

Prevention-Only Treatable Disease (P-O.T.D.) - ?

Job Stress and Chronic Disease

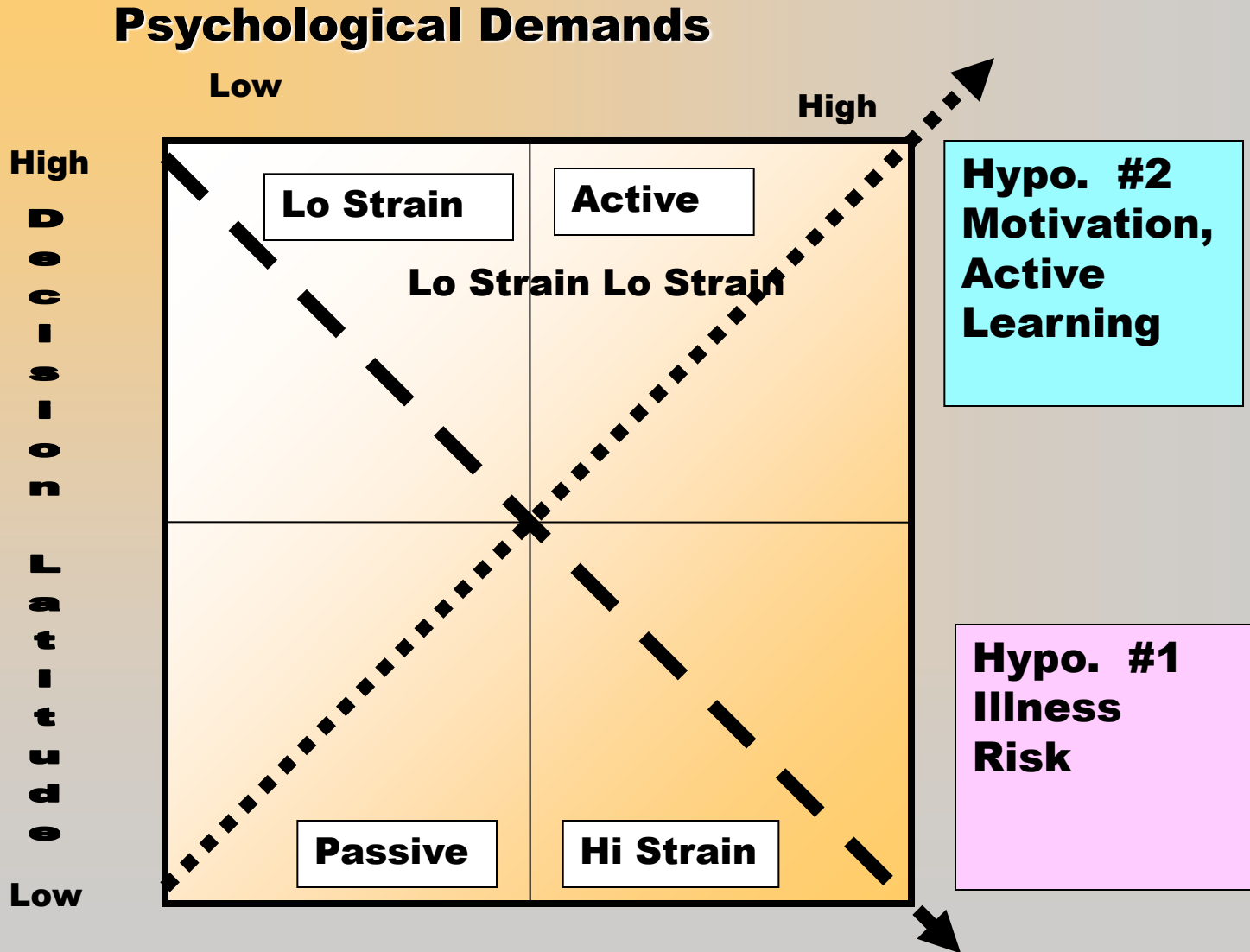
**- A Speculative Hypothesis from the
Demand/Control Model and Stress-
Disequilibrium Theory**

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The Demand/Control Model ...



Job Stress & Disability Pensions in Sweden

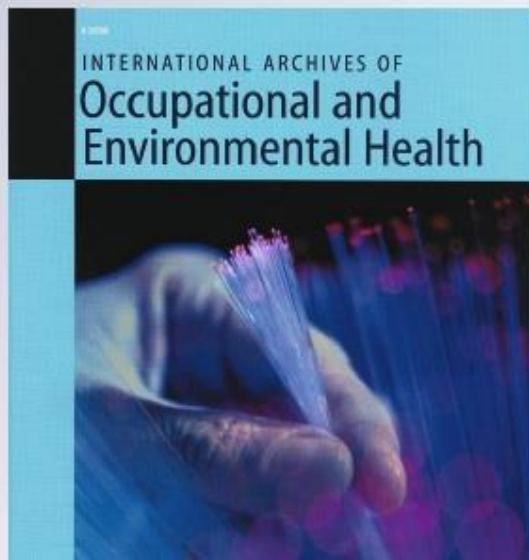
Can high psychological job demands, low decision latitude, and high job strain predict disability pensions? A 12-year follow-up of middle-aged Swedish workers

**Catarina Canivet, BongKyo Choi,
Robert Karasek, Mahnaz Moghaddassi,
Carin Staland-Nyman & Per-Olof
Östergren**

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UML Kerr Institute and Lund University researchers, in Sweden, have just published findings showing substantial increased pension payment for Swedish middle-aged workers with Job Strain (low decision latitude and high job demands) in a 12 year follow-up study - one of the largest such rare national registry data base studies (n= 6,500).

There were many steps in this collaboration (next slide).

This finding highlights a serious challenge for policy makers facing aging workforces: the need for prevention of workplace risk to supplement the currently increasing emphasis on restriction of access to benefits.

Job Stress & Disability: Kerr Instit. Collaboration

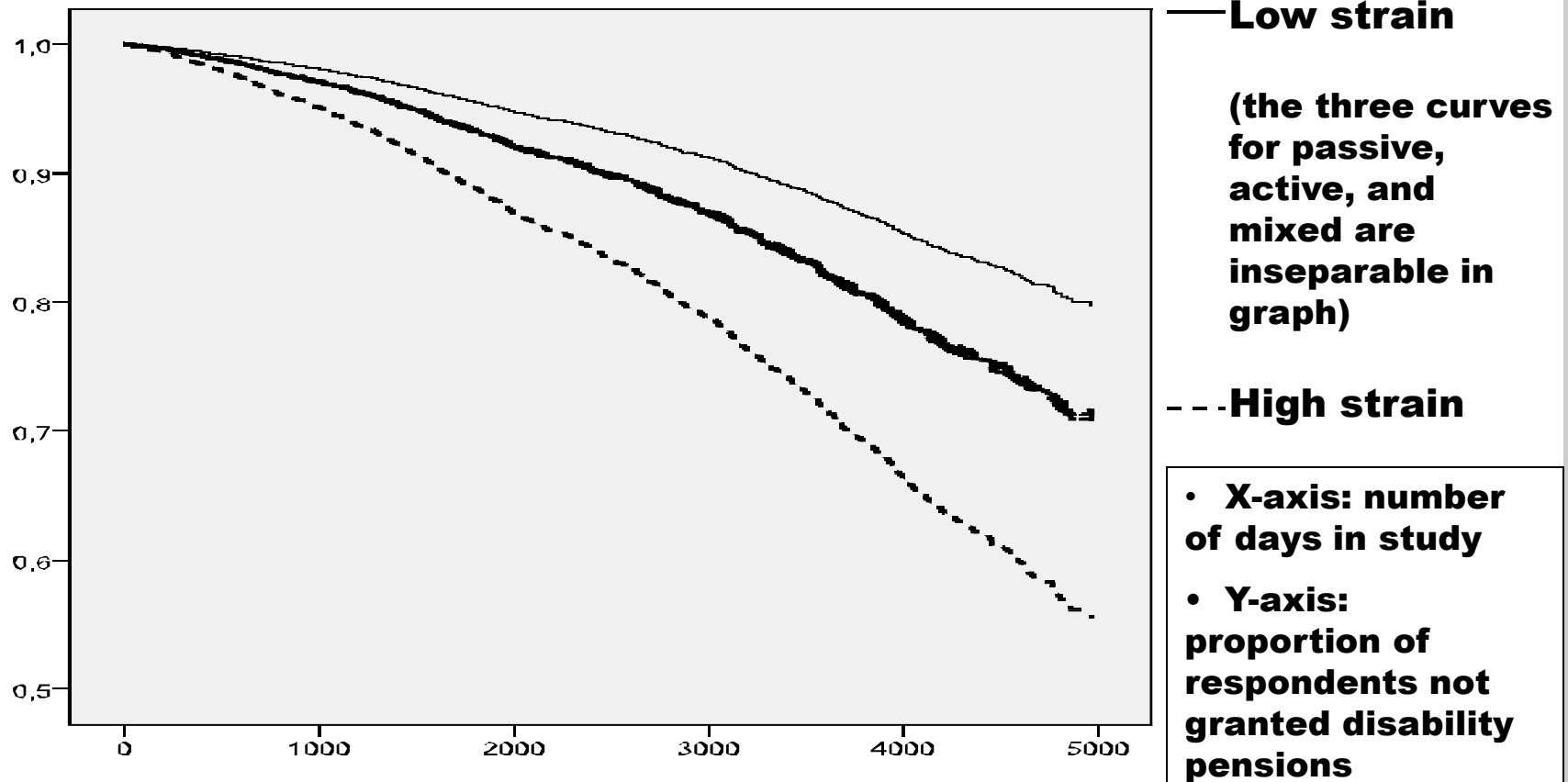
Canivet, Choi, Karasek, et al, 2012, IAOEH

Decision latitude (quartiles)	HIGH	Low Strain	RR=1.0		Active
		RR=1.0	Mixed Exposure		
	LOW	Passive	M: RR=1.3	F: RR=1.1	High Strain
				M:RR=1.5	F: RR=1.7
		LOW	↔		HIGH
Psychological demands (quartiles)					

Increased pension payments for Swedish middle-aged workers with **Job Strain (low decision latitude and high job demands)** in a 12 year follow-up study (**1.5. RR; 95% CI**) for males and (**1.7 RR, 95% CI**) in women (national register linkage study, n=6,500).

Job Stress & Disability: Kerr Instit. Collaboration *Canivet, Choi, Karasek, et al, 2012, IAOEH*

"Survival Curve:" Non-disability by job type, according to combinations of demands and decision latitude



Components of Disability by Country

An Increasing Cost of Work in the Global Economy [3]:

Figures : concern diagnosis among award beneficiaries in 2001

1. Mental Strain/Depression/Mood

- a. Netherlands¹ = 36%
- b. Sweden² = 27%
- c. US³ = 27%
- d. Denmark⁴ = 35%

2. Musculoskeletal Disorders

- a. Netherlands = 26%
- b. Sweden = 38%
- c. US = 22%
- d. Denmark = 25%

3. Cardiovascular Disorders

- a. Netherlands = 5%
- b. Sweden = 10%
- c. US = 10%
- d. Denmark = 7%

Source: 1. Veerle Brenninkmeijer et al., 2003

2. Social Insurance in Sweden 2003, NSIB, 2003

3. *Annual Statistical Report 2001*, SSA, 2001

4. Jan Hogelund et al., 2002

Job Stress & Disability: U.S. also?

The New York Times

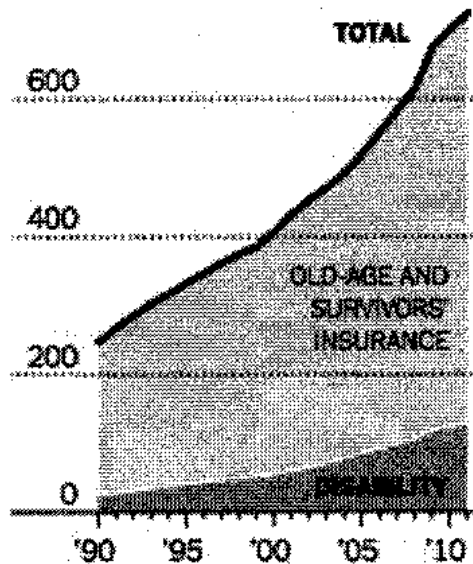
April 25, 2012

Payments Grow

Disability payments have grown to 18 percent of total Social Security benefits, compared with 10 percent in 1990.

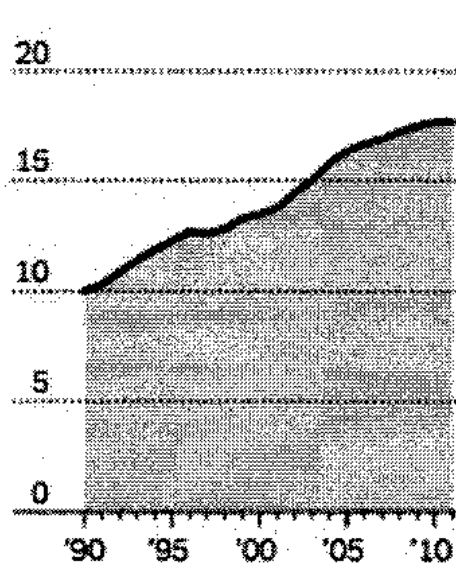
SOCIAL SECURITY BENEFITS

\$800 billion



DISABILITY PAYMENTS' SHARE OF TOTAL

25%



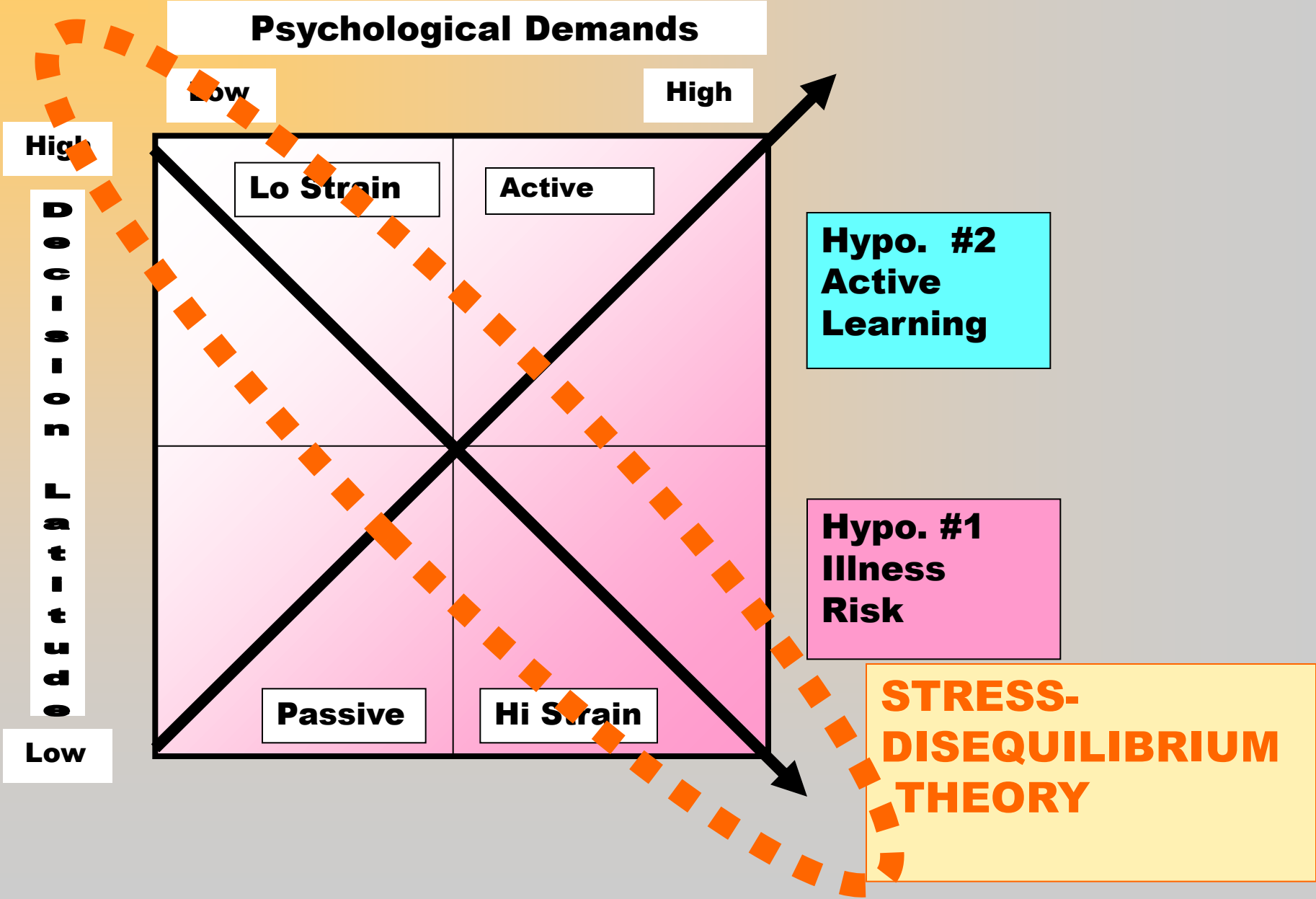
Source: Social Security Administration

THE NEW YORK TIMES

A Speculative Hypothesis:

**Prevention-Only Treatable Disease
(P-O. T. D.)**

Demand/Control Model



A High-Level Theory of Stress and Disease

- A Speculative Hypothesis based on the Stress-Disequilibrium Theory

Deficits in high-level physiological ordering capacity can explain disease:

without contribution of low-level pathological conditions, i.e., there maybe no low-level pathology involved in such disease.

Failure to meet physiological ordering capacity requirements - AT ANY LEVEL - can be a sufficient explanation of disease.

This could occur when here is a **transient vulnerability due to deficits in high level ordering capacity** - failure of restoration from insufficiency in normal low-level ordering capacity contributions (incomplete restorative cycling), or of restrictive external conditions.

A Mystery:

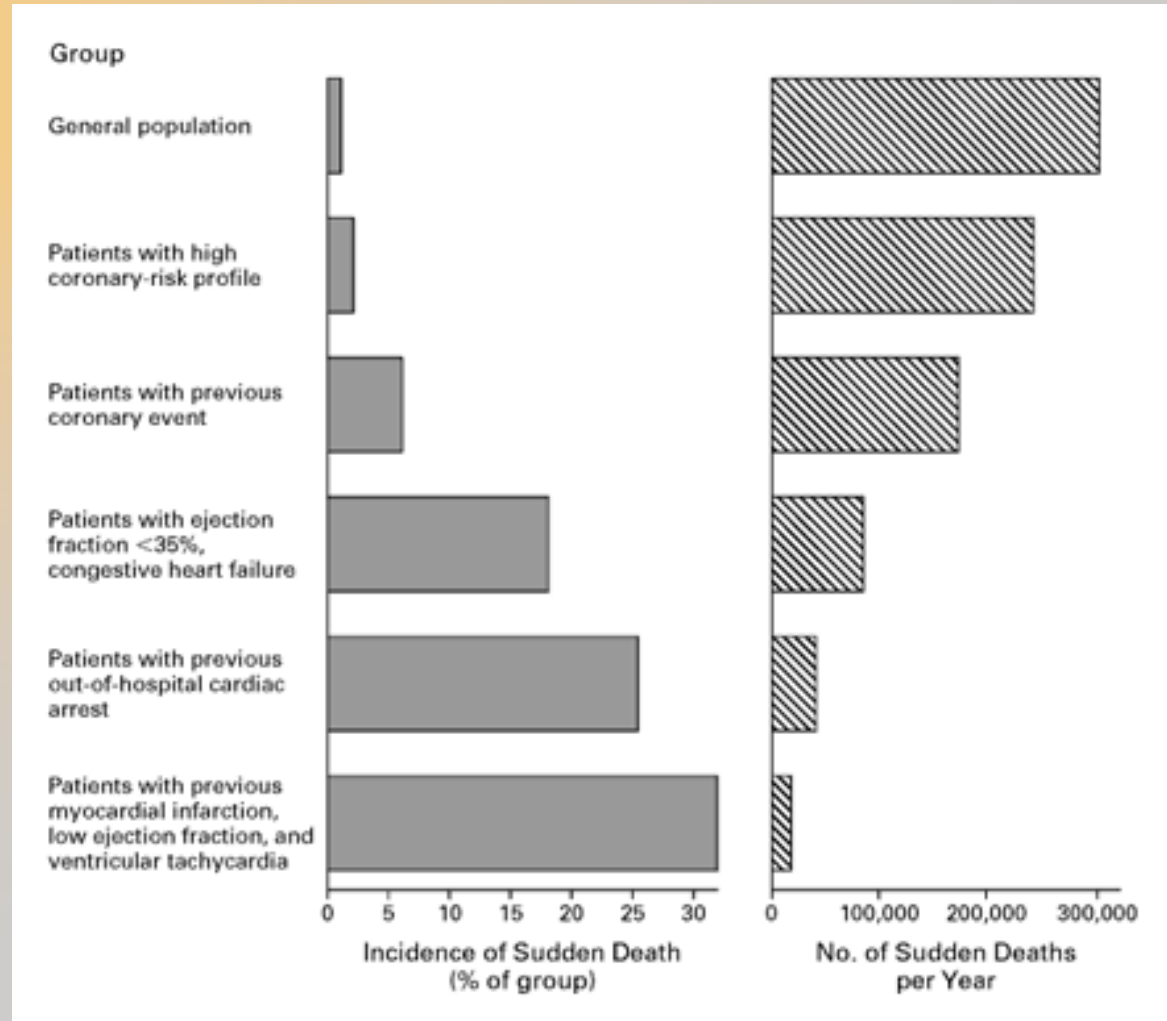
What is the cause of Sudden Cardiac Death --- or of asthma attacks

★ Huikuri, HV,,Castellanos, A, and Myerburg, RJ, N Engl Jour Med, 2001:

★ Sudden death from cardiac causes is estimated to account for approximately **50% of all deaths from cardiac causes.**

★ **There are no clear low-level biological explanations**

★ **It is an epidemiologic paradox ...**



Sudden Cardiac Death (SCD) */ Cardiovascular Arrhythmias*

Huikuri, HV,,Castellanos, A, and Myerburg, RJ, N Engl Jour Med, 2001:

- ★ Sudden death from cardiac causes is estimated to account for **approximately 50% of all deaths from cardiac causes.**
- ★ **There are no clear low-level biological explanations**
“**It is an epidemiologic paradox** that we lack information on specific markers of an increased risk of death from arrhythmia both in the general population and among those with nonspecific and intermediate risk profiles, who together account for the largest absolute numbers of events.” (op cit, Huikuri)
- ★ “...the majority of sudden deaths occur among patients who do not have the characteristics that would lead to their inclusion in trials of implantable defibrillators. (op cit, Huikuri)

Two examples of possible High-Level Control Failure and Disease: Sudden Cardiac Death and Asthma

- ★ **Two conditions both involve vagal control by the CNS:**
- ★ **- Cardiac pacing and sudden cardiac death (SCD);**
- ★ **- Respiration and asthma**
- ★ - Ventricular tachycardia and fibrillation: which can lead to sudden death. Sudden cardiac death (SCD) represents about **50% of all CVD deaths**.
- ★ - Asthma attacks: these are a dramatically increasing contributor to childhood morbidity (especially now in low SES populations).
- ★ **High Level Control Ordering Capacity - and Vagal Response?**
- ★ The vagal response is part of the **autonomic nervous systems'** capability - thus, not the highest, conscious form of CNS control, a la mental decision making.
- ★ However, **vagal response IS under partially under conscious control**, in the short term, via regulation of breathing, and in the long term through biofeedback training to increase HRV to increase “power” of vagal response.
- ★ Thus, we discuss evidence for it in this presentation as evidence for High level control (ordering capacity).

High Level Mechanisms: Sudden stress – sudden death

★ Stress & Sudden Cardiac Death

Dimsdale, JACC, 2008

“Cardiovascular responses to (sudden) stress are exquisitely coordinated and functional up to a point.....One would have to conclude that the overall data suggest that stress contributes to adverse clinical cardiac events **and provides a milieu of increased vulnerability to the heart.**”

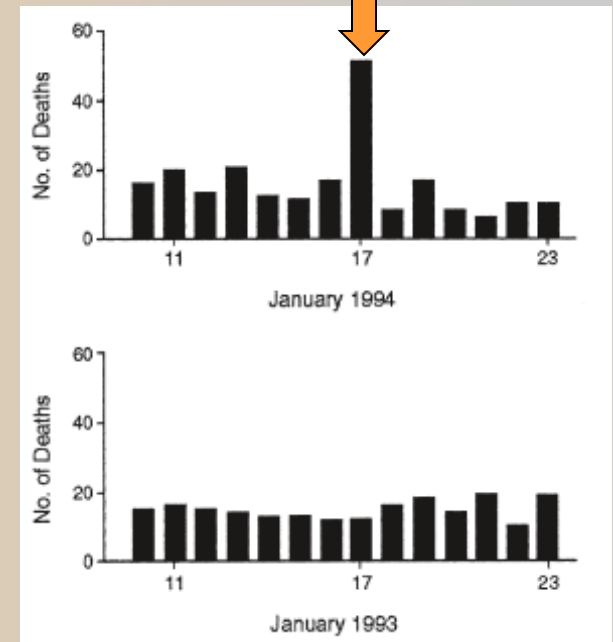
Zipps & Wellens, Circulation, 1998

“Abnormalities of the autonomic nervous system appear to be involved in the genesis of sudden cardiac death... **Any process that creates electrical heterogeneity favors the development of ventricular fibrillation.**”

Martino & Sole, Circ Res, 2009

“Cell physiology is 4 dimensional; the substrate and enzymatic components of a given metabolic pathway must be presented not only in the right compartmental space within the cell but also at the right time.**we show disrupting this integral relationship (of cell rhythms and behavioral rhythms) has devastating effects..... Harmony between our biology and our environment is vital to health.**”

Los Angeles Earthquake, 17 Jan 1994



Leor J, Poole W, Kloner R. Sudden cardiac death triggered by an earthquake. N Engl J Med 1996;334:413–9.

High Level Mechanisms - Vagal control: Cardiac pacing and sudden cardiac death

- ★ a. La Rovere, MT, et al, Lancet, 1998, show that in patients recovering from myocardial infarction, those with **subnormal baoreflex gains have high risk** of fatal cardiac events, especially if the patient has **low HRV**.
(in Lehrer PM, et al, Psychosomatic Med, p. 796)

- ★ b. Interventions known to increase **baroreflex gain** including beta-adreneregic blockade (Yusuf, et al, Progr Cardiovasc Dis, 1985), and exercise training (La Rovere, et al, Circulation, 2002) also **prevent sudden death (SCD)** in high-risk populations.
(in Lehrer PM, et al, Psychosomatic Med, p. 804)

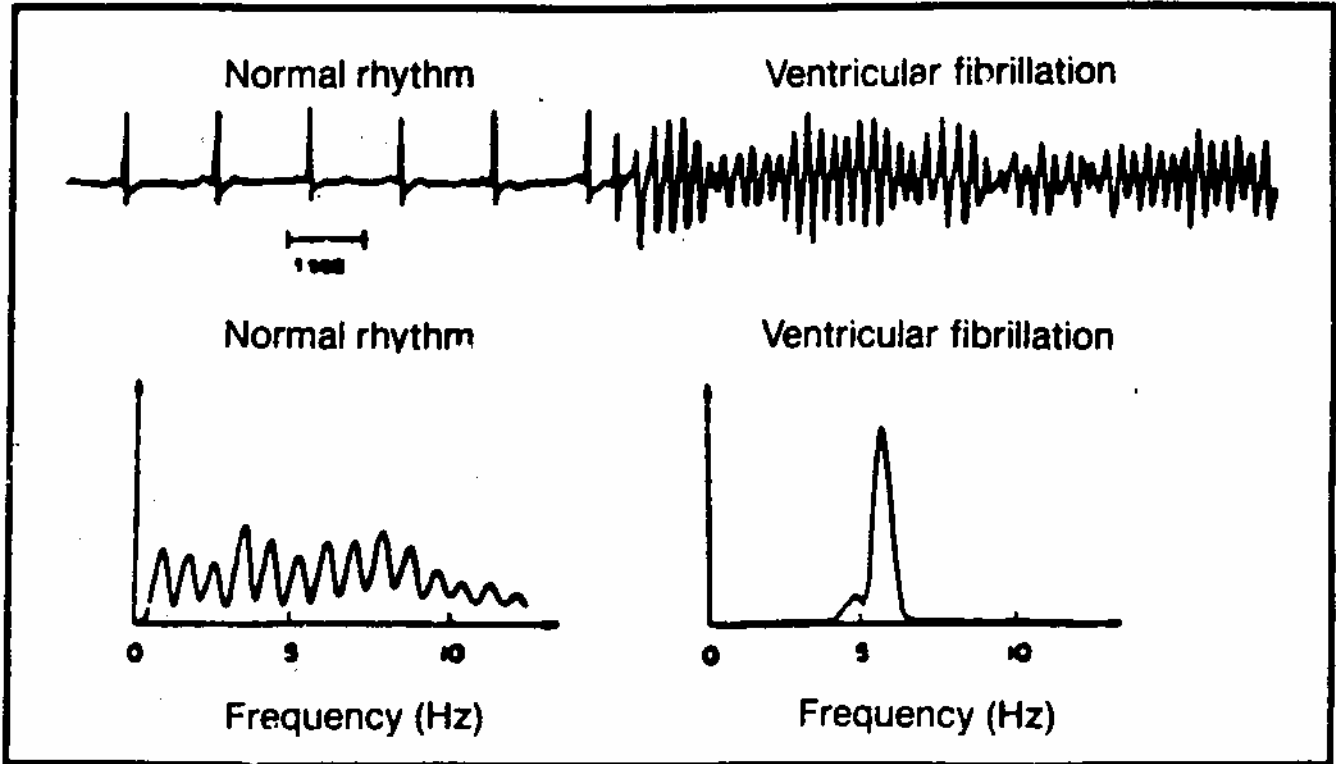
High Level Mechanisms #2 - Vagal control: Respiration and Asthma

Vagal mechanisms also figure importantly in asthma, because the parasympathetic nervous system plays a major role in modulating airway smooth muscle tone (Yousef, et al, 1985). Just as **increased baroreflex responsiveness may promote successful responses to abrupt rhythm disturbances in cardiac patients, increased vagal activity can cause bronoconstriction in asthma**, and asthma exacerbations can be associated with cholinergic activity (Lehrer, et al, Psychosomatic Med, 1996).

(op cit, Lehrer PM, et al, p. 796)

And a relation also between social stress (& perhaps low control) and asthma

- ★ a. Work-related stress, inability to relax after work and risk of adult asthma: a population-based study (*n=5114*), Loerbroks A, et al, Allergy, 2010
- ★ b. Stressful life events promote the manifestation of asthma and atopic diseases, (*a postal survey of 10, 667 Finnish university students*), Kilpelainen M, et al, Clin Exp Allergy, 2002
- ★ c. Much of the current asthma epidemic involves low SES children.



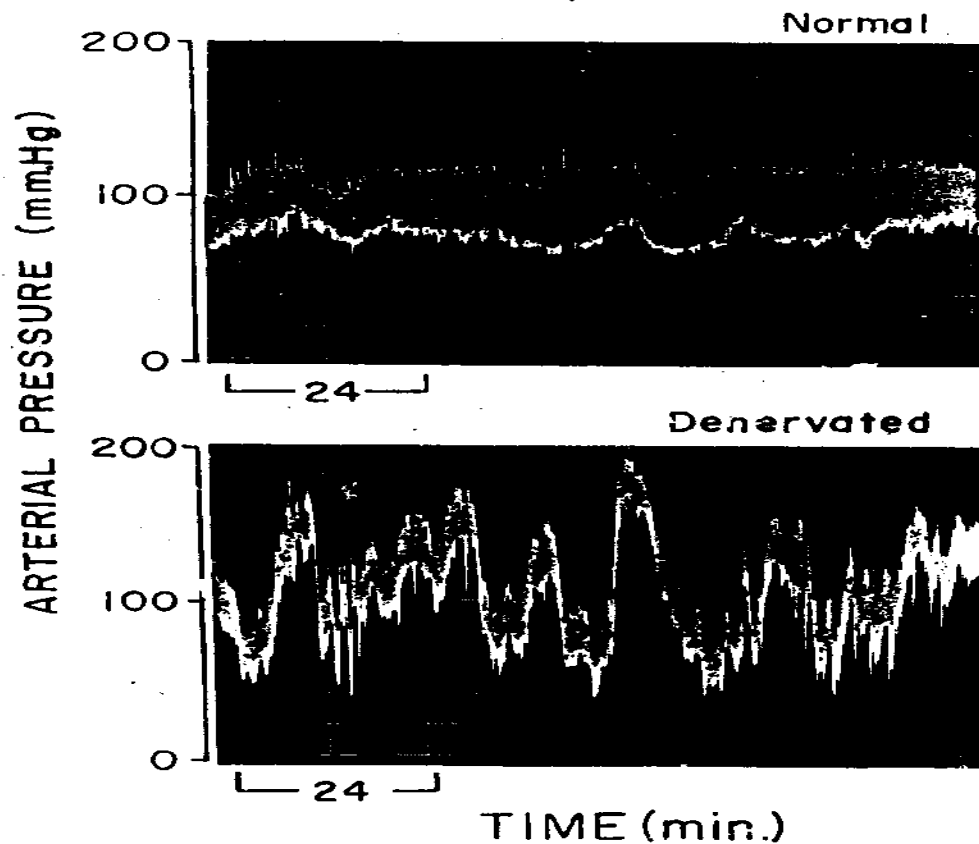
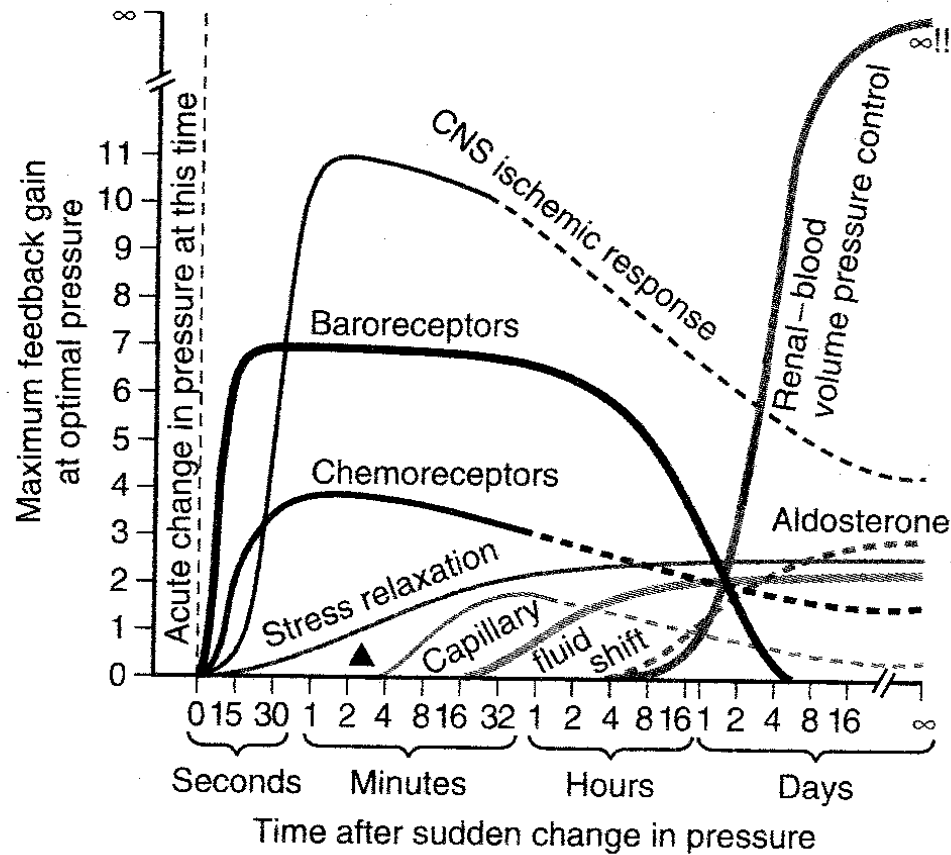


Figure 21-7. Two hour records of arterial pressure in a normal dog (above) and in the same dog (below) several weeks after the baroreceptors had been denervated. (Courtesy of Dr. Allen W. Cowley, Jr.)



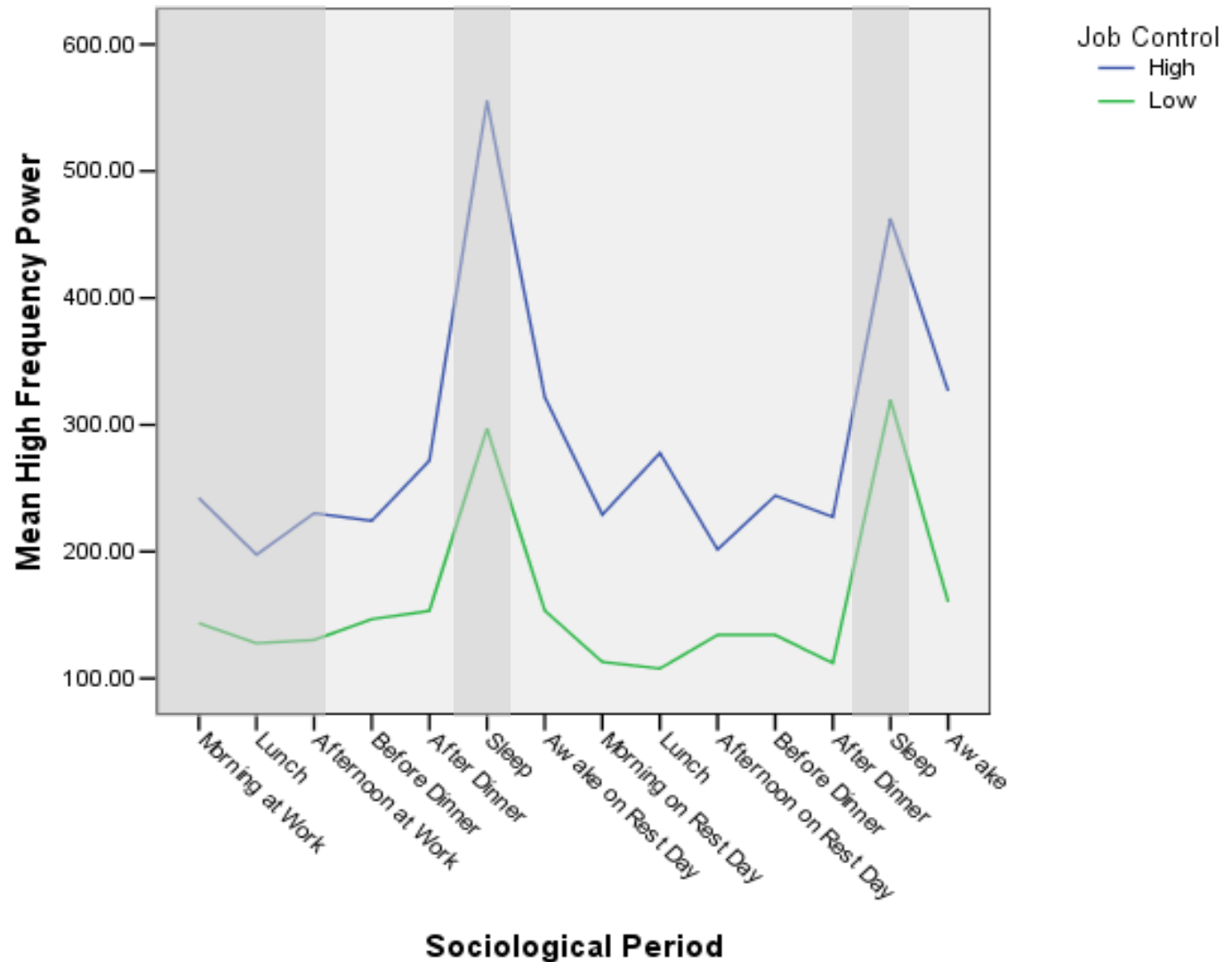
▲ Renin-angiotensin-vasoconstriction

FIGURE 19-15

Approximate potency of various arterial pressure control mechanisms at different time intervals after the onset of a disturbance to the arterial pressure. Note especially the infinite gain of the renal body fluid pressure control mechanism that occurs after a few weeks' time. (Redrawn from Guyton AC: Arterial Pressure and Hypertension. Philadelphia: WB Saunders Co, 1980.)

Job Control and High Frequency Power

Collins, Karasek and Costas, 2005



New Theory of Stress-Disease linkage:

Exhaustion of self-regulatory capacity

- ★ **Beyond Homeostasis:** (Bernard, 1865)

Deviation from optimal physiological parameter levels

- ★ **Beyond Allostasis** (Sterling and Eyer, 1981) - **and the specific pathways of Cannon (1914) and Selye (1936):**

Sympathetic over-arousal (too many adaptive demands)

- ★ **To: Stress-Disequilibrium Theory**(Karasek, 2004)

Exhaustion of self-regulatory capacity, and limits of self-regulatory stability

Stress-Disequilibrium Theory: Stages in stress-related disease development:

1. **Normal: Equilibrium** of flows.
2. **Then: Overload** of demands - or - depletion of ordering capacity.
3. **Organism switches to alternative** subsystems, or coordination strategies(Selye). ...The costs of inefficient performance mount up.
4. **The possibility of maintaining mutual coordination of the ensemble of sub-systems diminishes: organizing capacity is overloaded: “stressed”** (K &T, 1990, p. 87): “Stress is a systemic concept referring to a disequilibrium of the system’s control capacities,” – in particular its capacity to maintain internal organization, as it deals with adaptive loads.
5. A **spontaneous reorganization**, ..representing a lower overall cost - and capacity .. is likely to occur. This organization will permanently change the change **changes the equilibrium.**

A High Level Theory of Disease:

High level failures of ordering capacity could be themselves sufficient to explain disease. (a very non-reductionistic hypothesis).

Two Central issues in High-Level disease theory

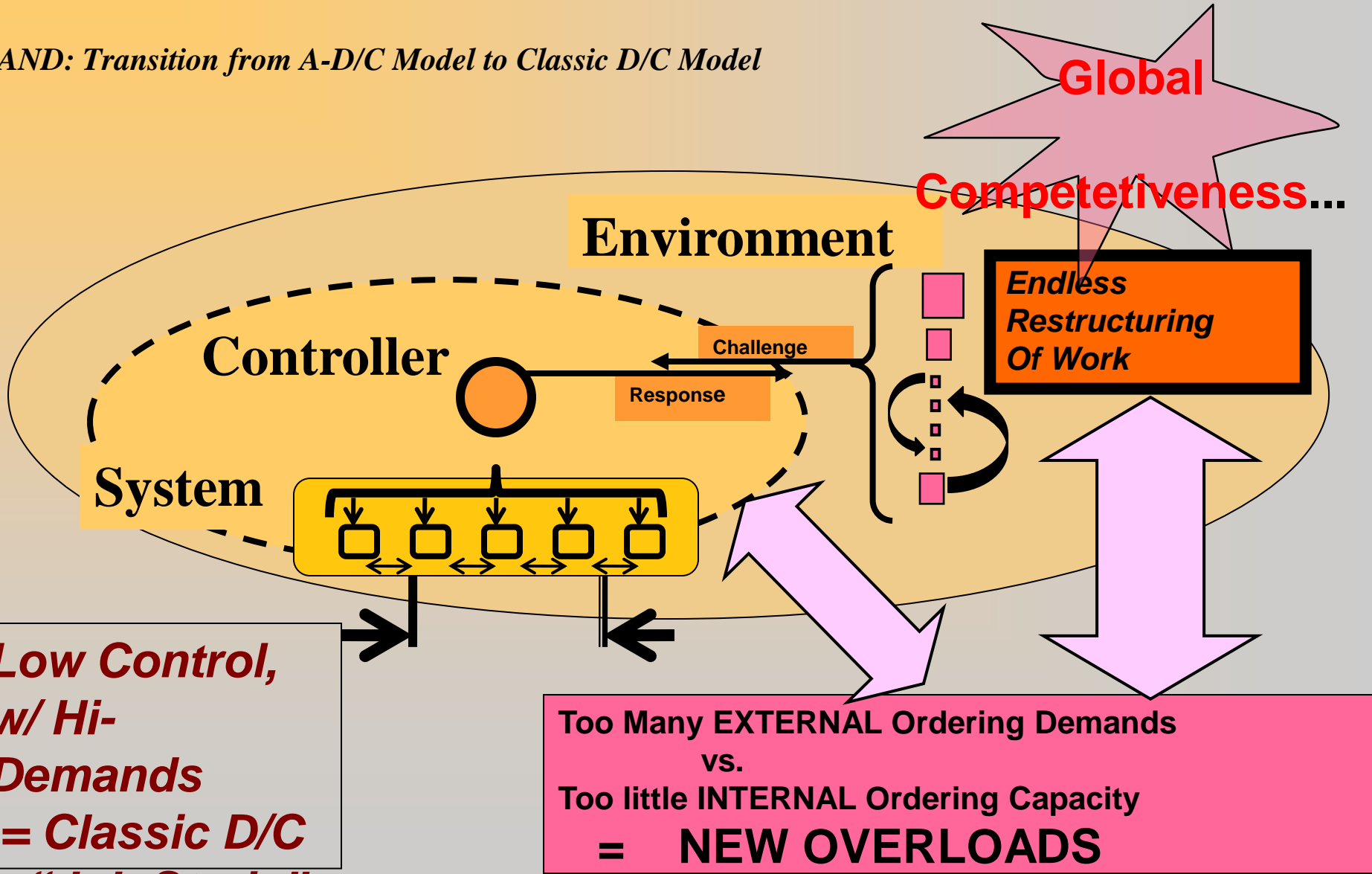
- ★ **1. Cycles of ordering capacity creation and expenditure**
- ★ **2. Linked high and low levels.**
- ★ **Low-level contributions are needed to sustain high level ordering capacity (and high level environmental support is needed to insure successful lower-level functioning).**
- ★ **In the LONG TERM, LINKAGE exists between levels - contributing to high level ordering capacity. BUT, in the SHORT TERM, levels can be INDEPENDENT - implying transient vulnerability at the higher levels.**
- ★ **There is a transient vulnerability due to deficits in high level ordering capacity.**
- ★ **These deficits represent a failure of restoration that may come from insufficiency in normal low-level ordering capacity contributions (incomplete restorative cycling), or of restrictive external conditions.**
- ★ **There maybe no low-level pathology involved in such disease.**

P.O.T.D.: “Prevention-Only Treatable Disease:”
- A “High Level” Theory of Disease

- ★ **High level failures of ordering capacity could be themselves sufficient to explain disease.**
(“high level theory” = functionality-related theory, at highest level consciously controlled)
- ★ **HIGH LEVEL FAILURE IS PROXIMAL TO SOCIAL ENVIRONMENTAL CAUSES.**
- ★ **Thus, social organizational changes in control structures could have DIRECT health promoting effects.**

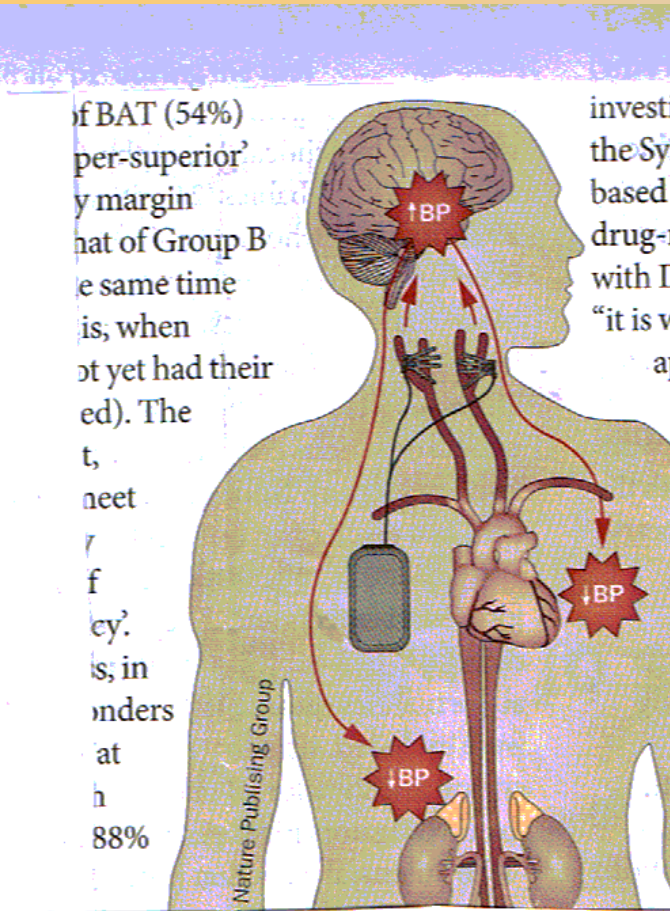
Direct Effects of Work Organization Complexity from the Global Economy on Organizational De-Regulation

-AND: Transition from A-D/C Model to Classic D/C Model



Low Control, w/ Hi-Demands = Classic D/C

Surgical Interventions?



- ★ **Baroreflex surgery to augment blood pressure control** - for patients resist to pharmacological therapies....
- ★ RHEOS Pivotal Trial : **260 subjects - 68 adverse events**, including 25 permanent or transient nerve injuries

Long-term Pharmacological Interventions for Asthma - LABA?

- ★ Long-acting Beta Agonists (LABA) have “broncho-protective effects,” but they can produce “desensitization” and “down regulation” (tolerance), and mask asthma status.
- ★ Also: Many reports of heart “racing” irregular breaths, feeling of imminent heart attack, and 16 deaths (SMART Trial, terminated 2003) ...

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A Conference:
“From the Demand/Control Model to
A Feasible Economy
of Innovative & Healthy Work”

at University of Bordeaux,
April 28-29, 2016

Four Expert Subgroup Discussion Areas

,...Then: Stakeholders:

1. Overview: Day 1: Experts (n=25-40)

- ★ ***Group 1: “Youth, Work and Smart Employment Dynamics”***
- ★ ***Group 2: “Aging Workforce, Work Stress Social Costs, and Healthy Work Re-design”***
- ★ ***Group 3: A Micro-focus: Managing Companies in an Economy of Innovation and Health***
- ★ ***Group 4: A Macro-focus: Political Economy of Innovation and Health, New Institutions, and Value Transitions***

2. Overview Day: 2: Stakeholders (n=200)

Step 4: Bridging the Conducive Economy and the Commodity Economy

CONFLICTING POLICIES!! : Conducive Econ./ Commodity Econ.

