

# Grit and Resilience: What can we learn from our prokaryotic friends

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# What is a growth mindset

- Dr Carol Dweck- 30 years of research and studies
  - The understanding that abilities and intelligence can be developed
  - If you believe your brain can grow, you behave differently
  - We can indeed change a person's mindset from increased experiences
  - Leads to increased motivation and achievement

"Failure is an opportunity to grow"

## GROWTH MINDSET

"I can learn to do anything I want"

"Challenges help me to grow"

"My effort and attitude determine my abilities"

"Feedback is constructive"

"I am inspired by the success of others"

"I like to try new things"

"Failure is the limit of my abilities"

## FIXED MINDSET

"I'm either good at it or I'm not"

"My abilities are unchanging"

"I don't like to be challenged"

"I can either do it, or I can't"

"My potential is predetermined"

"When I'm frustrated, I give up"

"Feedback and criticism are personal"

"I stick to what I know"


# Why is growth mindset critical?

- Encourages challenges-seeking mentality as opposed to a defeatist or perfectionist mentality
- Supports problem solving
  - This is something I can solve
  - This is something I can solve on MY OWN
- It is more than just being positive, it is having the ability to learn from mistakes/failures, face challenges, and work through struggles
  - What worked and why?
  - What didn't work and how can I adjust it when I try again




## Why is growth mindset critical?

- Look for challenges. To not be satisfied with good enough
- A person's mindset sets the stage for their performance goals and learning goals
- People's theories about their own intelligence has a significant impact on their motivation, effort, and approach to challenges.




## Grit and how it helps a growth mindset

- Perseverance to accomplish long-term or higher-order goals in the face of challenges and setbacks, engaging ones psychological resources, such as their academic mindsets, effortful control, and strategies and tactics
- Perseverance when faced with challenges and adversity



Resilience is an  
integral part of  
growth mindset

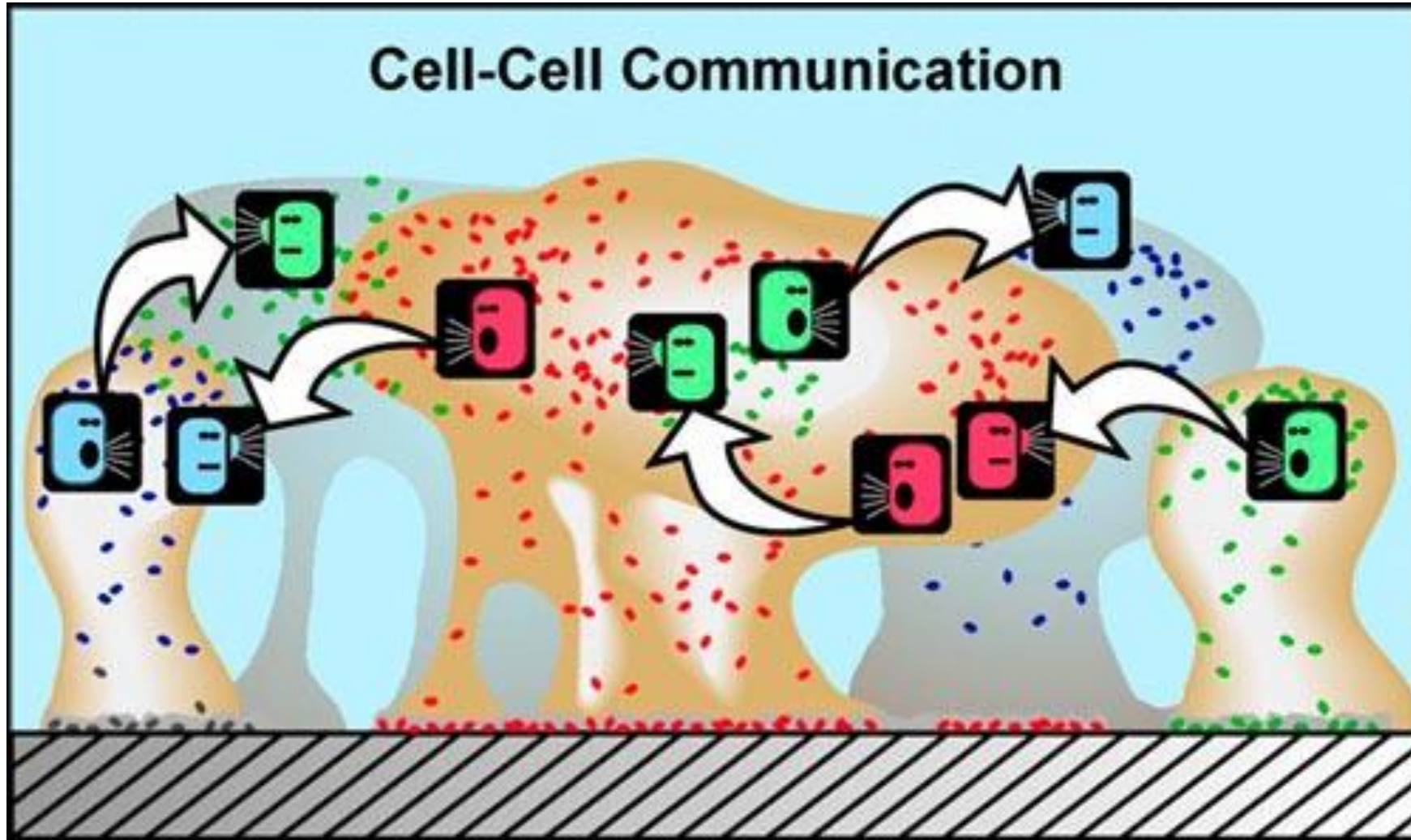
- The capacity of a system to absorb disturbances and reorganize while undergoing change so as to still retain essentially the same function structure identity and feedback



How do you  
promote and  
develop a  
growth mindset

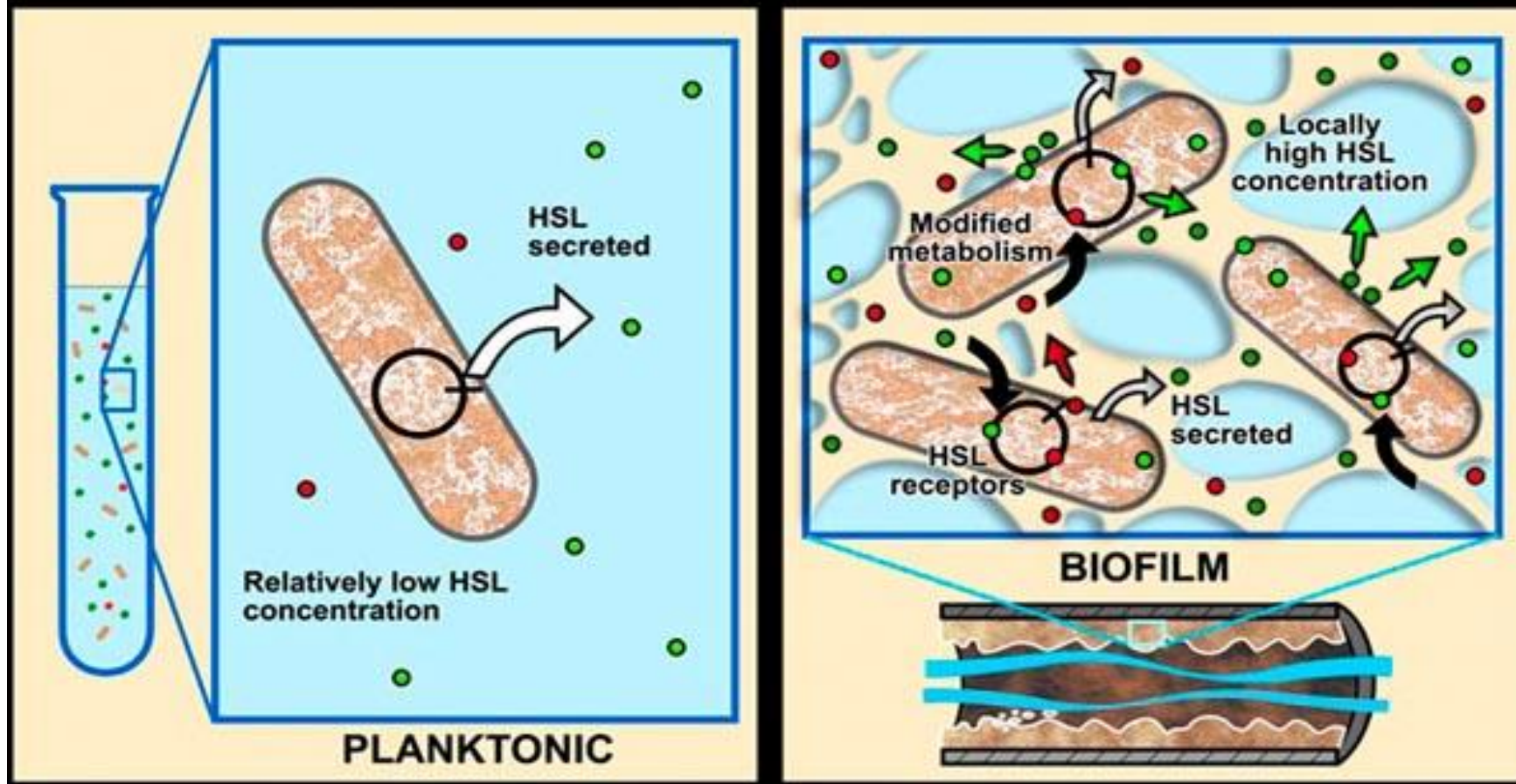
1. LEARN
2. TALK
3. ACCEPT
4. UNDERSTAND
5. FIND






In the cartoon above, various species of bacteria are represented by different colors. Bacteria can produce chemical signals ("talk") and other bacteria can respond to them ("listen") in a process commonly known as cell-cell communication or cell-cell signaling. This communication can result in coordinated behavior of microbial populations.

# Quorum Sensing



Though planktonic cells secrete chemical signals (HSLs, for homoserine lactones), the low concentration of signal molecules does not change genetic expression. Biofilm cells are held together in dense populations, so the secreted HSLs attain higher concentrations. HSL molecules then re-cross the cell membranes and trigger changes in genetic activity

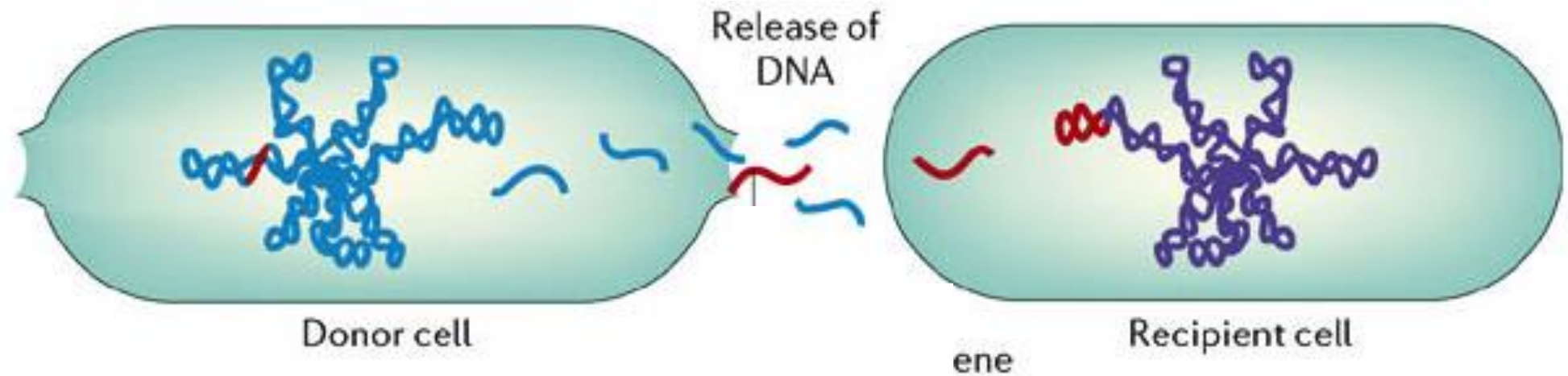


Antibacterial  
Resistance or is  
resilience: learn  
from your  
environment

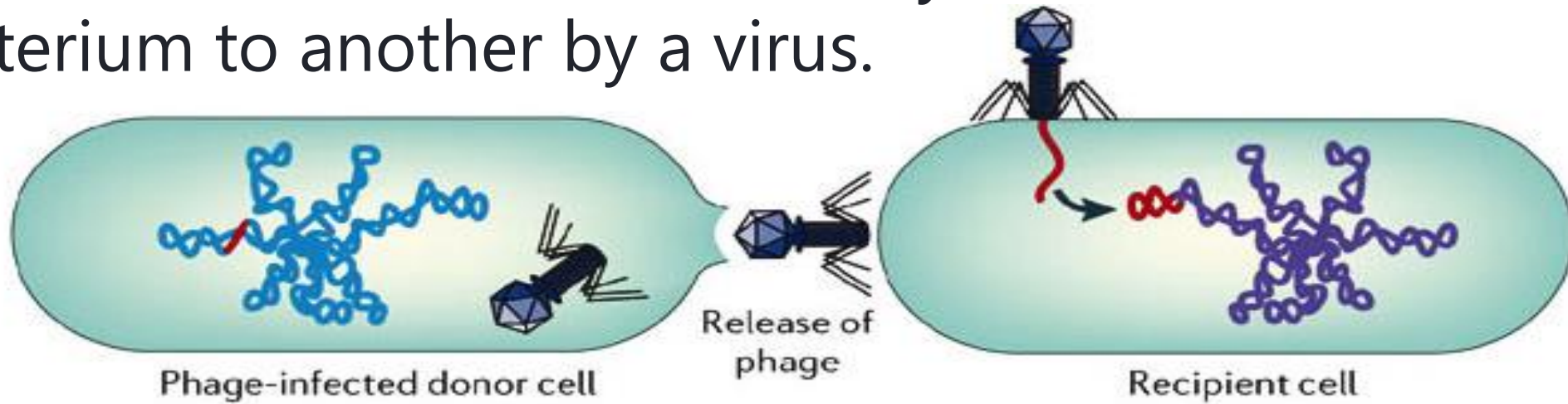
- Learn and accept from you colleagues
  - Transfer, transduction, or conjugation
    - MecA gene
    - ESBL
    - carbapenemases
    - Porins

# Sharing is caring

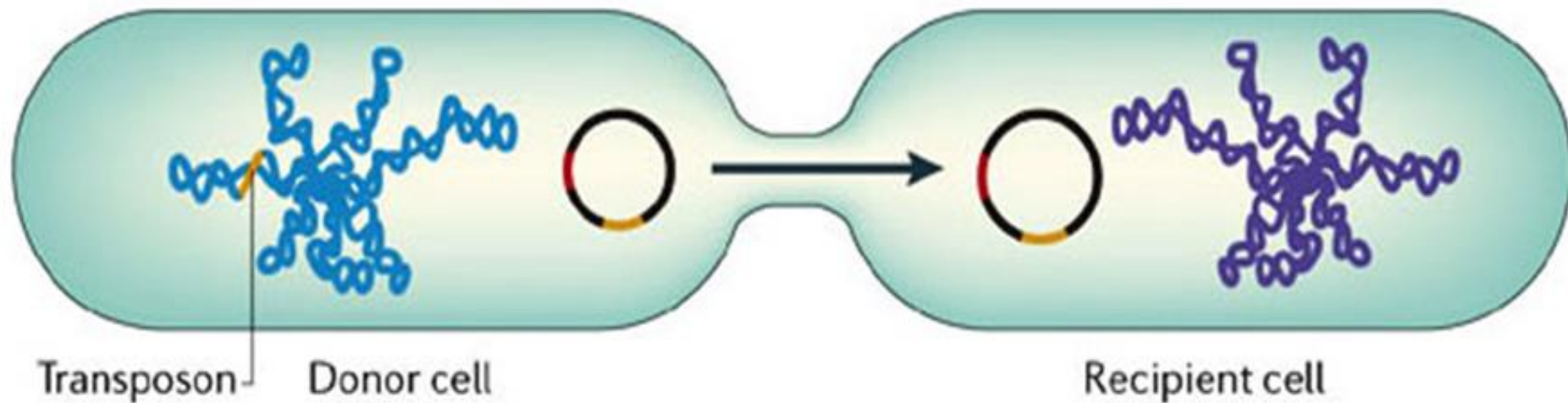
**Transformation:** taking up a piece of DNA floating in its environment



**Transduction**, DNA is accidentally moved from one bacterium to another by a virus.



**Conjugation**, DNA is transferred between bacteria through a tube between cells.



# Lets talk about grit

- Oh the places you will grow.....
  - Inside solid rock: South African gold mine has discovered bacteria over 1.5 miles below the ground that seem to subsist purely off of radioactive waste
  - Thermal hot spring: PCR: *Thermus aquaticus*
  - NASA clean rooms: *Tersicoccus phoenicis*
  - Deepest placed on earth: Mariana Trench
  - Upper atmosphere
  - On and on and on



# Resilience has a cost, but then there is grit

- Resistant genotypes are less fit than their sensitive counterparts in the absence of antibiotic
- However the cost of antibiotic resistance may be substantially diminished, even eliminated, by evolutionary changes in bacteria over rather short periods of time. As a consequence of this adaptation of bacteria to their resistance genes, it become increasingly difficult to eliminate resistant genotypes





# We all just want to talk about the rise

- Failing hurts.....the end
  - “We like recovery stories to move quickly through the dark so we can get to the sweeping redemptive ending” .....I fell then I fought my way back and here is the happy ending.
- There can be no innovation, learning, or creativity without failure but there is a cost and that cost can be great
- shame

# Changing to meet your environment

- Bacteria can adapt to their environmental condition
  - Temperature, pH, concentrations of ions
  - *Vibrio parahaemolyticus* o growth in a watery environment versus a more viscous environment
    - In viscous environments they form swarmer cells which move differently along solid surfaces
  - E coli and urinary streams
    - expression of adhesins that allow them to bind tighter to epithelial cells

# The rising process

“ It is inevitable that some defeat will enter even the most victorious life. The human spirit is never finished when it is defeated... it is finished when it surrenders” Ben Stein

# How do you change?

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- Reframing: the process of replacing maladaptive thought patterns with constructive thoughts and beliefs
  - Through small changes in our questions or comments, we can reframe our thinking, our own minds
  - Respect yourself and your limits
  - Be honest ask and answer the real questions, reflect
  - Recuperate, rest, fill your bucket
  - Reach out to others and learn
  - Try again
- Be afraid but do it anyway

It is not the critic who counts; not the man who points out how the strong man stumbles, or where the doer of deeds could have done them better.

The credit belongs to the man who is actually in the arena, whose face is marred by dust and sweat and blood; who strives valiantly; who errs, who comes short again and again, because there is no effort without error and shortcoming; but who does actually strive to do the deeds; who knows great enthusiasms, the great devotions; who spends himself in a worthy cause; who at the best knows in the end the triumph of high achievement,

GRIT and RESILIENCE: the end game

There is no greater threat to the critics and cynics and fear mongers than those of us who are willing to fall because we have learned how to rise

