



Animation and Illustrations by Vanessa Hand/MEDILL REPORTS

Run the course of the Chicago Marathon from inside your body by scrolling over the red hotspots on the map.

Running a marathon from the inside out

by VANESSA HAND
June 09, 2009

Your feet are pounding on the pavement. Your heart is beating so loudly against your ribcage you can't hear yourself think. After 20 miles, the sound of the crowds and the distinct smell of fall have faded. It's just you and the gravel road on that final stretch to Soldier Field.

Willpower alone won't get you past the finish line. Your body is your vehicle and it's working at full force to survive.

"Running [a marathon] is one of the most enduring and physically grueling events," says Dr. George Chiampas, Chicago Marathon Medical Director and adjunct professor at Northwestern University.

But a marathon is more than just long-term physical exertion.

"Our body wasn't made to run 26.2 miles every day," says Chiampas.

After 20 miles "you're pushing your body and entering the unknown," says Mike Swisher, training program manager for the Chicago Area

Runner's Association (CARA).

Muscle functions change and organs adapt, but what really happens inside the body through the course of a marathon?

This is a big week for marathon runners. For 45,000 brave souls from all over the globe, it marks the start of the 18-week training program for the [Chicago Marathon](#) in October. [New York City](#) runners will learn whether they've won the lottery for a coveted spot in that city's November marathon.

Both marathons are months away, but participating is not a last minute decision. You don't just wake up one day and decide to run a marathon. It's a test of endurance and a test of discipline.

"It's a huge time commitment to fit all those runs into your life," says Swisher.

Running is an old sport. Our early ancestors chased after prey, readily running long distances in pursuit of a good meal.

There is a reason they domesticated animals: too much physical exertion compared to the amount of food they got in return.

So who had the brilliant idea of doing this as a sport? Of voluntarily subjecting our bodies to what our ancestors would likely describe as 26.2 miles of torture?

Blame it on the Greeks. Legend has it that during the Persian war some over-zealous Greek messenger was sent from Marathon to Athens to announce the Persian defeat. Instead of walking, he felt it necessary to run the entire 40 km (25 miles).

He got the message across. He also dropped dead from exhaustion shortly after.

We've come a long way since the Battle of Marathon even adding an extra mile, but still refusing to learn from mistakes of the past, paying tribute to the Greek messenger by having marathons all over the world. The difference is now we have the knowledge so most people can complete them without keeling over.

While running, all systems are a go inside the body. Every last cell is working to propel you to that finish line.

According to Chiampas, the brain is the "thermostat" and regulates body temperature relative to air temperature to prevent our "engine" from overheating.

"[Running] stresses the heart, the metabolism, the kidneys, the joints, and the core and leg muscles," says Chiampas.

With so many systems overworking simultaneously, there is the potential for a lot go wrong.

The average person only has enough food reserves to last for about an hour of exercise before it freaks out and kicks into survival mode, according to [Jonathan Dugas](#), exercise physiologist at the [University of Illinois at Chicago](#) and coauthor of [The Runner's Body](#).

This was likely an issue for our Greek friend back in 490 BC, but can now be avoided easily with the help of carbohydrate-rich energy drinks and gels.

Oxygen is another form of energy during exercise and the main fuel for the muscles. The heart is responsible for distributing oxygen through the body and therefore the MVP on our running team.

"The heart delivers oxygen to working muscles to produce energy, and the muscles pump it right back," says Chiampas.

How do researchers translate this information into tips to help a runner complete a marathon?

"Science without application is nothing more than stamp collecting," says Dugas.

To get results researchers must use science as a tool for training.

"We can use [scientific] data to develop formulas to determine fitness levels and training paces to improve performance," says Bill Pierce, professor and chair of the exercise science department at the [Furman Institute of Running and Scientific Training \(FIRST\)](#) in Greenville, SC.

Scientists can't change genetics, but other measurements can be enhanced with training.

Lab assessments using an oxygen analyzer can determine a runner's maximal oxygen consumption known as VO2 max, or how efficient the body is at using the oxygen it takes in. It serves as a baseline to assess physical capacity.

"Maximum oxygen consumption is genetically determined, but can be improved by 10 to 15 percent with training," says Dugas.

By monitoring oxygen consumption researchers can determine the point at which a runner switches from aerobic exercise to anaerobic exercise. Aerobic exercise is, as the name implies, exercise in which the body is still able to provide enough oxygen to the muscles.

After an extended period of strain "the body reaches a point where oxygen demands of muscles are greater than the delivery capacity of the body," says Dr. Jason Conviser, exercise physiologist with the [Chicago Area Runner's Association](#).

This point is called the anaerobic threshold (AT) because there is a lack of oxygen.

"The better shape you are in, the more efficient you become at using oxygen," says Conviser.

The more efficient runners are at using oxygen, the longer it takes for them to reach AT, and the greater the intensity or duration they can exercise.

This is where the science ends and the training begins.

Once you know your limitations, you can work to break them by gradually increasing mileage, and intensity of each workout, always teetering on the edge between aerobic and anaerobic exercise.

"Keep pushing the limit to create a bigger engine so that more fuel [oxygen] can be used," says Conviser.

By overloading the body during training you force it to adapt. But there are many ways to "overload" and an abundance of marathon training programs exist promising optimal results. Most preach similar concepts, but some focus on increasing intensity while others emphasize distance and endurance.

Pierce is of the group that believes in less running and focuses on cross training.

"Each workout should serve a purpose," says Pierce.

The **FIRST** program is 16 weeks, exercising for five days, but only running for three days during the week. The first run is made up of speed intervals at a faster than average pace. This is set to increase maximum oxygen consumption. Second is the mid distance run (tempo run) at slightly harder than average pace to increase anaerobic threshold. Last is the long run intended for the body to learn to use fat as fuel.

"This is for people with busy lives who can't run for six days during the week," says Pierce.

The **Chicago Area Runner's Association** uses **Hal Higdon's** program, which focuses on mileage with four runs per week and increases total mileage gradually over 18 weeks.

No program is foolproof, and no program is necessarily better than the others. So many personal factors affect training including lifestyle, body composition and age, that even the same program can yield different results for different people. The experts agree that training is individual and largely about listening to your body.

"If there was only one way [of running the marathon] there would only be one program," says Swisher.

However, no matter the training program, runners must respect recovery time.

"If you build up every single week your body never catches up and is always struggling to get to the next level." Swisher said.

And running through an injury is just as bad and can cause more harm in the long run (pun intended).

The true marathon did not start off with the best reputation. But given today's science, risks are low and the benefits high.

"You're more likely to die driving the marathon course than actually running it," says Chiampas, and it would probably take just as long during rush hour traffic on a Friday afternoon.



Drawing by Vanessa Hand/MEDILL

While running, both the heart and leg muscles work together to pump blood.

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A VO2 max test helps runners determine how efficient their bodies are at using oxygen and serves as a basis to assess physical capacity.

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The Chicago Area Runners Association is among the many organizations leading marathon training groups on the lakefront trail.

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