ACKNOWLEDGEMENTS

First, I need to thank my parents for everything I have ever accomplished. Their support has been a driving force behind every goal I have ever attained. Also, I need to thank my grandparents, particularly my grandmother who just recently passed from complications due to congestive heart failure. I hope this work can help others who suffer from this condition.

Second, I need to thank Michelle Stockunas, my fiancée, who has been such a wonderful supporter of everything I do. She has made more sacrifices for me than I count and she means the world to me. I love you.

I also need to thank the U-10 New River Rapids, who taught me more about life in a given game or practice than I have experienced in my 27 years.

I also need to thank every graduate student who has passed the halls of Wallace Hall. Each one of you has taught me something whether they know it or not. Particularly I need to thank Jeff Otis and Simon Lees for their help in the lab. Best of luck in the future.

I also must thank Janet Rinehart, Kathy Reynolds, Sherry Saville, and Kathy Miller for the help you have given me over the years. Without their help and support I would have never made it this far. I also need to especially thank Sherry Terry, who deserves a special retirement package because of me. She has spent countless hours helping me and just listening to me, for that I can't thank her enough.

I would like to acknowledge my committee members who have bent over backwards helping me progress as a student: Dr. Thomas Caceci, who graciously agreed to serve on this committee even though he is incredibly busy. Dr. David Moore, who has

spent hours answering every question I could come up with involving animal lab work. Dr. Barbara Davis for listening and answering molecular biology questions at any given moment. Dr. Michael Houston for writing recommendations, listening to me complain, teaching me how to think, and asking tough questions. Lastly, Dr. Robert Talmadge who has answered close to a million questions that I have asked and spent countless hours helping me in the lab. Without his help this project would not have been possible. Also, I need to thank him for his good advice and interesting perspectives on the sporting world (GO DUKE).

Finally, I need to thank Jay Williams, who took so much of his time to teach me an appreciation of science that I could not have gotten anywhere else. Also, for doing countless favors for me at the last minute and providing me with encouragement to complete this program. I figure I owe him a couple dozen new pens for reading this dissertation. Also, I need to thank his family, for they have become like a second family to me. Jay has done more for me than I could ever ask and I will never be able to thank him enough.

Best of luck in everyone's future endeavors.

TABLE OF CONTENTS

		Page
Abstract		ii
Acknowledgements		iv
List of Tables		viii
List of Figures		ix
Defintions		x
I.	**Introduction**	1
	Statement of Problem	7
	Significance of Study	9
	Research Hypothesis	10
	Delimitations	11
	Limitations/Assumptions	12
II.	**Literature Review**	13
	Introduction	14
	Myocardium and exercise capacity	15
	Is the heart really the limiting factor?	16
	Human skeletal muscle and CHF	17
	Changes in skeletal muscle metabolism	18
	Are the skeletal muscle changes related to inactivity ?	19
	Reduced peripheral blood flow and skeletal muscle alterations	20
	Skeletal muscle excitation-contraction coupling and fatigue	21
	The effects of myosin heavy chain isoforms on skeletal muscle contractile properties	23
	Skeletal muscle ECC and CHF	25
	Skeletal muscle MHC and SERCA changes during CHF	26
	Is skeletal muscle the limiting factor?	27
	Endurance training and CHF	28
	Strength training and CHF	29
	Summary	30
III.	**Methodology**	32
	Experimental designs	33
	Detailed methodology	35
IV.	**Results**	43
	Study #1	44
	Study #2	45
V.	**Discussion**	68
	Study #1	69

Study #2 72
Overall conclusions 78
Future research 79

Bibliography 81

Appendix 87
ANOVA Tables 88

VITA 95

LIST OF TABLES

		Page
1.	Antibody specificity	42
2.	Changes in cardiac morphology	49
3.	Correlations of heart morphology and muscle MHC expression	50
4.	Two-way RM ANOVA Tables	88

LIST OF FIGURES

Page

Figure

1.	Changes in plantaris MHC expression	51
2.	Changes in soleus MHC expression	52
3.	Changes in white gastrocnemius MHC expression	53
4.	Changes in red gastrocnemius MHC expression	54
5.	Changes in overall heart mass	55
6.	Changes in right ventricular mass	56
7.	Changes in left ventricular mass	57
8.	Changes in lung mass	58
9.	Changes in absolute plantaris mass	59
10.	Changes in relative plantaris mass	60
11.	Changes in individual fiber cross sectional area	61
12.	Changes in MHC expression	62
13.	Changes in overload MHC expression	63
14.	Changes in MHC-based fiber type expression	64
15.	Changes in Ca^{2+} uptake rates	65
16.	Changes in SERCA expression	66
17.	Changes in individual fiber expression of SERCA	67

DEFINITIONS

1. MHC – myosin heavy chain
2. SERCA – sacro/endo plasmic reticulum Ca^{2+}-ATPase
3. Ca^{2+} - calcium ion
4. SR – sacroplasmic reticulum
5. FO – functional overload or removal of a synergist muscle causing the remaining muscles to hypertrophy
6. MI – myocardial infarction
7. SHAM – control animal
8. CHF – congestive heart failure
9. Phenotype – expression of genetic information
10. mRNA – messenger RNA