



The role of nutrition and exercise in muscle wasting in the critically ill patient

Zudin Puthucheary



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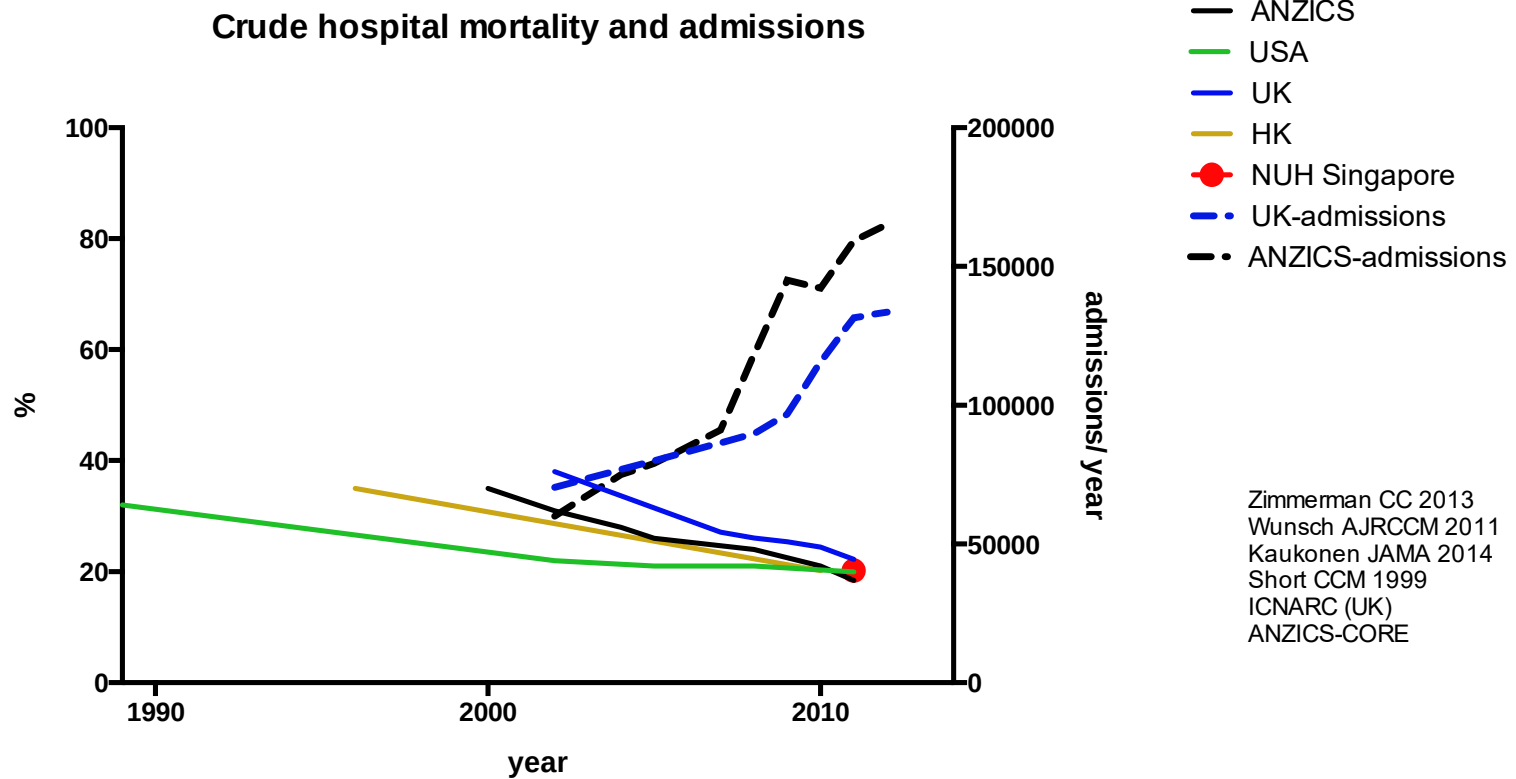
@Zudin_P



DISCLOSURES

- Specialist Advisor Board
 - Fresenius Kabi*
 - *Nestle*
- Consultancy
 - *Lyric Pharmaceuticals*
 - *Faraday Pharmaceuticals*
- Speakers Fees
 - *Orion Pharmaceuticals*
 - *Nestle*

Death, morbidity and economics are the only endpoints for trials *Koretz 2005*



Long-term mortality and quality of life after prolonged mechanical ventilation*

The NEW ENGLAND
JOURNAL of MEDICINE

ESTABLISHED IN 1812

FEBRUARY 20, 2003

VOL. 348 NO. 8

One-Year Outcomes in Survivors
of the Acute Respiratory Distress Syndrome

Margaret S. Herridge, M.D., M.P.H., Angela M. Cheung, M.D., Ph.D., Catherine M. Tansey, M.Sc.,
Andrea Matte-Martyn, B.Sc., Natalia Diaz-Granados, B.Sc., Fatma Al-Saidi, M.D., Andrew B. Cooper, M.D.,
Cameron B. Guest, M.D., C. David Mazer, M.D., Sangeeta Mehta, M.D., Thomas E. Stewart, M.D., Aiala Barr, Ph.D.,
Deborah Cook, M.D., and Arthur S. Slutsky, M.D., for the Canadian Critical Care Trials Group

ORIGINAL CONTRIBUTIONS

**Three-Year Outcomes for Medicare Beneficiaries
Who Survive Intensive Care**

Hannah Wunsch, MD, MSc

Context. Although hospital mortality has decreased over time in the United States

Su
chal

st

	INTENSIVE CARE ACQUIRED WEAKNESS	VENTILATOR ASSOCIATED PNEUMONIA	VENOUS THROMBOSIS	CENTRAL LINE INFECTION
highest incidence	50%	25%	30%	0.058%
Lowest incidence	25%	10%	4%	0.001%

De Jonghe JAMA 2002
ATS AJRCCM 2005
Boddi JTN 2010
Provonost NEJM 2006

Skeletal Muscle Weakness Is Associated With Both Early and Late Mortality After Acute Respiratory Distress Syndrome*

ORIGINAL



Zudin Puthucheary, MRCP, PhD
Division of Critical Care
Institute of Sports and Exercise Health
University College London Hospitals
London, UK

Physical declines occurring after hospital discharge in ARDS survivors: a 5-year longitudinal study

Elizabeth R. Pfoh^{1,2}, Amy W. Wozniak³, Elizabeth Colantuoni^{3,4}, Victor D. Dinglas^{4,5}, Pedro A. Mendez-Tellez^{4,6}, Carl Shanholtz⁷, Nancy D. Ciesla⁴, Peter J. Pronovost^{4,6,8,9} and Dale M. Needham^{4,5,10*}

Hallie Prescott, MD, MSC
Division of Pulmonary and Critical Care Medicine
University of Michigan Health System; and
HSR&D Center for Clinical Management Research
VA Ann Arbor Healthcare System
Ann Arbor, MI

Triangulating Weakness, Morbidity, and Mortality Among Acute Respiratory Distress Syndrome Survivors: A Story Emerges*

The NEW ENGLAND
JOURNAL of MEDICINE

ESTABLISHED IN 1912

APRIL 7, 2011

VOL. 364 NO. 14

Muscle Weakness and 5-Year Survival in Acute Respiratory Distress Syndrome Survivors*

Victor D. Dinglas, MPH^{1,2}; Lisa Aronson Friedman, ScM^{1,3}; Elizabeth Colantuoni, PhD^{1,3}; Pedro A. Mendez-Tellez, MD^{1,4}; Carl B. Shanholtz, MD⁵; Nancy D. Ciesla, DPT, MS^{1,2}; Peter J. Pronovost, MD, PhD^{6,7}; Dale M. Needham, FCPA, MD, PhD^{8,9}

Functional Disability 5 Years after Acute Respiratory Distress Syndrome

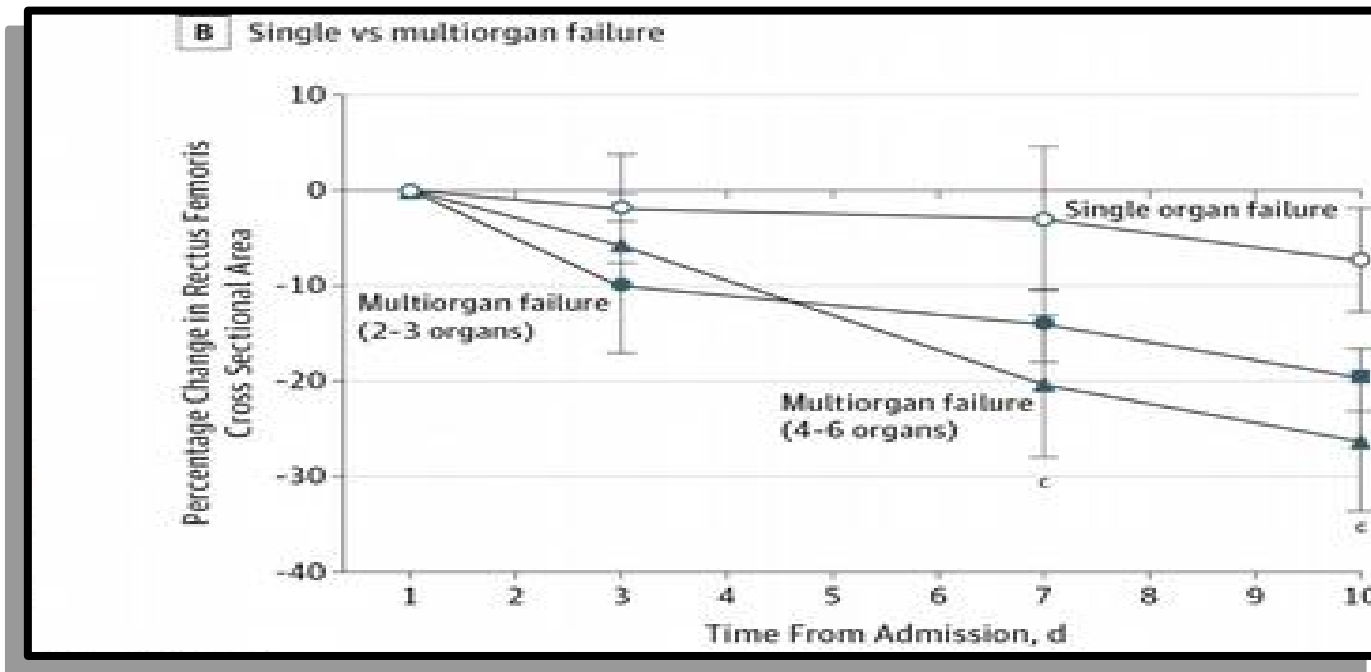
Margaret S. Herridge, M.D., M.P.H., Catherine M. Tansy, M.Sc., Andrea Matté, B.Sc., George Tomlin, Natalia Diaz-Granados, M.Sc., Andrew Cooper, M.D., Cameron B. Guest, M.D., C. David Mazer, Sangeeta Mehta, M.D., Thomas E. Stewart, M.D., Paul Kudlow, B.Sc., Deborah Cook, M.C., Arthur S. Slutsky, M.D., and Angela M. Cheung, M.D., Ph.D., for the Canadian Critical Care Trials Group

Evaluating Muscle Mass in Survivors of Acute Respiratory Distress Syndrome: A 1-Year Multicenter Longitudinal Study*

Kitty S. Chan, PhD¹; Marina Mourtzakis, PhD²; Lisa Aronson Friedman, ScM^{1,4}; Victor D. Dinglas, MPH^{1,4}; Catherine L. Hough, MD, MSc⁵; E. Wesley Ely, MD, MPH⁶; Peter E. Morris, MD⁷; Ramona O. Hopkins, PhD^{8,9,11}; Dale M. Needham, FCPA, MD, PhD^{10,12}; for the National Institutes of Health National Heart, Lung, and Blood Institute (NHLBI) Acute Respiratory Distress Syndrome (ARDS) Network

From: **Acute Skeletal Muscle Wasting in Critical Illness**

JAMA. 2013;310(15):1591-1600. doi:10.1001/jama.2013.278481

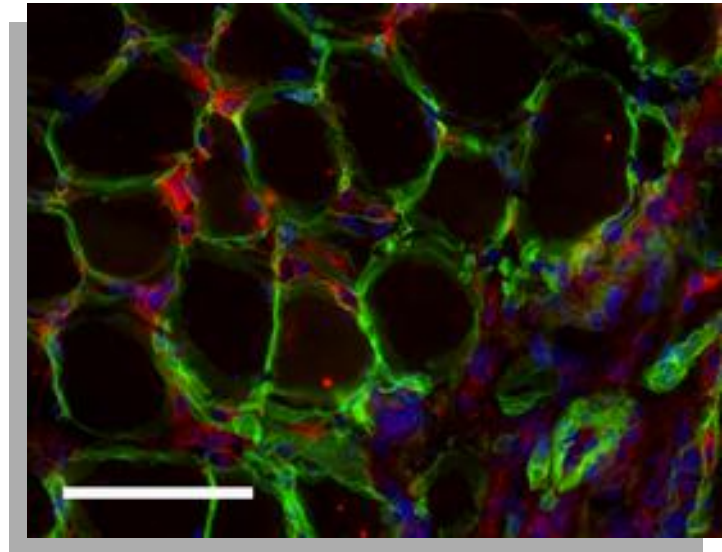
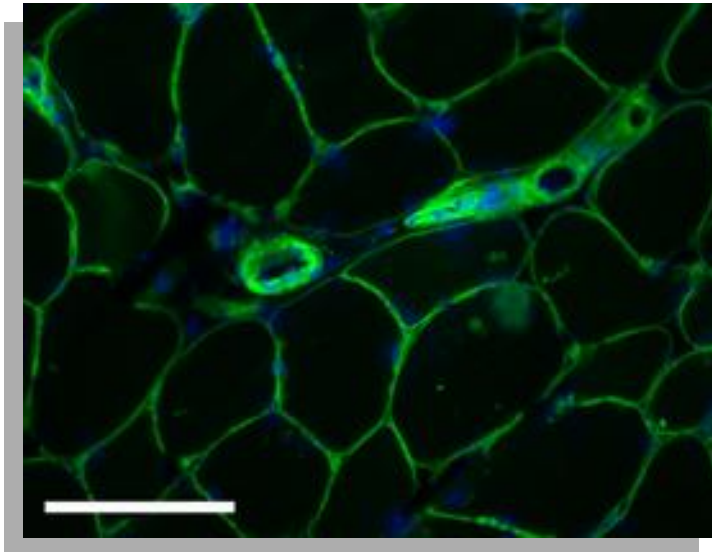
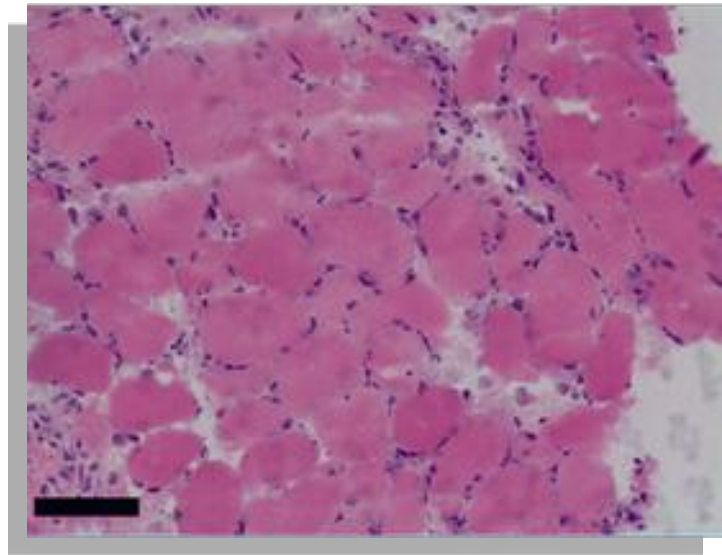
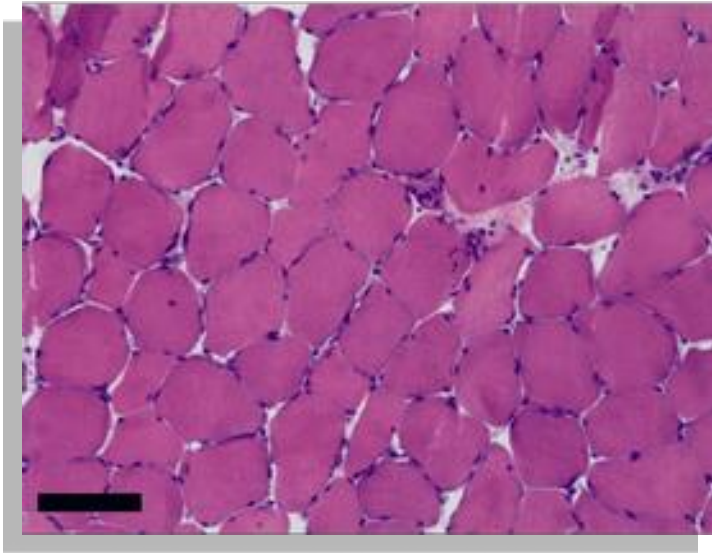


Muscle wasting was significantly greater in the sickest patients

20% loss in RF_{CSA} with > 2 organ failure

26% loss in RF_{CSA} with > 4 organ failure

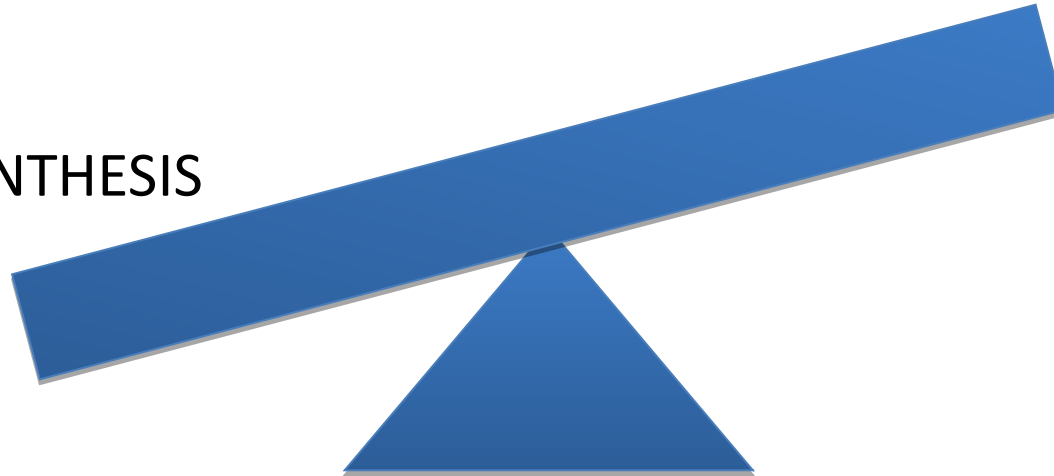
NECROSIS SEEN IN 40% OF CASES



MUSCLE PROTEIN HOMEOSTASIS

BREAKDOWN

SYNTHESIS



Anabolism

Catabolism

Feeding

Tipton KD et al Am J Physiol Endocrinol Metab 2007
Moore et al J Physiol 2009

Insulin

Greenhaff et al. Am J Physiol Endocrinol Metab 2008
Fryburg et al J Clin Invest 1995

Exercise Therapy

Bechoshoeft et al. Clin Nutr 2103
Yang et al Br J Nutr 2012

Inflammation

Biolo et al J Clin Endocrinol Metab 2002
Vesali RF et al. Clin Sci (Lond) 2009

Immobilisation & Bed Rest

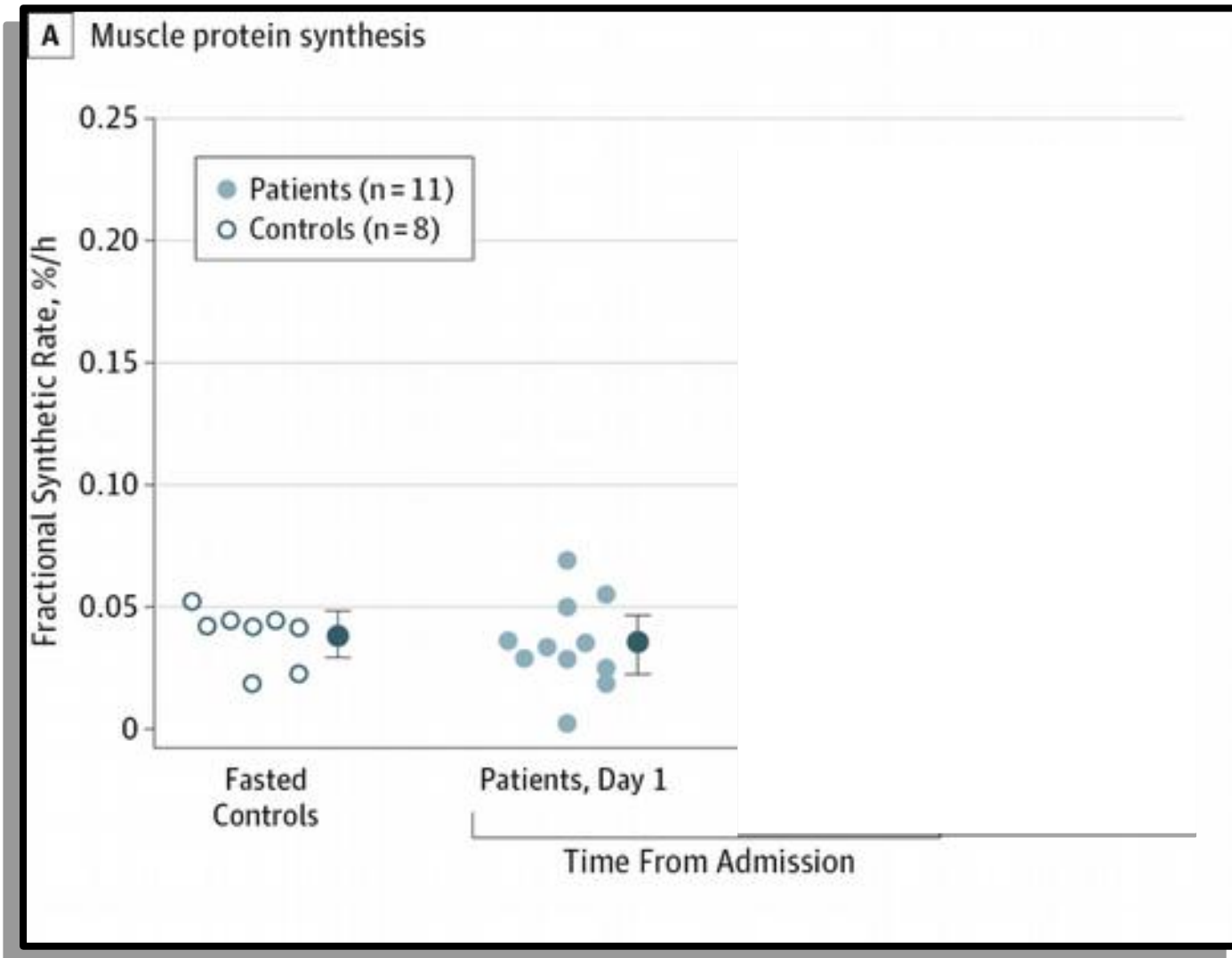
Ferrando et al Am J Physiol 1996
Glover et al J Physiol 2008

Ageing

de Boer et al J Physiol 2007
Kumar et al J Physiology 2009

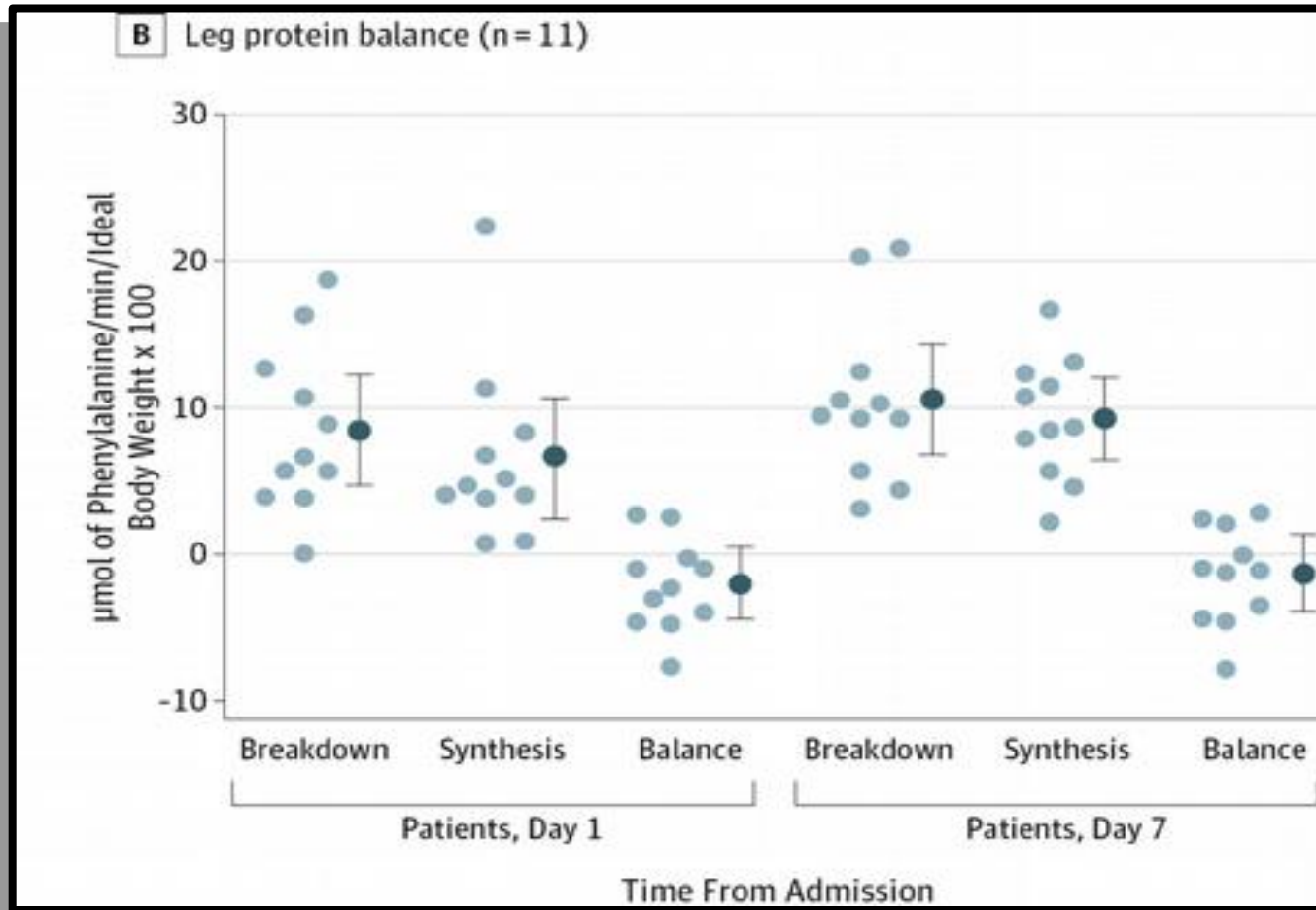
From: **Acute Skeletal Muscle Wasting in Critical Illness**

JAMA. 2013;310(15):1591-1600. doi:10.1001/jama.2013.278481

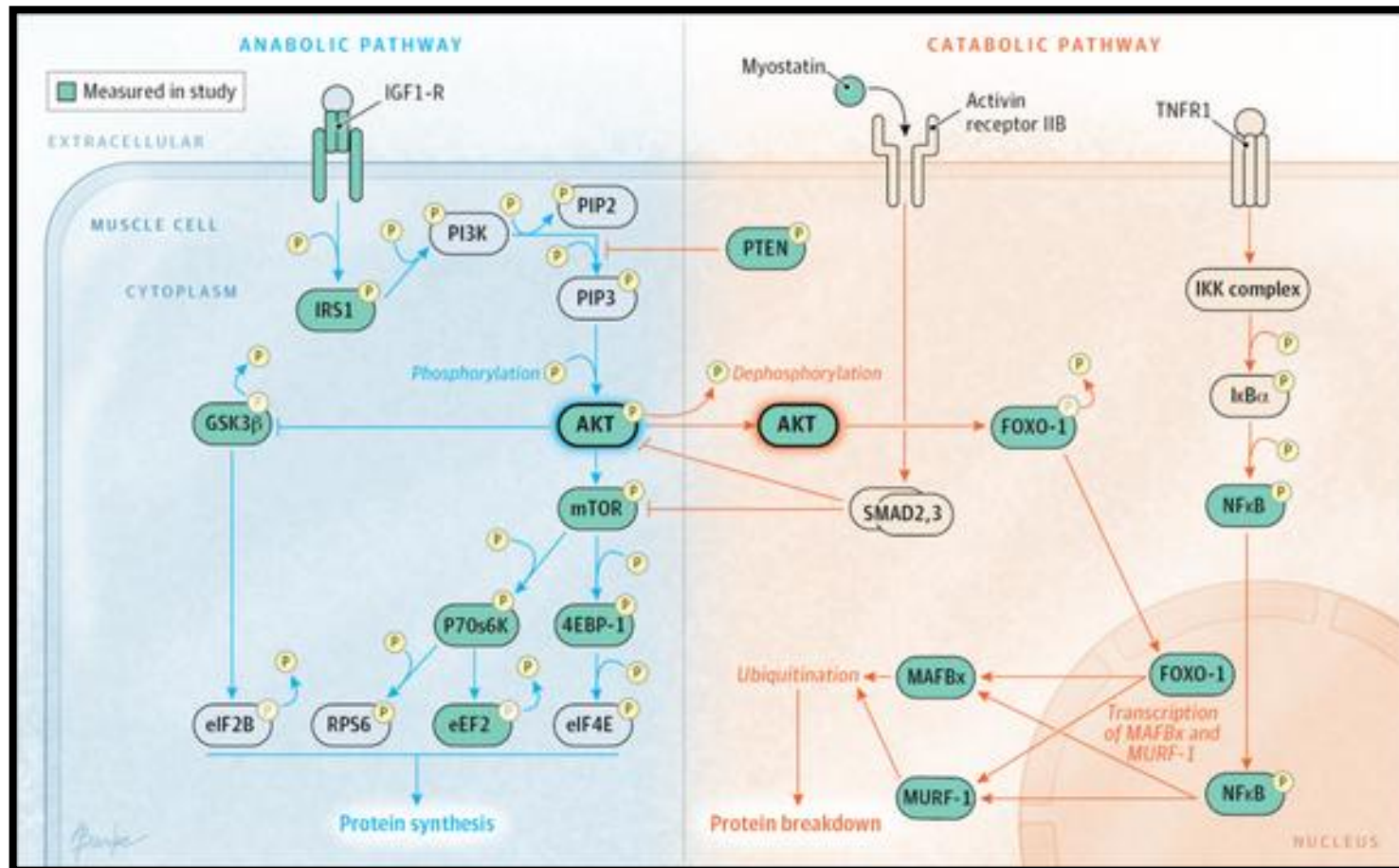


From: **Acute Skeletal Muscle Wasting in Critical Illness**

JAMA. 2013;310(15):1591-1600. doi:10.1001/jama.2013.278481



INTRACELLULAR SIGNALLING




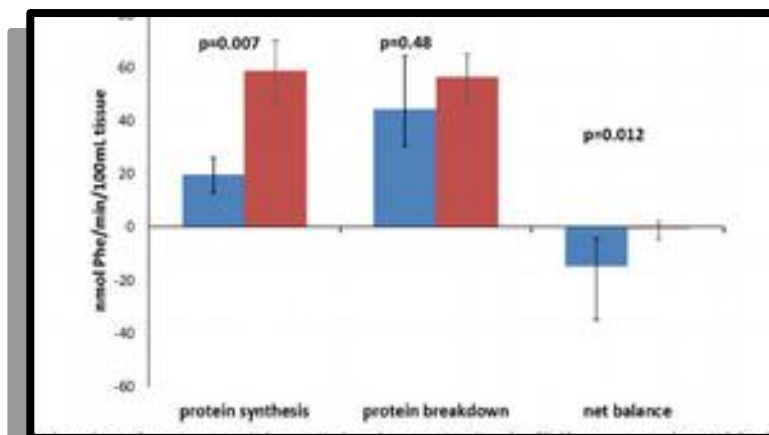
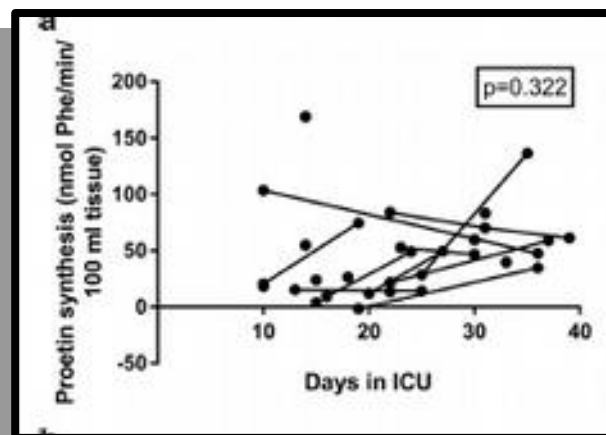
RESEARCH

Open Access



An attenuated rate of leg muscle protein depletion and leg free amino acid efflux over time is seen in ICU long-stayers

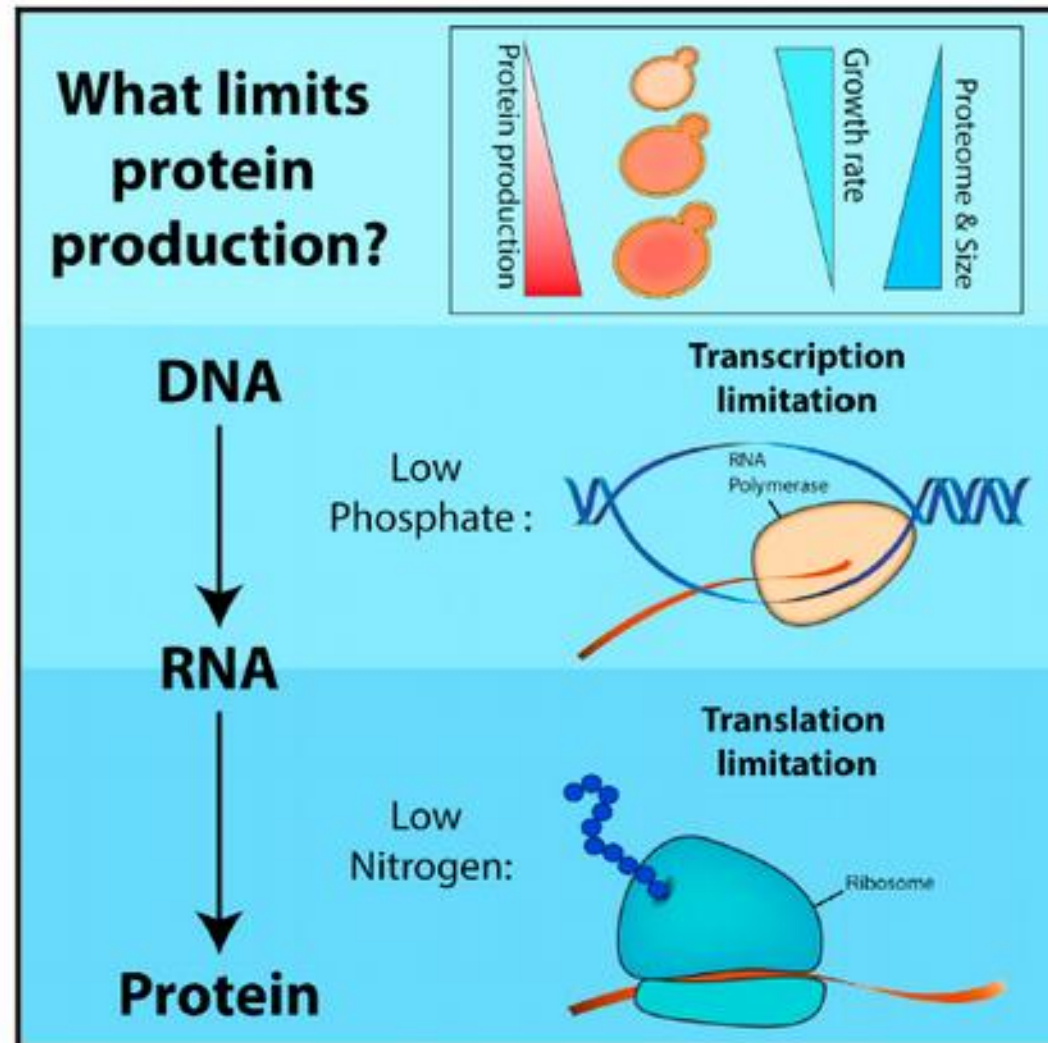
Lena Gamrin-Gripenberg^{1,2}, Martin Sundström-Rehal^{1,2}, Daniel Olsson³, Jonathan Grip^{1,2}, Jan Wernerman^{1,2} and Olav Rooyackers^{1,2*} 



Cell Reports

The Cost of Protein Production

Graphical Abstract



Authors

Moshe Kafri, Eyal Metzl-Raz, Ghil Jona, Naama Barkai

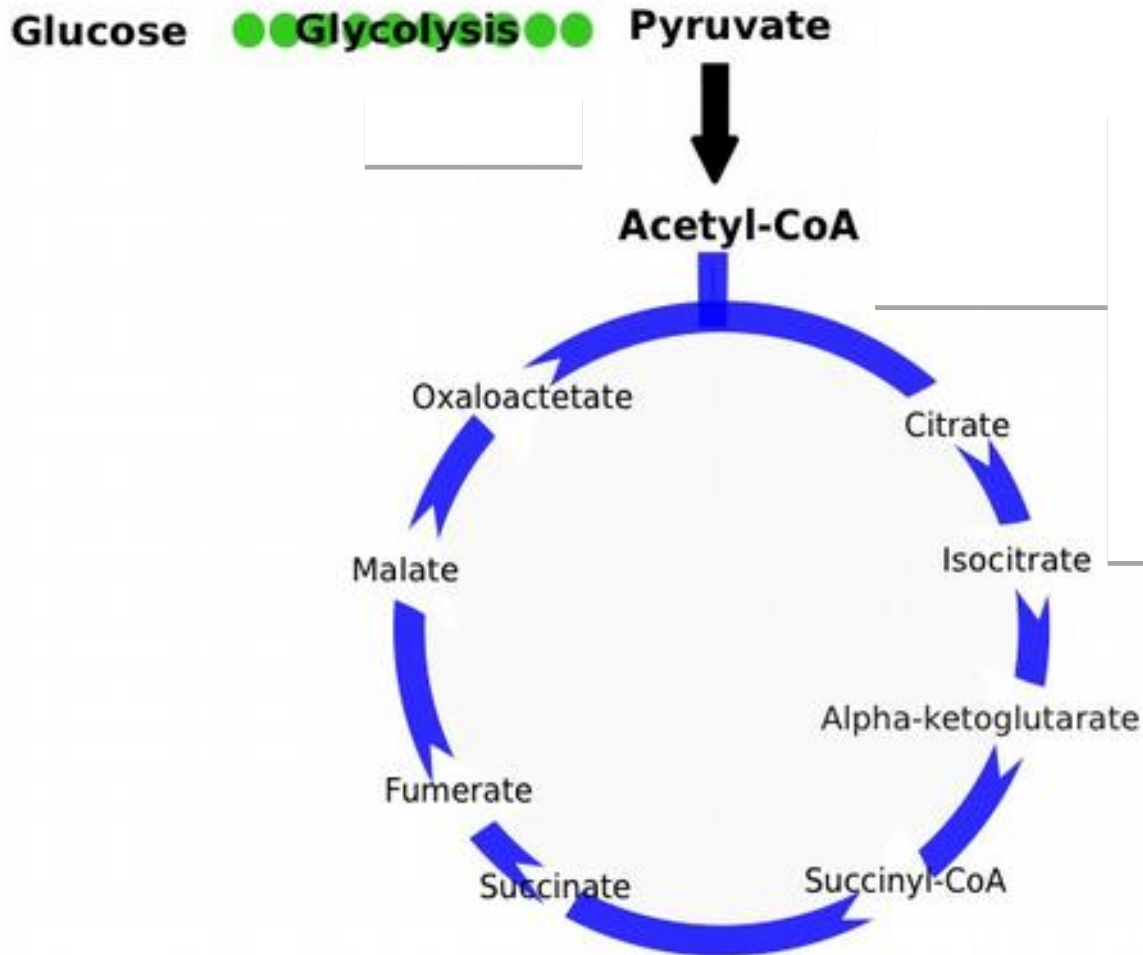
Correspondence

naama.barkai@weizmann.ac.il

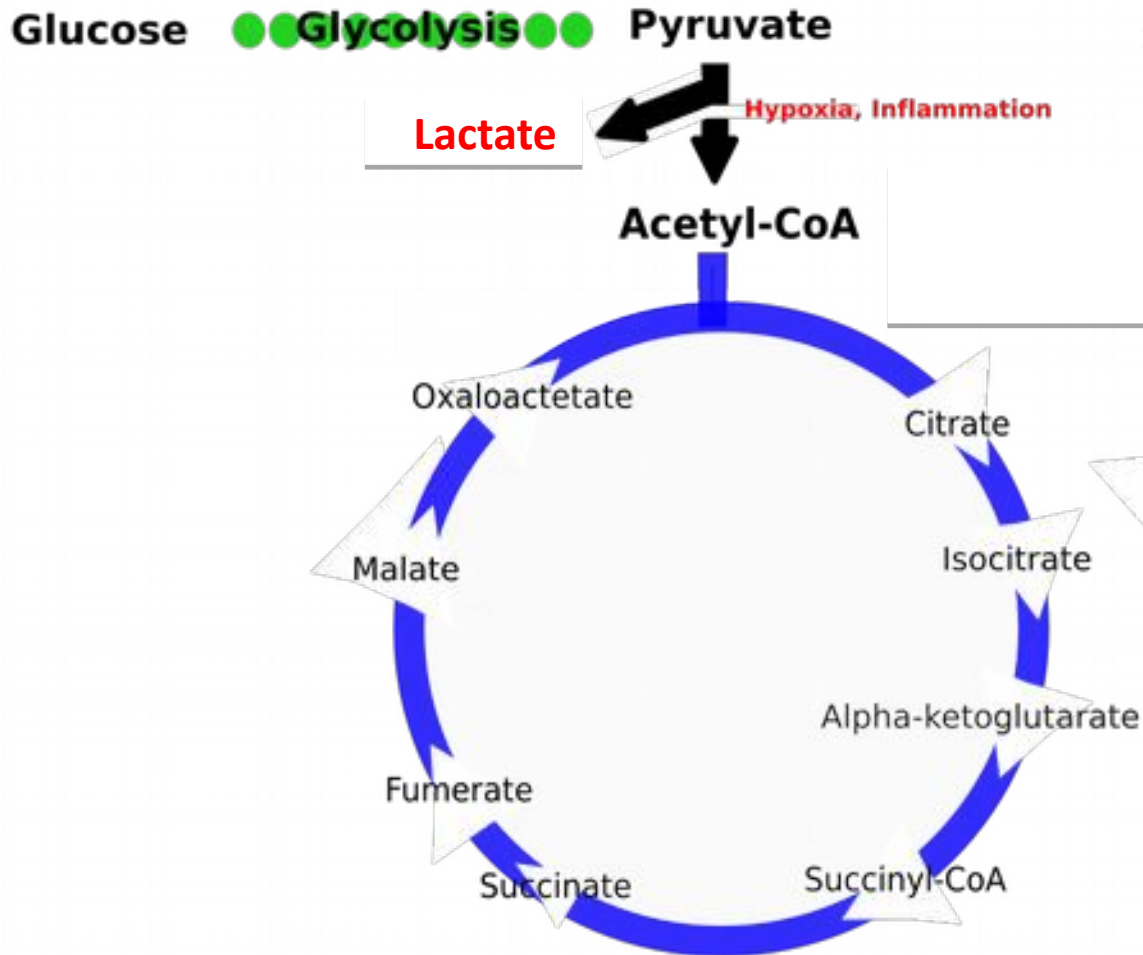
In Brief

Kafri et al. investigate the processes that limit protein production. They find that enforcing either gene transcription or protein translation reduces growth rate, depending on growth conditions. Cells adapt by increasing their size and endogenous proteome content, suggesting that rapidly growing cells are not resource limited.

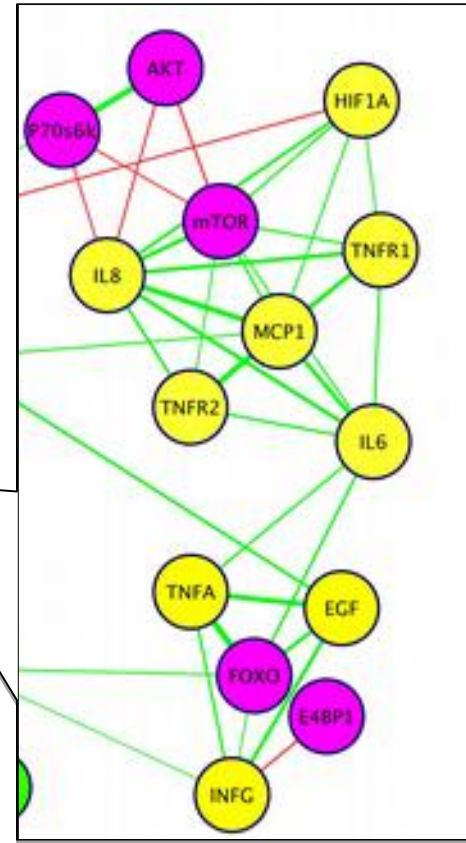
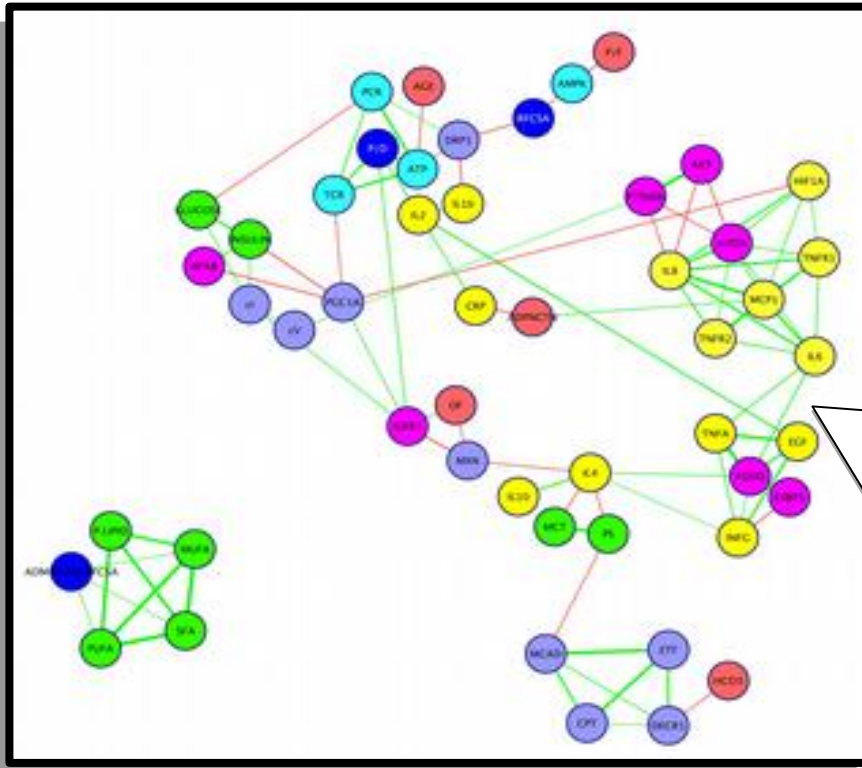
SUBSTRATES FOR ATP GENERATION



SUBSTRATES FOR ATP GENERATION



INTRAMUSCULAR HYPOXIA AND INFLAMMATION



PROTEIN
HOMEOSTASIS

MUSCLE MASS

NUTRITIONAL

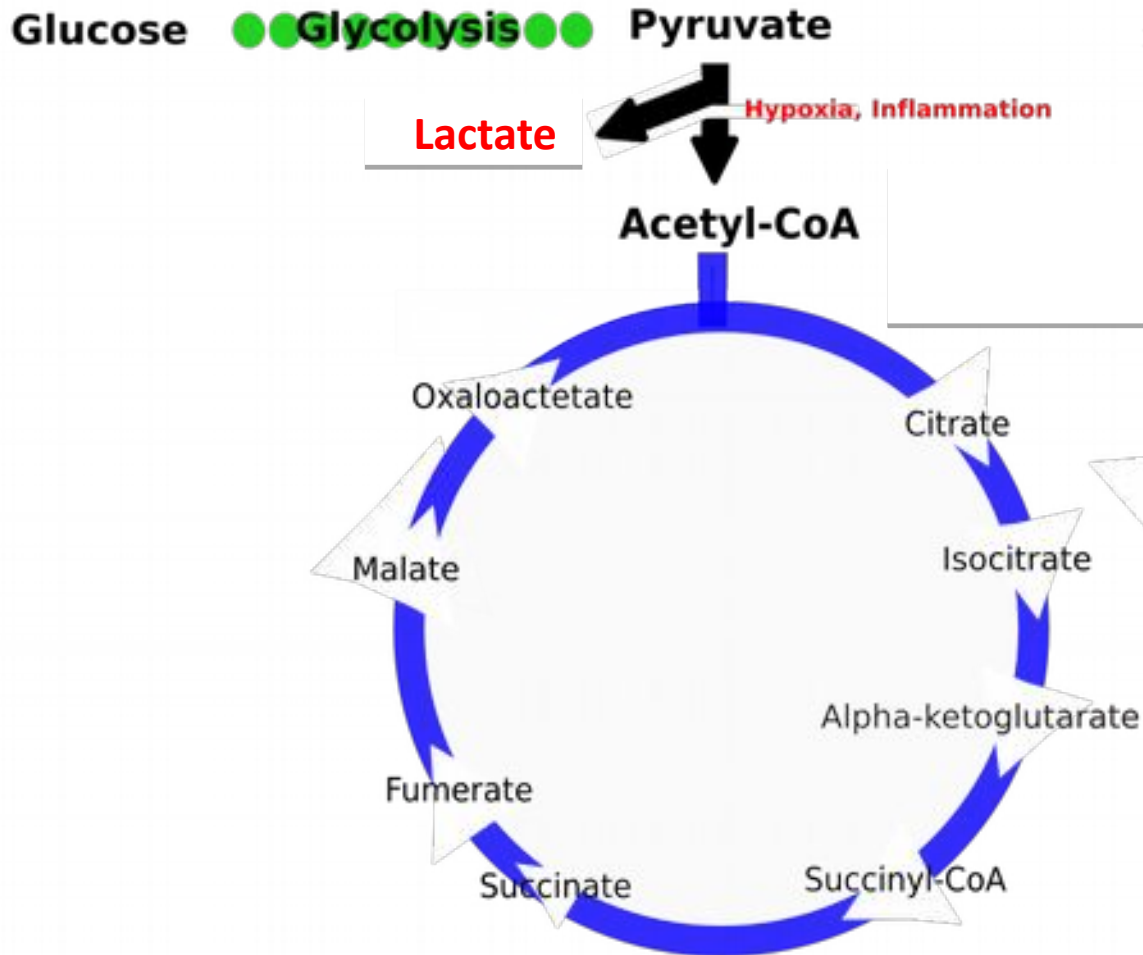
ENERGETIC

INFLAMMATION

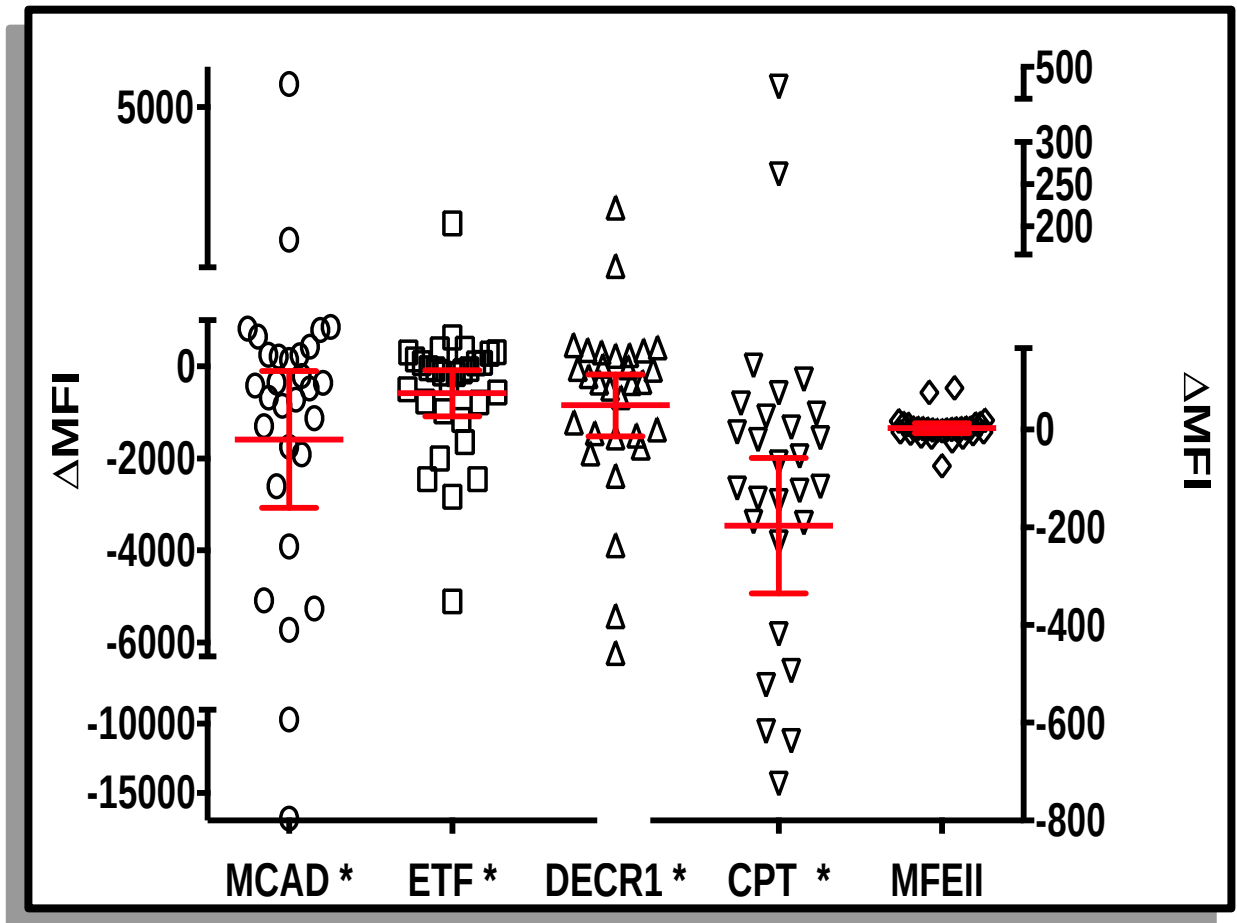
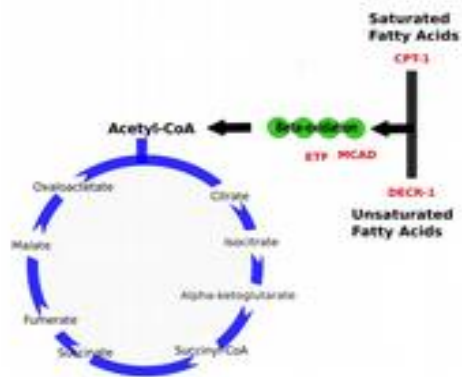
MITOCHONDRIA

CLINICAL

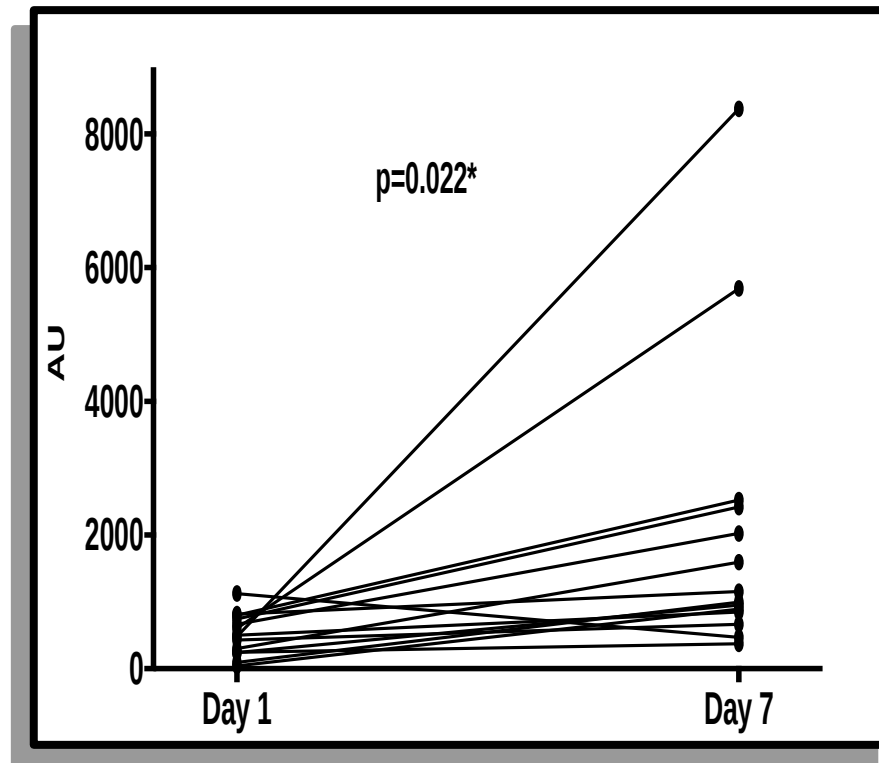
SUBSTRATES FOR ATP GENERATION



MITOCHONDRIAL BETA-OXIDATION DECREASES IN THE FIRST WEEK



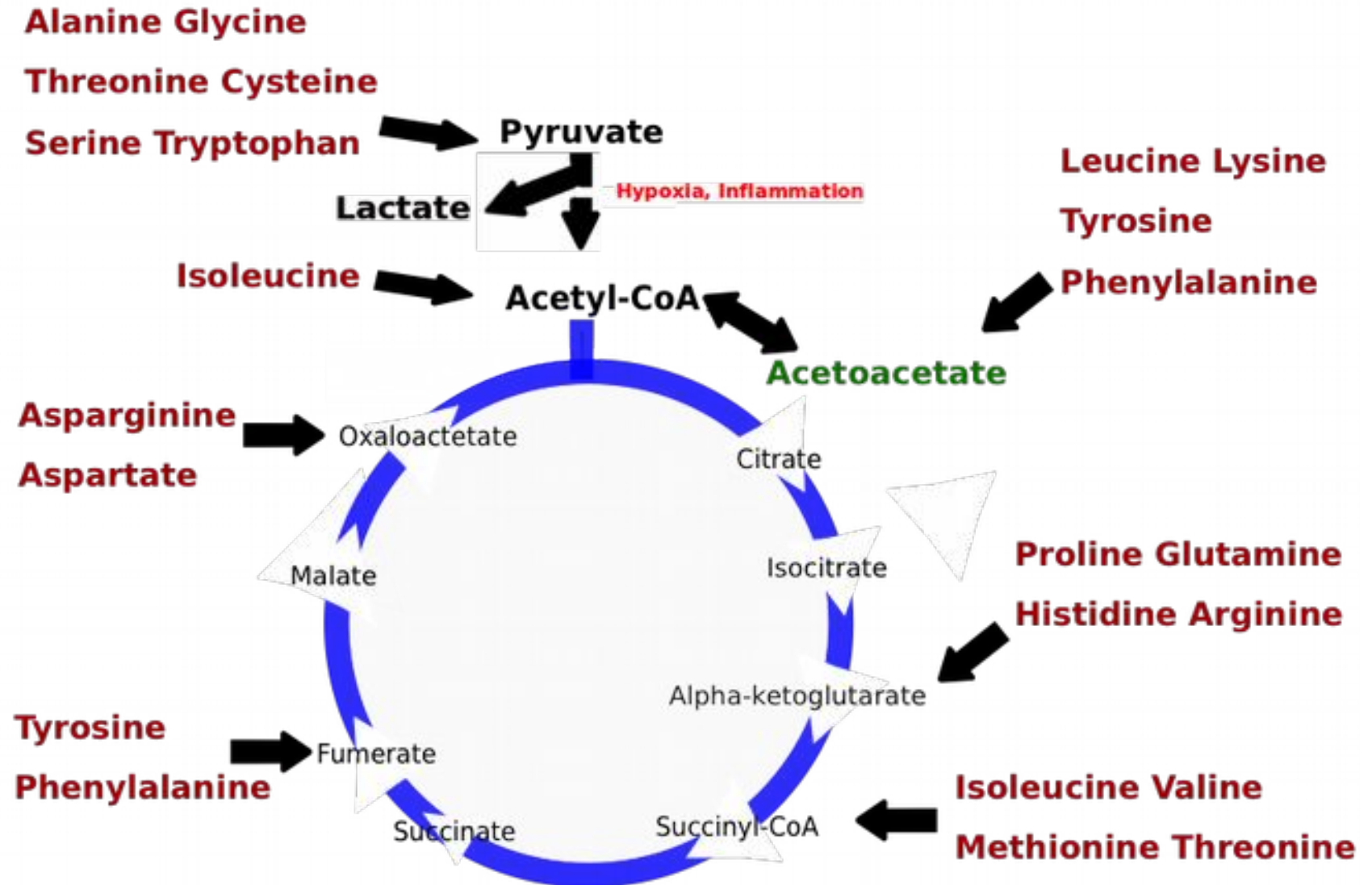
INCREASES IN INTRAMUSCULAR PHOSPHOLIPIDS



Puthuchery ZA, et al. *Thorax* 2018;0:1–10. doi:10.1136/thoraxjnl-2017-211073



SUBSTRATES FOR ATP GENERATION



SUBSTRATES FOR ATP GENERATION: 1kcal/ml feed

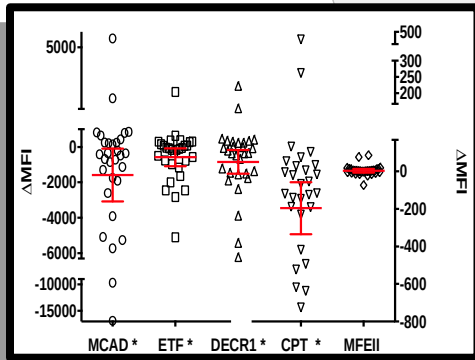
Alanine Glycine

Threonine Cysteine

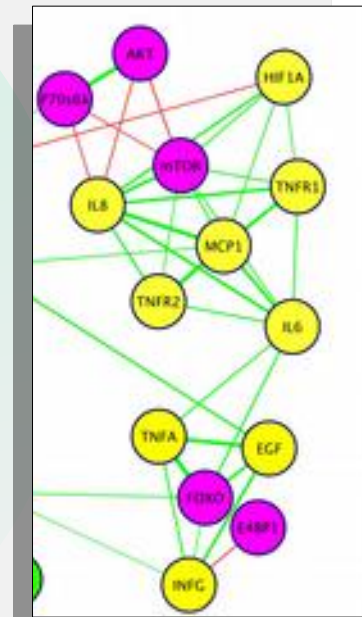
Serine Tryptophan



Protein ~~4%~~ 3.2%



LOSS OF β -OXIDATION



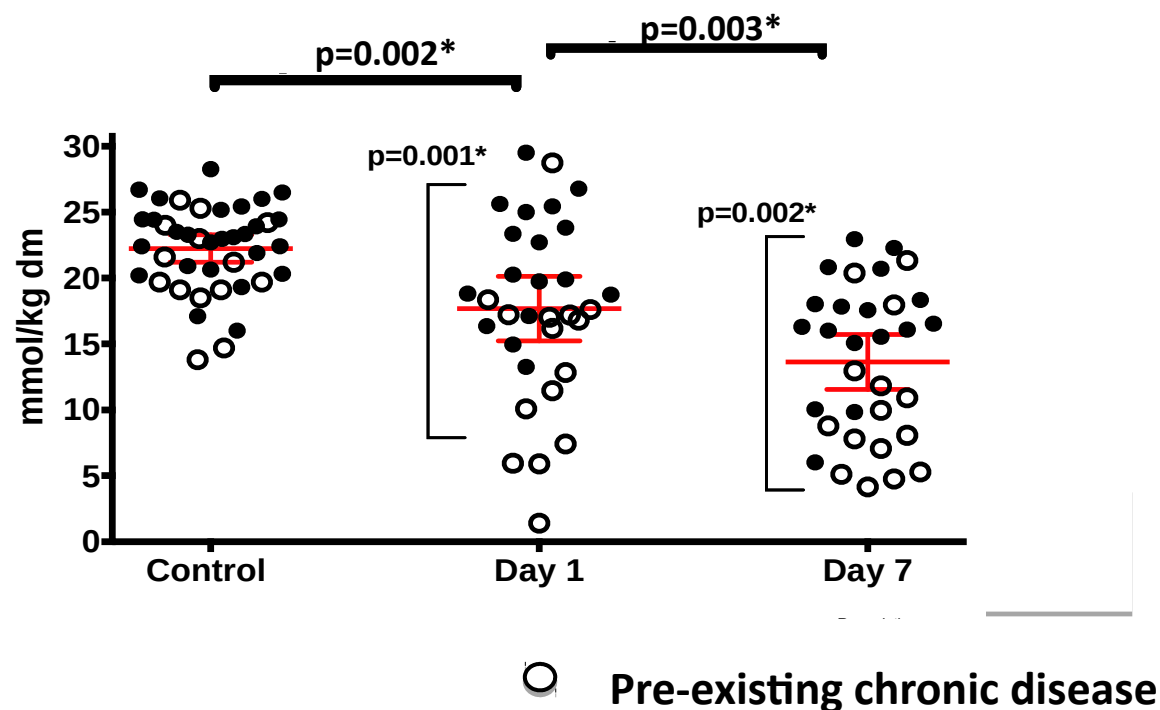
PASTEUR EFFECT



ORIGINAL ARTICLE

Metabolic phenotype of skeletal muscle in early critical illness

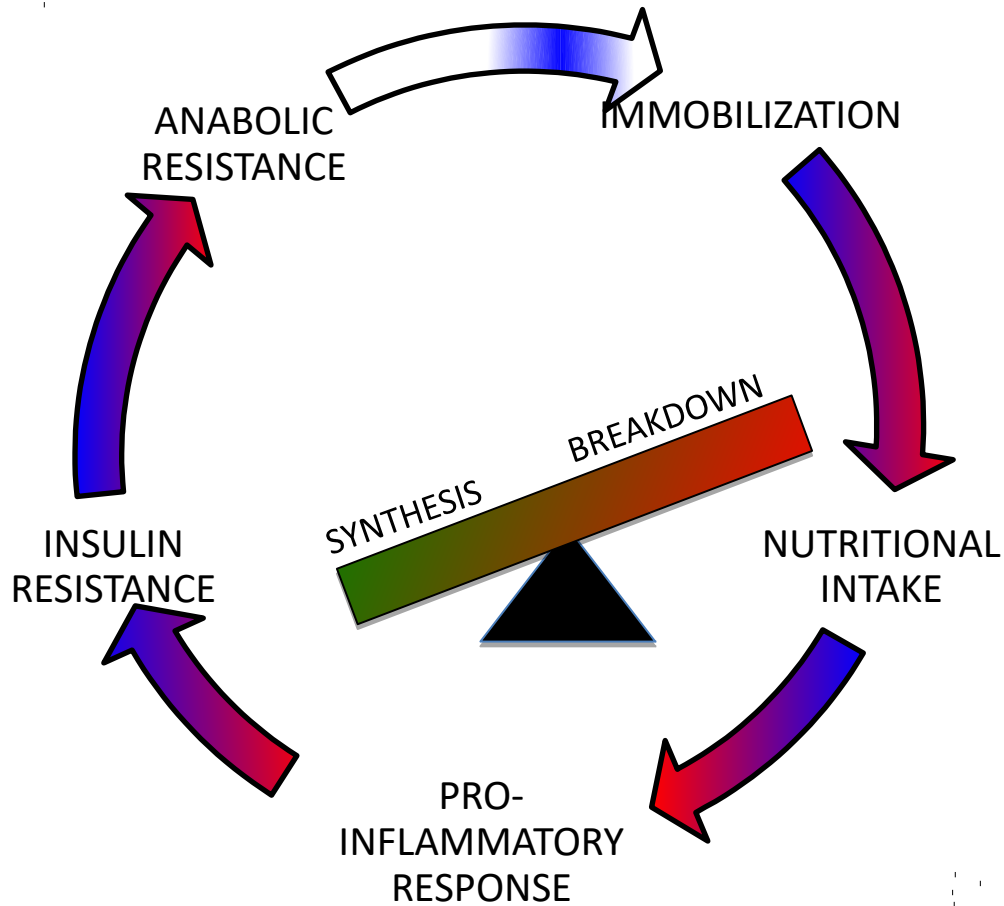
Zudin A Puthuchery,^{1,2,3,4} Ronan Astin,^{1,2} Mark J W Mcphail,^{5,6} Saima Saeed,⁷ Yasmin Pasha,⁵ Danielle E Bear,^{4,8,9,10} Despina Constantin,¹¹ Cristiana Velloso,⁴ Sean Manning,^{12,13,14} Lori Calvert,¹⁵ Mervyn Singer,^{3,7} Rachel L Batterham,^{12,13} Maria Gomez-Romero,¹⁶ Elaine Holmes,¹⁶ Michael C Steiner,¹⁷ Philip J Atherton,¹¹ Paul Greenhaff,¹¹ Lindsay M Edwards,¹⁸ Kenneth Smith,¹¹ Stephen D Harridge,⁴ Nicholas Hart,^{10,19} Hugh E Montgomery^{1,2}



CRITICALLY ILL PATIENTS

- **Lose muscle mass rapidly- 2-3% per day**
- **Muscle Protein Synthesis is depressed**
- **Bioenergetic failure occurs in skeletal muscle**

BREAKING THE CYCLE



INCREASING PROTEIN DELIVERY

RATIONALE:

1. Stimulate MPS directly
2. Amino acids for incorporation into new muscle

FLAWS:

1. Delivery \neq Availability
2. Muscle Full Effect
3. Does not address other components
4. Breakdown products may be harmful

EVIDENCE FOR MUSCLE MASS

Hermans LRM 2013- **NO** (Fibre_{CSA}
MRC-SS)

EVIDENCE FOR FUNCTIONAL OUTCOMES

Doig ICM 2015- **NO** (RAND-36 PF)

INCREASING CALORIE DELIVERY

RATIONALE:

1. Address energy deficit issue

FLAWS:

1. Delivery \neq Availability
2. Muscle Full Effect
3. Does not address other components
4. Pasteur Effect

EVIDENCE FOR MUSCLE MASS

Caesar CCM 2013 – **NO** (↓quality)

EVIDENCE FOR FUNCTIONAL OUTCOMES

Caesar Lancet 2013 – **NO** (6min walk)
Heiddiger Lancet 2015- **NO** (LOS)
Allinstrup ICM 2017- **NO** (PCS 6/12)

INDIRECT EVIDENCE FROM THE REVERSE APPROACH

Caring for the Critically Ill Patient

February 22/29, 2012

Initial Trophic vs Full Enteral Feeding in Patients With Acute Lung Injury The EDEN Randomized Trial

The National Heart, Lung, and Blood Institute Acute Respiratory Distress Syndrome (ARDS) Clinical Trials Network*

> Author Affiliations | Article Information

JAMA. 2012;307(8):795-803. doi:10.1001/jama.2012.137

BMJ

BMJ/2013;346:f1532 doi: 10.1136/bmj.f1532 (Published 19 March 2013)

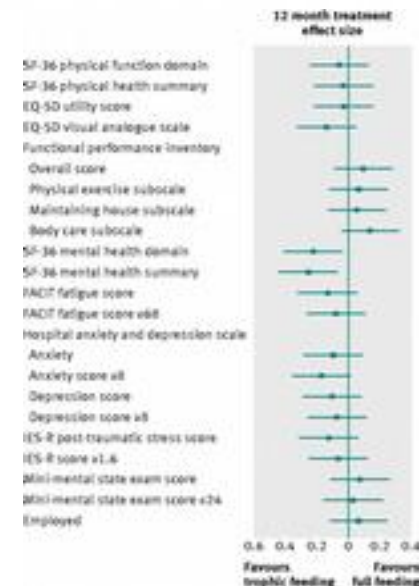
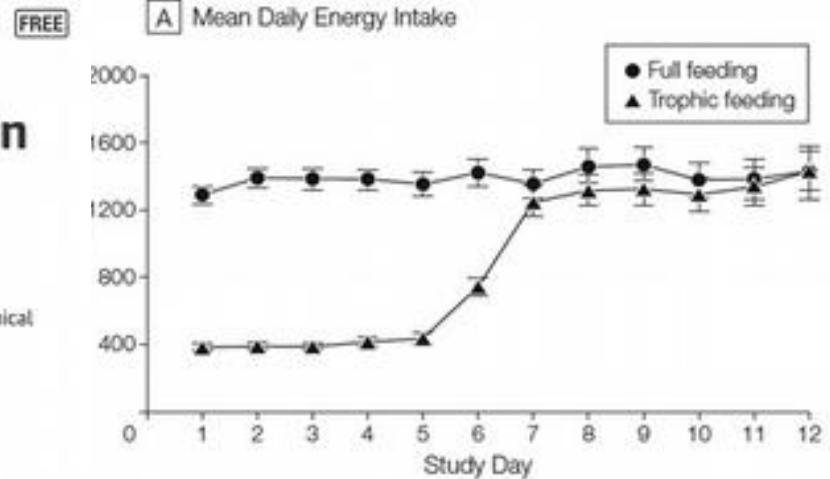
Page 1 of 12

RESEARCH

One year outcomes in patients with acute lung injury randomised to initial trophic or full enteral feeding: prospective follow-up of EDEN randomised trial

OPEN ACCESS

Dale M Needham associate professor^{1,2,3}, Victor D Dinglas research program supervisor^{1,2}, O Joseph Bienvenu associate professor^{4,5}, Elizabeth Colantuoni assistant scientist^{1,6}, Amy W Wozniak research associate^{1,6}, Todd W Rice assistant professor⁷, Ramona O Hopkins professor^{8,9}, for the NIH NHLBI ARDS Network

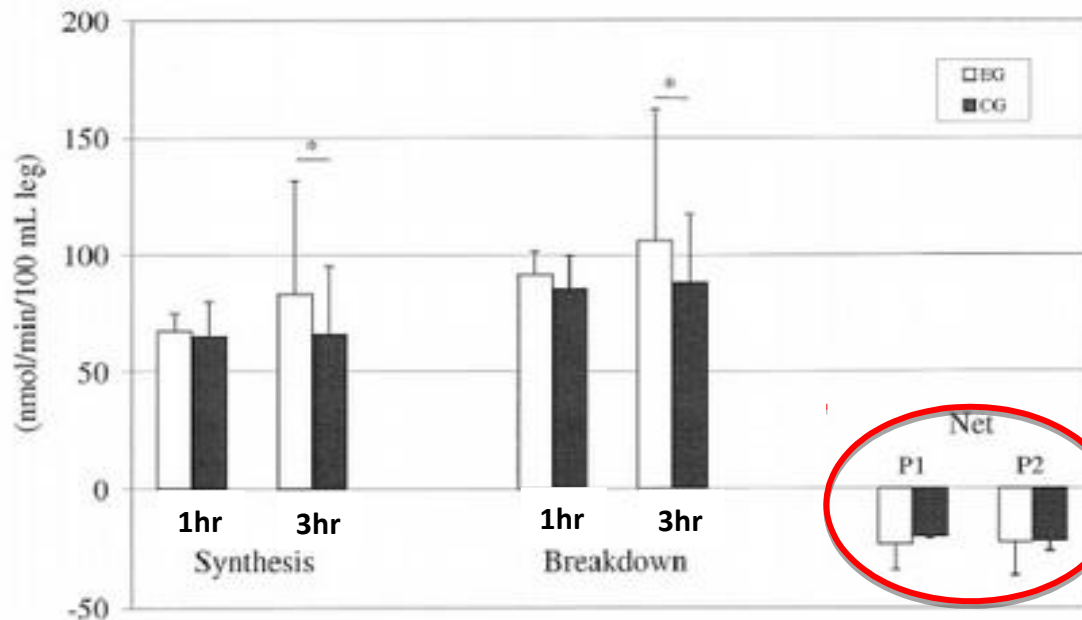


Clinical nutrition delivery in its current form is unlikely to protect skeletal muscle during critical illness

EXERCISE

Free Amino Acid Pool and Muscle Protein Balance after Resistance Exercise

HANNU T. PITKÄNEN^{1,4}, TARJA NYKÄNEN¹, JUHA KNUUTINEN², KAISA LAHTI², OLAVI KEINÄNEN³, MARKKU ALEN⁵, PAAVO V. KOMI¹, and ANTTI A. MERO¹



**EXERCISE
ALONE IS
CATABOLIC**

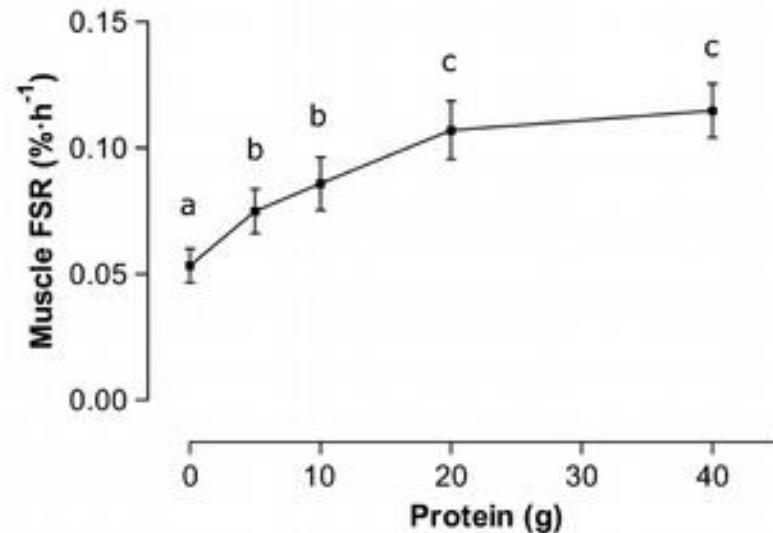
EXERCISE AND AMINO ACIDS



The American Journal of Clinical Nutrition

Ingested protein dose response of muscle and albumin protein synthesis after resistance exercise in young men¹⁻³

Daniel R Moore, Meghann J Robinson, Jessica L Fry, Jason E Tang, Elisa I Glover, Sarah B Wilkinson, Todd Prior, Mark A Tarnopolsky, and Stuart M Phillips



NEUTRAL REHABILITATION TRIALS (n>10)

BMJ

RESEARCH

The PRaCTICaL study of nurse led, intensive care follow-up programmes for improving long term outcomes from critical illness: a pragmatic randomised controlled trial

BH Cutbertson, chief of critical care medicine and professor of anaesthesia; J Potts, senior lecturer; M K Campbell, director and professor; M Gage, intensive care follow-up nurse; S Raughton, intensive care follow-up nurse; A Smith, intensive care follow-up nurse; A Hill, consultant psychiatrist; S Sheeman, trial manager; J Neme, professor of biomedical statistics; D Jenkinson, statistician; R Hernández, health psychologist; M Johnston, professor of health psychology; E Wilson, consultant in anaesthesia and intensive care; C Waldmann, consultant in anaesthesia and intensive care on behalf of the PRaCTICaL study group

Original Investigation

Increased Hospital-Based Physical Rehabilitation and Information Provision After Intensive Care Unit Discharge
The RECOVER Randomized Clinical Trial

Trevithy S Walsh, MD, Lisa G. Salsbery, PhD, Judith L. Mermelstein, PhD, Julia A. Boyd, PhD, David M. Griffin, MD, Gurjitpaljy, PhD, Suzanne Ryan, PhD, Simon J. Mackenzie, MChD, Ashraful Haque, MSc, Stephanie C. Lewis, PhD, Gordon D. Murray, PhD, John T. Forbes, PhD, Joel Smith, PhD, James E. Rabbay, PhD, Alexander M. Hull, MD, Pamela Ramsey, PhD for the RECOVER Investigators

Ellott et al. *Critical Care* 2013, 18:R142
<http://dx.doi.org/10.1186/cc12142>



RESEARCH

Open Access

Health-related quality of life and physical recovery after a critical illness: a multi-centre randomised controlled trial of a home-based physical rehabilitation program

Doug Elliot^{1*}, Sharon McKinley², Jennifer Alison³, Leanne M Aitken⁴, Madeleine King⁵, Gavin D Leslie⁶, Patricia Kenny⁷, Penny Taylor⁸, Rachel Foley⁹ and Elizabeth Burneiser⁹

Denchy et al. *Critical Care* 2013, 17:R156
<http://dx.doi.org/10.1186/cc121156>



RESEARCH

Open Access

Exercise rehabilitation for patients with critical illness: a randomized controlled trial with 12 months of follow-up

Linda Denchy^{1*}, Elizabeth H Skinner², Lara Edbrooke³, Kimberley Haines⁴, Stephen Wainlow⁵, Graeme Hawthorne⁶, Raifa Gough⁷, Steven Vander Hoorn⁸, Ning E Morris⁹ and Sue Boney⁹

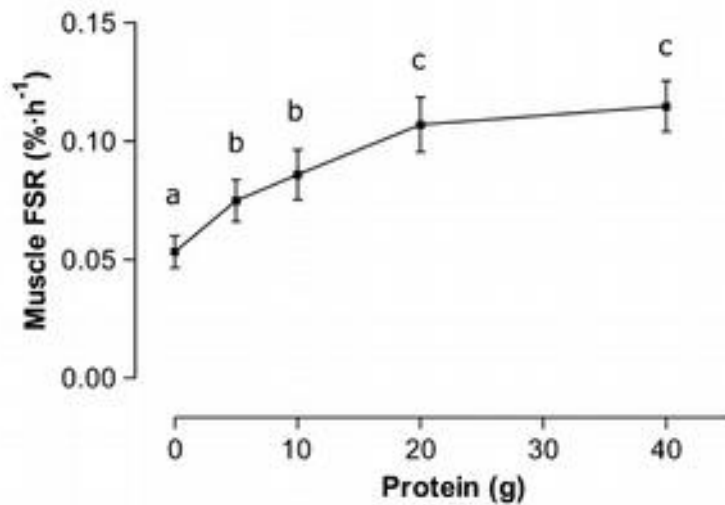
A Randomized Trial of an Intensive Physical Therapy Program for Acute Respiratory Failure Patients
Marc Moss, Amy Nordon-Craft, Dan Malone, David Van Pelt, Stephen K Frankel, Mary Laird Warner, Wendy Kriekels, Monica McNulty, Diane L Fairclough, and Margaret Schenkman *AJRCCM* 2015


INABILITY TO PERFORM EXERCISE

Ingested protein dose response of muscle and albumin protein synthesis after resistance exercise in young men¹⁻³

 *The American Journal of Clinical Nutrition*

Daniel R Moore, Meghan J Robinson, Jessica L Fry, Jason E Tang, Elina I Glover, Sarah B Wilkinson, Todd Prior, Mark A Turnipolok, and Stuart M Phillips



 Archives of Physical Medicine and Rehabilitation
Journal homepage: www.aphm.com

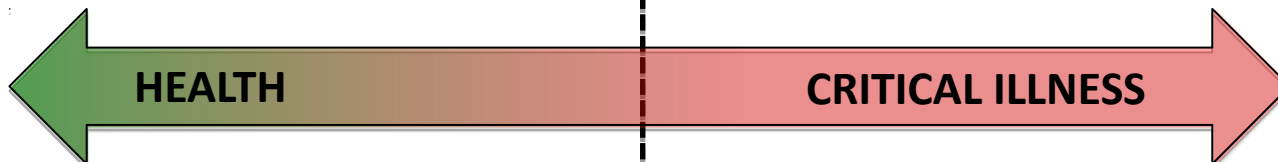
ORIGINAL RESEARCH

Feasibility of Exercise Testing in Patients Who Are Critically Ill: A Prospective, Observational Multicenter Study

Joukje Sommers, MSc,¹ Emily Klooster, MSc,² Siebrand B. Joethout, MSc,³ Houb L.A. van den Geer, MD,⁴ Frans Nolliet, Prof,⁵ Robert Tepernik, PhD,⁶ Jannike Horn, PhD,⁷ Raoul H.M. Engelbert, Prof,⁸ Marika van der Schaaf, PhD⁹

Median duration of exercise was 6.1 min at 5.0 Watts with a Borg score of 13.

“ We conclude that the ability of our patients to tolerate exercise was very low”



- **Despite Grade I evidence in other populations, there is little evidence that exercise rehabilitation increases physical function in critically ill patients.**

WHAT CAN I DO RIGHT NOW?

Ten reasons why ICU patients should be mobilized early

Linda Denehy¹, Julie Lanphere² and Dale M. Needham^{3*}

Intensive Care Med (2017) 43:86–90
DOI 10.1007/s00134-016-4513-2

1. Minimise complications of bed rest
2. Address sequelae of ICU-AW
3. Perceived barriers are modifiable
4. Implementation is feasible
5. Promotes reduction of sedation
6. It is safe
7. Promotes improved functional outcomes if early start
8. May improve delirium
9. New technologies expand opportunities
10. May reduce overall resource utilization

Improving Hospital Survival and Reducing Brain Dysfunction at Seven California Community Hospitals: Implementing PAD Guidelines Via the ABCDEF Bundle in 6,064 Patients*

Mary Ann Barnes-Daly, MS, RN, CCRN, DC¹; Gary Phillips, MAS²; E. Wesley Ely, MD, MPH, FCCM^{3,4}

“12% increase in hospital survival with each 10% increase in bundle compliance OR 1.12;95%CI 1.07-1.17 p<0.01”

SEDATION

A=Awakening trials

B= Spontaneous Breathing

C= Coordination of Care

D=Delirium assessment

E=Early mobilization

F=Family engagement

TEAMWORKING

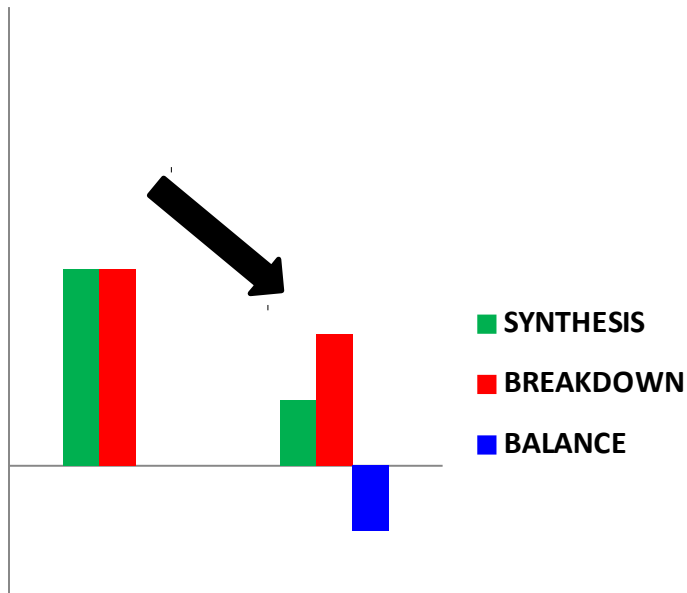
IMMOBILIZATION

IMMOBILIZATION

The Journal of Physiology

The temporal responses of protein synthesis, gene expression and cell signalling in human quadriceps muscle and patellar tendon to disuse

Maarten D. de Boer¹, Anna Selby², Philip Atherton², Ken Smith², Olivier R. Seynnes¹,
Constantinos N. Maganaris¹, Nicola Maffulli², Tomas Movin⁴, Marco V. Narici¹ and Michael J. Rennie³



INTERNATIONAL POINT PREVALENCE

Percentage of non-intubated patients mobilized out of bed

Percentage of intubated patients mobilized out of bed



56%

16%



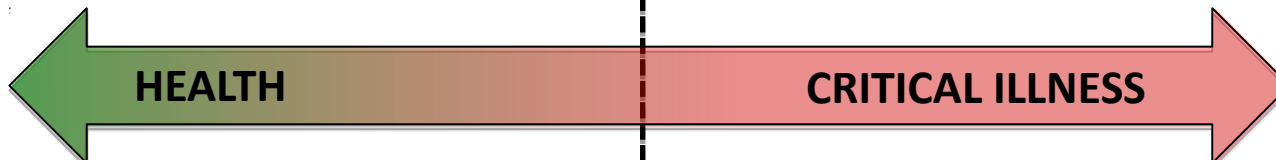
24%

8%



37%

0%



HIGHLIGHTED TOPIC | *Physiology and Pathophysiology of Physical Inactivity*

Physical inactivity as the culprit of metabolic inflexibility: evidence from bed-rest studies

Audrey Bergouignan,^{1,2} Floriane Rufwll,³ Chantal Simon,^{4*} and Stéphane Blanc^{1*}

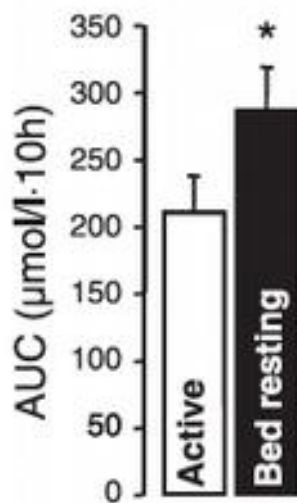
¹Université de Strasbourg, Institut Pluridisciplinaire Hubert Curien, Département d'Ecologie, Physiologie et Ethologie, CNRS, UMR1178, Strasbourg, France; ²University of Colorado Anschutz Medical Campus, Department of Pediatrics, Centre for Human Nutrition, Aurora, Colorado; and ³INSERM U870VINA 1215, Faculté de Médecine de Lyon Sud, Lyon, France

Submitted 7 June 2011; accepted in final form 8 August 2011

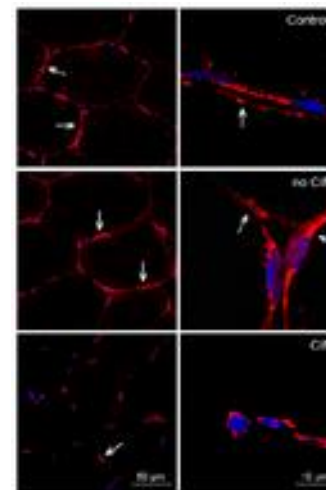
Critical Illness Myopathy and GLUT4
Significance of Insulin and Muscle Contraction

Steffen Weber-Carstens^{1*}, Joanna Schneider^{2*}, Tobias Wollersheim³, Anke Assmann³, Jeffrey Bierbrauer¹, Andreas Marg², Hadi Al Hasani⁴, Alexandra Chadt⁴, Katrin Wenzel², Susanne Koch¹, Jens Fielitz², Christian Kleber², Katharina Faust⁶, Knut Mai³, Claudia D. Spies¹, Friedrich C. Luft², Michael Boschmann², Joachim Spranger^{3*}, and Simone Spuler^{2*}

Insulin



GLUT-4 Translocation



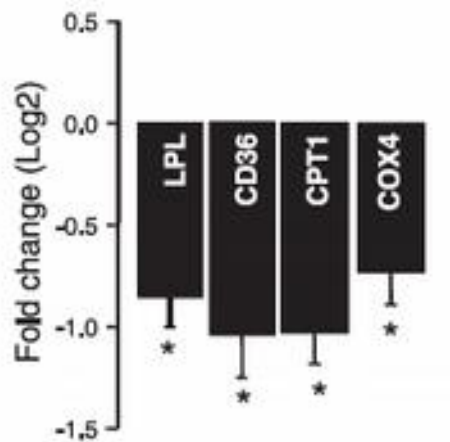
INSULIN RESISTANCE AND IMPAIRED GLUT-4
TRANSLOCATION

HIGHLIGHTED TOPIC | *Physiology and Pathophysiology of Physical Inactivity*

Physical inactivity as the culprit of metabolic inflexibility: evidence from bed-rest studies

Audrey Bergouignan,^{1,2} Floriane Rufwll,⁴ Chantal Simon,^{5*} and Stéphane Blanc^{1*}

¹Université de Strasbourg, Institut Pluridisciplinaire Hubert Curien, Département d'Ecologie, Physiologie et Ethologie, CNRS, UMR1178, Strasbourg, France; ²University of Colorado Anschutz Medical Campus, Department of Pediatrics, Centre for Human Nutrition, Aurora, Colorado; and ³INSERM U870YNRA 1215, Faculté de Médecine de Lyon Sud, Lyon, France
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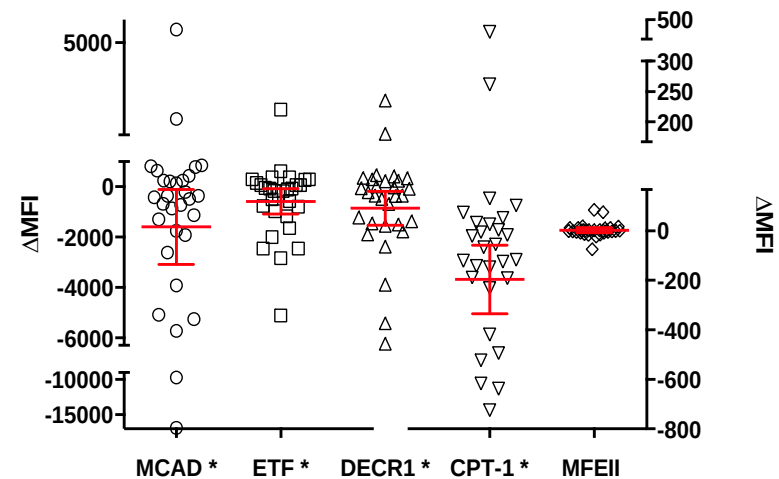


ORIGINAL ARTICLE

Thorax

Metabolic phenotype of skeletal muscle in early critical illness

Zudin A Puthuchery,^{1,2,3,4} Ronan Astin,^{1,2} Mark J W Mcphail,^{5,6} Saima Saeed,⁷ Yasmin Pasha,⁵ Danielle E Bear,^{8,9,10} Despina Constantin,¹¹ Cristiana Velloso,⁴ Sean Manning,^{12,13,14} Lori Calvert,¹⁵ Mervyn Singer,^{3,7} Rachel L Batterham,^{12,13} Maria Gomez-Romero,¹⁶ Elaine Holmes,¹⁵ Michael C Steiner,¹⁷ Philip J Atherton,¹¹ Paul Greenhaff,¹¹ Lindsay M Edwards,¹⁸ Kenneth Smith,¹¹ Stephen D Harridge,⁴ Nicholas Hart,^{10,19} Hugh E Montgomery^{1,2}



IMPAIRED BETA-OXIDATION

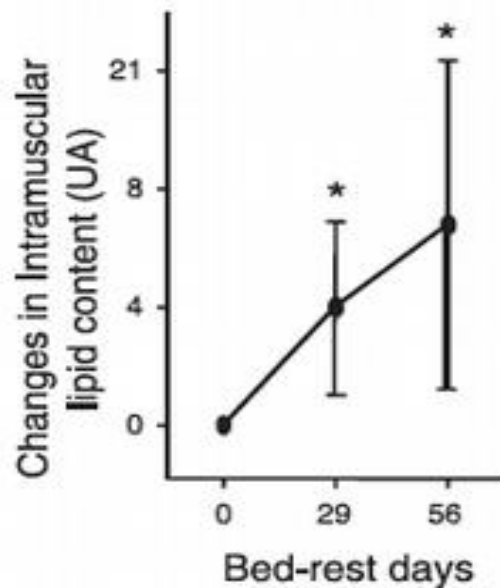
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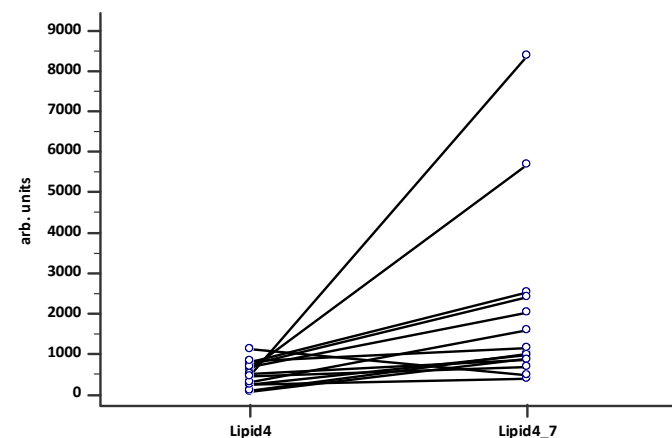
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Increased intramuscular phospholipids



INCREASED INTRAMUSCULAR LIPID ACCUMULATION

OVERCOMING BARRIERS

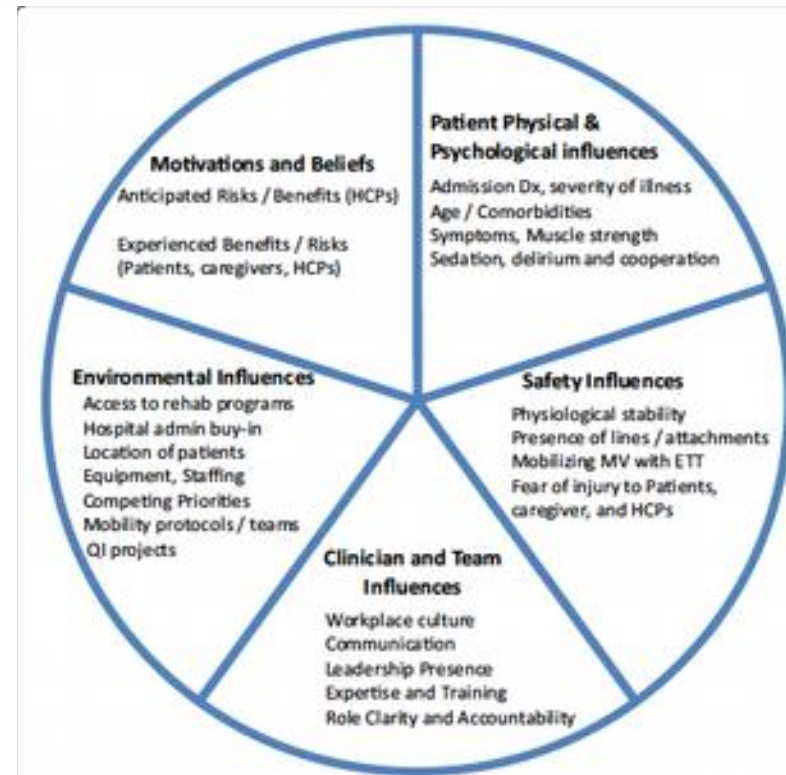
SYSTEMATIC REVIEW



Factors influencing physical activity and rehabilitation in survivors of critical illness: a systematic review of quantitative and qualitative studies

Selina M. Parry^{1*}, Laura D. Knight², Bronwen Connolly^{3,4,5}, Claire Baldwin⁶, Zudin Puthuchearu^{4,7}, Peter Morris⁹, Jessica Mortimore^{3,5}, Nicholas Hart^{3,5,8}, Linda Denehy¹ and Catherine L. Granger^{1,2,10}

- **TEAM WORKING**
- **SEDATION**
- **SAFETY**



RESEARCH

Open Access

Expert consensus and recommendations on safety criteria for active mobilization of mechanically ventilated critically ill adults

Carol L Hodgson^{1,2*}, Kathy Stiller³, Dale M Needham⁴, Claire J Tipping², Megan Harrold⁵, Claire E Baldwin^{6,7}, Scott Bradley², Sue Berney⁸, Lawrence R Caruana⁹, Doug Elliott¹⁰, Margot Green¹¹, Kimberley Haines^{8,12}, Alisa M Higgins¹, Kirsi-Majja Kaukonen^{1,13}, Isabel Anne Leditschke^{14,15}, Marc R Nickels¹⁶, Jennifer Paratz^{17,18}, Shane Patman¹⁹, Elizabeth H Skinner^{20,21}, Paul J Young^{22,23}, Jennifer M Zanni²⁴, Linda Denehy²⁵ and Steven A Webb^{1,26}

Safety Concerns

- 1449 mobilizations- 14 minor adverse events (<1%)
- 593 with ETT- no extubations

OVERCOMING BARRIERS

SYSTEMATIC REVIEW



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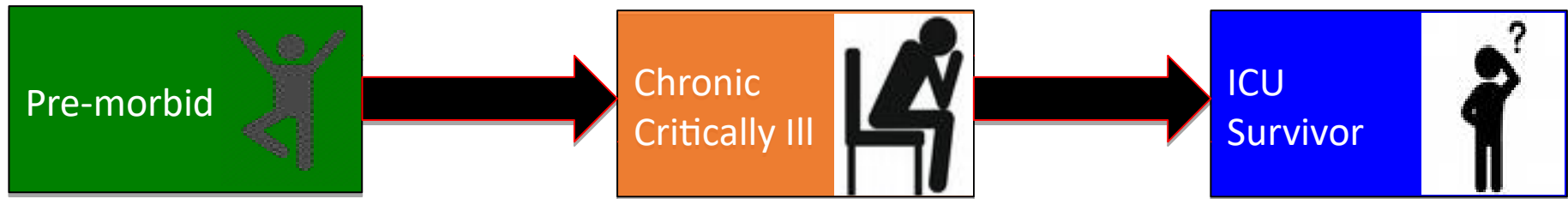
Selina M. Parry^{1*}, Laura D. Knight², Bronwen Connolly^{3,4,5}, Claire Baldwin⁶, Zudin Puthucheary^{4,7}, Peter Morris⁹, Jessica Mortimore^{3,5}, Nicholas Hart^{3,5,8}, Linda Denehy¹ and Catherine L. Granger^{1,2,10}

- Culture change is the major barrier
 - Not a “Physio problem” - a team problem
 - Identification by doctors and nurses of the “unmet mobilization need”

BMJ Open Qualitative, grounded theory exploration of patients' experience of early mobilisation, rehabilitation and recovery after critical illness

Evelyn J Corner,^{1,2} Eleanor J Murray,³ Stephen J Brett^{4,5}

RECALIBRATION OF SELF



"Prior self to current self"

"current self to future self"

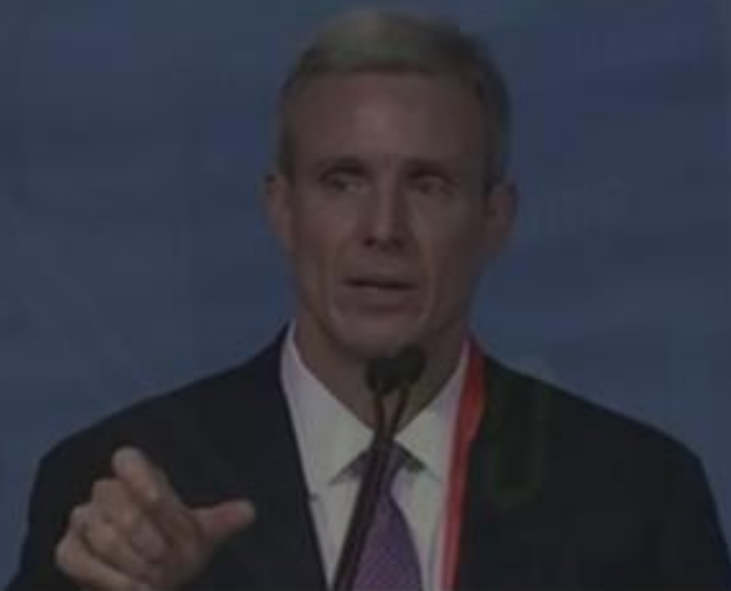
"It's a blank"

"you lose all dignity in this state"

"even now I feel embarrassed"

**EPISODIC
MEMORY
LOSS**

**COGNITIVE
IMPAIRMENT**



The Science, Why, and What of ICU Liberation
and the ABCDEF Bundle for Patients and
Families: Dr. Wes Ely Hawaii SCCM 2017
Plenary

WATCH THE VIDEO

for Medical Professionals

for Patients and Families

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ABCDEFs of Prevention and Safety

ABCDEF is a standard bundle of ICU measures that includes spontaneous Assess for and manage pain, Both Spontaneous Awakening Trials (SAT) & Spontaneous Breathing Trials (SBT), attention to the Choice of sedation and analgesia, Delirium monitoring and

SUPPORT THE RESEARCH

what is Delirium?

Delirium is basically

Muscle wasting in Critically Ill patients

1. Occurs rapidly- 2-3% per day

2. Is the result of:

- Decreased Muscle Protein Synthesis**
- Bioenergetic failure**
- Intramuscular Inflammation**

3. Mobilization is the only intervention that has evidence of demonstrable benefit

4. No good evidence exists for rehabilitation or nutritional interventions currently