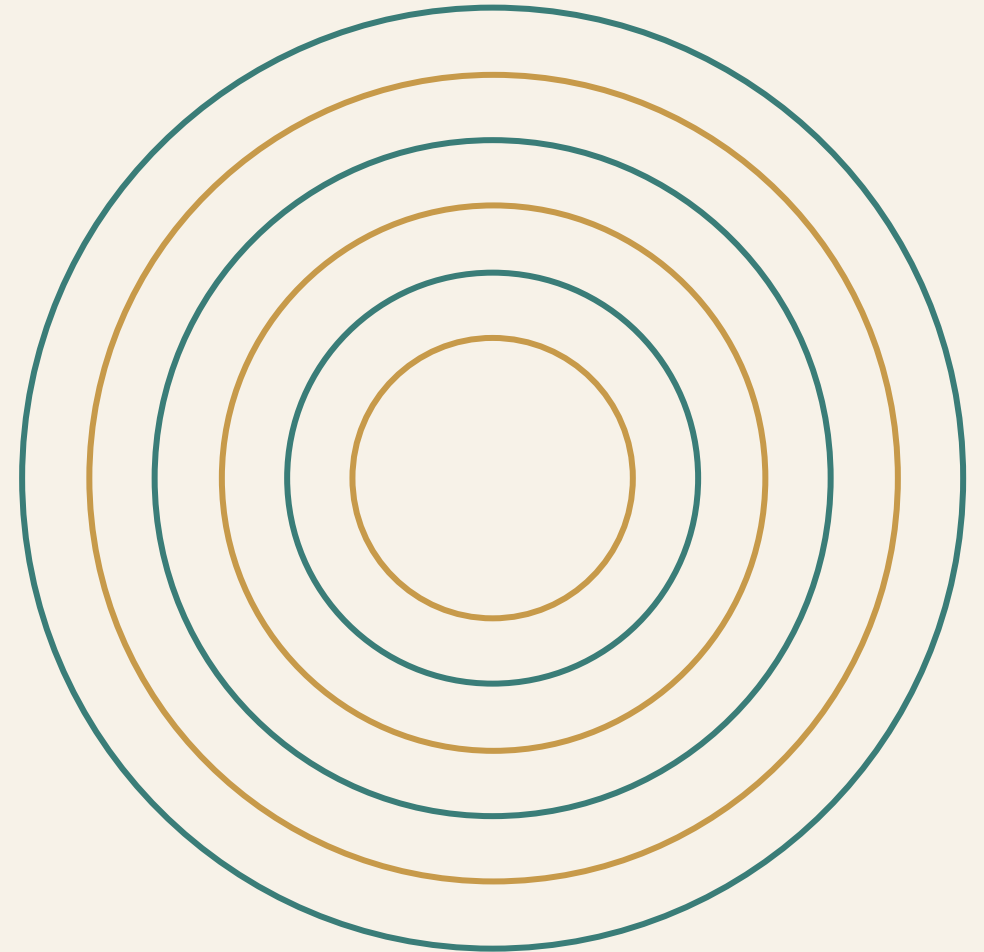


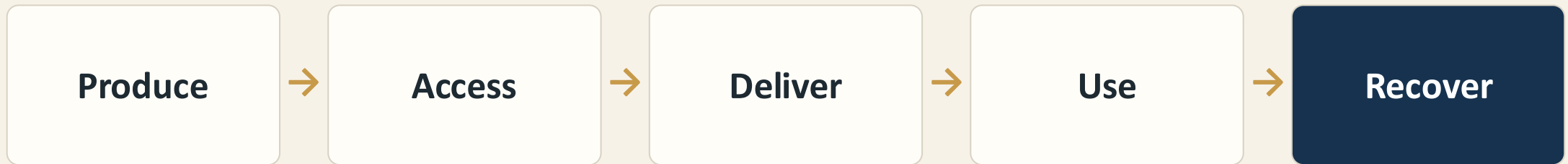
Energy: When the System Falls Behind

Fatigue, stress physiology, circadian timing, medications, disease, and protecting reserve



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The Week 2 energy model



Today's learning goals

Distinguish ordinary tiredness from persistent loss of capacity

Explain how stress physiology and circadian timing allocate energy

Recognize how medications and disease can erode reserve

Identify practical ways to protect energy without promising perfect control

“

Fatigue is often where energy failure becomes visible.

The symptom is real even when one test does not explain it.

Fatigue as information

When supply, demand, allocation, and recovery no longer match

Tiredness and fatigue are not always the same

Ordinary tiredness

Expected after exertion;
improves with adequate
rest

Persistent fatigue

Disproportionate effort,
slower recovery, or loss of
usual capacity

Warning pattern

New, progressive, severe,
or associated symptoms
require evaluation

“

Fatigue is a state—not a diagnosis.

Many different pathways can produce the same experience.

Static tests can miss a dynamic problem

At rest

Numbers may appear acceptable

Under demand

Delivery or output may fail to rise

During recovery

The system may take longer to return to baseline

Where can energy be lost?



Physical and cognitive fatigue

Peripheral

Weakness, reduced endurance, early muscle exhaustion

Central

Slowed thinking, low focus, reduced mental drive

Often together

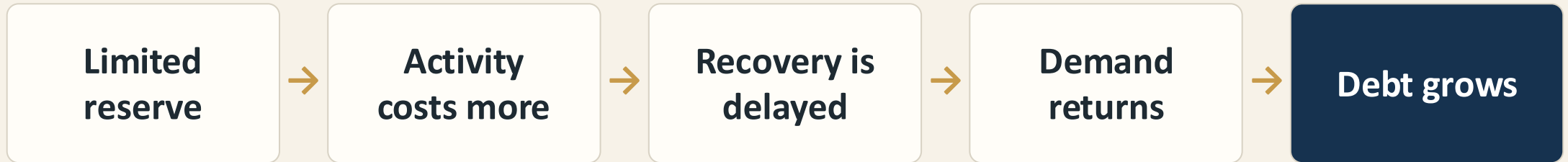
The experience may feel diffuse because the system is integrated

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Small inefficiencies can add up to a large loss of capacity.

No single pathway has to fail completely.

Energy debt



Post-viral and inflammatory fatigue

Immune demand

Energy is redirected during infection

Incomplete reset

Inflammation or autonomic disruption may persist

Daily effect

Exertion may produce disproportionate and delayed symptoms

“

Chronic immune activation diverts energy from other work.

Movement, cognition, repair, and recovery can all be affected.

Deconditioning versus exertional intolerance

Deconditioning

Often improves predictably with appropriately graded training

Exertional intolerance

May cause disproportionate symptoms or delayed worsening after activity

Clinical importance

The pattern should guide pacing, evaluation, and rehabilitation

“

Rest lowers demand. It does not automatically rebuild capacity.

Too much rest can also accelerate deconditioning.

Fatigue that needs prompt assessment

Chest pain, fainting, severe shortness of breath, or new neurologic symptoms

Bleeding, persistent fever, unexplained weight loss, or marked weakness

Rapid progression or major loss of function

New fatigue after a medication change

Persistent fatigue that interferes with daily life

A structured fatigue history

When did it begin, and was onset sudden or gradual?

Is it sleepiness, weakness, breathlessness, low motivation, or post-exertional worsening?

What makes it better or worse—and how long is recovery?

What changed in sleep, illness, stress, nutrition, activity, or medications?

Which daily functions are being lost?

“

The better question is: where is the system losing efficiency?

A diagnosis may still be necessary; the systems view helps organize the search.

Stress physiology

The body decides where limited energy goes

“

Energy is allocated—not merely generated.

Under threat, the budget changes.

The energy-budget analogy

Stable conditions

Resources support movement, digestion, repair, and reserve

Acute threat

Energy shifts toward vigilance and immediate action

Chronic threat

Repair is repeatedly postponed and reserve narrows

The autonomic control dial

Sympathetic

Mobilizes energy for action

Parasympathetic

Supports restoration,
digestion, and repair

Healthy regulation

Moves flexibly between
activation and recovery

Sympathetic activation

Heart rate and blood pressure rise

Breathing accelerates

Glucose becomes more available

Blood flow shifts toward brain and muscle

Digestion and repair are temporarily deprioritized

Parasympathetic restoration

Heart rate slows and pressure stabilizes

Digestion and nutrient handling improve

Repair and maintenance receive more resources

Energy stores are replenished

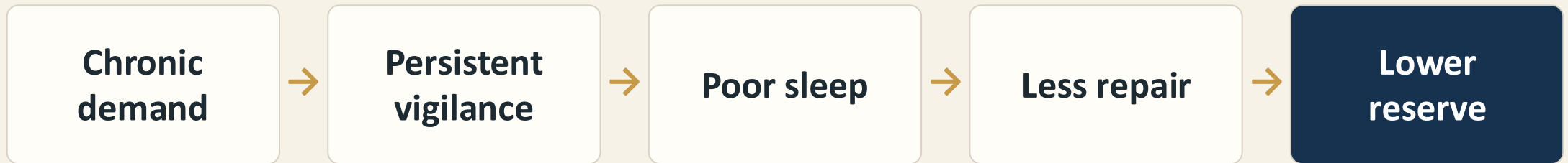
The body returns toward baseline

“

Activation is not bad. Recovery is not weakness.

Health requires access to both states.

When the dial gets stuck



“

Exhausted—but unable to settle.

The “wired but tired” pattern reflects activation without adequate restoration.

Stress hormones change priorities

Cortisol

Mobilizes fuel and supports acute adaptation

Adrenaline

Raises alertness, heart rate, and rapid response

Chronic activation

Can disrupt sleep, insulin sensitivity, mood, and recovery

The mental experience of energy

Dopamine

Drive, reward, and initiation

Norepinephrine

Attention and arousal

Serotonin

Mood, sleep, and appetite

Context matters

Symptoms do not map neatly to one chemical

Hormonal contributors require context

Thyroid

Sets metabolic pace; symptoms and testing must be interpreted together

Estrogen

Changes can affect sleep, vascular function, and perceived stamina

Testosterone

Low levels may affect muscle, red-cell production, and capacity

Caution

Fatigue alone does not diagnose a hormone disorder

“

The test is flexibility: can the body activate—and then recover?

Adaptation matters more than living in permanent calm.

Inputs that support regulation

Regular physical activity appropriate to capacity

Consistent sleep and wake timing

Breathing or relaxation practices that reduce persistent arousal

Adequate nutrition and recovery

Treatment of pain, inflammation, mood, and medical contributors

Circadian timing

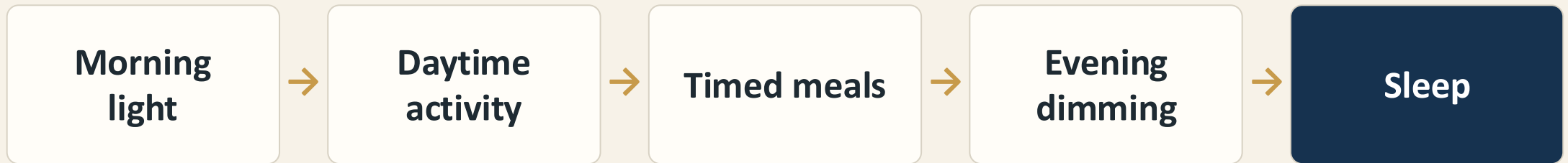
The body must know when to activate and when to repair

“

Circadian rhythm is the body's timing system.

It coordinates sleep, hormones, metabolism, temperature, and repair.

The daily timing loop



Light is the strongest time cue

Morning

Bright light helps anchor alertness and the internal day

Evening

Dimmer light allows melatonin and sleep signals to rise

At night

Bright or blue-enriched light can delay the clock

“

Morning light tells the brain when the day begins.

A stronger day signal can help create a clearer night signal.

Melatonin is primarily a timing signal

What it does

Signals biological night

What it is not

A complete substitute for circadian alignment or sleep opportunity

Why timing matters

Too early, too late, or excessive dosing may not solve the real problem

Food also tells time

Daytime eating

Aligns fuel intake with the active period

Late heavy meals

Can conflict with sleep and overnight metabolic patterns

Regularity

Consistent timing strengthens predictable signals

Movement anchors the clock

Daytime activity

Reinforces wakefulness
and energy demand

Exercise timing

Individual response
matters; vigorous late
activity may disrupt some
sleepers

Consistency

Regular movement
supports sleep pressure
and metabolic rhythm

“

Sleep is an active period of repair.

Restoration depends on both sufficient time and biological timing.

Circadian rhythm changes with age

Weaker signals

Day–night contrast may diminish

Fragmented sleep

Awakenings become more common

Still modifiable

Light, activity, meals, and routine can strengthen timing cues

“

Shift work is biological misalignment—not a failure of discipline.

Repeated timing disruption can strain metabolic, cardiovascular, and cognitive health.

A circadian alignment check

Is wake time reasonably consistent?

Do you receive bright outdoor light early in the day?

Are meals and activity concentrated during the active period?

Does evening light and stimulation decrease?

Is sleep scheduled when the body is prepared for it?

Pause and reset

Stand, hydrate, or step out as needed

Medications and energy

Life-saving treatment can still carry functional trade-offs

“

Both truths can coexist.

Medications can protect health—and sometimes reduce stamina,
clarity, or recovery.

Iatrogenic energy loss

Cellular

Reduced mitochondrial efficiency

Metabolic

Worsened access to fuel or altered signaling

Cardiovascular

Blunted heart-rate or blood-pressure response

Neurologic

Sedation, slowed attention, or impaired coordination

“

Medication effects can be mistaken for normal aging.

The clue may be a gradual loss of capacity after treatments accumulate.

Statins: a trade-off, not an ideology

Benefit

Substantially reduce cardiovascular risk in appropriate patients

Possible cost

Can modestly worsen glycemic measures in some people; muscle symptoms require assessment

Decision

Risk, benefit, symptoms, alternatives, and patient priorities determine the plan

Blood-pressure treatment and capacity

Benefit

Protects brain, heart,
kidneys, and vessels

Possible burden

Excess lowering or rate
limitation may contribute
to dizziness or exercise
intolerance

Review

Symptoms, standing
pressure, dose, and goals
should be reassessed

“

Sedation is not the same as restorative sleep.

Morning grogginess, falls, and cognitive slowing may outweigh benefit—
especially with age.

“

Polypharmacy can resemble a crowded control room.

The number matters less than the combined burden and conflicting signals.

Deprescribing is active medical care

Clarify the current indication and expected benefit

Identify side effects, interactions, and treatment burden

Consider time-to-benefit and what matters most

Taper when abrupt stopping is unsafe

Monitor what changes after the adjustment

“

Every medication should earn its place.

The goal is alignment—not the fewest possible pills.

Energy and disease

Pathology becomes more limiting when reserve cannot compensate

Four disease pathways

Heart disease

Delivery and output fail to meet demand

Metabolic disease

Fuel access and flexibility decline

Cancer

Dysregulated cellular growth and treatment place major demands on reserve

Cognitive disease

The energy-demanding brain is vulnerable to impaired fuel, flow, and signaling

“

Energy capacity does not guarantee prevention.

It can influence function, treatment tolerance, recovery, and independence.

Cancer and reserve

Disease biology

Cancer cells alter fuel use
and growth signaling

Treatment demand

Surgery, radiation, and
systemic therapies
consume reserve

Clinical meaning

Nutrition, movement,
symptom control, and
rehabilitation support
tolerance—not cure

Brain energy and cognitive resilience

High demand

The brain requires stable fuel and oxygen

Early symptoms

Brain fog and reduced stress tolerance are nonspecific but meaningful

Long view

Vascular, metabolic, sleep, sensory, and social health all contribute

“

Reserve helps explain different outcomes from the same diagnosis.

Disease burden and adaptive capacity both matter.

Protecting the energy network

Use muscle and cardiovascular systems regularly

Support metabolic access through movement, sleep, and nutrition

Strengthen circadian signals with consistent timing

Build recovery after appropriate challenge

Reassess medications and investigate persistent change

“

Resilient systems oscillate.

Demand followed by restoration. Use followed by repair.

An integrated case

The story

A 68-year-old feels exhausted, sleeps poorly, and stopped walking after illness

The pattern

Deconditioning, circadian drift, medication burden, mood, inflammation, and disease all need consideration

The plan

Evaluate danger and reversible causes; then rebuild timing, movement, treatment alignment, and recovery

Protect your energy

Choose one pattern to notice and one realistic change to test

Your Week 3 reflection

Drain

What most consistently depletes your energy?

Restore

What reliably helps you recover?

Timing

Which light, meal, movement, or sleep cue is least consistent?

Medical review

What symptom or medication question should you bring to your clinician?

What to carry forward

Fatigue is a state with many possible causes

Energy must be allocated and timed—not only produced

Chronic activation without recovery narrows reserve

Medications may protect health while creating functional trade-offs

Protecting capacity supports recovery; it does not promise control over disease

Next: Activity—how the right demand builds reserve