A recent Team Fisher House training poll found the majority of respondents have a specific finish time goal or hope to set a personal record at the Marine Corps Marathon. Following a training plan is helpful, but how hard should you train? Ideally, you should tailor your runs by how your body is adapting to your training plan, rather than following mindless pace targets that disregard how your body is feeling. We have all had runs that seemed effortless one day, but the same distance seemed insurmountable the next. Overtraining or consistently running at a fast pace will diminish your race day performance. The best way to train to your potential is to use a heart rate monitor. Here's how….

Your heart rate is *the* best indicator of how hard you are training. Most people train and race at random paces, and don't take advantage of technology and their own physiology. A pace of 10:00 min/mile may have the same exercise *intensity* as a 10:30 min/mile pace on a different day, due to fatigue, lack of sleep, weather, diet, or stress. The quality of a training run is determined by intensity (percentage of your maximum heart rate), not by pace. A heart rate monitor allows precise control of the exercise intensity that is not possible from a subjective feeling. Many of us have a GPS watch and heart rate monitor, but aren't sure how to effectively used it. Problem is, the information you read in running magazines or on web sites is often wrong or confusing. Even the automatic heart rate training zones in your GPS watch are based on faulty data. I hope to explain in easy terms how you can use your heart rate monitor to maximize your training.

Trying to run at a particular pace can be counterproductive to your training. What you want to do is run at a set intensity. The same intensity will correspond to different paces on different days, and with consistent training, the same intensity will result in a faster pace (you'll run faster but it won't seem harder). Using your heart rate monitor, you can train at specific target zones for specific workouts. Most marathon programs have different training runs, such as an easy run, tempo run, and long run. You can determine your unique target zones for each workout, and use your monitor to stay in the zone. What you will most likely find is that you have been running too fast!

Heart rate training zones are based on your maximum heart rate, which varies by age and physical fitness. The fastest a heart can beat (without being abnormal) is 220 beats per minute. This limit starts in childhood and decreases by approximately 1 beat per minute per year. There

is no evidence to suggest training influences the decline in maximal heart rate but it *does* influence your resting heart rate. To determine your maximum heart rate, you have probably seen the equation **Maximum Heart Rate (HRmax) =220 - age**. Yet the medical and scientific literature have proven no formula currently exists to provide an acceptable maximum heart rate prediction. Individuals of the same age may have very different maximal heart rates. Even though this equation is widely used, there is no published record of research for the development of this equation. It was merely a note for a data graph in a 1971 article on Physical Activity and the prevention of coronary heart disease.

When I reviewed the scientific studies, I found a wide variety of maximum heart rate prediction formulas. The widely used HRMax= 220 – age is a traditional male-based calculation that overestimates the maximum heart rate for age in women, and only calculates a rough estimate, with an accuracy range of ±20 beats/minute. (not so accurate!).

Many studies have tried to calculate an accurate HRmax formula. Each one has an accuracy range of 5 to 10 beats. Using myself as an example, I'm 49 years old and have a maximum heart rate of 178 (measured during a maximal race effort on several occasions). The traditional formula HRmax = 220 − age predicts my HRmax as 171. A Runners World article suggests two different formulas: (A) HRmax = 208 - (.7 x age) and (B) HRmax = 205 - (.5 x age). They concluded both seem to work almost equally well for runners under 40, but for runners over 40, formula (B) appears to be more accurate. They use formula B as the Runner's World standard**. If you want to estimate your HRmax**, I recommend you use **HRmax = 205 - (.5 x age)**.

In order to use your heart rate monitor to train, you have to determine both your maximum heart rate and resting heart rate (this is known as the Karvonen method). **To determine your resting heart rate**, count your pulse for 1 minute each morning before getting out of bed. Take an average of several readings.

To accurately determine your maximum heart rate, you have to measure it by pushing yourself to your limit (with your doctor's approval). The Runner's World article explains how test yourself.

Using your maximum heart rate and resting heart rate, you can determine your individual heart rate training zones. Each type of training run corresponds to a percentage of your maximum heart (which is why an accurate HRmax is so important).

I could write a book about what are the best training zones (based on a percentage of HRmax), but here is the short version. Your Easy/Recovery Runs should be run at ~60-70% of your maximum heart rate. Long Runs (Aerobic zone) runs are done at ~70-80%, Tempo (Anaerobic) runs are done at ~80-90%, and Interval training is done at ~ 90-100%. These percentages happen to correlate with my Garmin Forerunner training zones. Garmin uses the five Zone system. Here is how it calculates my 178 max heart rate:

Zone 1 (warm up/ brisk walking)	50-60%	114-127 beats per minute
Zone 2 (easy/recovery run)	60-70%	127-140 bpm
Zone 3 (long run/aerobic)	70-80%	140-152 bpm
Zone 4 (tempo run/anaerobic)	80-90%	152-165 bpm
Zone 5 (intervals/sprints)	90-100%	165-178 bpm

Use your heart rate monitor to help you reach your marathon goal. You can determine your percentages with this calculator. Running experts say a marathon should be run at ~80% of your maximum heart rate. Last year, I ran the MCM at an average heart rate of 156 (~88% of my HRmax)… and crashed at mile 20. The last 6 miles were miserable, and the medical tent is no after party. The next weekend, I ran the NYC marathon at an average heart rate of 145 (81%) and had an awesome experience. What a difference the correct effort can make!

Once I learned about heart rate zones and training, I understood why I hit the wall during the MCM. I was running too fast, my body in an anaerobic (fat burning) state that could not be maintained. Running the NYC marathon at a heart rate only 9 bpm lower put me in a sustainable aerobic (glucose burning) state that I could easily maintain for hours, by taking in calories.

If you have a heart rate monitor, try using these training zones. I guarantee you'll find you have been training too hard, running too fast, and ultimately limiting your body's potential. Pay attention to what it feels like running in each zone, so you can run at the right effort with or without your heart rate monitor. Running at the correct effort will allow you to perform at your personal best!

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You can read more about heart monitor training at MarathonGuide.com, or check out a book such as Heart Monitor Training for the Compleat Idiot**.** A more detailed introduction into using heart rate monitors can be found on Dr Mark Jenkins Rice University website. If you have any questions about heart rate monitor training, post them on the Team Fisher House discussion board.

Good luck with your training and stay in the zone!
Dr Connelly