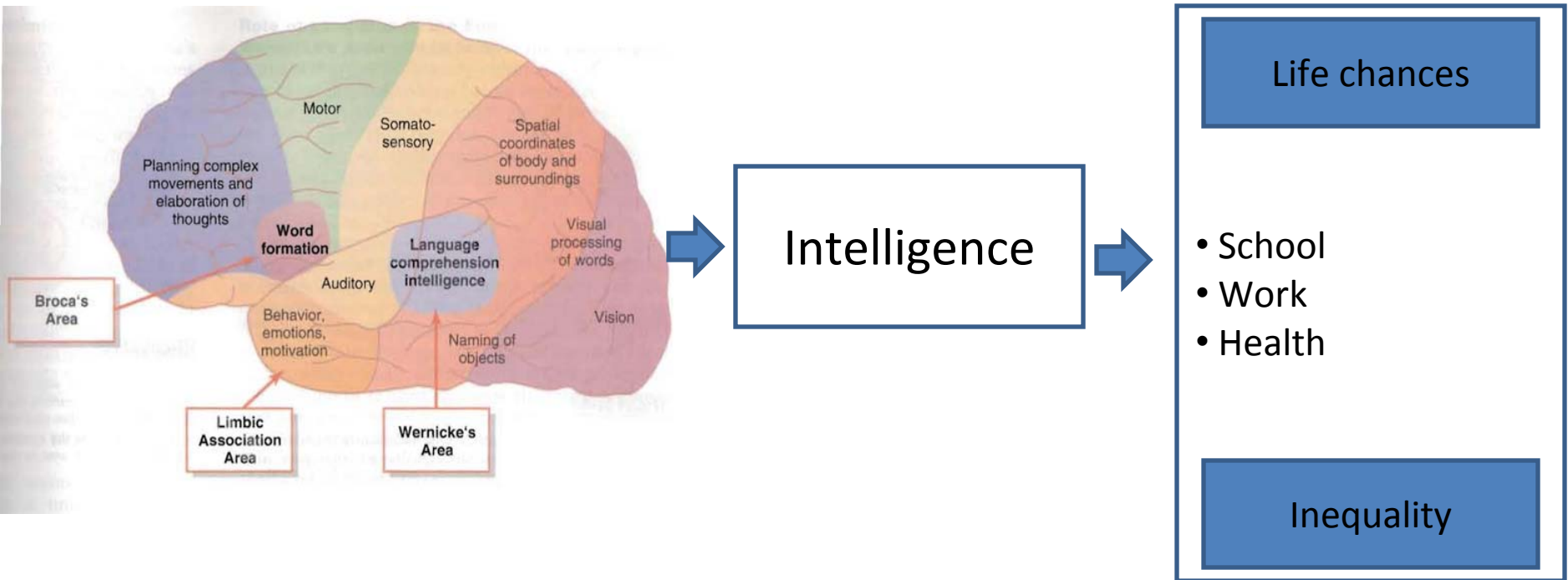


The *Fragility* of Maximal Performance

Linda S. Gottfredson
School of Education
University of Delaware

September 16, 2008
Conference: “How can we improve our brains?”
Banbury Center, Cold Spring Harbor, New York

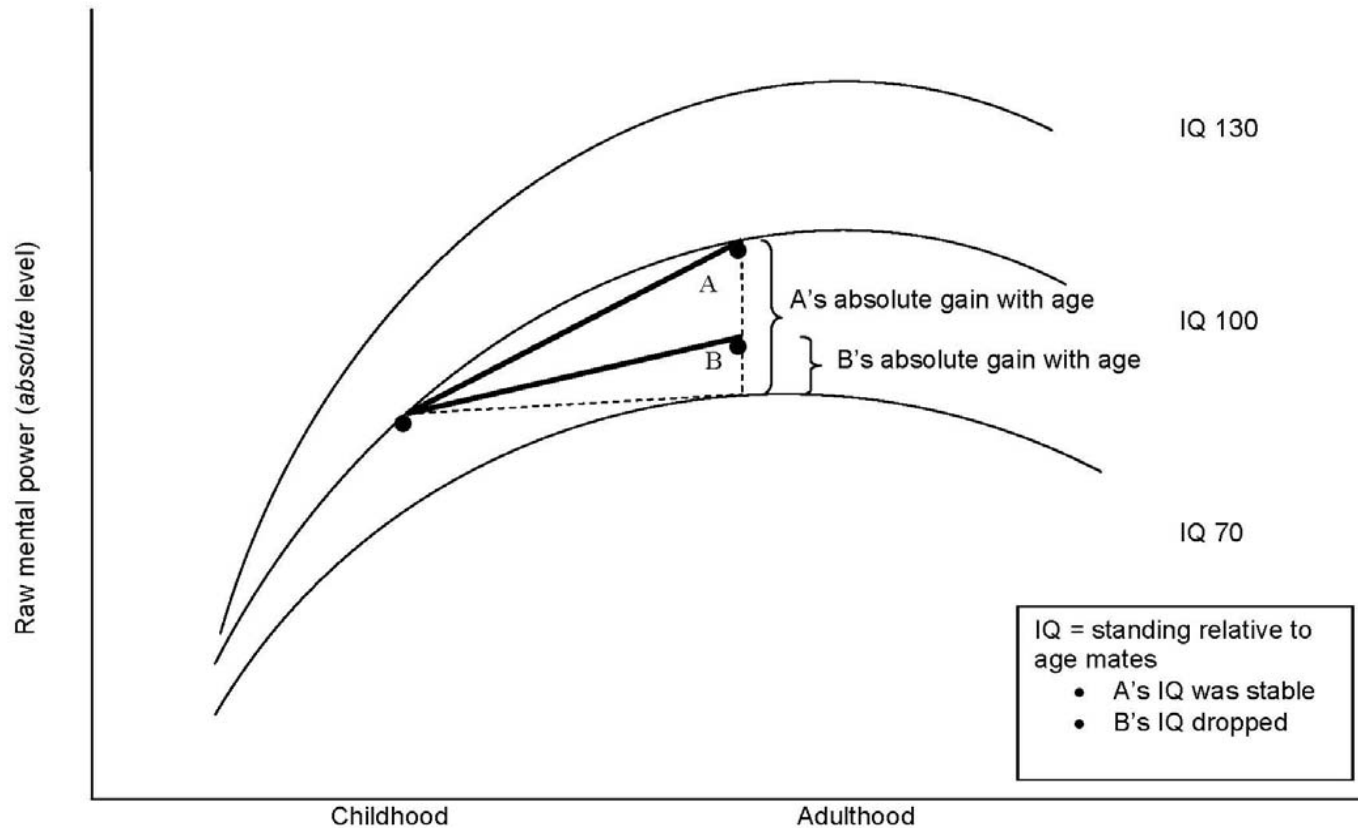
How can we improve our brains?



The problem with “intelligence”: I

Human norm, or variations on it?

(E.g., developmental change, or inter-individual differences?)

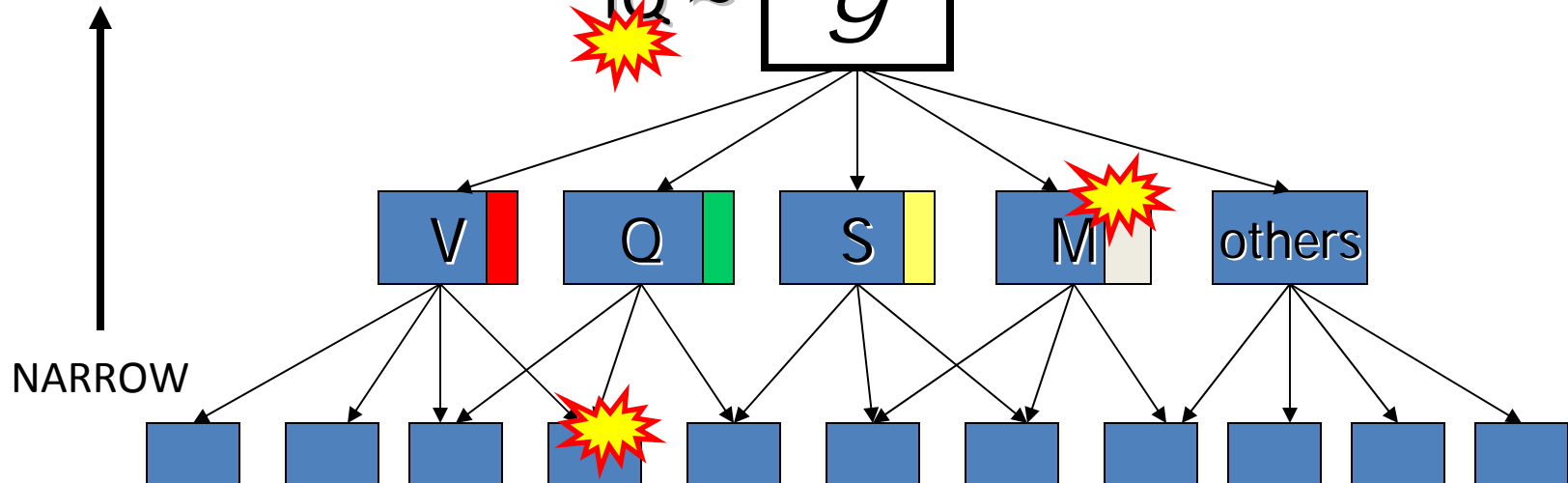


The problem with “intelligence”: II

Which inter-individual differences are we talking about?

GENERAL

- Domain general
- More heritable
- *Psychometrically* unitary
- *Physiologically* distributed



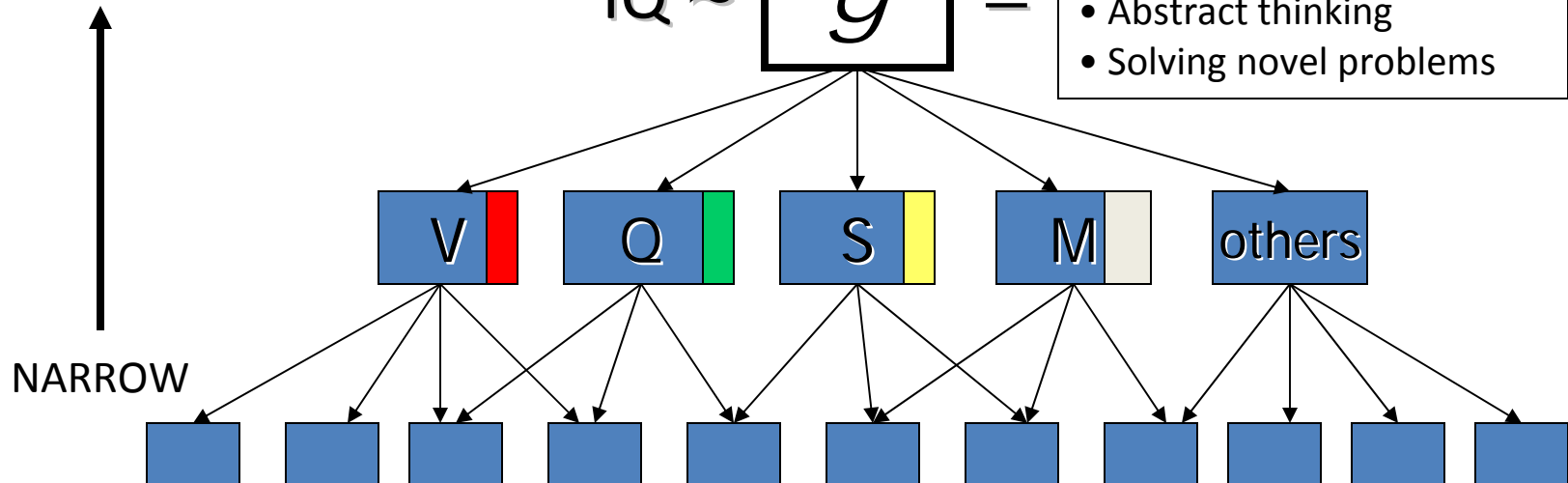
P	E
H	M
Y	O
S	T
I	I
C	O
I	N
A	A
L	L

The problem “intelligence”: II

Which inter-individual differences are we talking about?

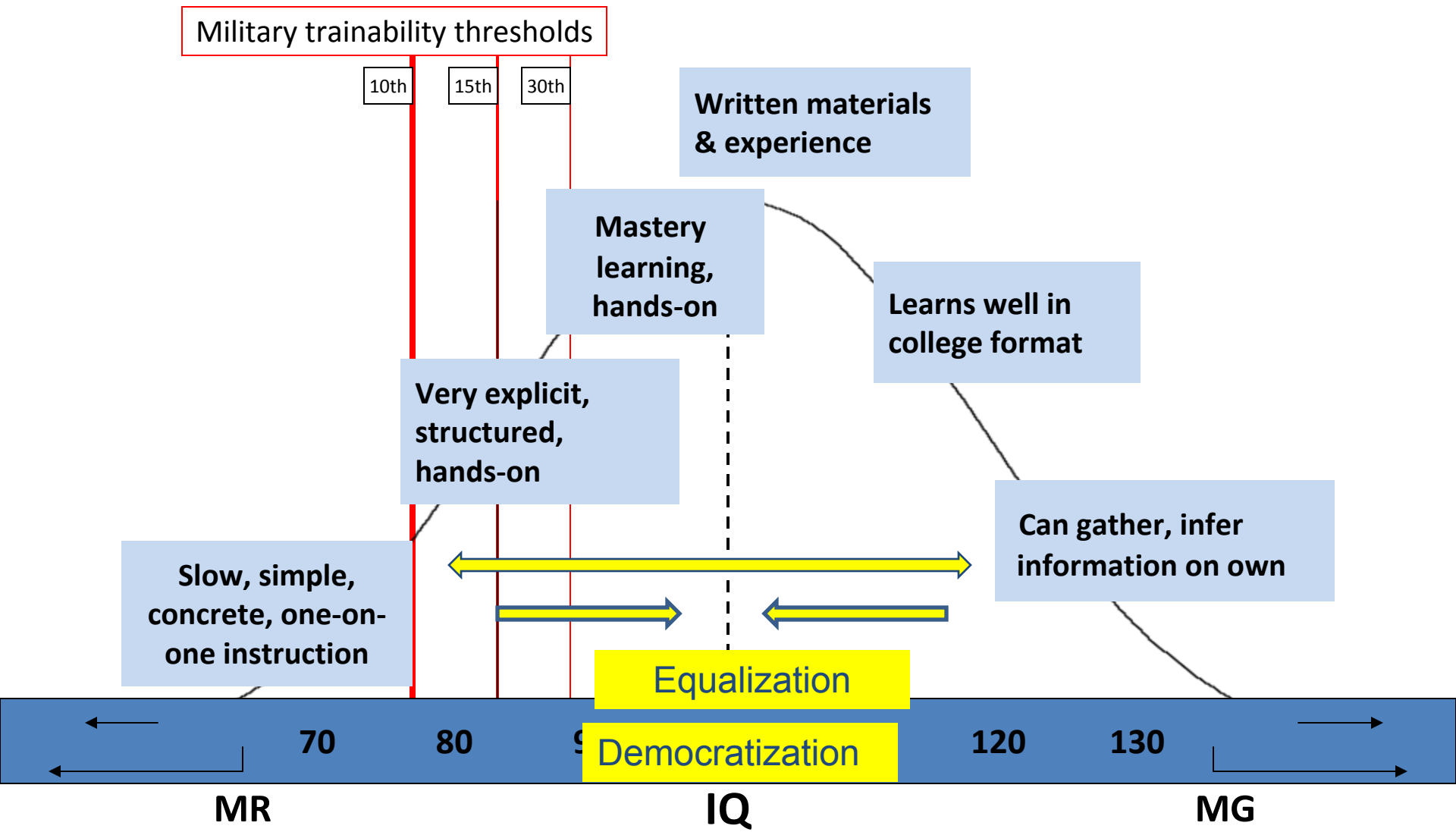
GENERAL

- Domain general
- More heritable
- *Psychometrically* unitary
- *Physiologically* distributed



Global phenotype differences

(e.g., typical learning needs by IQ level)



Correlated life consequences

Typical IQ range of workers

Military trainability thresholds

10th

15th

30th

Clerk, teller
Police officer
Machinist, sales

Assembler
Food service
Nurse's aide

Manager
Teacher
Accountant

No jobs
centered here

Attorney
Chemist
Executive

70

80

90

100

110

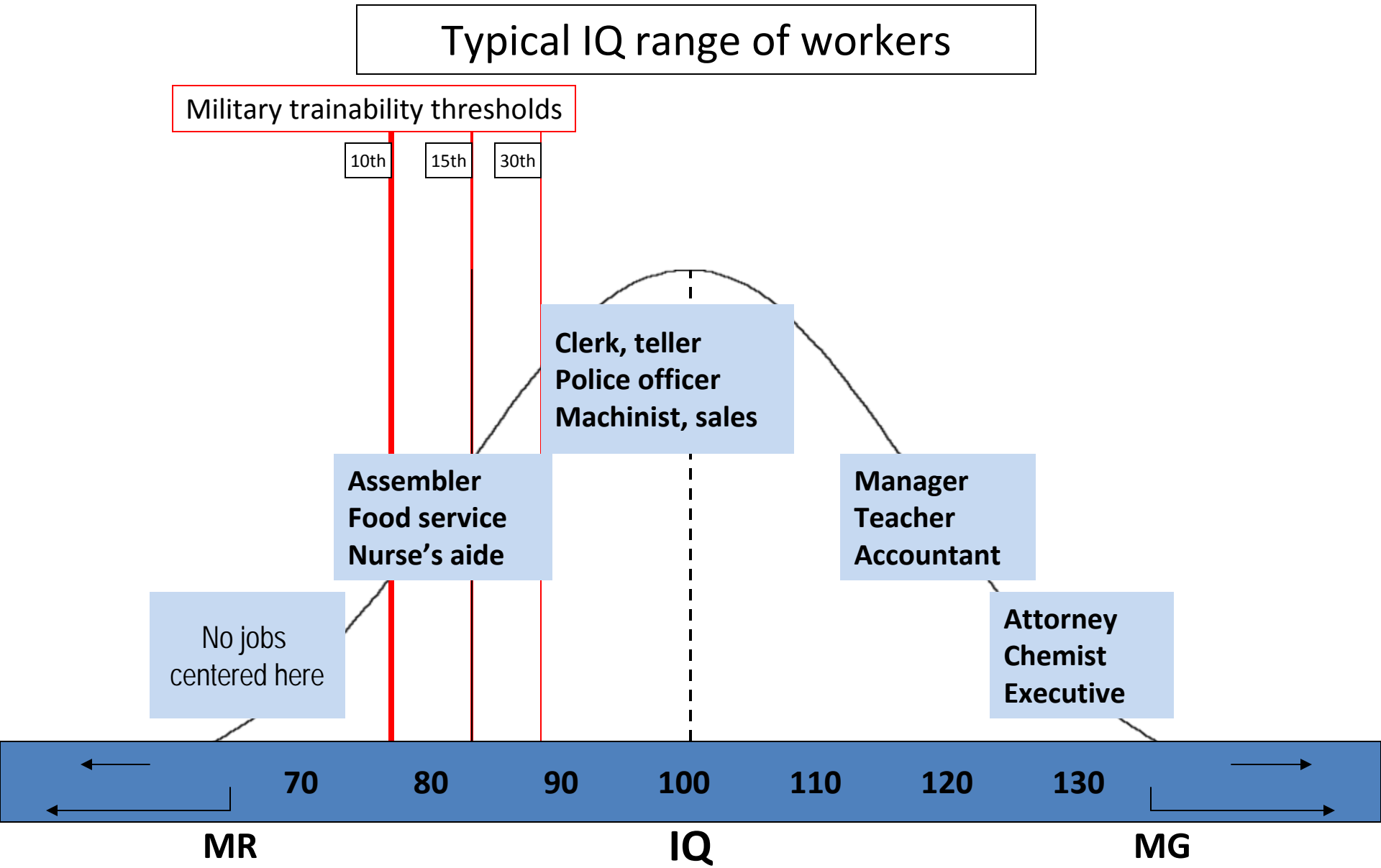
120

130

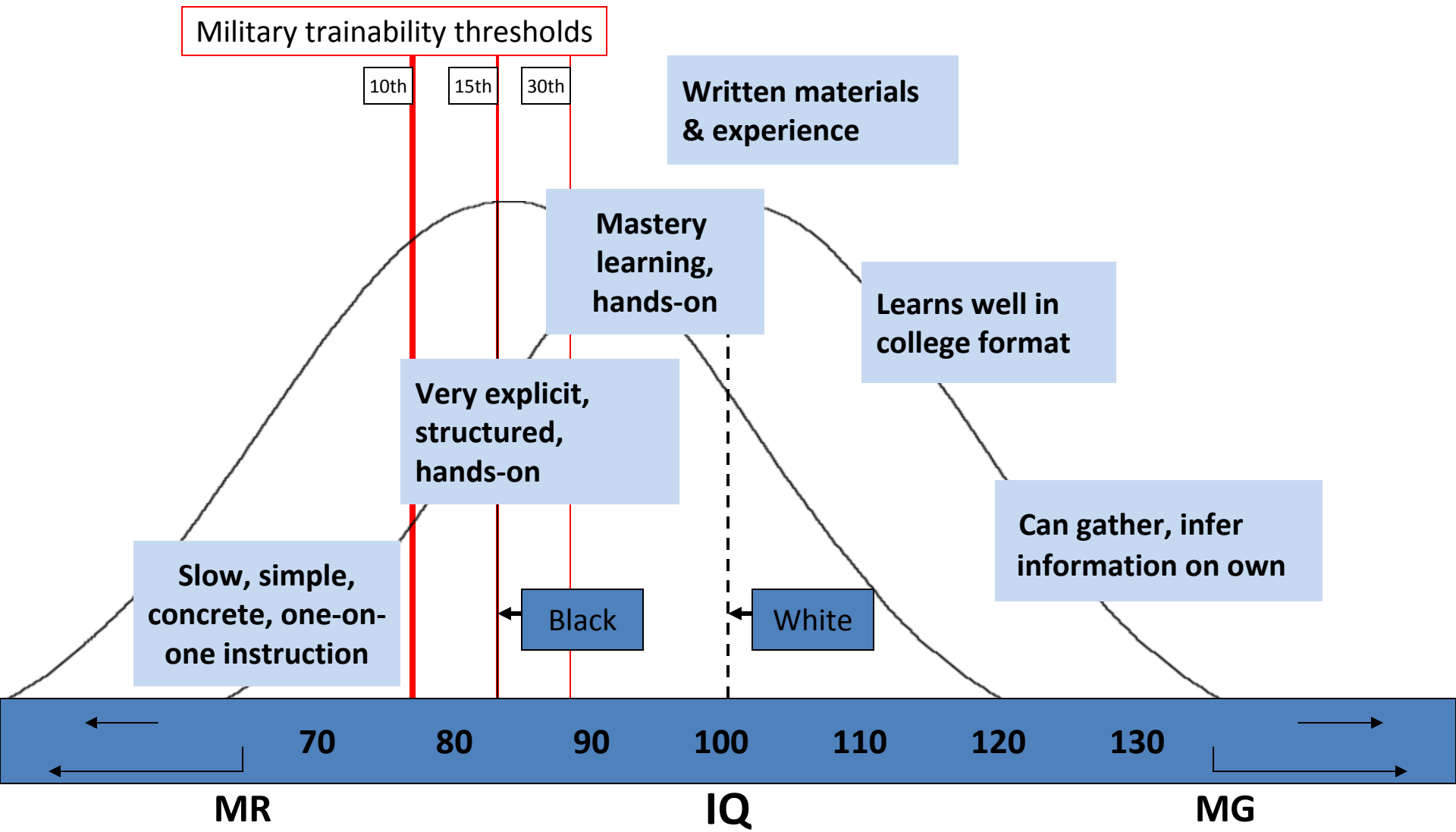
MR

IQ

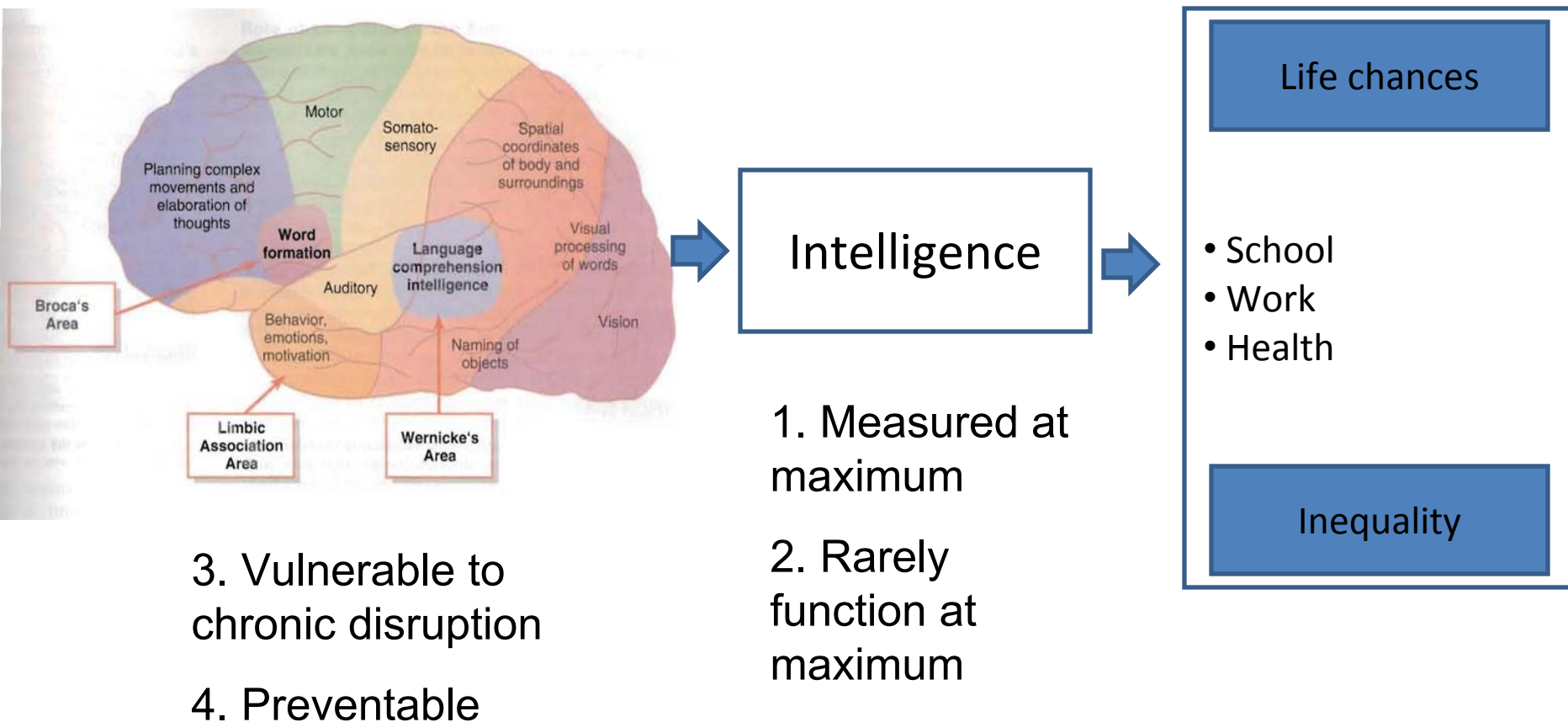
MG



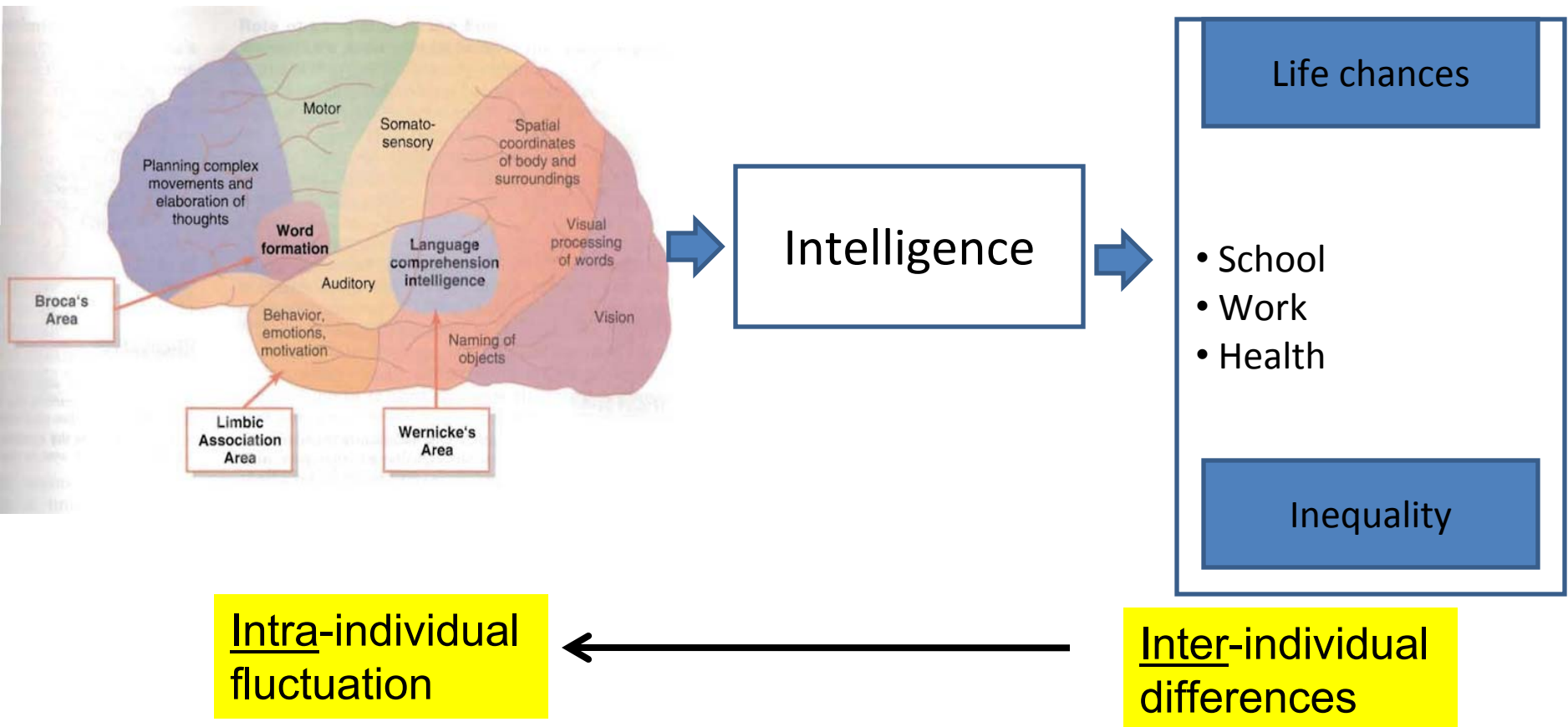
Black-white disproportions



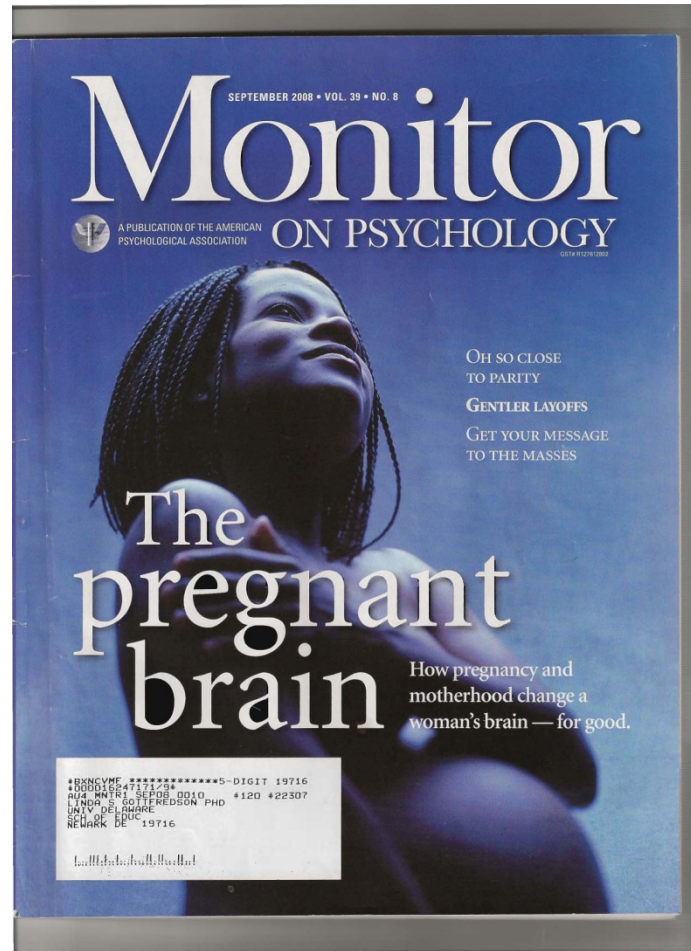
My focus: How can we better use and protect our brains?



My focus: How can we better use and protect our brains?




Species-typical influences on brain



Evolutionarily novel influences on brain



Coping with Physical & Emotional Changes

print 
close 

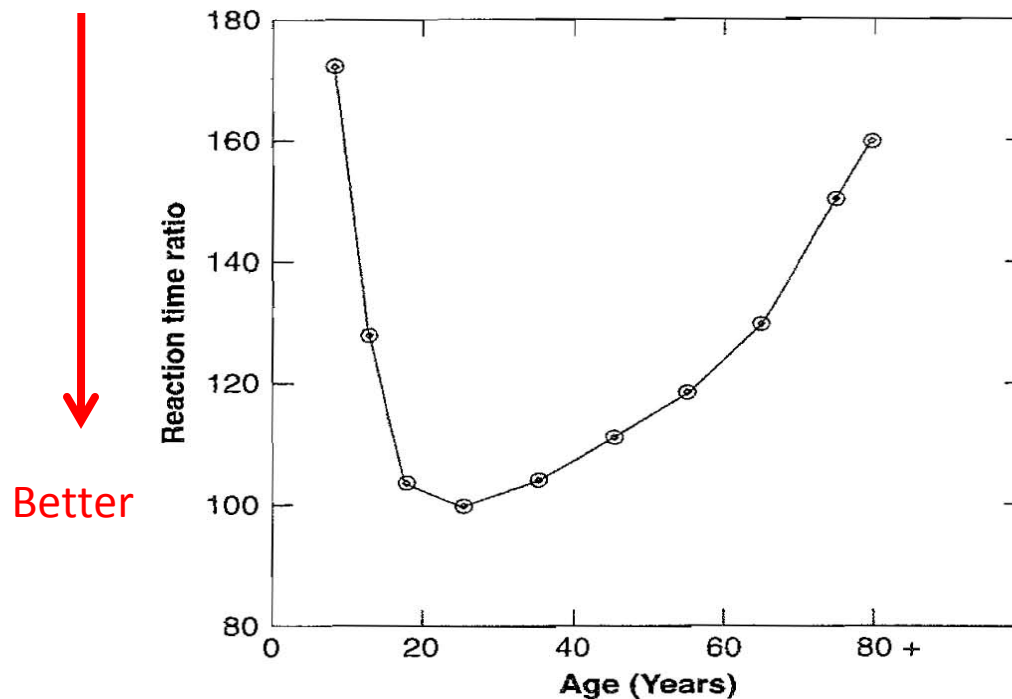
Chemo Brain

For many years cancer survivors have worried about, joked about, and been frustrated with the mental cloudiness they notice before, during, and after chemotherapy. We don't know its exact cause but this mental fog is commonly called "chemo brain." Patients have noticed this mental fog for some time, but only recently have studies been done that could start to explain it.

Research has shown that some cancer drugs can, indeed, cause changes in the brain. Imaging tests have shown that after chemotherapy, some patients have smaller brain size in the parts of the brain that deal with memory, planning, putting thoughts into action, monitoring thought processes and behavior, and inhibition.

Effects of Aging on Brain (Reaction Time)

78 *Clocking the Mind*



Behavior that increases brain's vulnerability to aging

William Milberg, PhD

■ **Hometown:** Newton, Mass.

■ **APA member since:** 1981. Fellow beginning this year.

■ **Occupation:** Overseeing the Geriatric Neuropsychology Laboratory and clinical training program in geriatric neuropsychology at the Geriatric Research, Education and Clinical Center within the VA Boston Healthcare System where he is the associate director for research.

■ **Top research interest:** His lab uses imaging to measure structural variations in the brain as they relate to variations in risk for the cognitive disorders of aging and dementia. The researchers' goal is to determine how such differences relate to human cognition and functioning.

■ **Take-home message from his findings:**

Drop the chocolate chip cookies and get moving. The cognitive diseases that come with aging appear to be closely linked to our heart health. "It's all the usual suspects of diet and exercise," says Milberg. "Once you're on the road toward impaired cardiac and metabolic function, you may also be on the road to impaired brain function."

■ **Future forecast:** Milberg says we're not far away from being able to use imaging to identify red flags in younger adults. "Even in just the last couple of years, brain technology has become incredibly precise." Not only can it measure structure, it can show neurochemical differences and how well the blood supply is distributed within the

stages and find out whether there are interventions that would prevent disease before it's too late."

■ **How he unwinds:** Playing guitar. "I'm a frustrated, bad jazz guitarist."

He experimented with the instrument in high school but abandoned it as his studies took off. Fifteen years ago, his wife gave him a new guitar that he plays in the evenings, sometimes in front of the TV, envisioning the "fantasy life" he set aside for psychology.

■ **Future goal:** "To avoid what it is I'm seeing in aging people and to continue to work on the problem."

—S. MARTIN

Each month, "Random Sample" introduces you to a randomly chosen APA member. You might be next.

Accumulation of preventable injuries

control and Preventable more troubling, as of all high school in concussions and. Because teenage developing, injuries specially damaging: ls and colleges fail the kind of neuro- g that's needed to

ches have become it concussions. The hlete who's had his ckside and sending ne are diminishing, at someone who's eds rest. He or she a break from the school. This allows all its resources to

victim risks devel- n syndrome, which headaches, dizzi

scans cannot reveal when the athlete has had enough rest, because they are not sensitive enough to detect the kind of microscopic damage to brain cells and brain chemistry that concussions can cause.

The only way to know for sure whether a concussion victim's brain has re-

Schools must do more to protect athletes from concussions.

turned to normal is to compare the results of neuropsychological tests conducted before and after the injury. That requires preparing athletes for the season by putting them through baseline

control one's emotions and impulses.

The baseline evaluation also includes a medical history, which helps determine the athlete's future risk of head injury and his long-term prognosis in the event of a concussion. At greatest risk for post-concussion syndrome are people who have had concussions before, have a family member with a psychiatric disorder or have a condition like attention deficit hyperactivity disorder, seizures or bipolar disorder. Also, the risk is greater for females than for males.

A brain injury can do lasting damage to neurons and arteries and alter brain chemistry, too. That can reduce a patient's ability to concentrate or cope with frustration, and lead to moodiness, irritability and depression. Such impairments make it more difficult to deal with daily stresses, and thus often lead to significant social problems.

To fully recover from a concussion, the brain must quickly reorganize itself

Clueless, snee Charlie?"

"Well, what do said Mr. Gibson.

"His worldview

Later, in the commentators point that there voters — some "hockey moms" the Bush doctrine reason we have campaigns. You uals who best u who will address and creative w well-being of the

The Bush doc the doors to the such a fundam ministration's fo gers the imagin someone no fu away from th doesn't even kn

New York Times, 9/13/08, p. A19

Fatigue, sleepiness

Pilot Fatigue Spurs Renewed Calls For Safeguards, Shorter Flying Times

BY ANDY PASZTOR
AND SUSAN CAREY

Safety experts and regulators have long been concerned about the dangers of exhausted, overworked or downright sleepy pilots. But the problem is intensifying as financially strapped airlines try to squeeze more productivity out of pilots, who by most measures are log-

manageable on paper often don't account for storms, air-traffic congestion or other potential delays that can make a long work day longer. In July, according to the latest government statistics, 19 U.S. airlines saw one quarter of all their flights, on average, arrive late by more than 15 minutes. And pilots say certain airlines schedule flight times at or just under eight hours—the FAA-mandated

After working more than 12 hours in a row—inside and out of the cockpit—error rates shoot up, complacency increases and communications become impaired, says Peter Demitry, a former test pilot and fatigue expert who consults for pilot groups. One symptom of fatigue that scientists are now studying is “micro sleep,” when pilots become unresponsive for

Wall Street Journal, 9/12/08, p. A1



CLINICAL REVIEW

Alertness management strategies for operational contexts

John A. Caldwell^{a,*}, J. Lynn Caldwell^{b,1}, Regina M. Schmidt^{b,2}

^aArchinoetics, LLC, Topa Financial Center, 700 Bishop Street, Suite 2000, Honolulu, HI 96813, USA

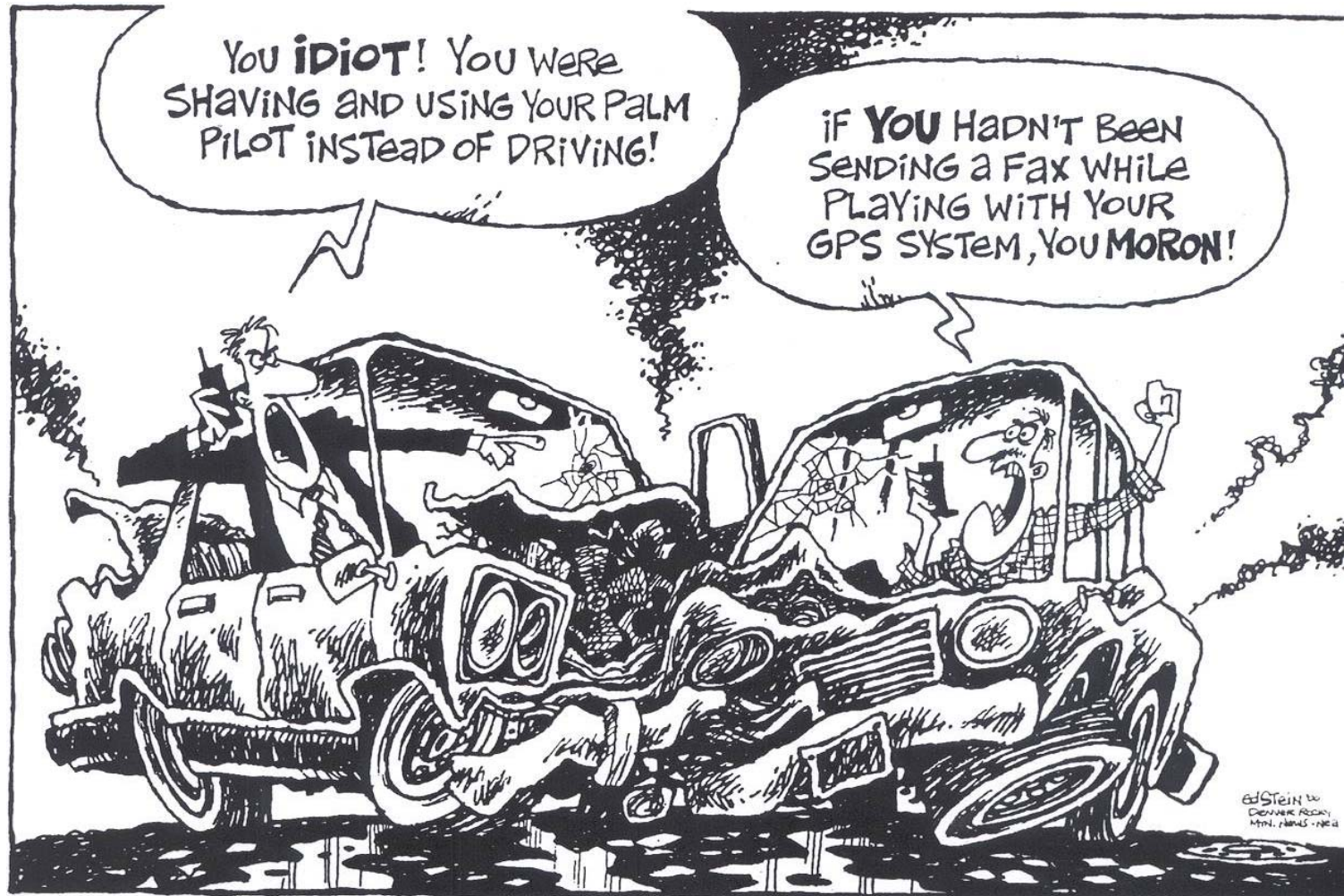
^bAir Force Research Laboratory, Biosciences and Protection Division, 2215 First Street, Bldg. 33, Wright-Patterson AFB, OH 45433, USA

KEYWORDS

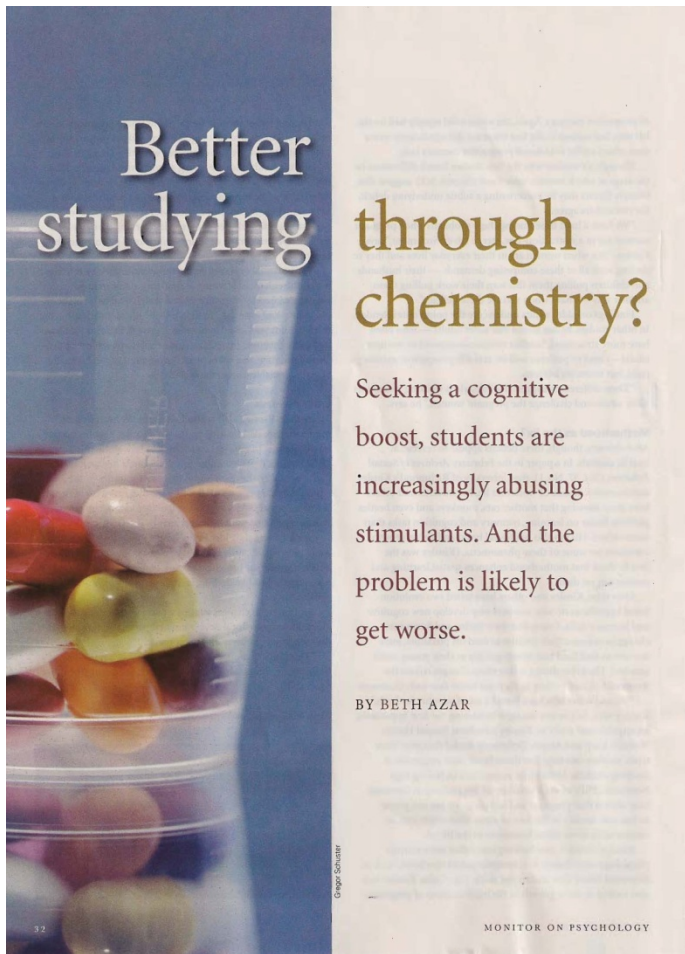
Fatigue
management;
Occupational health
and safety;
Alertness;
Sleep deprivation;
Fatigue detection

Summary This review addresses the problem of fatigue (on-the-job-sleepiness) attributable to sleep loss in modern society and the scientifically proven strategies useful for reducing fatigue-related risks. Fatigue has become pervasive because many people work non-standard schedules, and/or they consistently fail to obtain sufficient sleep. Sleep restriction, sleep deprivation, and circadian desynchronization produce a variety of decrements in cognitive performance as well as an array of occupational and health risks. A number of real-world mishaps have resulted from performance failures associated with operator sleepiness. In some cases, fatigue/sleepiness is unavoidable, at least temporarily, due to job-related or other factors, but in other cases, fatigue/sleepiness results from poor personal choices.

Disrupted attention



Cognitive enhancers (doping?)



“It’s a brave new world”

Before—

- caffeine
- ephedrine-based drugs

Now—

- Ritalin
- Adderall
- Modafinil

Seeking the competitive edge

Vol 450 | 20/27 December 2007

nature

COMMENTARY

Professor's little helper

The use of cognitive-enhancing drugs by both ill and healthy individuals raises ethical questions that should not be ignored, argue **Barbara Sahakian** and **Sharon Morein-Zamir**.

Today there are several drugs on the market that improve memory, concentration, planning and reduce impulsive behaviour and risky decision-making, and many more are being developed. Doctors already prescribe these drugs to treat cognitive disabilities and improve quality of life for patients with neuropsychiatric disorders and brain injury. The prescription use of such drugs is being extended to other conditions, including shift-workers. Meanwhile, off-label and non-prescription use by the general public is becoming increasingly commonplace.

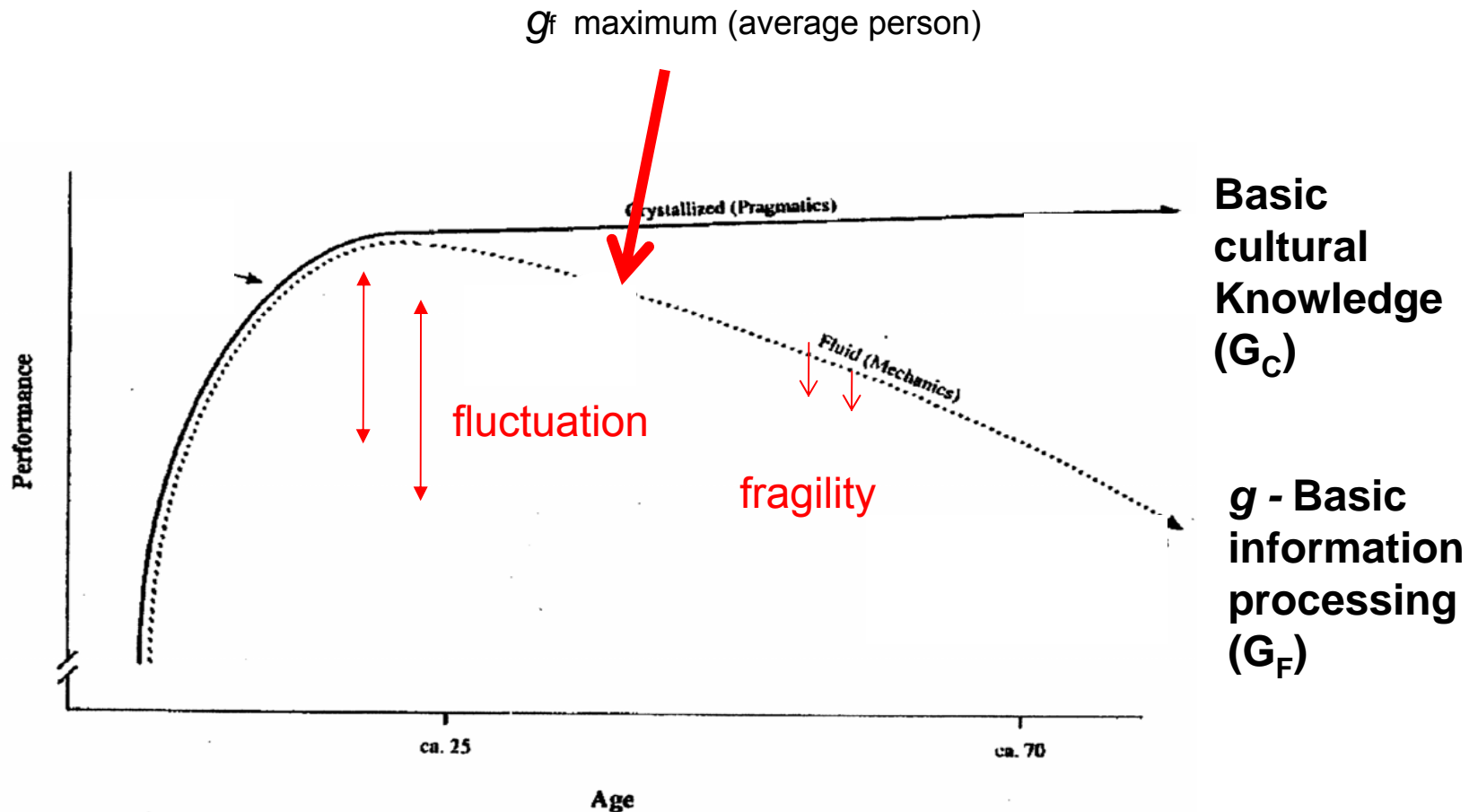
Although the appeal of pharmaceutical cognitive enhancers — to help one study longer, work more effectively or better manage everyday stresses — is understandable, potential users, both healthy and diseased, must consider the pros and cons of their choices. To enable this, scientists, doctors and policy-makers should provide easy access to information about the advantages and dangers of using cognitive-enhancing drugs and set out clear guidelines for their future use. To trigger broader discussion of these issues we offer the following questions, to



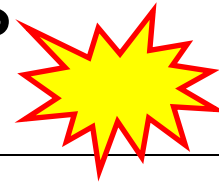
NINOS/ZEEA/CORBIS

Suppose a physiological maximum and:

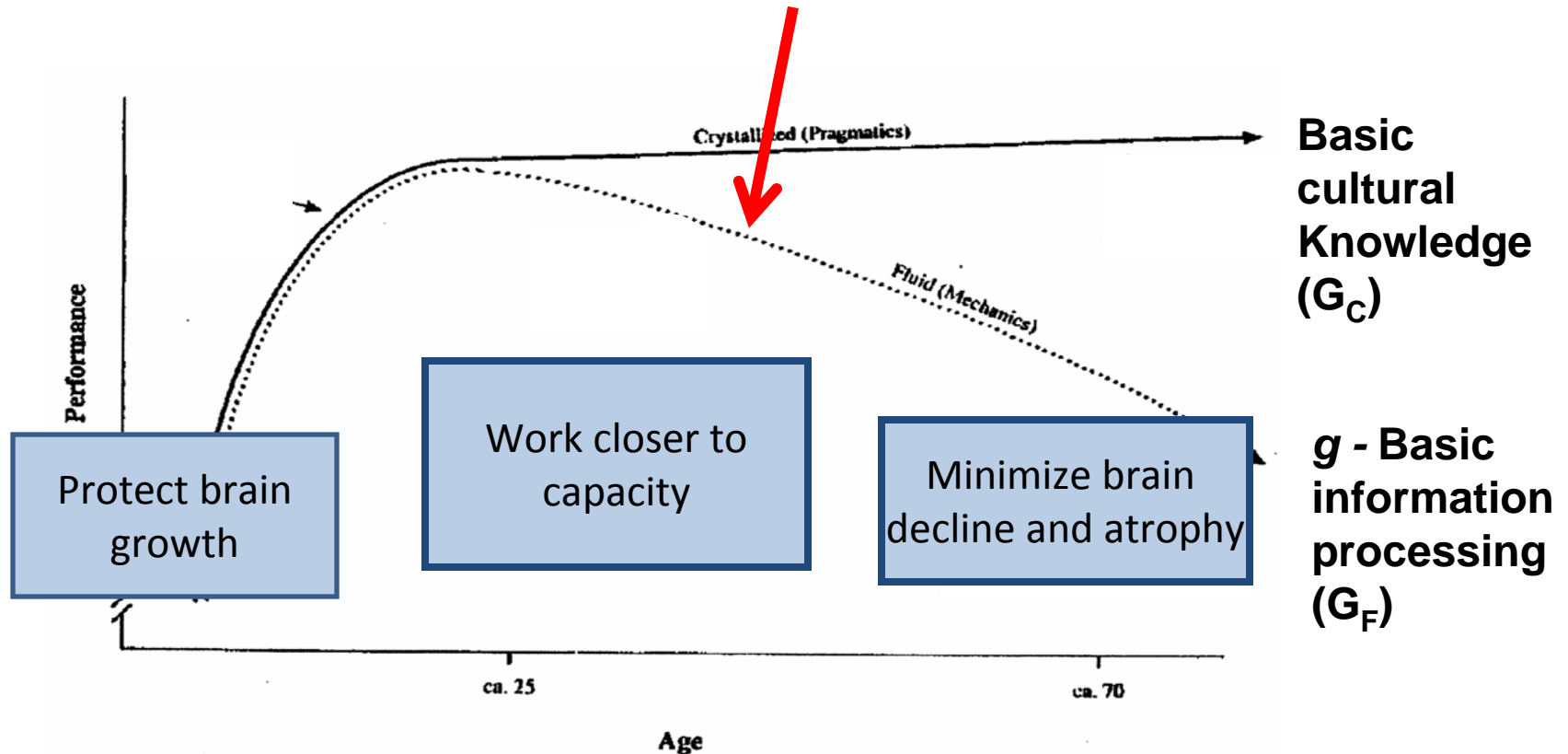
- myriad cognitive disturbances
- threats to system integrity



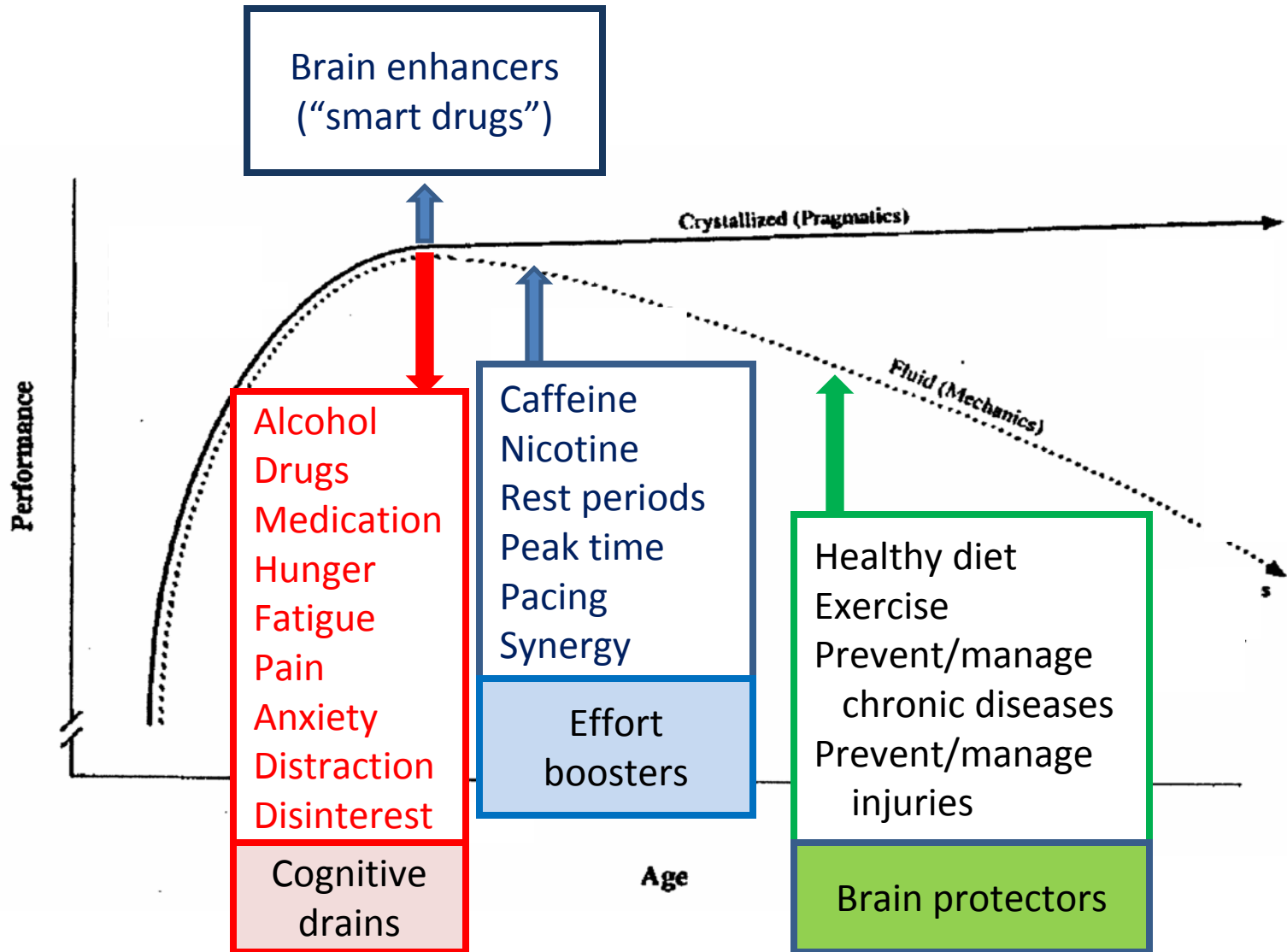
Opportunities



g_f maximum (average person)



Behavioral influences



Environmental drains

- Constant interruptions (visitors, phone, meetings)
- Many distractions (email, noise)
- Disrupted sleep cycles (jet lag, shift work, artificial light, schools start too early)
- Insufficient sleep (noisy dorms, soldiers, parents)
- Poor scheduling/pacing of work (airlines)
- Over-medication of elderly
- Other
 - Lower g and age increase vulnerability
 - All are manipulable

Thank you.

Closing thought

Need more precise, theoretically appropriate measurement

