

# AMSC 663/664 Introduction

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University of Maryland, College Park

AMSC - Scientific Computation track

# About Me – Previous Education

- The Cardinal Gibbons School
- Catonsville High School '11
  
- University of Maryland,  
Baltimore County '15
  - BS, Mathematics
  - BS, Physics



# “Why be normal when you can be fabulous” – Trinity Antoszewski



Top Left: [twitter.com, @Orioles](https://twitter.com/Orioles)



# UMBC Research – Wind Energy

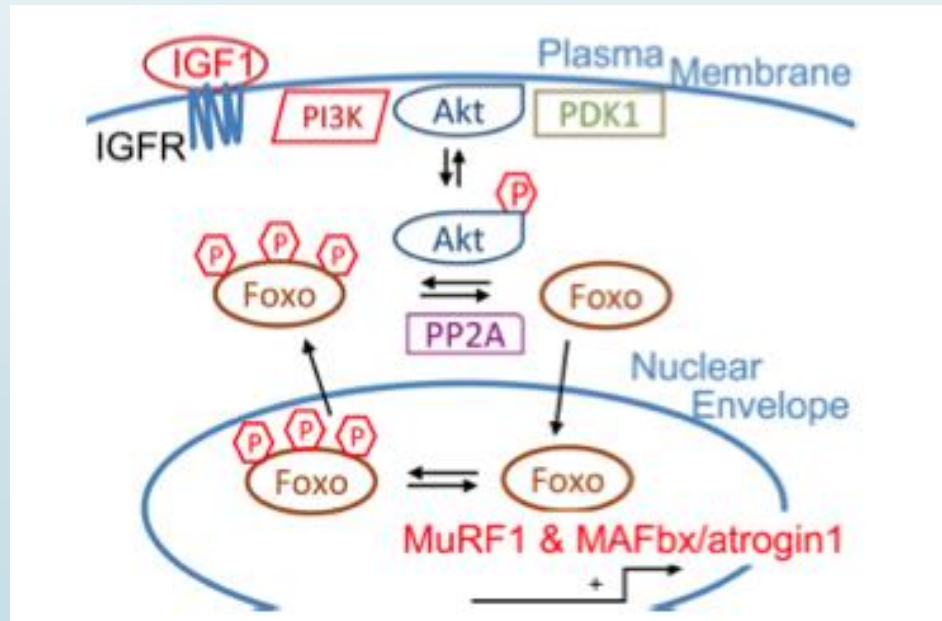
- ▶ Maryland Offshore Wind Energy Project, 2013-2014
- ▶ Surveying 20-30 miles east of Ocean City (3 months)
- ▶ Analysis of data with MATLAB program (1+ years)
  - ▶ Input – millisecond-resolution data
  - ▶ Output – turbines could power Eastern Shore
- ▶ Politicians nixed it last year



<http://www.baltimoresun.com/news/maryland/bs-md-wind-energy-hurdles-20150406-story.html>

# UMBC Research – Computational Biology

- Foxo-1 nuclear concentration known to affect skeletal muscle atrophy
- Modeled how insulin input affects Foxo-1 transport
- Could lead to advances in preventing muscle loss after major injuries



$$\begin{aligned}
 x_1 &= \text{insulin input} \\
 dx_2/dt &= k_{-1}x_3 + k_{-3}[PTP]x_5 - k_1x_1x_2 + k_{-4}x_6 - k_4x_2 \\
 dx_3/dt &= k_1x_1x_2 - k_{-1}x_3 - k_3x_3 \\
 dx_4/dt &= k_2x_1x_5 - k_{-2}x_4 + k_{-4}x_7 - k_4x_4 \\
 dx_5/dt &= k_3x_3 + k_{-2}x_4 - k_2x_1x_5 - k_{-3}[PTP]x_5 + k_{-4}x_8 - k_4x_5 \\
 dx_6/dt &= k_5 - k_{-5}x_6 + k_6[PTP](x_7 + x_8) + k_4x_2 - k_{-4}x_6 \\
 dx_7/dt &= k_4x_4 - k_{-4}x_7 - k_6[PTP]x_7 \\
 dx_8/dt &= k_4x_5 - k_{-4}x_8 - k_6[PTP]x_8 \\
 dx_9/dt &= k_{-7}[PTP]x_{10} - k_7x_9(x_4 + x_5)/(IR_p) \\
 dx_{10}/dt &= k_7x_9(x_4 + x_5)/(IR_p) + k_{-8}x_{12} - (k_{-7}[PTP] + k_8x_{11})x_{10} \\
 dx_{11}/dt &= k_{-8}x_{12} - k_8x_{10}x_{11} \\
 dx_{12}/dt &= k_8x_{10}x_{11} - k_{-8}x_{12} \\
 dx_{13}/dt &= k_9x_{14} + k_{10}x_{15} - (k_{-9}[PTEN] + k_{-10}[SHIP])x_{13} \\
 dx_{14}/dt &= k_{-9}[PTEN]x_{13} - k_9x_{14} \\
 dx_{15}/dt &= k_{-10}[SHIP]x_{13} - k_{10}x_{15} \\
 dx_{16}/dt &= k_{-11}x_{17} - k_{11}x_{16} \\
 dx_{17}/dt &= k_{11}x_{16} - k_{-11}x_{17}
 \end{aligned}$$

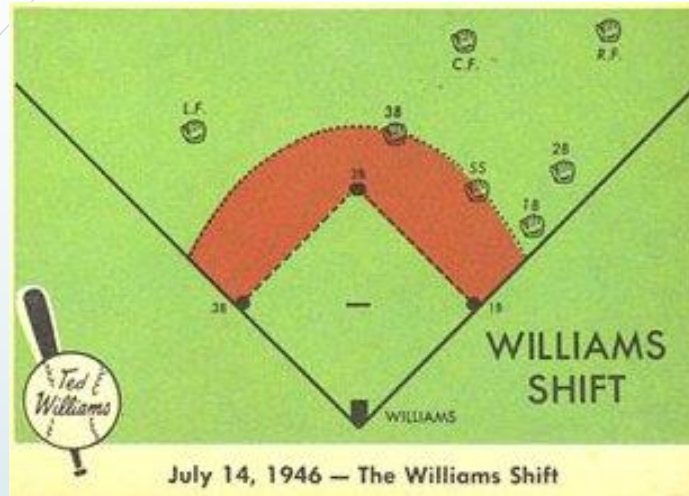


# Previous Research at UMD

- ▶ Brief stint under Dr. Ide working with Dr. Paley of Aerospace Engineering, Summer 2015
- ▶ End goal: self-automated underwater vehicle navigation
- ▶ Attempt to model currents to help with steering
  - ▶ Rankine Vortex
  - ▶ FTLE field
- ▶ Thank you Dr. Ide for putting up with me

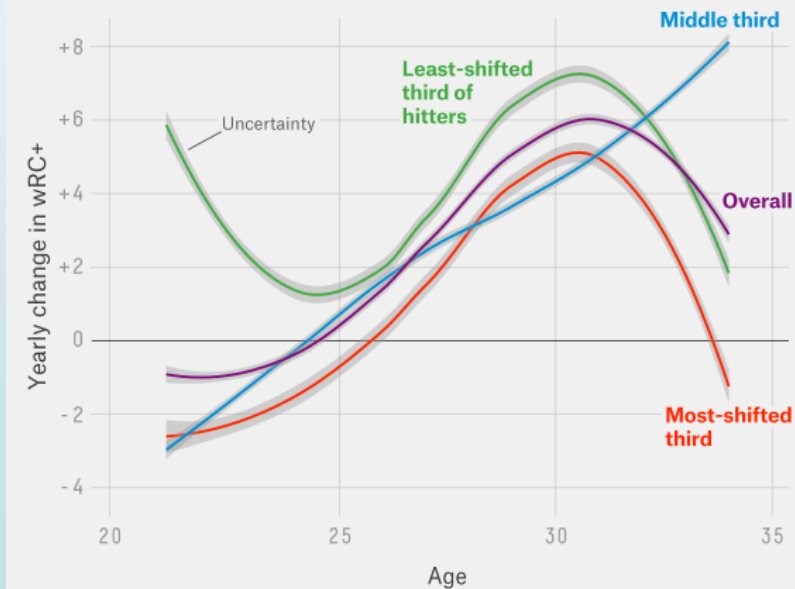
# Current Research Interests

- ▶ Sports analytics – how can I use statistics to help teams win?
- ▶ Example: defensive shifts in baseball



## The most shifted players age worse

wRC+ aging curve for all players with greater than 50 plate appearances in a season, 2010-15



FIVETHIRTYEIGHT

SOURCES: FANGRAPHS, BASEBALL INFO SOLUTIONS

# Current Research Interests

- ▶ Who will win NCAA March Madness?
- ▶ Regression analysis to predict winners using only statistics
- ▶ Offensive rebounds, away wins most crucial to tournament success

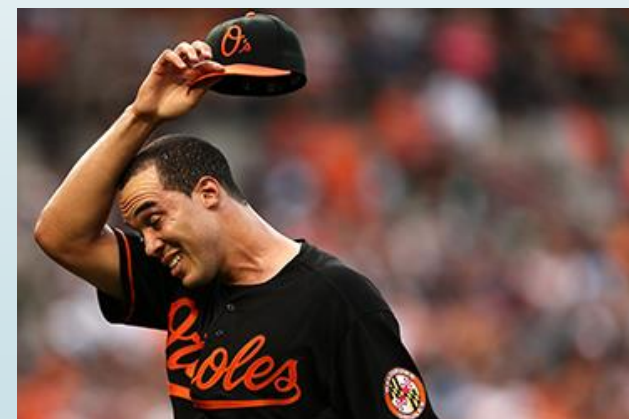
## My 2016 Brackets

CHAMP	BRACKET NAME	STATUS	GROUPS	PTS	PCT%	PPR
	<a href="#">As Long As Duke Loses</a>	● Game Over	Fans of Maryland Tournament Challenge ESPN Leaders March Madness	710	58%	0
	<a href="#">Combined Change 5</a>	● Game Over	ESPN's SportsNation Tournament Challenge ESPN ESPN's SportsCenter	830	78%	0
	<a href="#">Combined</a>	● Game Over	Mike & Mike ESPN's SportsNation ESPN's SportsCenter	940	92%	0
	<a href="#">guess2014</a>	● Game Over	ESPN's SportsNation ESPN's SportsCenter	420	6%	0
	<a href="#">guess2015</a>	● Game Over	ESPN's SportsNation ESPN's SportsCenter	410	6%	0



# What Do I Want to Work on Next?

- ▶ WAR – Wins Above Replacement
- ▶ openWAR\* – open-source code for a more accurate WAR
  - ▶ Uncertainty estimates
  - ▶ Reproducibility
- ▶ Allows teams to see if they are better or worse off with a given player
- ▶ Ubaldo Jimenez: WAR of 0.9
  
- ▶ ISSUE: input is runs created, not win probability!
  - ▶ Runs in closer games weighted more
  - ▶ How will this affect WAR rankings?



\*Baumer, B.S., J.T. Jensen, and G.J. Matthews 2015. "openWAR: An open source system for evaluating overall player performance in major league baseball." *Journal of Quantitative Analysis in Sports* 11: 69-84.  
Picture courtesy of masnsports.com