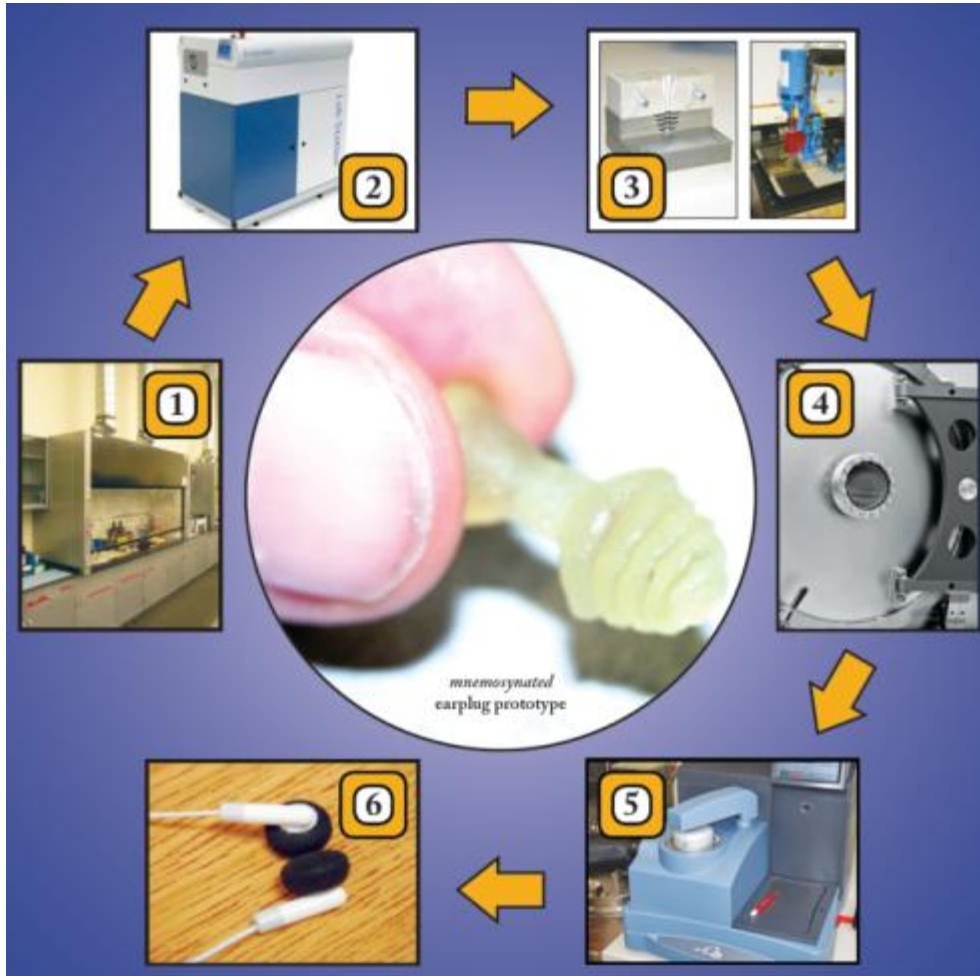
## □ EarPeace Solutions

- one size fits all
- heat activated
- shape-memory polymers
- actively seal the ear canal
- exerting optimal pressure
- to block unwanted noise

# Curing the Pain

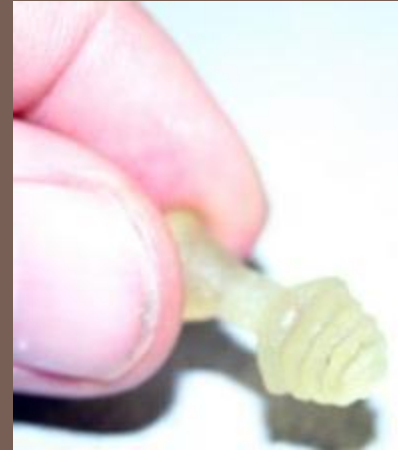


# Mnemosynation<sup>TM</sup>



**SMP mass-manufacturing technique that combines:**

- 1.) tunable thermoplastic polymer synthesis,
- 2.) crosslinker blending,
- 3.) plastic molding and
- 4.) high-energy radiation
- 5.) to control final thermo-mechanical properties
- 6.) in a custom device.

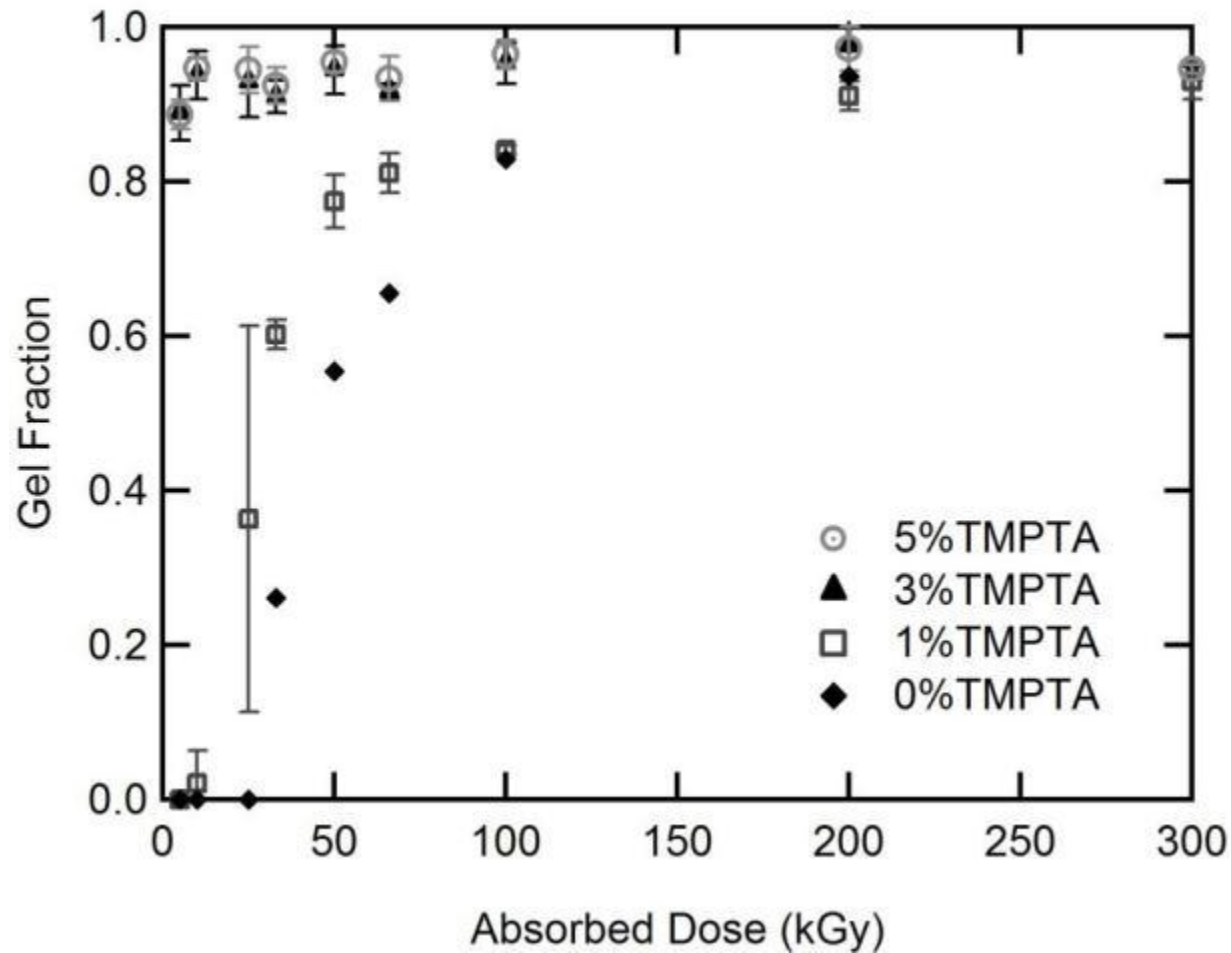


# TECHNICAL CONTENT

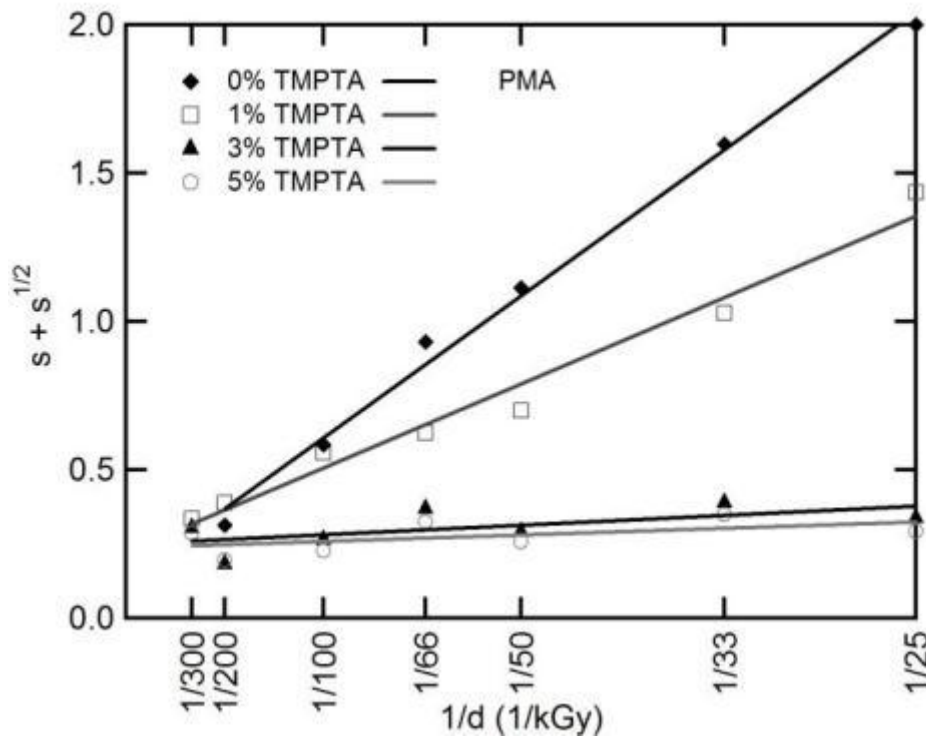
Shape Memory and Mnemosynation™



# Radiation Crosslinking



# Effects of Crosslinking Agent



Crosslinker	$p_0/q_0$	$d_0$ (kGy)	$R^2$
0%	.129	25.57	.993
1% TMPTA	.223	15.94	.976
3% TMPTA	.248	1.836	.383
5% TMPTA	.237	1.240	.300

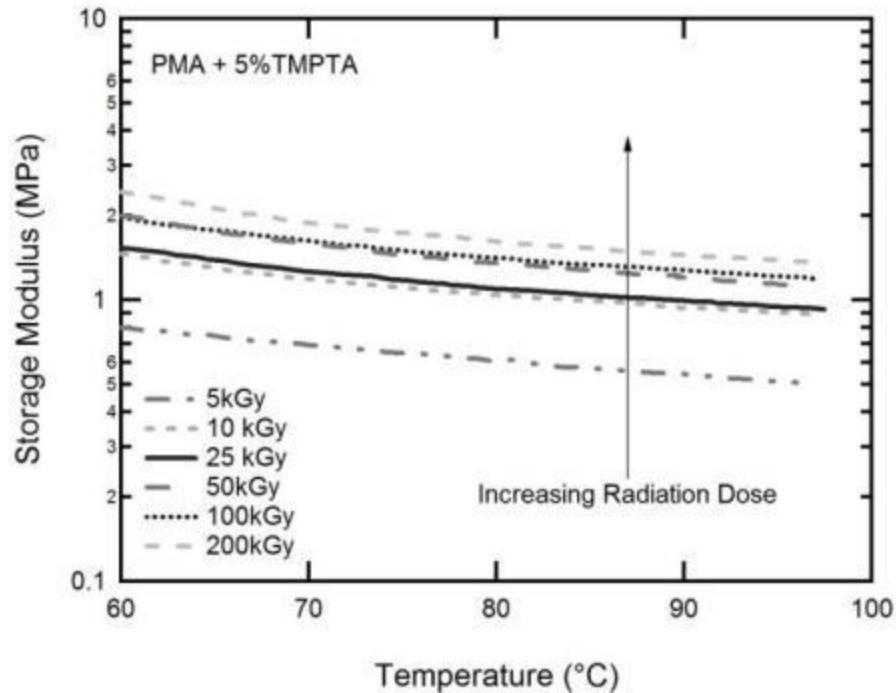
$p_0$  - degradation constant

$q_0$  - crosslinking constant

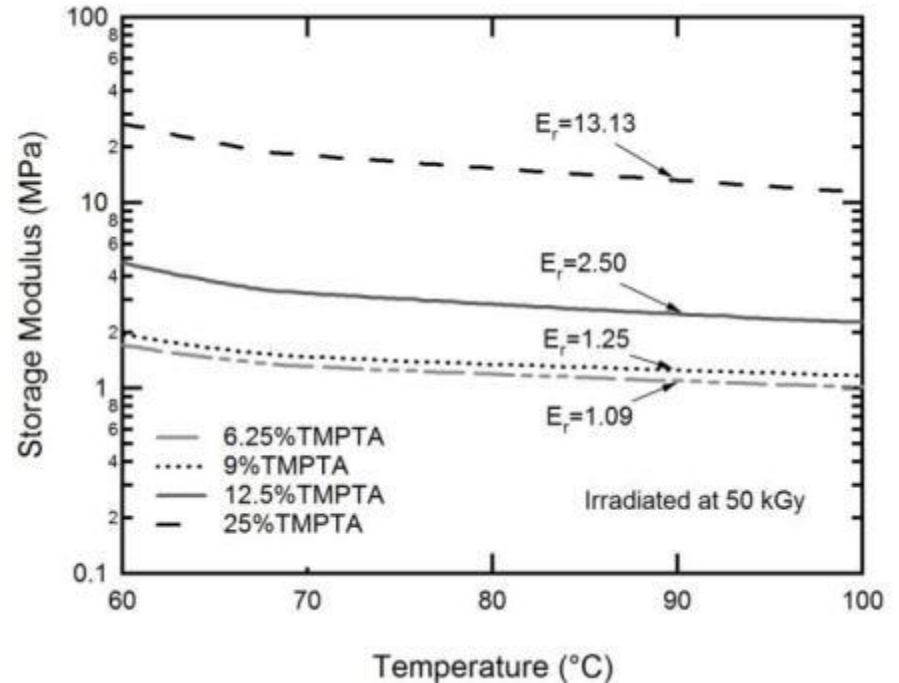
$d_0$  - minimum dose for gelation

$R^2$  - accuracy of linear fit

# Altering Rubbery Modulus

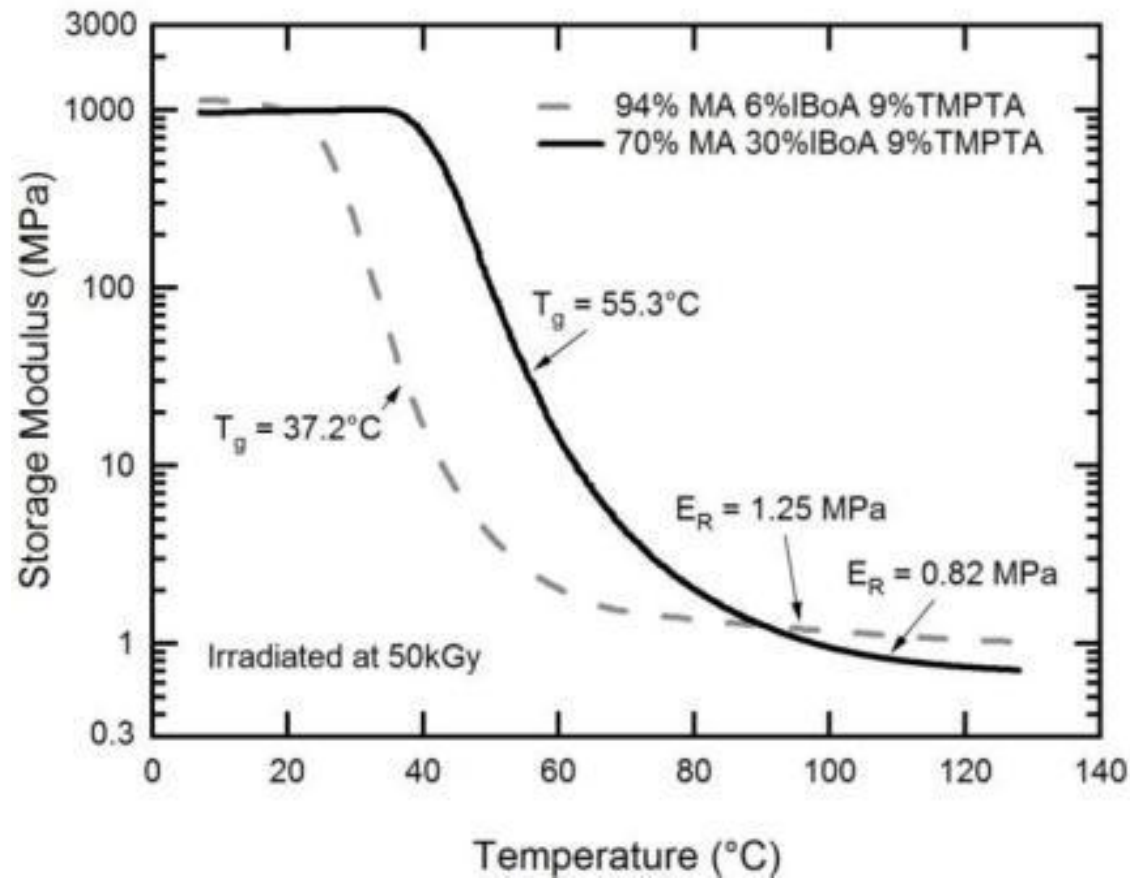


1. Changing dose

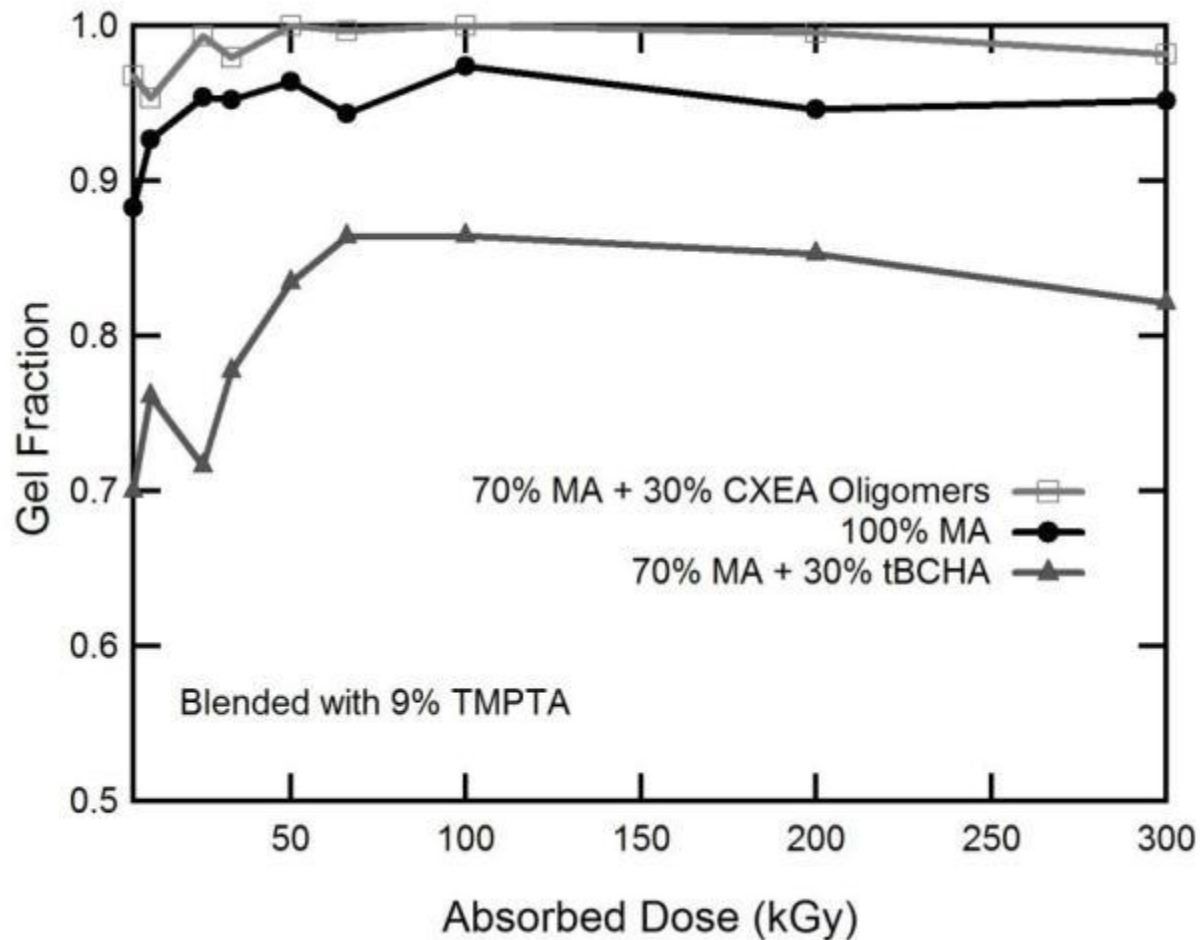


2. Changing concentration

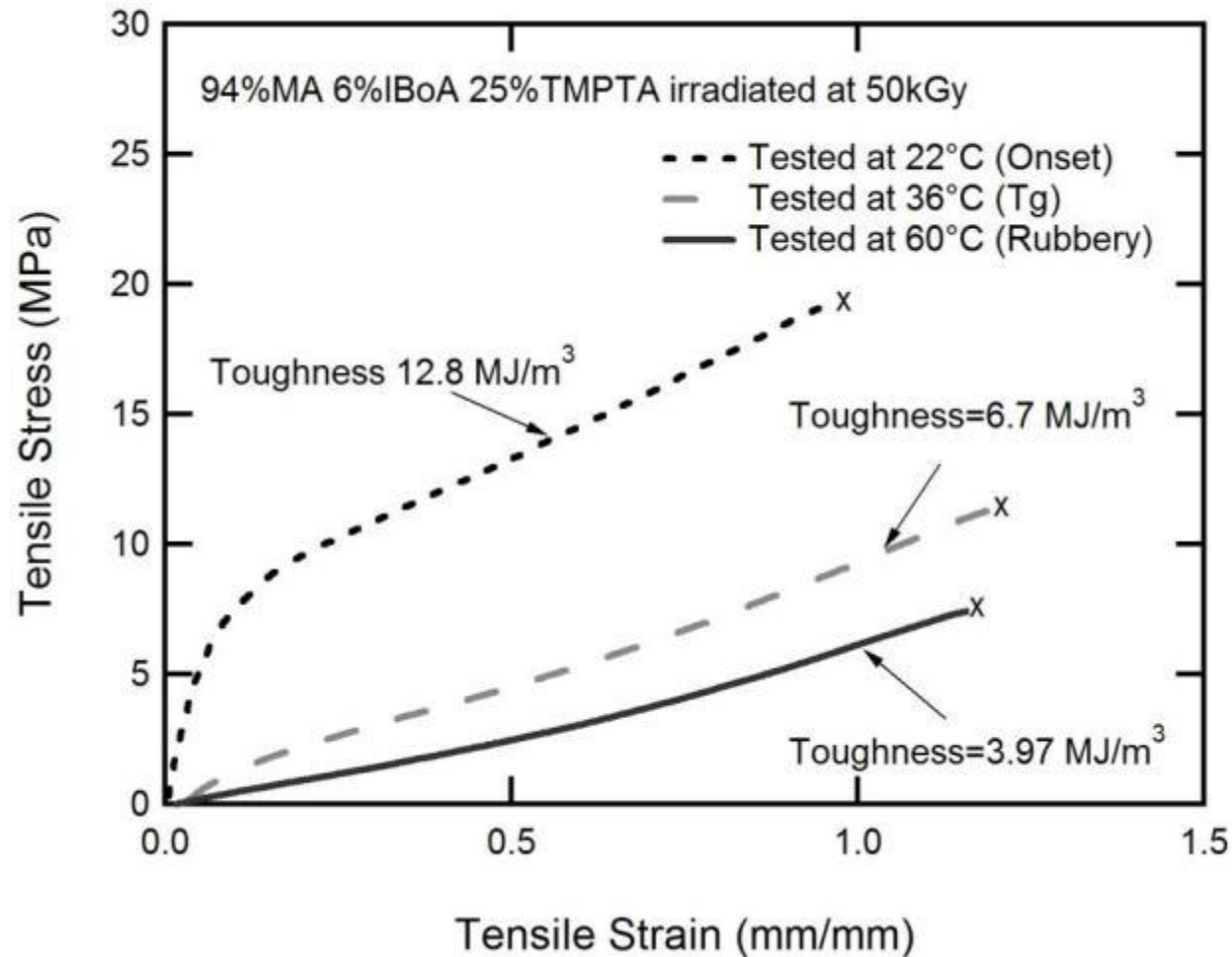
# Altering Glass Transition



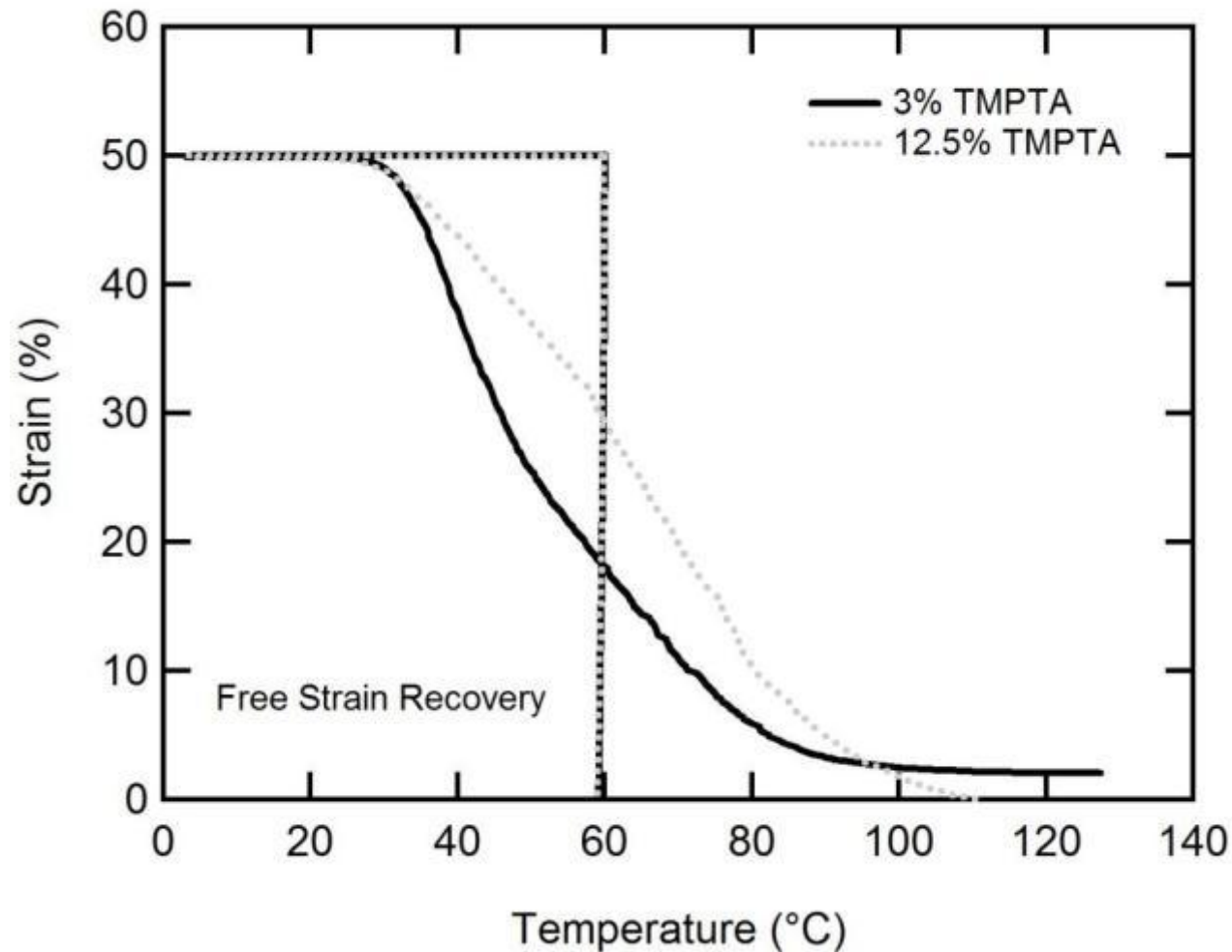
# Alpha Hydrogen Hypothesis



# The Stress-Strain Response



# Is it shape-memory?



# MARKETS AND CUSTOMERS

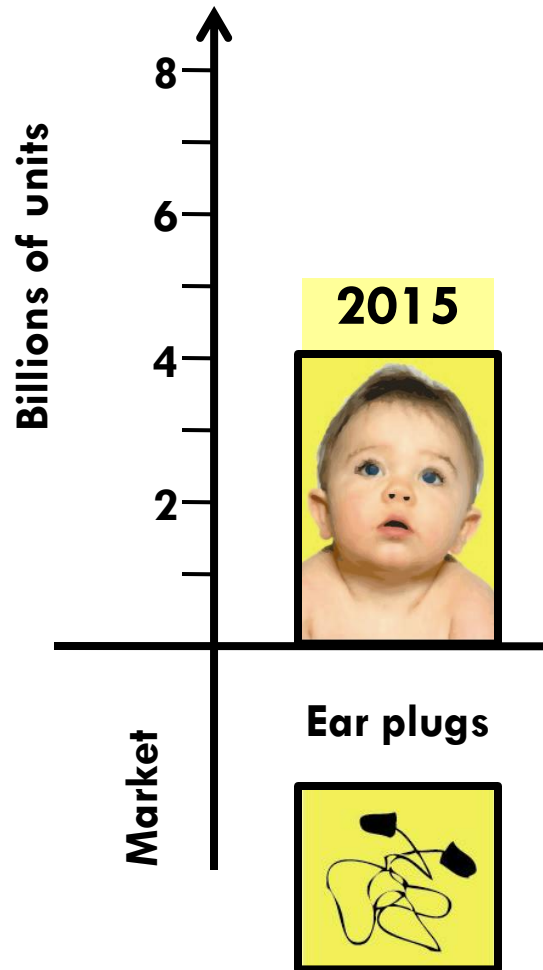
Penetration, Protection and Projections



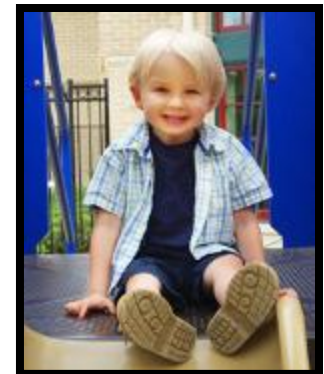
# US Markets



# Ear plug market snapshot



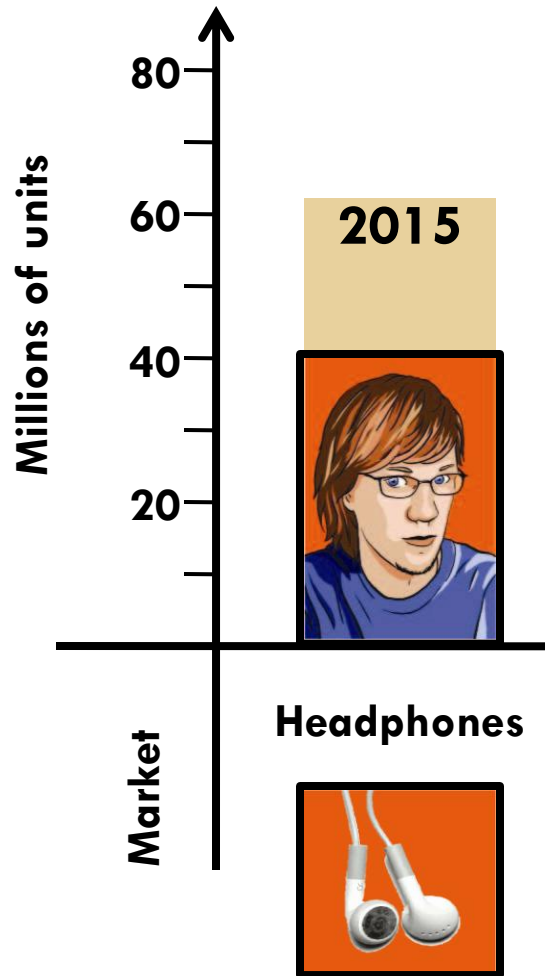
- Drivers: price, seal, comfort
- Minimal growth and low margins
- Niche submarkets:
  - Musicians, racecar drivers, heavy industry, hunters, swimmers
- Competitors:
  - Aearo Co, Comply
- ❖ R&D Partner
  - ❖ UTD Callier Center



# Who is Sam



# Headphone market snapshot



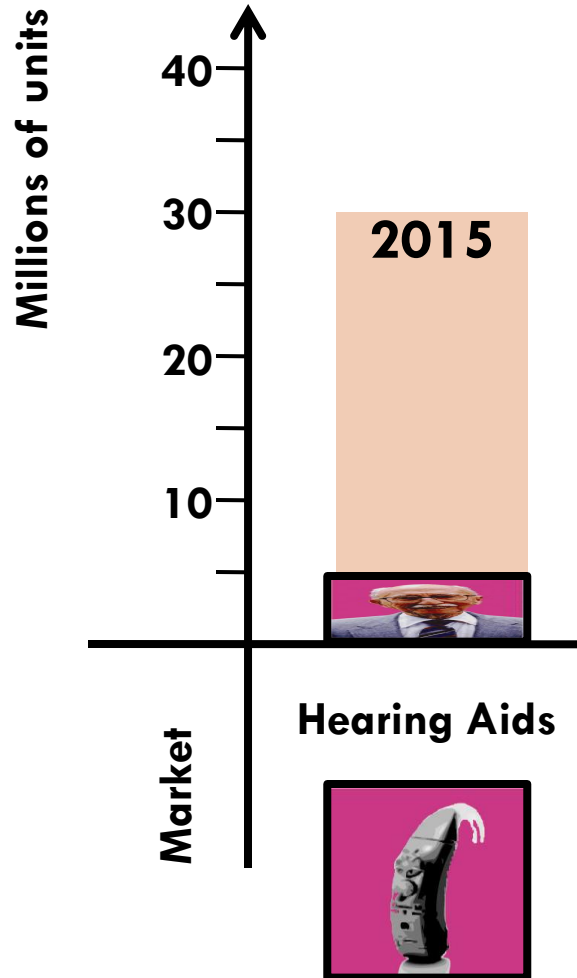
- Drivers: comfort, price
- Name brand competitors, existing capital infrastructure, packages
- First commercial target market
  - 37 million potential users
- Competitors:
  - Apple, JVC, Comply, Etymotic, RoadRunner, Shure, Bose, Sony

# Hands-free market snapshot



- Drivers: comfort, electronics
- Existing licenses, bundles,
- Submarkets:
  - Cell phone, blue-tooth
- Competitors:
  - Apple, Nokia, Samsung

# Hearing Aid market snapshot



- Drivers: comfort, ease-of-use
- Barriers?
- Huge projected growth\*
- Competitors:
  - Starkey, Phonak, Siemens

# From Idea to Product...



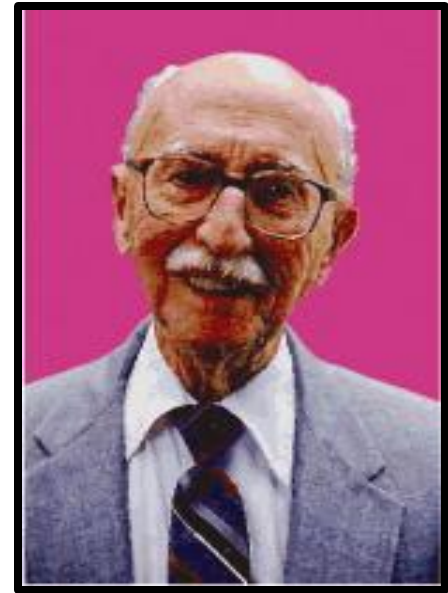
□ Sam



□ Luke



□ Margi



□ Joe

‘EarPeace Solutions’ keeps up with Joneses

THANK YOU

email questions to [walter.voit@utdallas.edu](mailto:walter.voit@utdallas.edu)