

A Peek Under the Hood

When body systems break down.

I am a doctor, but I am not your doctor. This is education, not medical advice, and nothing here is a substitute for the physician who knows your history. Any decision about screening or imaging belongs in that conversation.

You can drive a car for years without opening the hood. Skip the maintenance, ignore the noises, and it will keep going for a surprisingly long time. Then one day you are sitting in a waiting room while somebody tells you what it will cost.

Bodies work the same way, with one difference: you cannot see inside. I spend my working life looking inside, so this session is what that looks like, and what to measure so you find out earlier than the waiting room.

How we learned to see inside

- In November 1895 Wilhelm Roentgen was working with a vacuum tube in Wurzburg and noticed a screen across the room glowing when it had no business glowing. Within weeks he had imaged his wife's hand. Her reaction, on seeing the bones of her own hand, was "I have seen my death."
- He published in early 1896, never sought a patent, and gave the discovery away. He received the first Nobel Prize in Physics in 1901.
- The enthusiasm outran the caution. X-rays were briefly a fairground attraction and a shoe-shop novelty, and many early radiologists died of the exposure. The lead aprons came later, and they came from experience.
- **Ultrasound** descends from wartime sonar and entered medicine in the late 1950s. No radiation, real-time, and it is how most people first see their own children.
- **CT** arrived in 1967 through Godfrey Hounsfield, who won a Nobel Prize in 1979. It builds a cross-section from many X-ray projections, so instead of one flat shadow you get slices, and from slices you can rebuild anything in three dimensions.
- **MRI** reached clinical use through the late 1980s and 90s, with a Nobel Prize in 2003. A strong magnetic field, no ionizing radiation, and far better contrast between soft tissues.
- **PET** works on a different principle entirely: it tracks metabolism. Inject a tagged sugar, and tissue that consumes glucose greedily lights up. Combined with CT it shows both what something is and what it is doing.

What actually breaks

Four categories account for most of it, and every one traces back to the previous three sessions.

- **Cardiovascular disease.** Atherosclerosis, from the Greek for gruel and hardening, which is exactly right: soft fatty deposits that progressively stiffen the vessel. It presents as heart attack, stroke, aneurysm, or the slow failure of circulation to a limb or an organ. A stroke can be a clot or a bleed, and the treatments are opposite, which is why imaging happens before treatment.
- **Cancer**, where imaging is used to find it, to stage it, and to answer the only question that matters after treatment: did it work? Scans taken before and after chemotherapy are the most concrete evidence in medicine that something is working.
- **Neurodegenerative disease**, where you can watch tissue volume change over years, which is a strange and sobering thing to look at.
- **Metabolic disease and everything downstream:** type 2 diabetes, fatty liver, kidney disease, and the visceral fat that drives them.

The image that changes minds. Put a cross-section of a healthy 25-year-old beside one of a 55-year-old after thirty years of a poor diet, and the difference is not subtle. Fat packed around the liver and pancreas rather than under the skin. Organs displaced and compressed. And here is the part worth sitting with: this can happen in someone who looks thin from outside. There is a recognized pattern for it, thin outside, fat inside, and no mirror will ever show it to you.

Some things I see, and what they tell you

- **Bone.** Density is visible, and so is its absence. Disuse osteopenia is what a limb looks like after weeks in a cast, and the same process runs slowly through a sedentary skeleton. Load is what tells bone to stay.
- **Lungs.** Emphysema shows as tissue that has simply gone, replaced by air where there should be structure. Pneumonia shows as the opposite, air spaces filling in, and it looks different depending on whether the cause is bacterial or viral.

- **Vessels.** Calcium in a coronary artery is visible long before any symptom, which is the whole argument for measuring rather than waiting. Clots in the lungs, aneurysms in the aorta, narrowing in the neck: all of them silent until they are not.

Keeping score

Physical health is a game with rules, and you cannot win a game without keeping score. Four measures cover most of it, and they are long-term functional numbers rather than snapshots. If these four are in order, a great deal else follows.

The four

HbA1c for metabolic health, goal under 5.7.
VO2 max for cardiorespiratory fitness. **Body composition** by DEXA or air displacement.
Strength and function by the sit-to-stand and push-up tests, which cost nothing.

Aim for

The 50th to 75th percentile for your age, on all four. Not elite. Not average either, because average in this country is now a diagnosis.

Alongside those, the five metabolic markers: waist-to-height ratio under 0.5, blood pressure under 130 over 85, HDL above 40 for men and 50 for women, LDL under 100, triglycerides under 150, and fasting glucose under 100. Three of five on the wrong side is metabolic syndrome, and about half of Americans over sixty have it.

Then the screening that catches the things you cannot feel: mammography annually for women from 40, colonoscopy from 45 at the interval your doctor sets, and a skin check each year. These are unglamorous and they are the highest-yield medicine available to a well person.

The plan the numbers imply

- Resistance training, 3 to 5 sets of 10 to 12 reps per muscle group, twice a week.
- Zone 2 aerobic work, 45 minutes, three times a week.
- Zone 5 intervals once a week, four minutes on and four off.
- Seven to eight hours of sleep.
- Protein first, whole food, skip some meals, do not drink sugar.

That is the whole course in five lines, and none of it is new to you by now.

TRY THIS

- Book the blood panel and ask for HbA1c by name.
- Do the sit-to-stand and push-up tests today. They are free and they take four minutes.
- Check which screening you are overdue for and book it this week.
- Write the four numbers down somewhere you will find them next year.
- Pick one thing from the five-line plan and start it tomorrow.

Nobody cares about this the way you do. Not your doctor, not your family. They will watch with sympathy, and you are the one on the journey. The efforts you make now do pay off later, and that is not motivational language, it is compounding.

Resources

Tools worth owning

- **Sleep tracker.** Duration, awakenings, movement, heart rate variability, oxygen saturation. An Apple Watch or an Oura ring will do it.
- **Heart rate monitor.** A chest strap is more accurate than a wrist for training zones, and Zone 2 is easy to get wrong by feel.
- **Continuous glucose monitor.** Requires a prescription, and two weeks of wearing one teaches most people more about their own diet than a year of reading. Dexcom and Freestyle Libre are the common ones.
- **A tape measure,** which costs nothing and gives you the single most useful metabolic number.

The maintenance card

- **Fuel.** Move toward real food. Read labels for added sugar. Keep less processed food in the house. Share portions out. Do not drink calories. Do not over-fill.
- **Engine and chassis.** Know your conditioning status before starting. Consider a trainer to get going. Set a time and then do something, anything. Walk or jog 30 to 45 minutes. Add resistance: bands, weights, machines.
- **Recovery.** Set a bedtime and keep it, aiming at seven to eight hours, with a wind-down you repeat.

Referenced in this session

- Wilhelm Roentgen, 1895, and the first Nobel Prize in Physics, 1901.
- Godfrey Hounsfield, CT, 1967, Nobel Prize 1979.
- Paul Lauterbur and Peter Mansfield, MRI, Nobel Prize 2003.
- Jean Kerr, on the adorable pancreas.

Reading

- *Outlive*, Peter Attia. The best single account of measuring and acting on these numbers.
- *Why We Get Sick*, Benjamin Bikman, for the metabolic thread running under all four categories.
- *The Emperor of All Maladies*, Siddhartha Mukherjee, if the cancer section raised questions worth a book.

Theme: health. From my course *The Human Body*. The companion sessions are on nutrition, movement, and sleep.