Faster, Higher, Stronger

Anne Kim
Cecilia Cisar,
Evan Olin
Laila Shehata,
Kathryn Brink
Tony DiBlasi
Jonathan Guzman

The Real Skele-gro

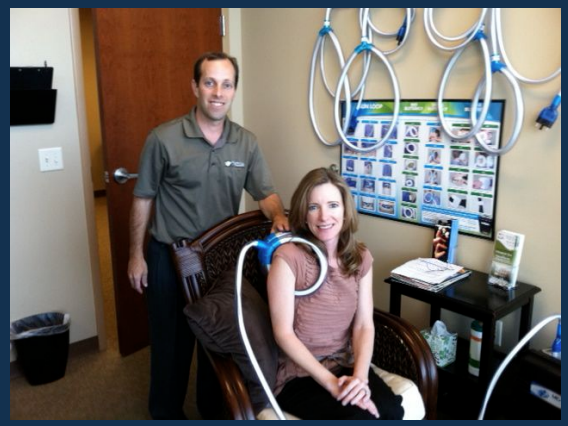
Fixing your bones in no time

Motivation

- Broken bones take a long time to heal
- Current recovery methods decrease quality of life
  - Limited mobility
  - Muscle loss
- Natural healing is imprecise
  - Improper alignment
  - Bone scarring

Competing Technology

- Immobilization
  - Promotes proper bone alignment
- Pulsed electromagnetic fields
  - Increase rate of healing
- Low intensity pulsed ultrasound
  - Increase rate of healing



VEGF

- Vascular Endothelial Growth Factor
  - Typically used in hearts and eyes to repair cell damage
  - Promotes human bone repair
- Over-expression of VEGF leads to vascular disease
  - Expression can be controlled with a tetracycline-regulated promoter

Our Solution

- We plan to deliver VEGF to the site of a broken bone in order to:
  - Decrease recovery time
  - Utilize the natural healing process

- We will include:
  - A delivery system to bring VEGF to broken bone sites
  - A method for detecting where to release VEGF
  - A regulatory system to prevent overexpression

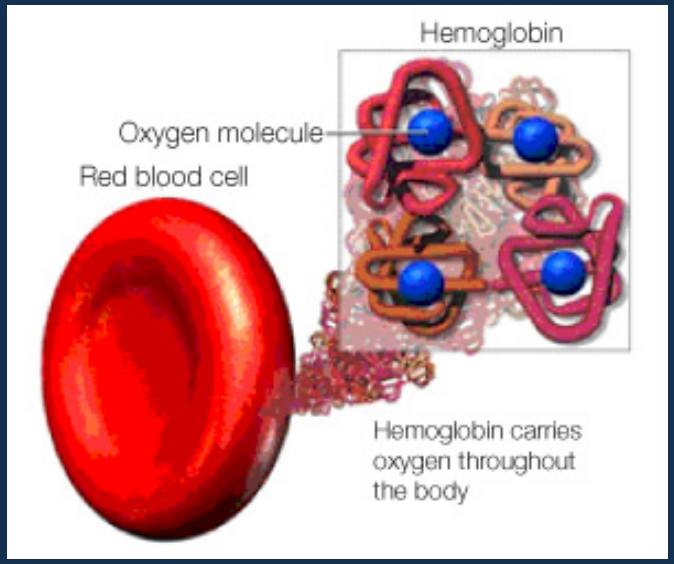
Topics for Further Research

- Delivery system for VEGF
  - Polymeric injectable carrier
    - Polytrimethylene carbonate
  - Nanoparticles
    - Hyaluronic acid/chitosan
- Method for detection of broken bone and release of VEGF

Athletes are *Iron*ically *Unhealthy:* *Improving Iron Absorption in Female Athletes*

Importance of Iron Regulation

- Iron is an essential electron donor and acceptor in hemoglobin.
- People should consume 15-18 mg of iron daily.

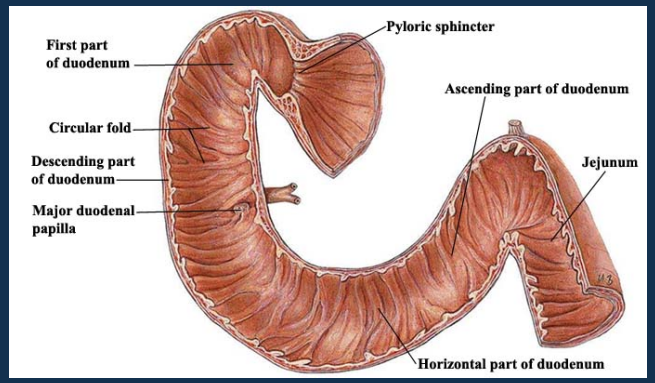


Comp utions

- Iron rich fo
- Iron Supple
- Hormone t

Iron Absorption

- Iron in the body is recycled from aged red blood cells.
- Dietary iron is absorbed through the duodenum
- Iron is stored in small ferritin complexes in every cell, especially hepatocytes



Relevance to Female Athletes

- Factors: sweat, faster metabolism, and menstruation.
- Anemia and Amenorrhea occurs more frequently in female athletes
- Negatively impacts performance

Impact of Solution

- Allow women to athletically excel to their fullest potentials.
- Increase convenience and efficiency of treatment

Key Factors in Iron Metabolism

- Hepcidin- increased hepcidin (HAMP gene) will increase iron storage in macrophages and decrease circulation
- Ferroporin- iron channel on the surface of the gut. Inhibiting this, reduces iron transportation.
- Transferrin- keeps iron nontoxic; transports iron and binds to the transferrin receptor on the cell to release

Our Solution
Increasing/Limiting Iron

- Couple two reactions.
  - **Increasing** iron- increase TFR1 on duodenum cells to increase dietary iron uptake.
  - Increase transferrin bound iron, which is responsible for developing erythrocytes.
  - **Limiting** iron- increase hepcidin, which would increase iron stores and decrease harmful levels of iron in the blood

Concerns

- How to regulate iron at a safe level without compromising the integrity of the body's natural system
- Best Mechanism- cellular, ingestion/ supplement, gene therapy

IgFREE

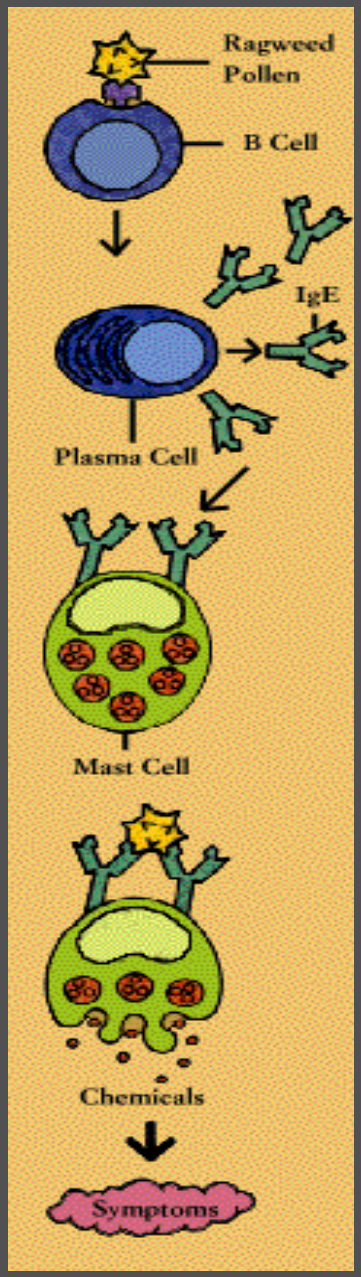
Seasonal Allergies:

Helping you run – not your nose

Importance

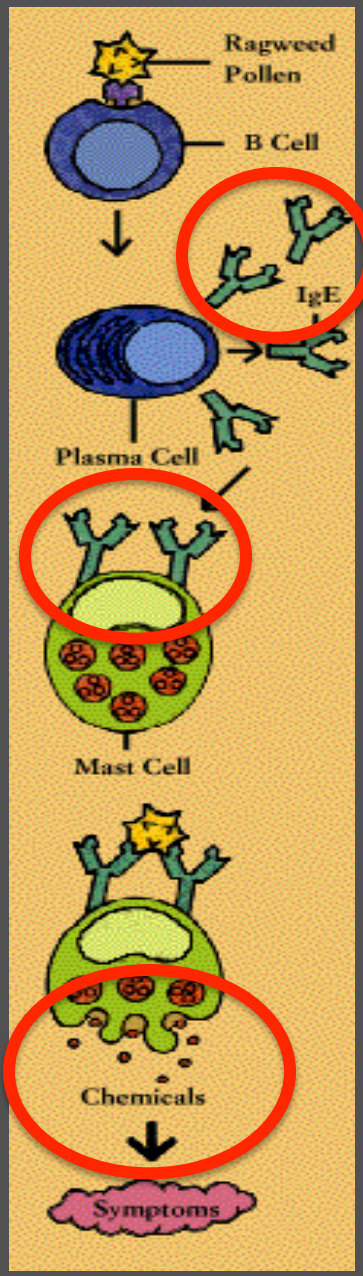
- 10-25% of people suffer from seasonal allergies
- Affects performance
- Makes you miserable

Allergy Response Mechanism



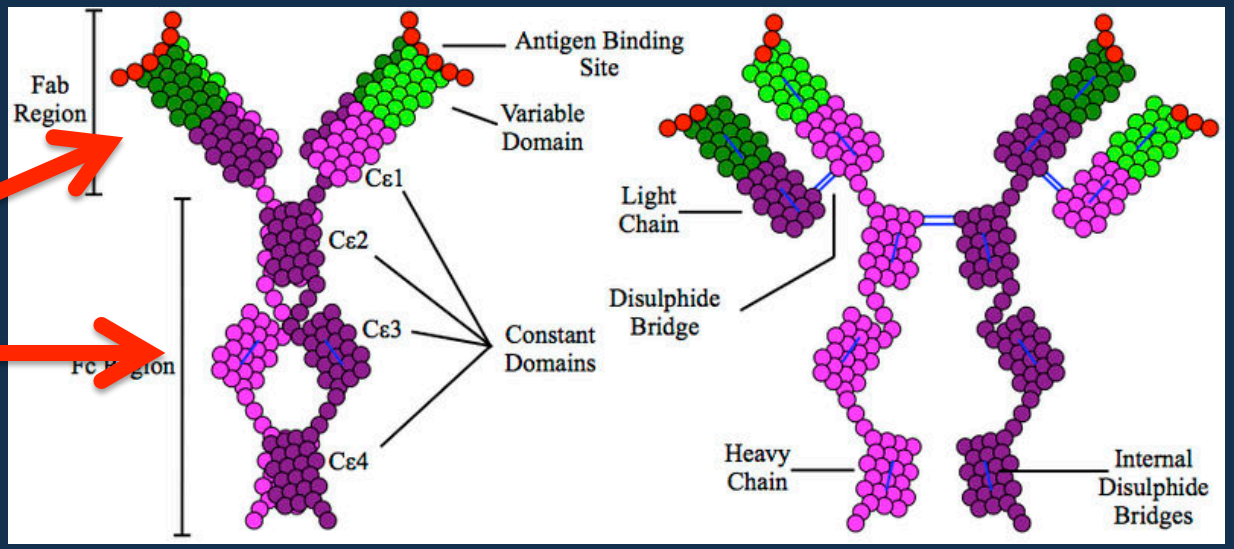
Competition

- Downstream
  - Typical antihistamines
  - Other drugs
    - Steroids
    - Leukotriene antagonists
  - Immunotherapy
- Upstream
  - Omalizumab



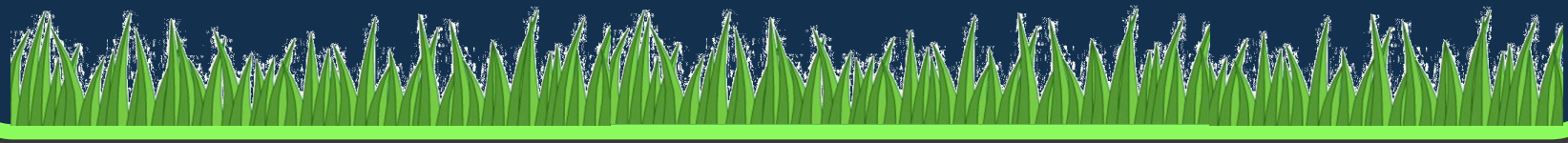
Proposed Solutions

- Competitively bind allergen-specific IgE
- Eliminate/modify allergen-specific IgE DNA sequence



Limitations

- Cause of hypersensitivity
- Specificity: allergen-antibody interaction, DNA-altering components
- Delivery without inducing immune response



Impact

- Permanent solution
- Minimum side effects
- Applications to other allergies

Questions?