

**PHYSIOLOGY OF CARDIAC
HYPERTROPHY IN
SEVERELY IRON DEFICIENT
RATS USING PRESSURE-
VOLUME LOOPS**

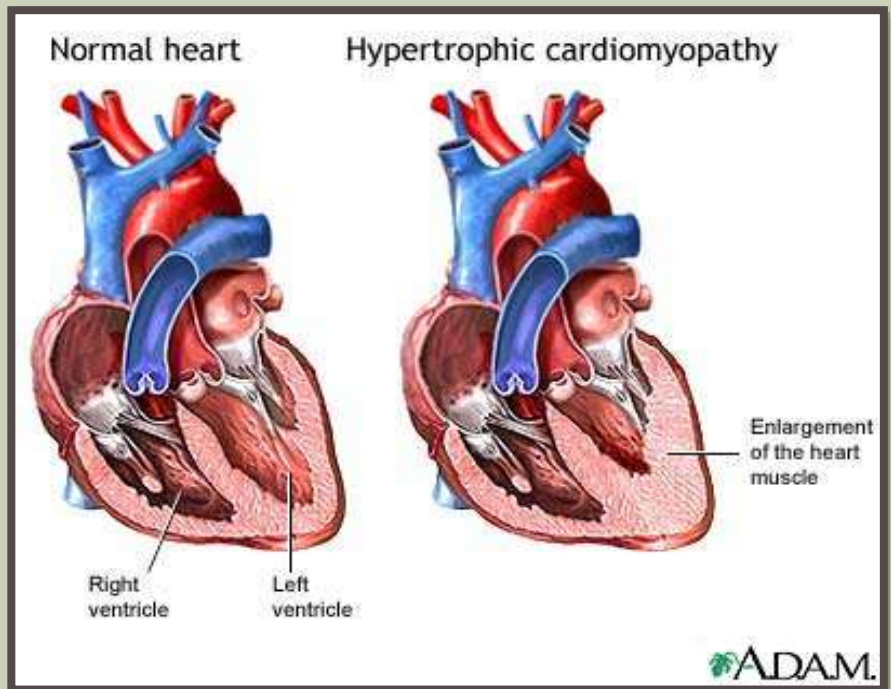
**BY: JACQUIE ZADRA, EMILY THOMPSON,
AND ASHLEY WEIGEL
FACULTY MENTOR: BUD CHEW, PH.D.**

**Biology
Department
Western
Wyoming
Community
College**

CARDIAC HYPERTROPHY

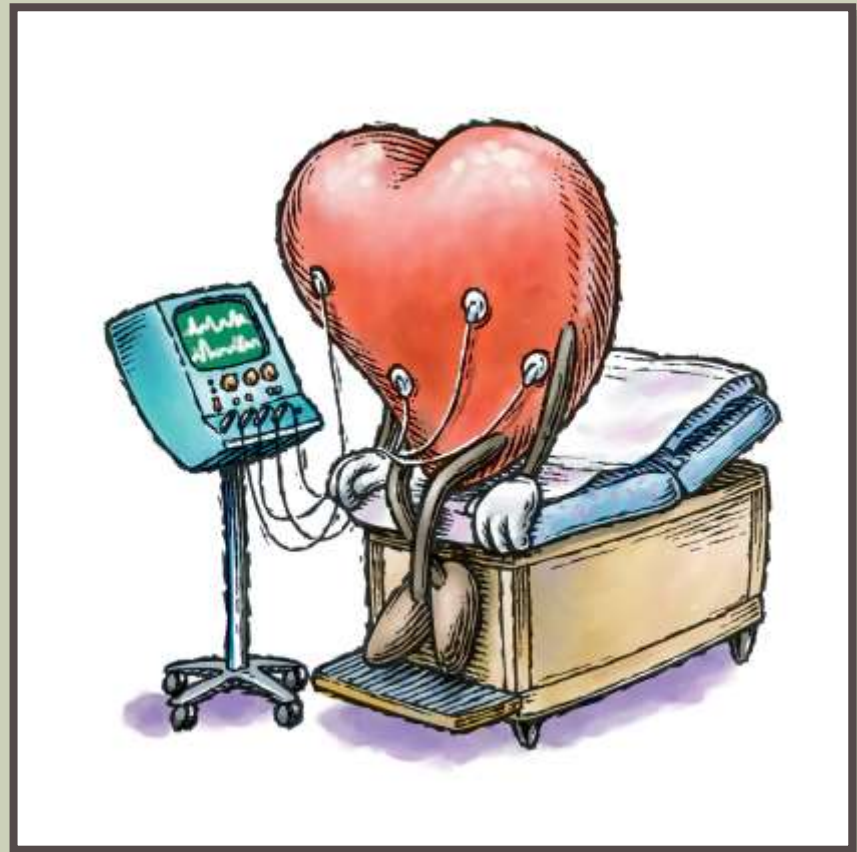
Enlargement of the heart

- Can either be adaptive or pathological
 - Adaptive hypertrophy is seen in aerobic athletes
 - Pathological hypertrophy is seen in diseases of the heart such as congestive heart failure

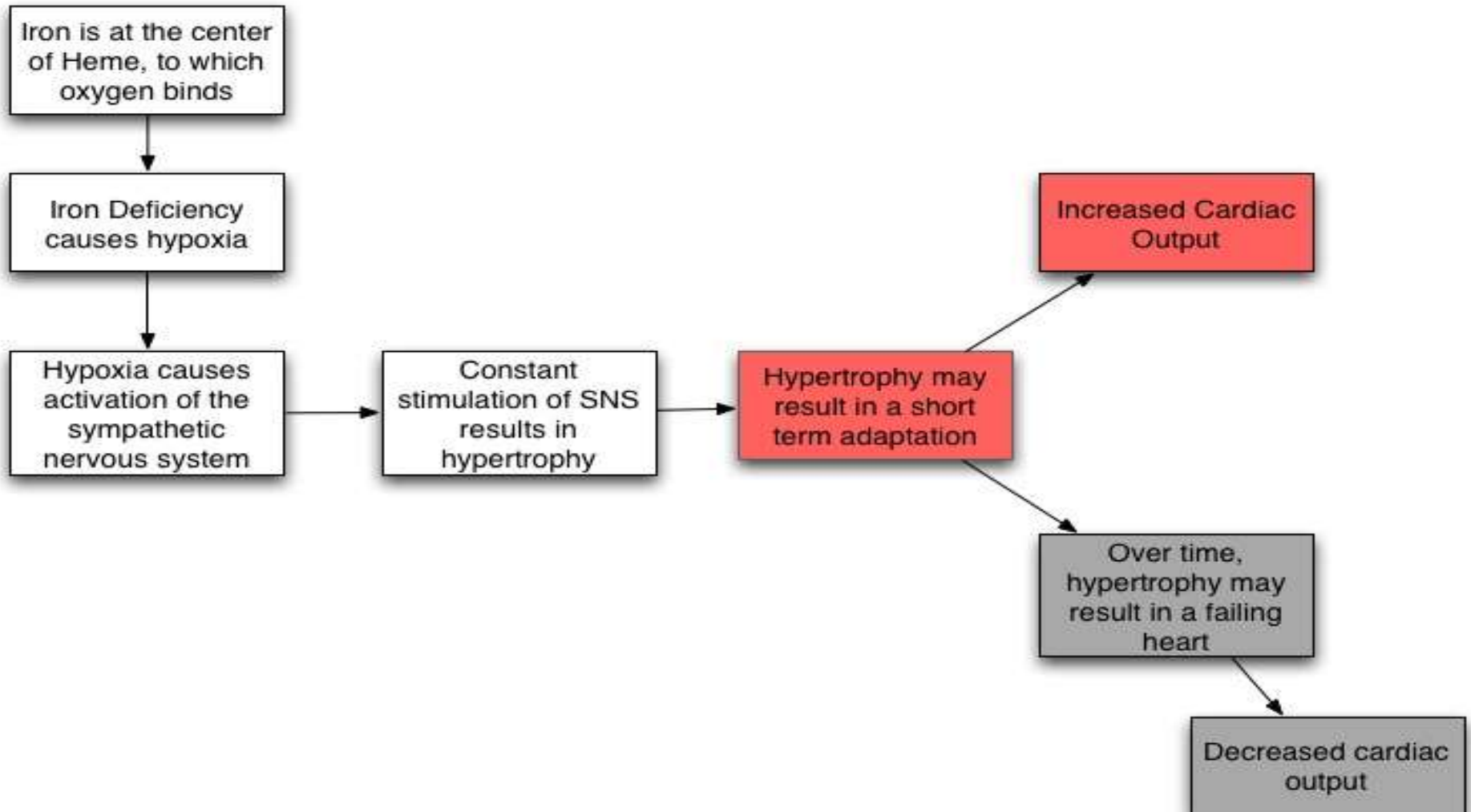


ADAPTIVE VS PATHOLOGICAL HYPERTROPHY

- **Adaptive hypertrophy**
 - Increased cardiac output
 - Increased heart chamber size
 - Healthy heart wall muscle
- **Pathological Hypertrophy**
 - Decreased cardiac output
 - No increase in heart chamber size
 - Fibrotic heart wall
 - Due to increase in collagen

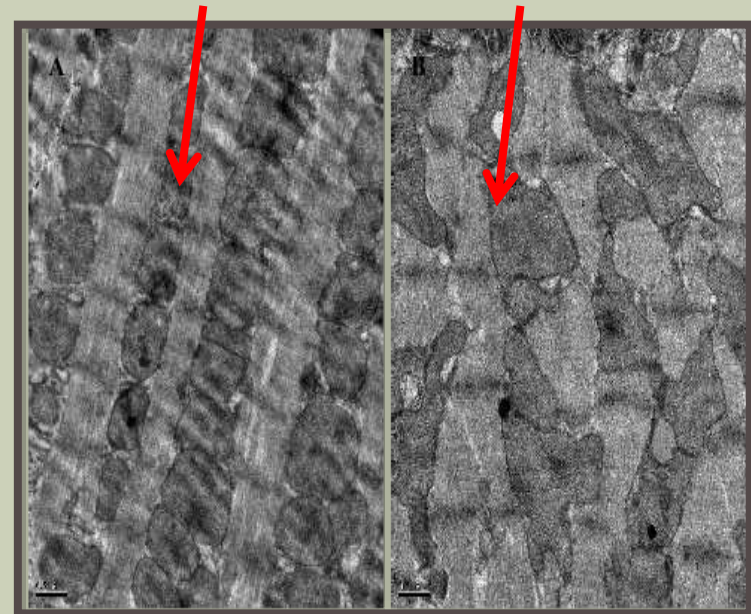
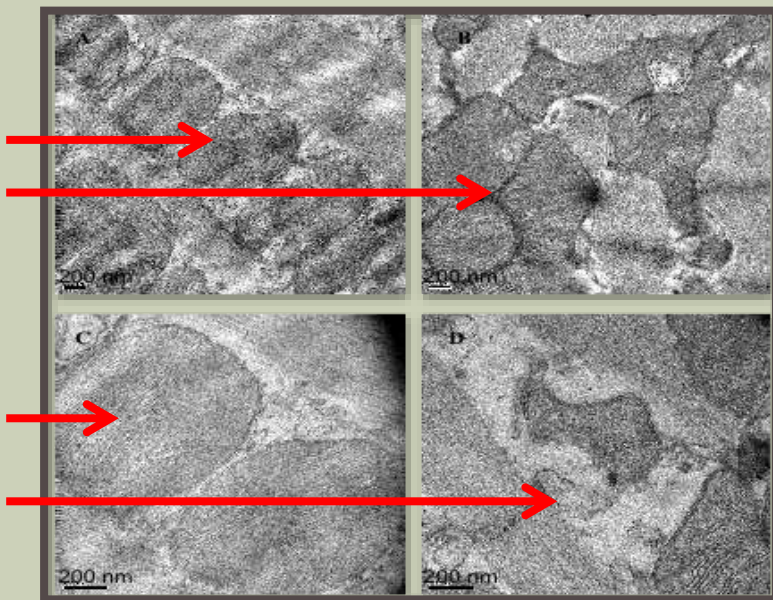


PROLONGED IRON DEFICIENCY CAUSES CARDIAC HYPERTROPHY



CURRENT UNDERSTANDING OF CARDIAC HYPERTROPHY FROM IRON DEFICIENCY

- 12 weeks of iron deficiency
- Morphological indications of failure
- Apoptosis stimulated
- Cardiac function of this hypertrophy is poorly understood



HYPOTHESIS

We hypothesized that four weeks of iron deficiency would result in failing cardiac function and decreased sympathetic neurotransmitter stores.

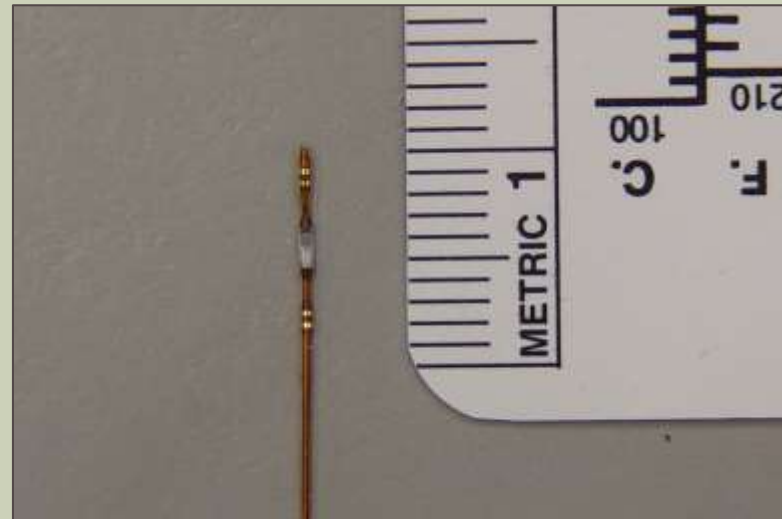
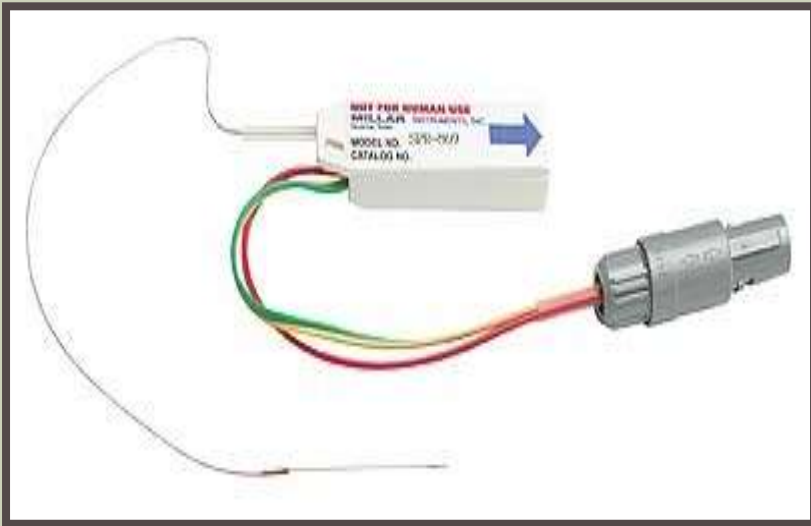
EXPERIMENTAL DESIGN

- **Two groups Sprague-Dawley Rats**
 - Four rats fed iron deficient diet (AIN-93G without iron)
 - Four rats fed control diet (AIN-93G)
- Four weeks of the respective dietary intervention
- Cardiac pressure-volume loop protocol
- Plasma and hearts frozen for HPLC analysis



PV LOOP PROTOCOL: SURGERY

- 2 femoral vein catheters for drug infusion
- 1 jugular vein catheter for saline calibration
- 1 carotid artery exposure for PV loop transducer
 - Inserted into the carotid artery and passed into the left ventricle

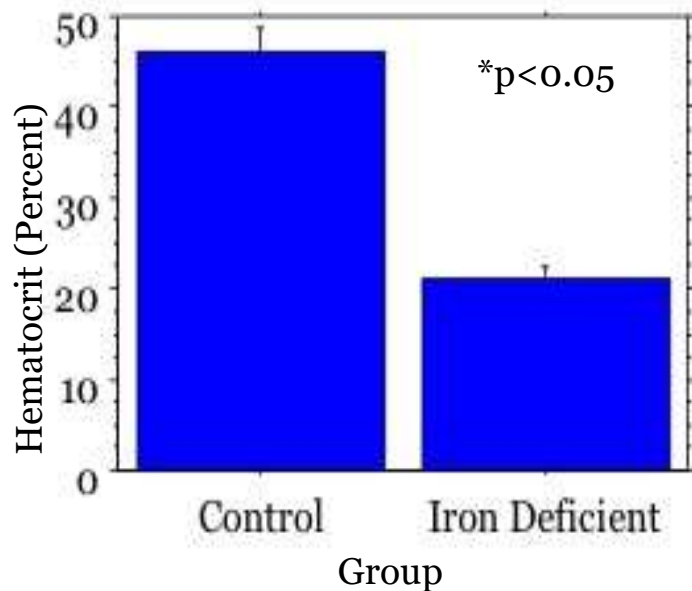


PV-LOOP PROTOCOL: DATA COLLECTION

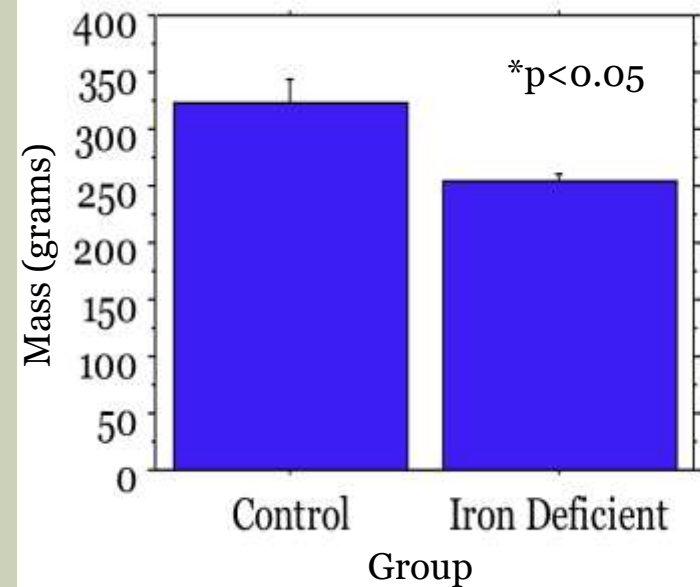
- Aortic pressure measurements and baseline cardiac function data
- Inferior Vena Cava occlusion for measure of contractility
- Saline calibration for parallel conductance subtraction
- Dopamine infusion
- Atenolol infusion
- Second baseline data
- Heparinized rat to prevent blood clotting
- Cuvette calibration for measure of true blood volume
- Collect microhematocrit samples
- Centrifuge remaining blood for plasma
- Freeze plasma and hearts for HPLC analysis

RESULTS: IRON DEFICIENCY

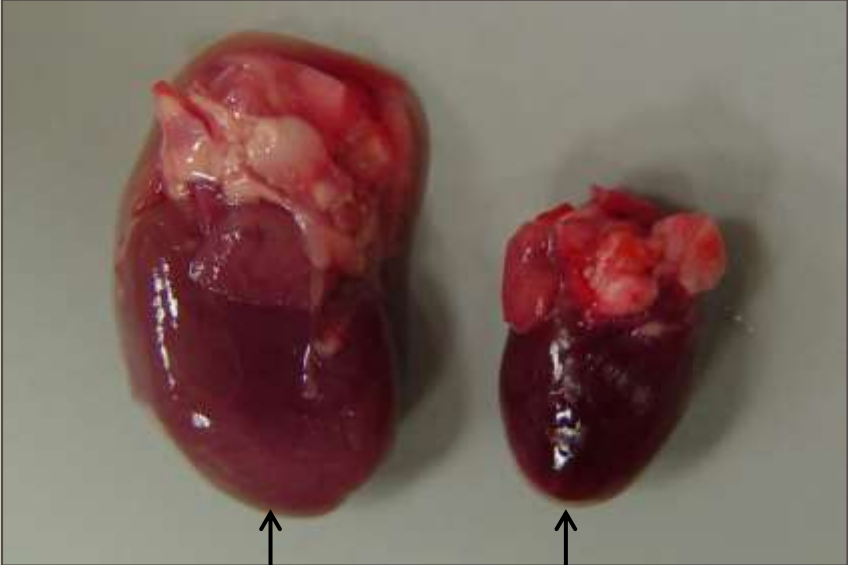
Hematocrit



Body Mass

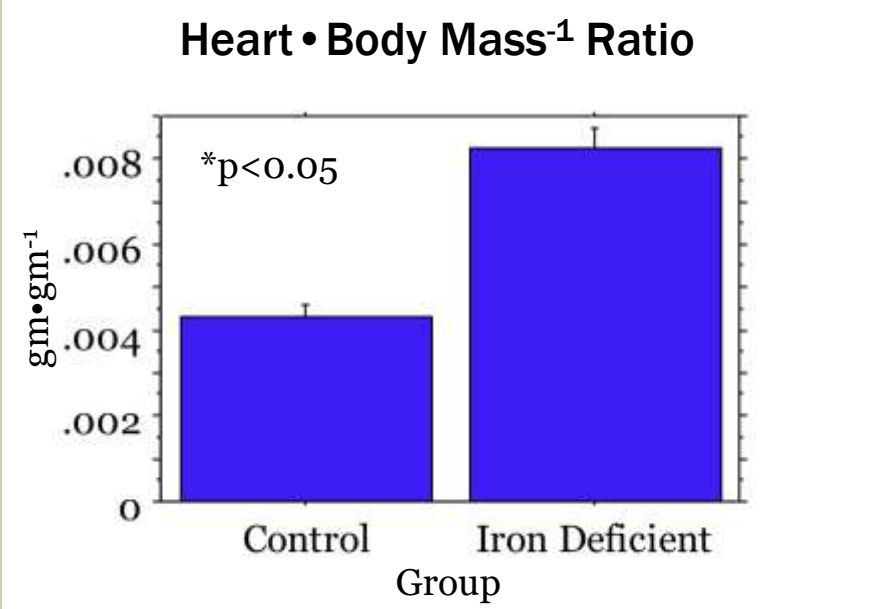


RESULTS: CARDIAC HYPERTROPHY

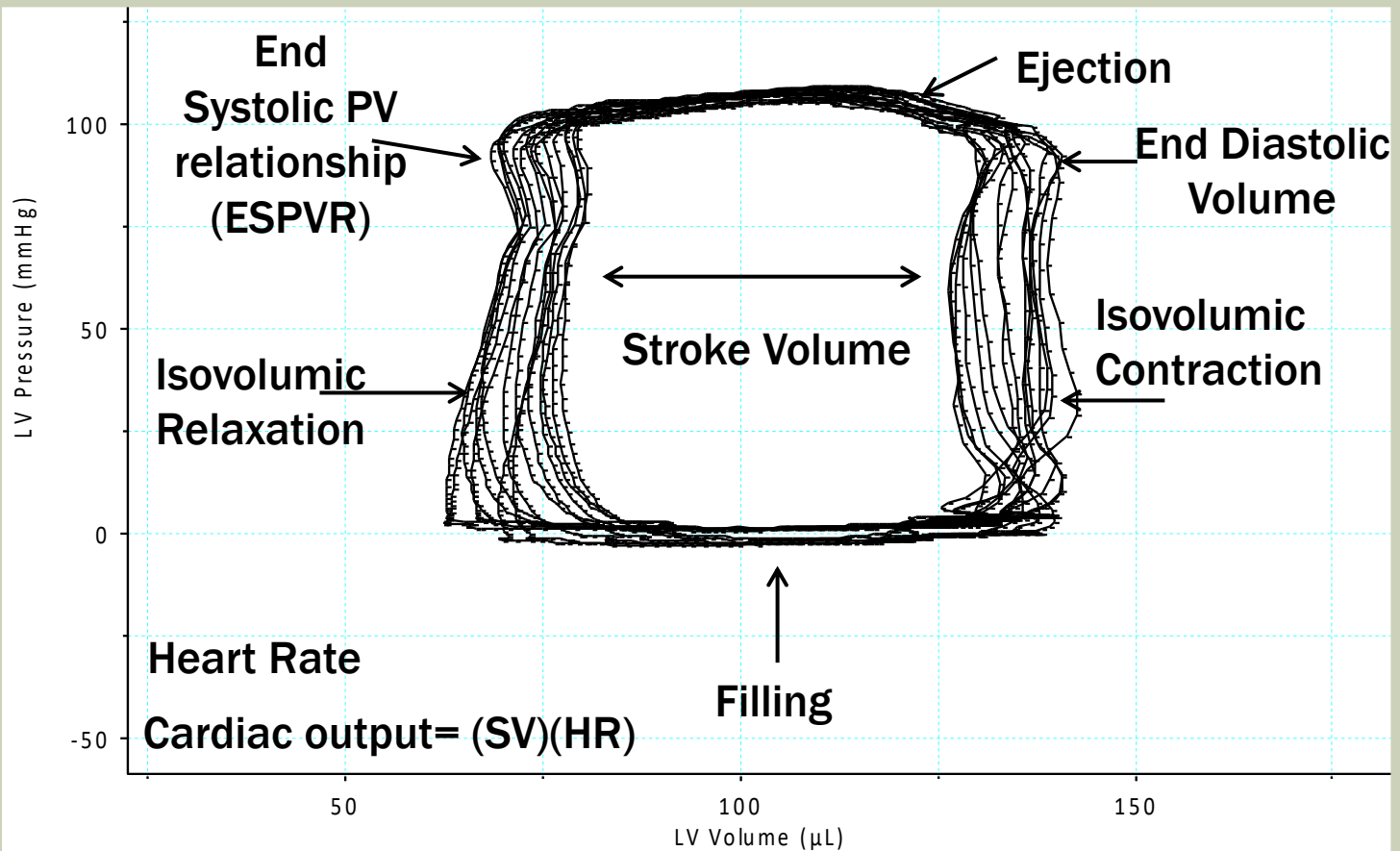


Iron Deficient

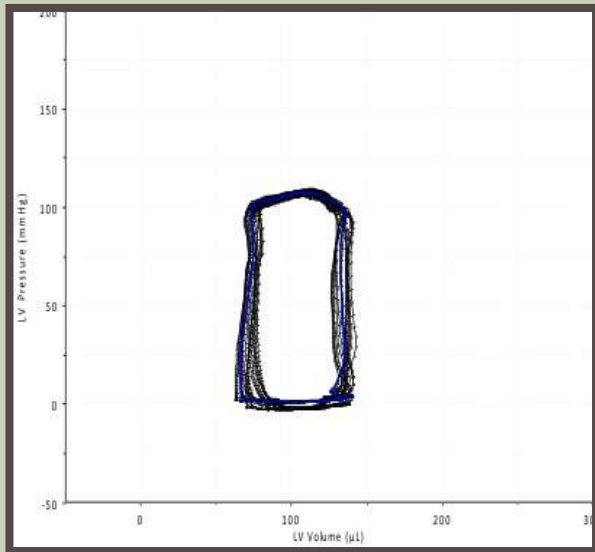
Control



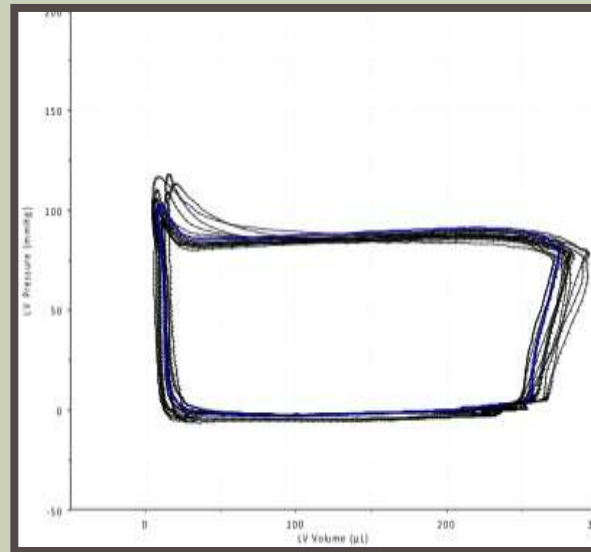
PRESSURE-VOLUME LOOPS



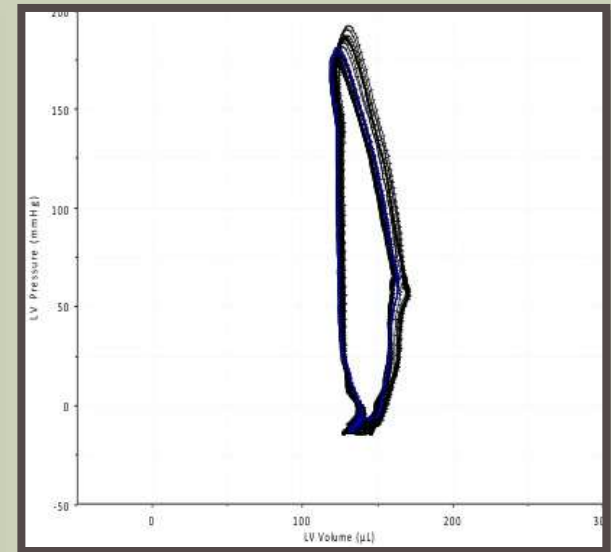
RESULTS: PRESSURE-VOLUME LOOPS



Control

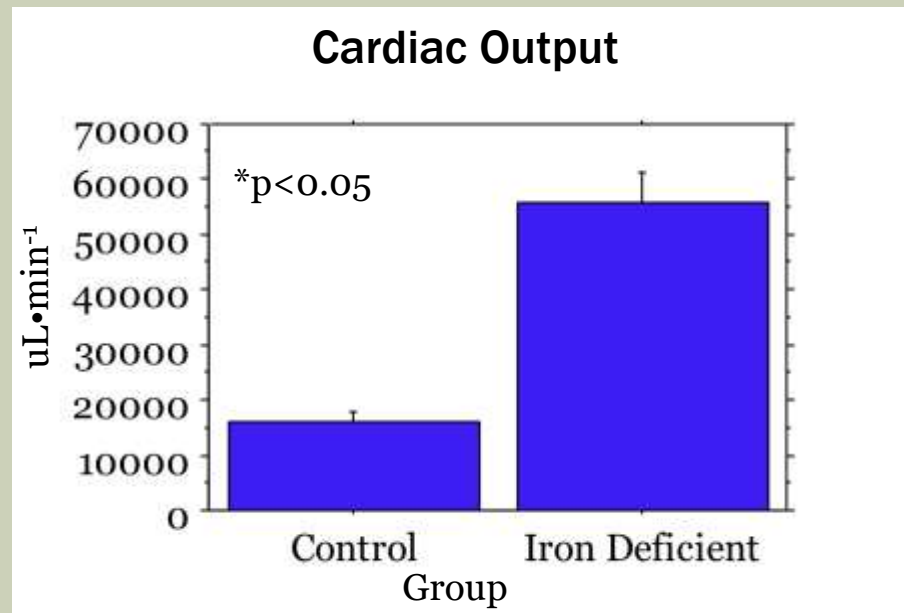


Iron Deficient-Adaptive



Iron Deficient-Failing

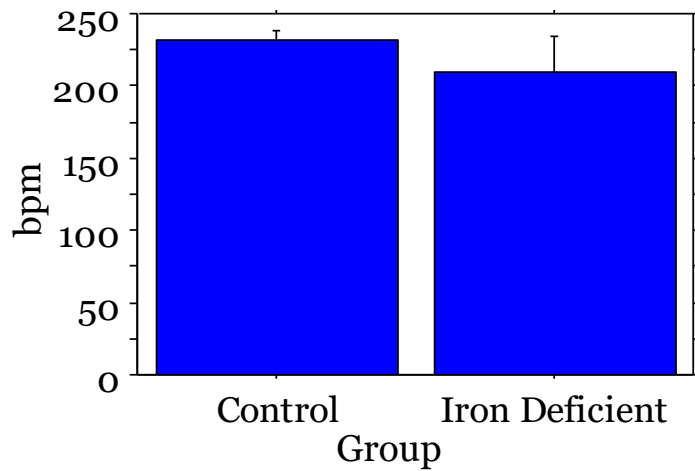
RESULTS: PRESSURE-VOLUME LOOPS



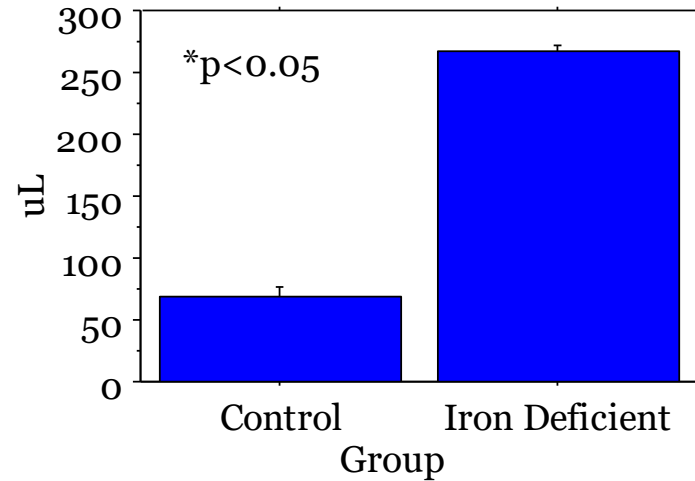
$$\text{CO} = \text{HR} * \text{SV}$$

RESULTS: PRESSURE VOLUME LOOPS

Heart Rate

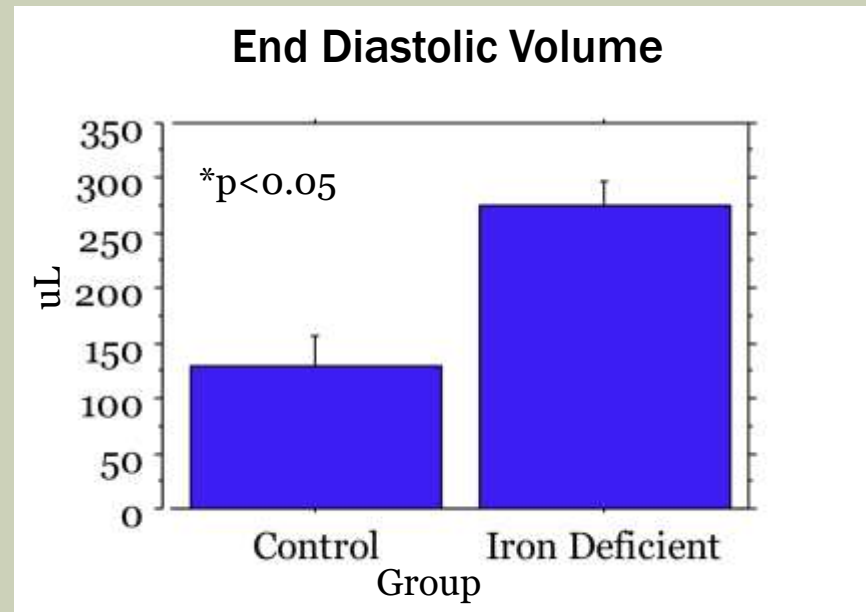


Stroke Volume



RESULTS: PRESSURE VOLUME LOOPS

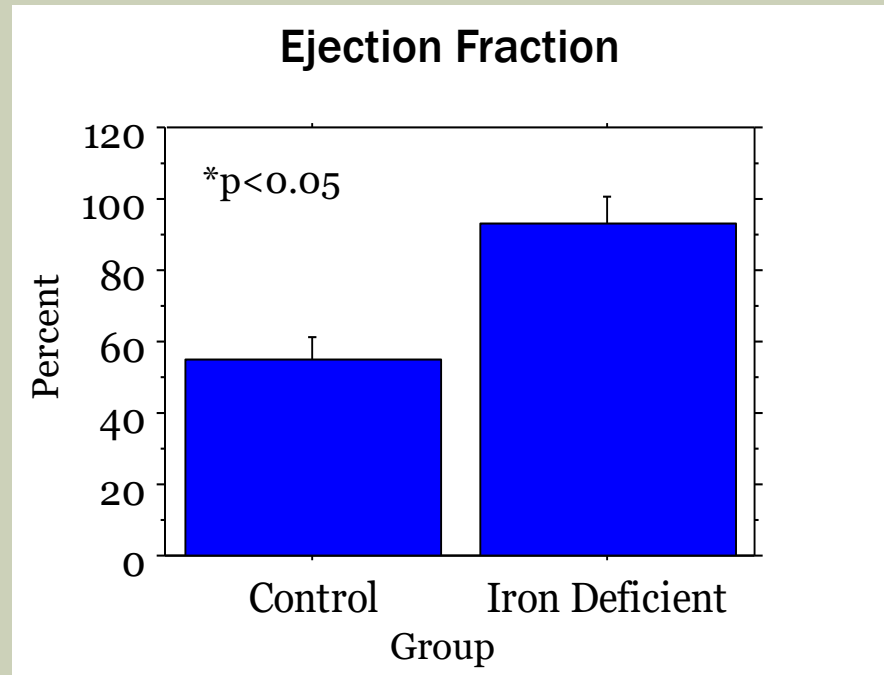
- Stroke volume is affected by three factors:
 - (1) Preload
 - End diastolic volume



RESULTS: PRESSURE-VOLUME LOOPS

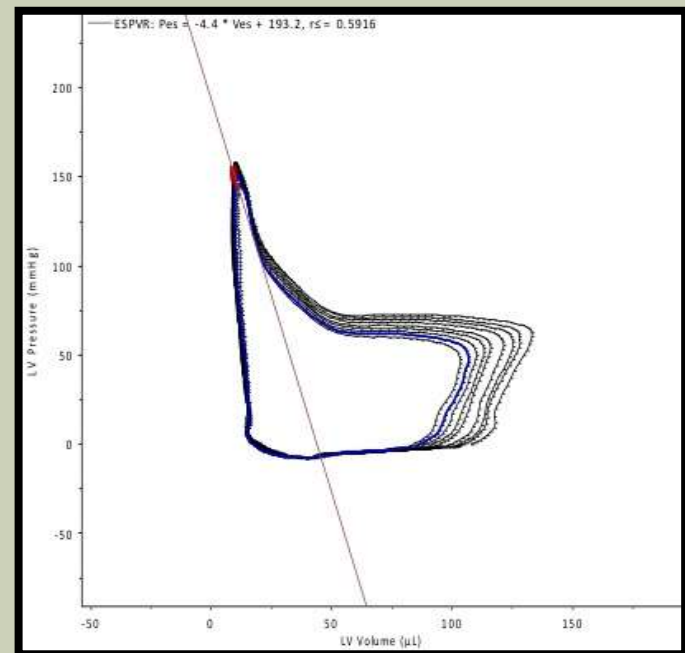
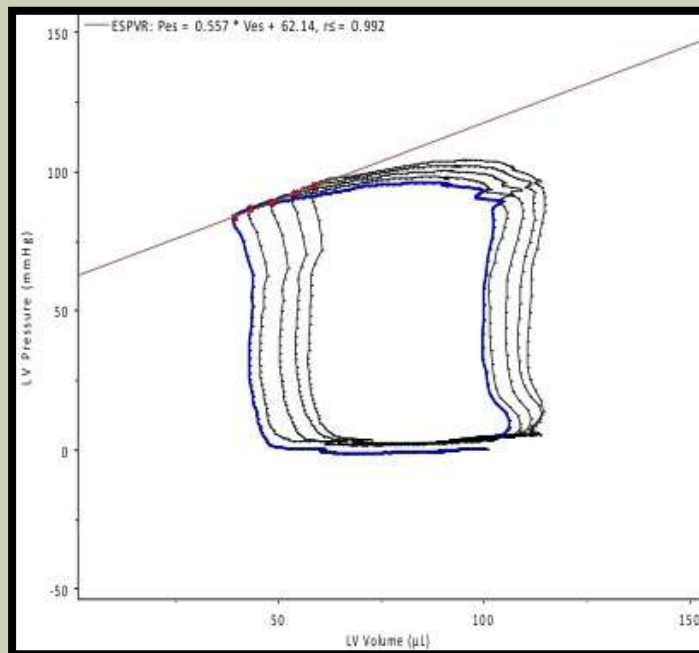
(2) Contractility

- Sympathetic nervous system
- Ejection fraction
- Frank-Starling Law of The Heart

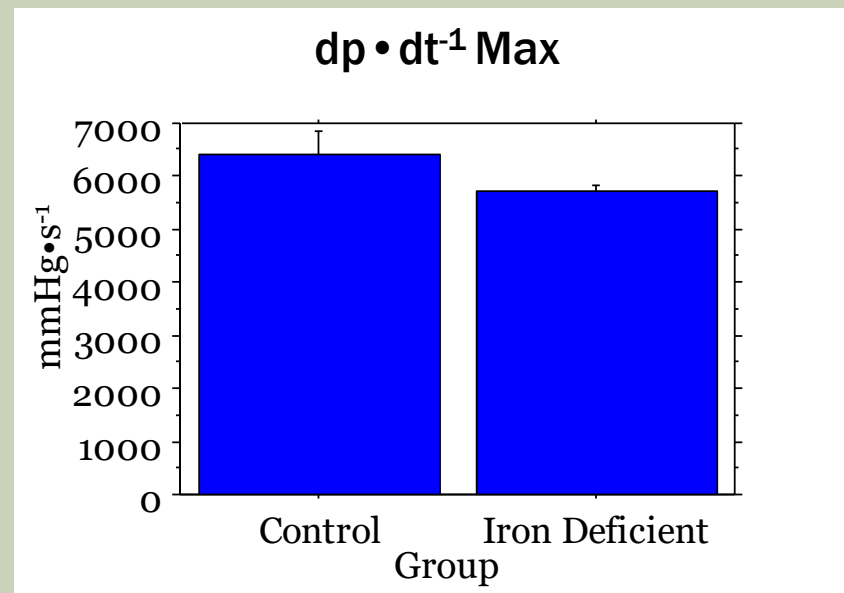


ESPVR AS A MEASURE OF CONTRACTILITY

- Control rat ejection fraction averaged 55%
- Iron deficient rat ejection fraction averaged 93%



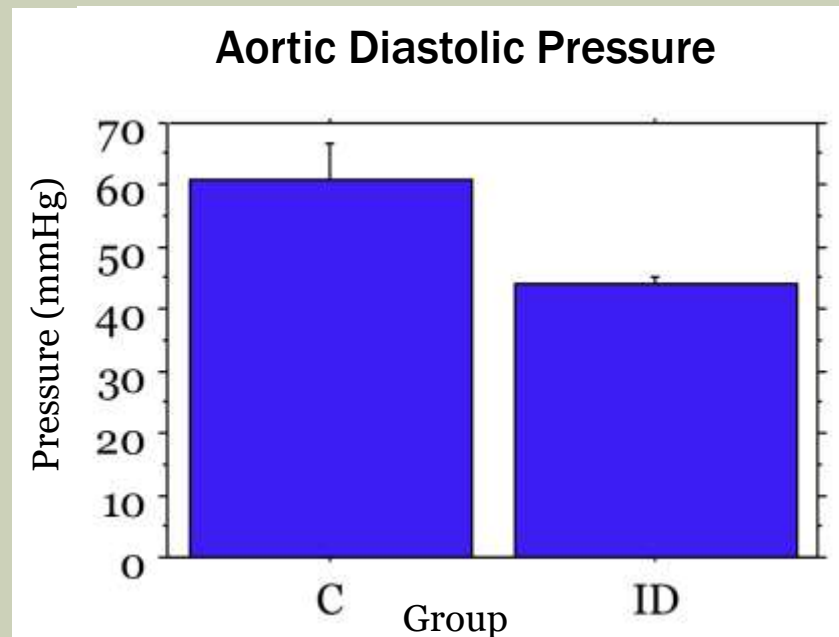
RESULTS: PRESSURE-VOLUME LOOPS



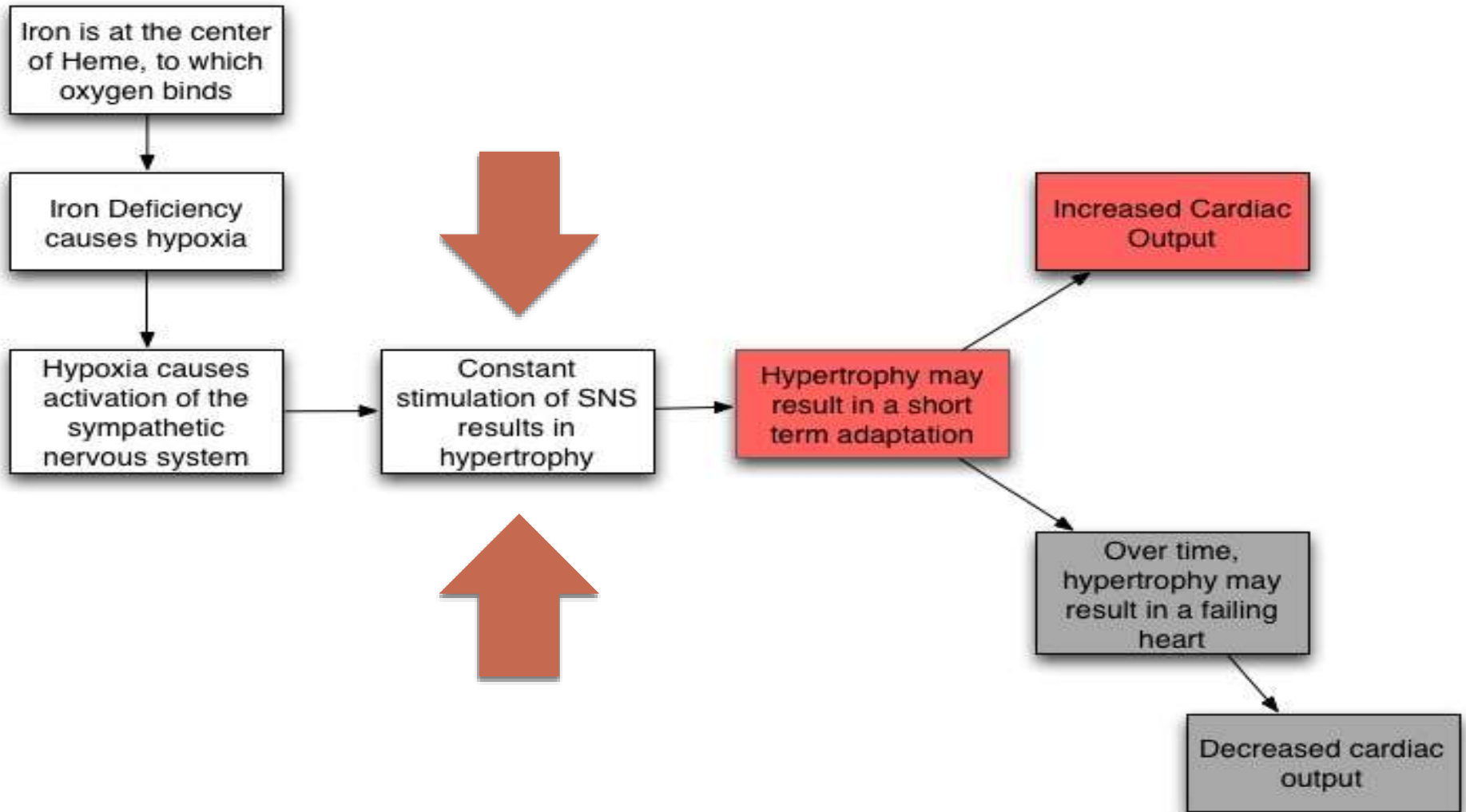
RESULTS: PRESSURE-VOLUME LOOPS

(3) Afterload

- Aortic diastolic pressure

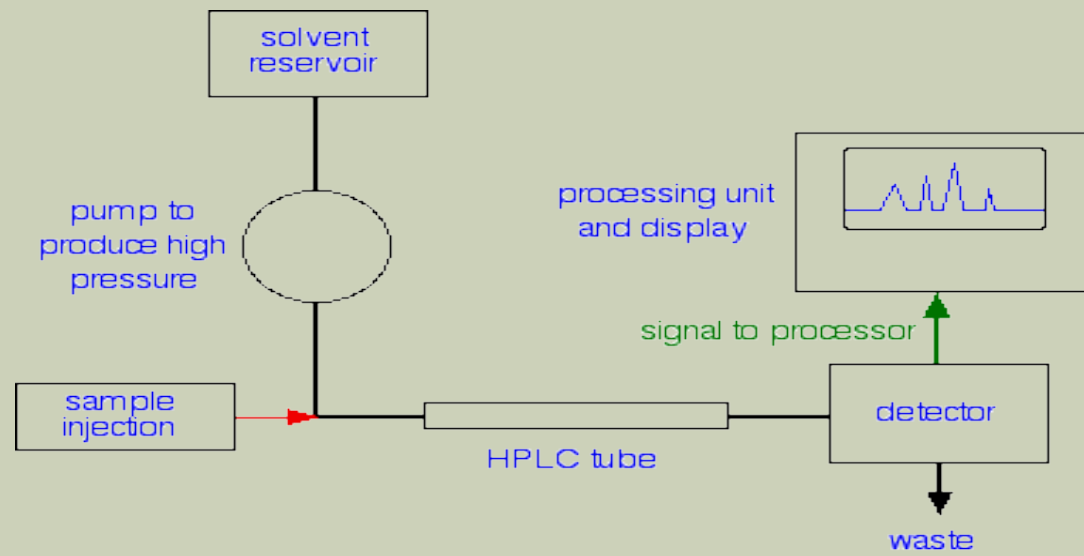


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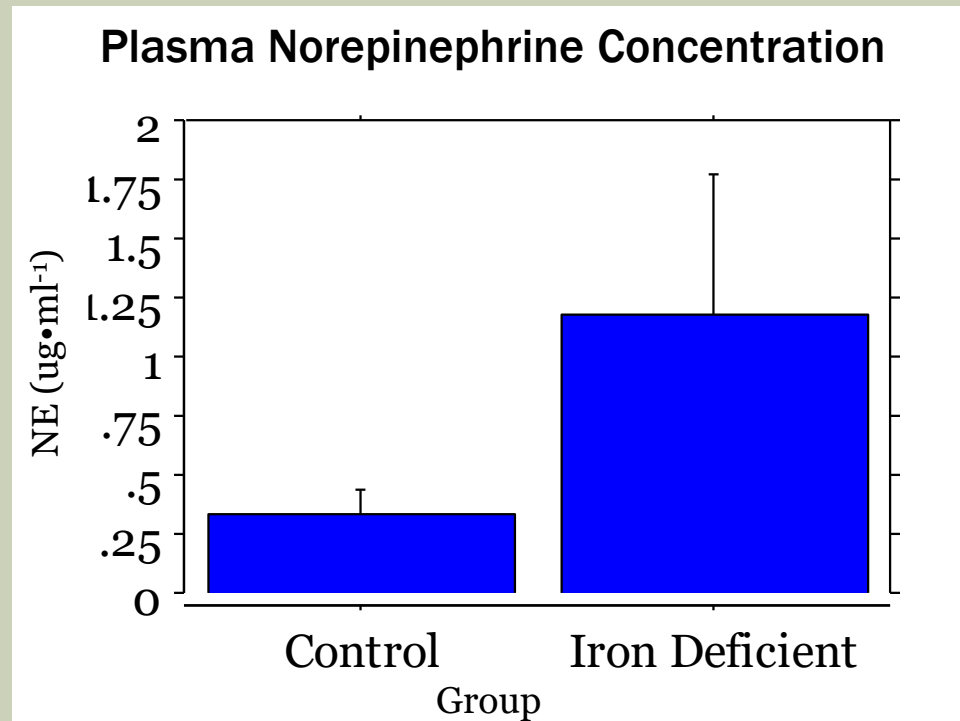


HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

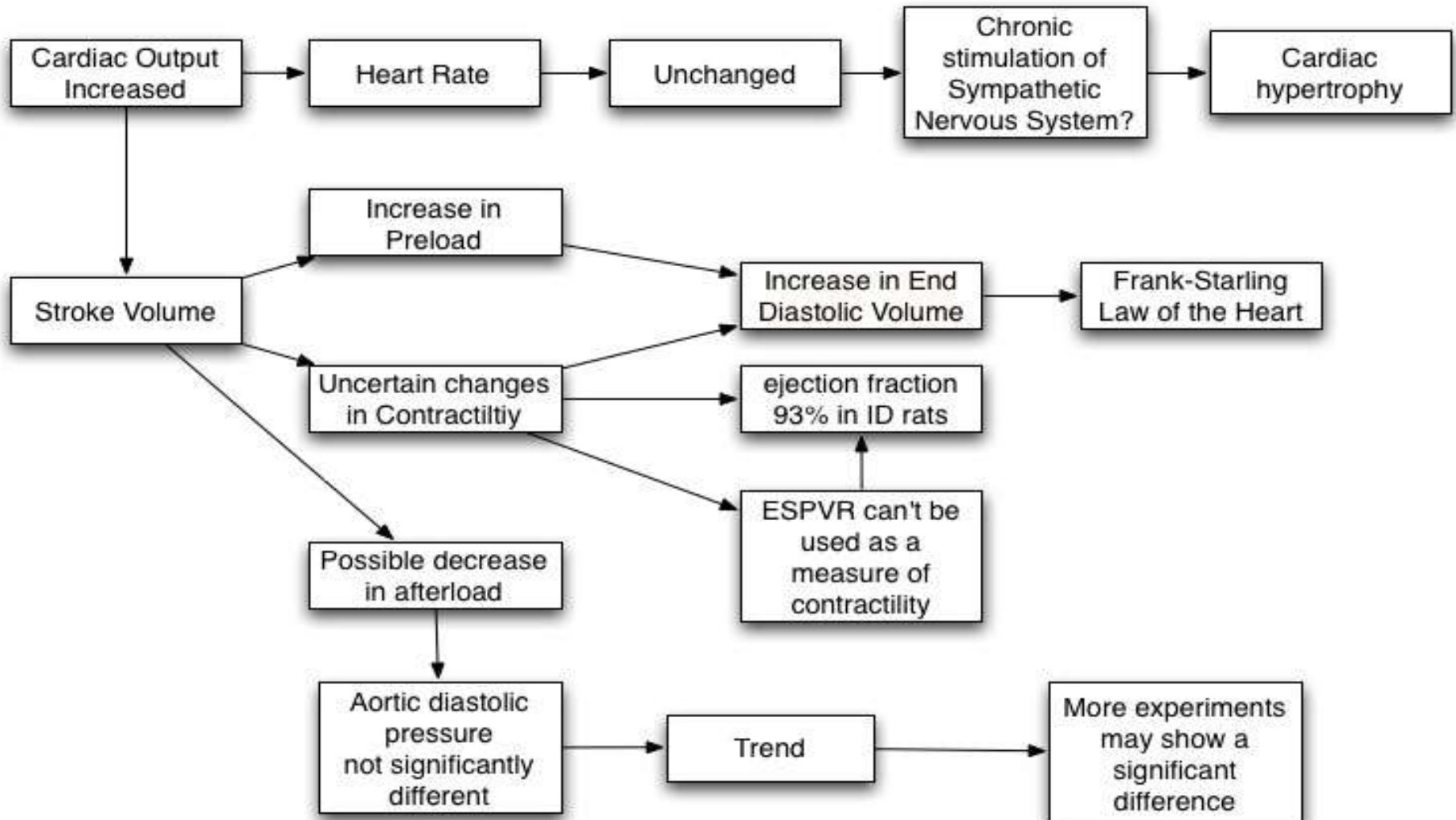
- HPLC is a technique used to separate and quantify chemical compounds in a liquid medium
- Used to determine concentration of norepinephrine in extracted plasma



RESULTS: HPLC



CONCLUSION: 3 ADAPTIVE ID HEARTS, 1 FAILING ID HEART



ACKNOWLEDGMENTS

Thanks to
Wyoming
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