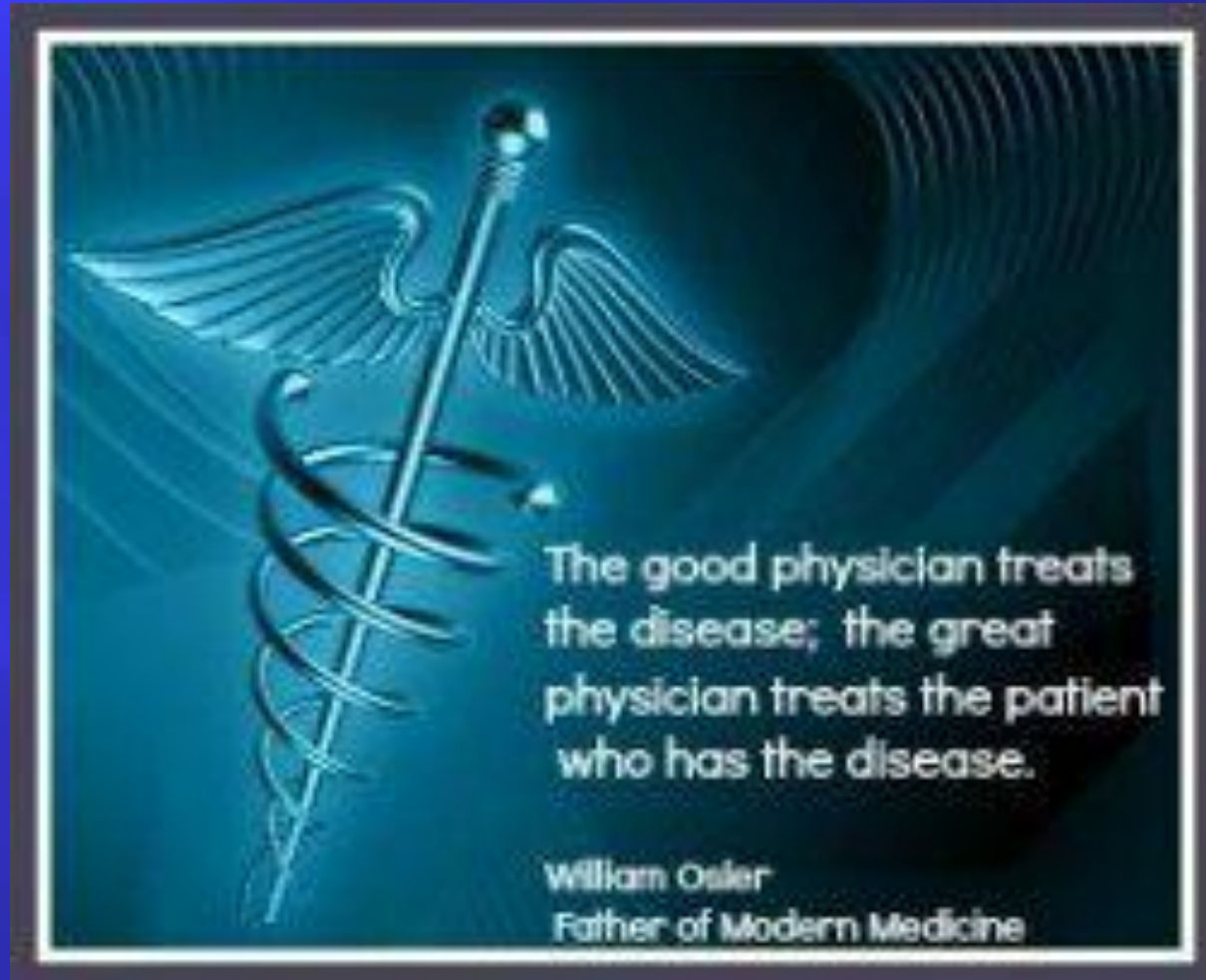
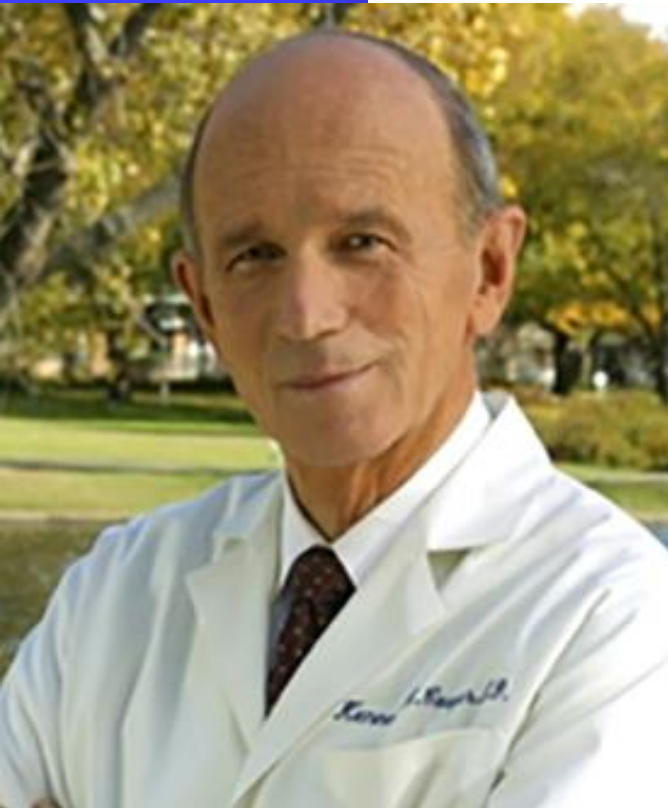


BEHAVIORAL SYMPTOMS, INFLAMMATION AND CORTISOL: RELATIONSHIP TO CARDIAC HEALTH AND QUALITY OF LIFE IN CARDIAC REHABILITATION PATIENTS



How I became interested



Dr. Kenneth Cooper

Coined the term: Aerobics

**Established a goal level of fitness
measured by analysis of
expired air CO₂ and O₂ to
a person's maximal**

**oxygen utilization:
Cooper Points**



Definition of Cardiac Rehab

“The coordinated sum of activities required to influence favorably the underlying cause of cardiovascular disease, as well as to provide the best possible physical, mental, and social conditions, so that patients may, by their own efforts, preserve or resume optimal functioning in their community, and, through improved health behavior, slow or reverse progression of disease.” (British Association for Cardiovascular Prevention and Rehabilitation, 2012, p.2)



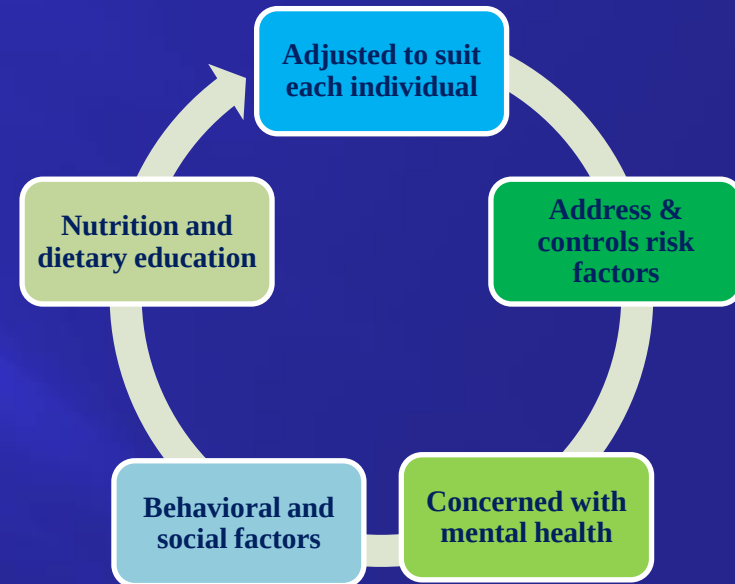
<https://www.hopedalemc.com/services/outpatient-services/profile/cardiac-rehabilitation>

Cardiac Rehabilitation



<http://jfkmc.com/service/cardiac-rehabilitation>

Began as a way to assist people in returning to physical activity after a cardiac event



Manpuya, 2012

What is known:

Cardiac rehabilitation has been shown to improve exercise capacity, quality of life, and to prolong survival in patients with CAD.

Gap in Knowledge:

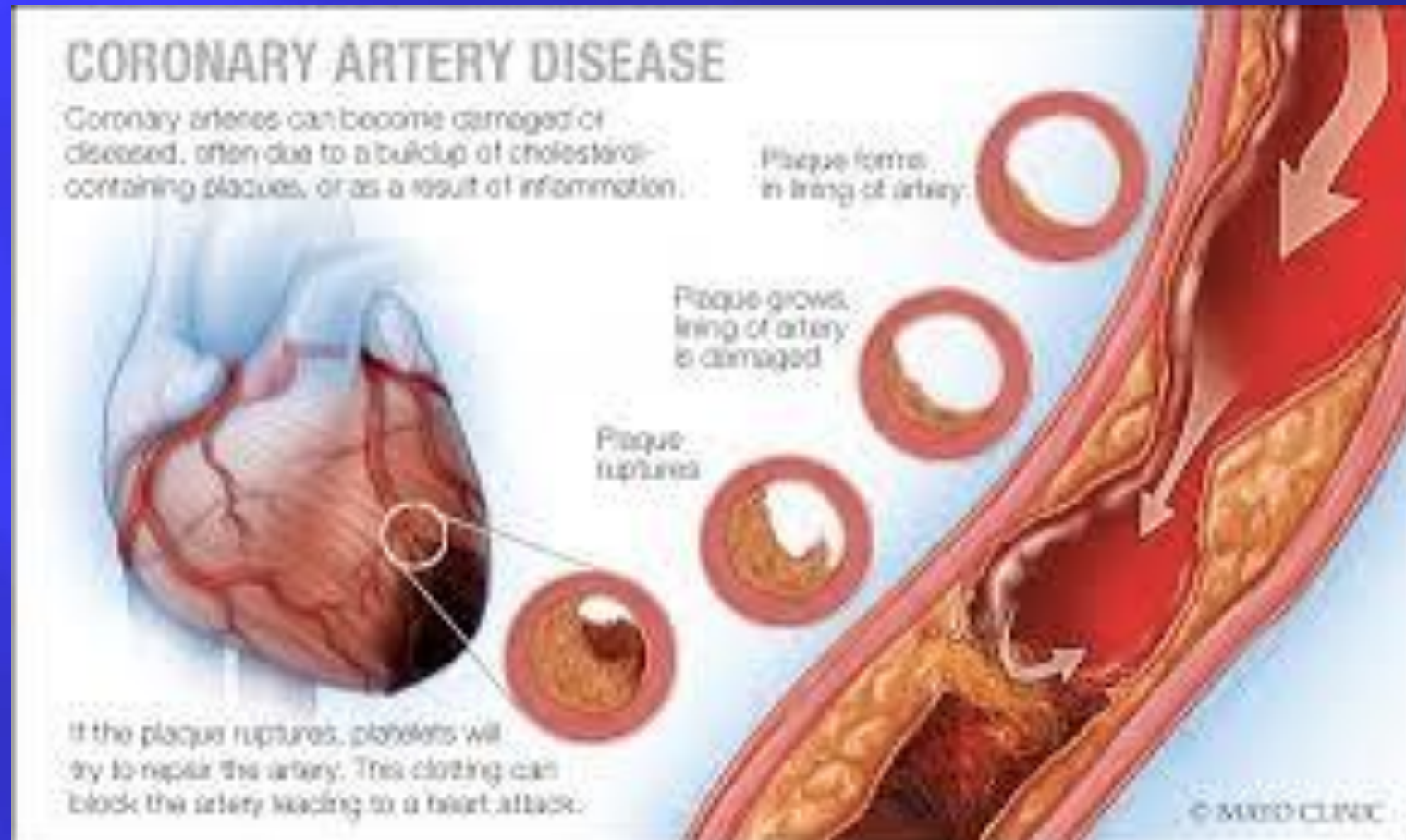
Yet, there is limited knowledge as to whether cardiac rehabilitation reduces psycho-behavioral symptoms and stress-related mediators to improve outcomes.

BACKGROUND AND SIGNIFICANCE



- Cardiac events result in psychological stress, depressive mood, fatigue, and sleep disturbance (Psycho-Behavioral Symptoms), which jeopardize cardiac health.
- To promote recovery, cardiac rehabilitation programs provide monitored exercise and counseling on health behaviors.
- Consist of a structured 12-week program (3 sessions/wk.)

Inflammation and Cardiovascular Disease



Depression and Cardiovascular Disease



Incidence of Depression in Cardiac Patients

- Depression is associated with progression of CVD (Barefoot et al., 1996, Aromas et al., 1994, Todaro et al., 2003) and with reoccurrence of Cardiac Events (Frasure et al., 1993, Frasure et al., 1995, Barefoot et al., 1996)



Relationship Between Depression and Inflammation

- Depression and Inflammation are Inter-connected (Kiecolt-Glaser et al., 2015)



Consequences of Depression in Cardiac Patients

INTERHEART study: anxiety and depression, when considered together, were as significant as smoking as a risk factor as smoking for CVD (Gallagher et al., 2015).



Inflammatory Theory of Depression

Interferon alpha therapy

- Initiated depressive symptoms
- Theories began to evolve

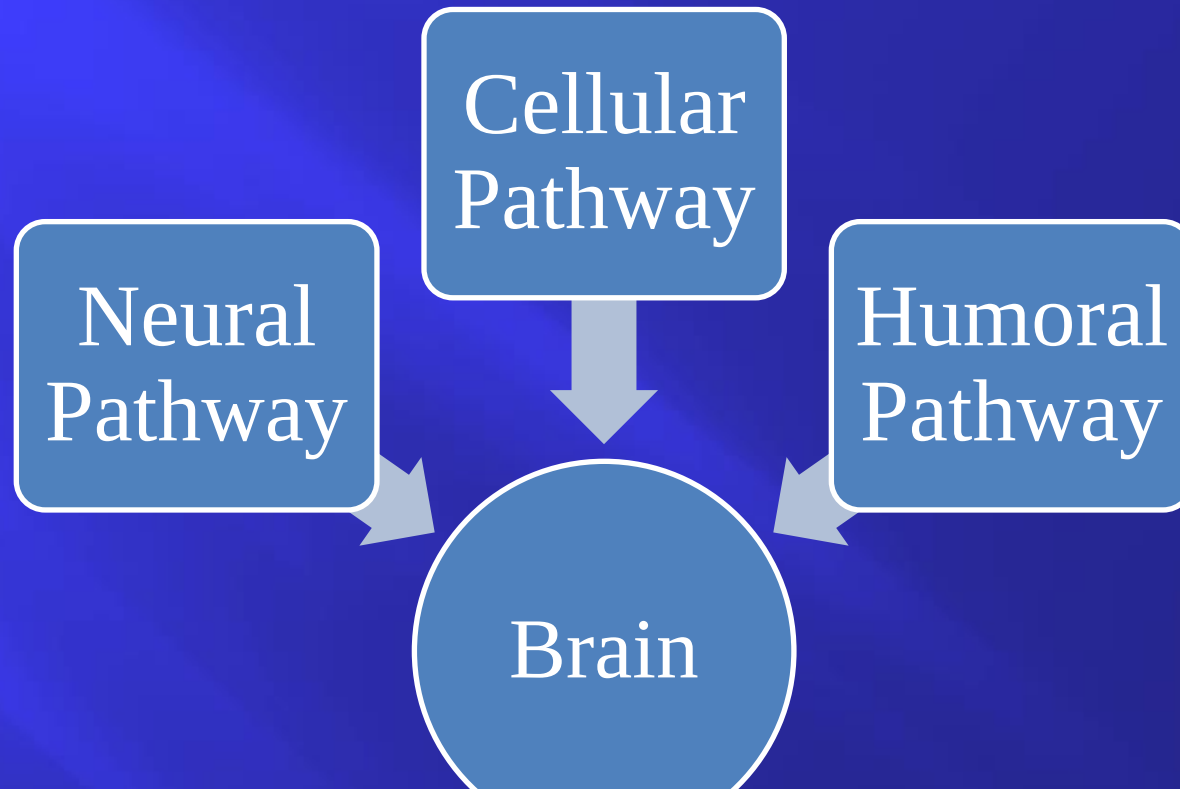
Inflammation in response to invasive microorganism or foreign antigen

- White blood cells sent to area of invasion
- Body aims to eliminate the invading agent and initiate repair of damage at cellular level

Immune response is directed by inflammatory cytokines from white blood cells

- Proinflammatory cytokines include: Interleukin 1- β , interleukin-6, and tumor necrosis factor- α (Miller & Blackwell, 2006).
- C-reactive protein synthesized in the liver in response to Il-6 (Miller & Blackwell, 2006).

Three Pathways By Which Inflammatory Signals are Relayed from Peripheral Body to the Brain



Sleep Disturbance in Cardiac Patients



Incidence of sleep disturbance in cardiac patients

Disordered sleep in cardiac patients reported to be as great as 69% at the 6 week mark of cardiac rehabilitation (LeGrande et al., 2016).



Sleep and Inflammation

- **In a large population sample, subjective poor sleep correlated with elevated inflammation (CRP & Il-6) (Cho et al., 2015)**
- **Il-6 and TNF- α both increase with sleep disturbance or limitation in sleep (Vgontzas et al., 2003).**



Consequences of sleep disruption on response to cardiac rehabilitation

- **Insomnia and sleep disruption lead to reduced commitment to treatment regimens and foretell anxiety and depression one year after a cardiac event (LeGrande et al., 2015).**

HPA Axis and Cortisol

Psychological Stress

- Activates the HPA axis
- To elevate levels of circulating cortisol

Over time, exposure to stress leads to harmful health outcomes

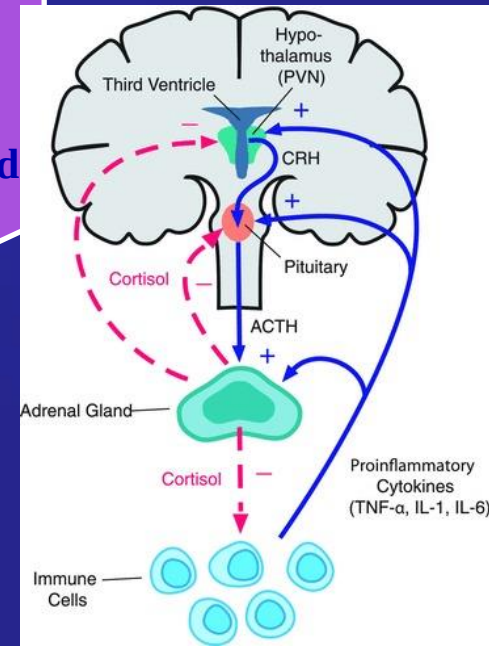
(Everson-Rose et al., 2005; Norberg et al., 2007; Rozanski et al., 1999)

- Development of visceral fat, atrophy of muscles close to the body's midline
- Hypertension, insulin resistance, blood lipid abnormalities

(Rosmond & Bjorntorp, 2000; Kelly et al., 1998)

All associated with an increase in CVD incidence

- Increase in pro-inflammatory cytokines
- Chronic stress/depression results in glucocorticoid resistance: reduces the ability of glucocorticoids to buffer stress-induced inflammation (Raison Miller, 2003)





The Gap

- Little is known about how psychological and behavioral factors, particularly sleep quality, fatigue, and depression, might influence a person's response to cardiac rehabilitation.

QUESTIONS ?



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