“FITNESS AND WELLNESS FOR THE PUBLIC SAFETY CYCLIST”

Written by Kathleen Vonk

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FITNESS AND WELLNESS
FOR THE PUBLIC SAFETY CYCLIST

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Written for: The International Police Mountain Bike Association

WHY ARE FITNESS AND WELLNESS IMPORTANT?

As public safety officers, EMS personnel, and security officers, we all have a duty to maintain our bodies at a standard higher than that of the average citizen. The two most important reasons are simple; short term and long term survival. At any given moment, we may become involved in the fight of our life, and we may literally have, the rest of our life to stop the threat in front of us. As a paramedic or fire rescue professional, we may have to draw upon every ounce of strength that we have to pull someone to safety and not succumb to fatigue ourselves. In the long term, public safety personnel have a 35% greater chance of contracting heart disease than the general public. Each year 70 to 90 officers are killed feloniously by suspects, however over 2000 police officers die on the job each year from heart disease.

Add a mountain bike. We must be able to rely on our physical abilities to ride significant distances while carrying additional weight on our persons or on our bicycles during a tour of duty, which may last up to twelve hours. In addition to the physiological requirements of riding the bicycle, the environmental conditions in which we work may increase the amount of physical exertion and stress on our bodies. These factors can include: sun, heat, humidity, body armor and the added weight of our equipment. The nature of our special assignment, along with the conditions in which we work, are key motivational factors for overall fitness as wellness.

THEN AND NOW:

Our ancestors hunted, fished, and gathered vegetation to sustain their bodies. This alone was a full-time activity, and if they weren't good at it they went hungry. They relied on a minimum level of fitness to survive. They had to be fast, agile, and smart just to prevent being caught and eaten by other wild animals! It's easy to see how an obese cavemen would have had trouble staying alive. In the 21st Century however, numerous technological advancements have taken place which have led many people to be lazy and overweight. We have elevators, televisions, computers, escalators, vehicles, and microwaves, to name a few. It doesn't take much physical prowess to place a frozen dinner in the microwave, and wait impatiently while it cooks!

The uniformed service professionals, including police officers, firefighters, EMS and other advanced life support and field medical personnel are not immune to this phenomenon. In fact, they are more prone than the average citizen to be overweight and unhealthy!

This is illustrated in the following:

Most in-service personnel discontinue their fitness and wellness habits shortly after graduating from the academy. In fact on the average, cardiovascular endurance decreases to pre-academy levels within one year, and body fat exceeds recommended amounts within three years.

Today's police officer lives an average of fifteen years less than the average American whom he/she is sworn to protect!

In the United States, 50% of all police officers will die from heart disease within five years of retirement, and heart disease is the single greatest cause of early retirement. It is also the second greatest cause of limited duty assignments.

Today's police officers are 25 times more likely to die on the job from heart disease than from a bullet shot from a suspect's gun.

(Source: North Carolina Justice Institute, 2001)

UNIQUE ISSUES

Many wellness issues experienced by public service personnel are not a factor with the general population. Firefighters are exposed to carbon monoxide and other products of combustion. Those in the police, fire, and EMS profession may experience excessive job-related stress such as critical incident stress, and tend to use alcohol and tobacco more frequently than the average citizen. We are restricted by when, where, and how long we can take to eat. This makes our dinner choices lean towards the quick and the easy (fast food!). Rotating shifts and extended tours contribute to poor sleep patterns and chronic fatigue. In addition, we may have to work in very close proximity with the sick, injured, and those with infectious diseases. All of these unique issues contribute to higher mortality rates for those of us who serve our communities in public safety careers.

FITNESS V. WELLNESS, CASE LAW, AND ACTUAL INCIDENTS

What's the difference between fitness and wellness? Fitness usually refers to our ability to perform our daily physical activities and recreation without unnecessary fatigue. Wellness is considered a "lifestyle" which includes our health related habits such as fitness activities, eating habits, stress reduction practices, and preventive health measures.

Before we can assist others during the course of our daily career duties, we must first be able to care for ourselves. We wouldn't want to be in a position to justify a higher level of force because of the allegation that we are unfit, such as the case in Parker v. Washington DC. In this incident, an officer was attempting to remove a suspect from a car to effect an arrest, and encountered physical resistance. The situation escalated to the point where the officer had to resort to deadly force. The initial court ruled that an officer has a duty to maintain his or her fitness level, so that an escalation of force should not be necessary (if the escalation is due to a poor fitness level). Upon appeal the judgement was overturned, however this case brings home a valid point--Do we, as public safety professionals, have a right to be unfit? What if the situation involved a victim in a burning car, and the officer lacked the strength to pull him out? How would a public safety officer feel for the rest of his life, if he knew that someone he was sworn to protect, died because he did not maintain his fitness at a level where he could perform his basic duties? How would your family feel knowing that because of your poor fitness level, your weapon was taken away and used against you during an intense struggle? Or that you suffered a heart attack while struggling with a suspect?

There have been documented cases where **public safety cyclists** have died from miocardial infarction (heart attack) while engaged in bicycle training. Reason leads us to believe that this could happen just as easily while responding to an emergency call at work. Will it happen to you? Hopefully not. Do you have any control over whether it does? Fortunately, you do.

WHAT CAN WE DO?

We are who we are because of two reasons: Genetics, and personal choices. We are not able to control our genetic predispositions to certain diseases and conditions, but we can educate ourselves on those which run in our families and take the necessary precautions for prevention. Genetics will also determine our body shape, to an extent. Our upper and lower limits are genetically programmed, but everything in between is up to us. In other words, we may not be able to lose the <u>entire</u> spare tire around the middle, or we may not be able to naturally make our muscles get any bigger no matter how many hours we spend in the gym. Certain limits are set by genetics. We choose however, where we are within those limits.

In order to care for our own wellness and fitness, we must first understand the common functions and activities inside our bodies. Once we understand these phenomenon we can design our activities and lives accordingly. We will be prepared both mentally and physically for the "fight of our life," or the "rescue of our life." We will

also be prepared to live a long and healthy life, confident that we are doing everything we can to extend our own long term survival.

SEVEN MAJOR RISK FACTORS FOR CVD:
The **7 major risk factors for cardiovascular disease (CVD) are:** High cholesterol, high blood pressure, cigarette smoking, diabetes mellitus, sedentary lifestyle, obesity, and family history. Other **contributing factors** include a lot of fat in the blood (triglycerides) and stress. Have a complete physical exam and a complete blood work up every year. It can usually be obtained at little or no cost with your health care coverage.

Cholesterol
Cholesterol is made in our bodies as well as taken in through the food we eat, and is an important substance for certain biochemical reactions. It is carried in the blood in one of three forms: HDL, LDL, and VLDL. **HDL** or high density lipoprotein, is considered **"good"** cholesterol because it lowers **LDL** (low density lipoprotein) or "bad" cholesterol. LDL sticks to your artery walls and restricts the blood flow through them. Moderate but regular exercise increases your level of HDL, reducing your overall cholesterol level. A recent study conducted at the University of Western Ontario in Canada showed that three cups of orange juice each day can raise your HDL by 21% (Kurowska, 2000)

Ideal Total Cholesterol Level
Age 20 - 29 = 180 mg/dl or less
Age 30 and up = 200 mg/dl or less

Total cholesterol : HDL ratio
This is a more precise indicator of risk than the total cholesterol level. The higher the ratio, the greater the risk of CVD.

The ideal ratio for men is less than or equal to 4.0
The ideal ratio for women is less than or equal to 3.5

Hypertension
Blood pressure is the force exerted by the blood on the vessel walls. Systolic blood pressure is the force on the walls while the heart contracts, and diastolic is when the heart is filling. Blood pressure is expressed as the systolic over the diastolic. High blood pressure is considered to be **140/90 mm HG** or above. Moderate but regular exercise lowers your every day blood pressure.

Cigarette smoking
Smoking decreases HDL cholesterol levels, damages the artery walls, and is a major risk factor for CVD, stroke, cancer, emphysema, bronchitis, and peripheral vascular disease. Quitting smoking is the most significant lifestyle change a smoker can make.

Diabetes Mellitus
90 - 95% of those who have diabetes, or high blood sugar (glucose), have Type II Diabetes in which insulin injections are not required. Major causes are upper body obesity, sedentary lifestyle and genetics. Many people are not aware they have diabetes. Regular exercise is one of the prescribed activities for diabetics.

Sedentary Lifestyle
25% of the US population exercises on a regular basis, 50% exercise occasionally, and 25% never even try. A study conducted by the Journal of American Medicine in 1996 showed that low fit men were 70% more likely to die from CVD than moderately to highly fit men, and that low fit women were 142% more likely to die from

heart disease than moderately to highly fit women. The good news is that those who exercise three times a week for 30 minutes at moderate levels, decrease their chances of heart disease by 58%.

Obesity

The most current national data indicates that 55% of American adults are overweight. If your waist circumference is over 35 inches and you are a woman, or if your circumference is over 40 inches and you are a man, you are considered to be obese.

The major causes of obesity are inactivity, excess calorie consumption, and genetics. As the average police officer, you are likely to gain one pound per year of service!

Since muscle weighs more than fat, body weight is not usually a good indicator of fatness. Body composition is a better indicator and can be done in most health clubs using skinfold calipers, bioelectrical impedence, or circumference techniques. Although the best method is hydrostatic weighing (under water), these other techniques are relatively good measures of a person's body fat percentage.

The average range of body fat percentage that we should be, is between **13 - 17% for men, and 20 - 27% for women.**

Men usually store excess fat around their mid-section, and women tend to carry it from the waist-down. The more fat that is stored above the waist, the more fat that envelopes the vital organs such as the heart. This "visceral fat" is indicative of an increased risk of cardiovascular disease. **Excess body fat increases our risk of contracting CVD and cancer.** Annually, cardiovascular disease costs the nation $7.3 billion, and cancer $3.2 billion! An important point to note is that **CVD is largely preventable**. With the exception of genetics, our chances of contracting CVD is greatly reduced if we exercise and eat sensibly as a lifestyle, not as a short term diet.

And no, we **can't spot reduce fat!** In other words, if we have a little too much around the middle, we won't lose it by doing sit-ups. We will tone and strengthen those muscles that are beneath the fat we want to lose, but we won't burn only the fat which covers those muscles. The body burns fat during prolonged exercise from **all** areas of the body, not just the part being worked the most.

NUTRIENTS ESSENTIAL FOR GOOD HEALTH

There are six basic nutrients essential for good health and top performance.

Water is the most important nutrient, since our bodies are comprised of 60% to 70% water. Water is important for temperature regulation. It carries nutrients to the cells and transports waste products away from the cells. Although it does not provide energy, it is critical to our bodies for normal functioning. Each day we lose twelve cups of water just by urinating, breathing, and sweating! We can lose three or four times as much when exerting ourselves in hot, humid weather with an additional 25 pounds of gear around our waist, or fifty pounds of gear in our panniers. It is imperative for public safety cyclists to replenish the water they have lost, and to supplement that amount to aid in recovery each day.

Some facts obtained from the Center for Disease Control include:

75% of Americans are chronically dehydrated

In 37% of Americans, the thirst mechanism is so weak that it is often mistaken for hunger.

Even mild dehydration will slow down one's metabolism as much as 3%

One glass of water shut down midnight hunger pangs for almost 100% of the dieters studied in a University of Washington study.

Lack of water is the #1 cause of daytime fatigue.

Preliminary research indicates that 8-10 glasses of water a day could significantly ease back and joint pain for up to 80% of sufferers.

A mere 2% drop in body water can trigger fuzzy short-term memory, trouble with basic math, and difficulty focusing on a computer screen or printed page.

Drinking five glasses of water daily decreases the risk of colon cancer by 45%, it can reduce the risk of breast cancer by 79%, and can reduce the risk of bladder cancer by 50%

Vitamins are not a source of energy, but they regulate chemical reactions within the body. They include vitamins A, B complex, C, D, E, and K. Most vitamins must be obtained through the diet since the body does not manufacture these substances. Vitamins A, D, E, and K are **fat soluble vitamins**, and can be stored with fat in the liver. Care should be taken to avoid excess fat soluble vitamin intake because they can build to harmful levels. Adequate intake however is essential, and diets which are deficient in fat can result in malabsorption of these important vitamins. The **water soluble vitamins** are not stored in the body in significant amounts so they must be consumed in the daily diet as well. They include Vitamin C, the B vitamins 1, 2, 3, 5, 6, 12, Biotin, and Folate.

Fat soluble vitamins

Vitamin A is known for assisting in vision. Beta-carotene can be converted to vitamin A in the body and known for being in carrots, although it is also found in all orange foods such as cantaloupe and squash, as well as green leafy vegetables. Excess beta-carotene does not appear to cause toxicity, but excess vitamin A can be dangerous and has not been shown to improve physical performance such as in active cycling.

Vitamin D's main function is to assist calcium and phosphorous in intestinal absorption, which leads to the normal hardening of the bone. This makes vitamin D important in preventing osteoporosis, a condition in which the bones become porous and are easily broken. Vitamin D has also been shown to enhance immunity, and in some cases to improve muscular strength. Vitamin D can be manufactured by the body when the skin is exposed to UV light.

Vitamin E has many functions but is most recognized for its role in reproduction. Its supplemental use has become popular among those hoping to enhance their sexual function. For active public safety cyclists and other athletes, vitamin E has been shown to decrease the formation of some waste products during exercise, lower the lactic acid level in the blood, and to maintain muscle tissue. Vitamin E is found in most vegetable oils, as well as the popular gelatin tablet supplement. Additional vitamin E can benefit those recovering from injury, and those who train at high altitudes. Although high levels are not toxic, excess vitamin E may interfere with the activity of vitamin K which can lead to problems with blood clotting.

Vitamin K is important in the function of blood clotting, and occurs naturally in green plants. Supplemental doses of vitamin K are not recommended for those engaged in regular intense activity because they are constantly damaging and repairing tissue.

Water soluble vitamins

Vitamin C is well-known for its roll in fighting colds and for being an antioxidant. It helps to heal wounds, fight infections, promotes healthy gums and teeth, assists in iron absorption, and protects cells from free-radical damage. For physically active adults, vitamin C assists in increasing muscular strength, reduces the lactic acid level in the blood, and spares glycogen. Vitamin C is found in citrus fruits, vegetables, spinach, tomatoes, potatoes, and strawberries. Excessive consumption is not recommended due to side effects.

There are some noteworthy facts on the **Vitamin B group** relative to public safety cyclists. The vitamins in the B complex all aid in carbohydrate metabolism, which benefits those engaged in physical activity. Supplemental thiamine, which is vitamin B1, may significantly improve accuracy in marksmanship shooting, as well as neural functioning. Niacin (Vitamin B3) and Pyridoxine (Vitamin B6), may both promote premature

fatigue in endurance activities such as easy to moderate cycling, but may enhance anaerobic activity. Higher doses are not recommended for endurance activities, but slightly elevated levels may help in anaerobic activities. Cobalamin (Vitamin B12) assists in new cell growth, nerve tissue development, energy production, and DNA synthesis. Athletes taking supplements report an increase in perceived energy level and an increase in appetite.

Overall, an adequate intake of vitamins are essential to a person's overall health, fitness, and wellness, especially when physical activity occurs on a daily basis. Public safety cyclists should be sure that they are consuming at least the RDA of all vitamins and minerals, and a daily supplement may be needed in some cases.

Minerals regulate bodily processes (iron in the blood transports oxygen) and combine in numerous ways to form structures of the body, such as calcium and phosphorus in bones and teeth, but they do not provide energy to the body. For normal individuals who take in the Recommended Daily Allowance (RDA) of minerals, there is no evidence that supplementation benefits physical performance. However, the unique conditions in which public safety cyclists work may require limited supplementation. Sodium, potassium, and chlorine are collectively called **electrolytes** because they are dissolved in the body as electrically charged particles. These electrolytes are lost through sweat when we cycle, especially in hot, humid climates. If these minerals are not maintained, conditions such as heat cramps, heat exhaustion, and heat stroke can occur. Phosphorus is an essential component of high-energy compounds such as **adenosine triphosphate (ATP)** and **creatine phosphate (CP)**. These compounds are especially important to energy production for public safety cyclists, and will be addressed in a later section, "Energy Systems of the Body." Other examples of minerals found in the body include magnesium, zinc, and chromium.

Fiber

Fiber is found in plants and cannot be digested by humans. Some types of fiber simply pass through the digestive tract. So why is it important that we consume adequate amounts of fiber? Because by simply passing through the intestines and resisting digestion, fiber keeps the digestive tract healthy by preventing constipation, reducing chances of developing colon cancer, and by "toning" the intestinal muscles. Fiber is vital not only for our health but also for our physical performance as public safety cyclists. Water soluble fiber is found in oats, beans, carrots, raisins, apples and prunes. It combines with and traps cholesterol in the intestines before the cholesterol can be absorbed into the blood vessels where it does its damage. For this reason, water soluble fiber can help lower cholesterol amounts by as much as 15%, thus lowering our chances of CVD. For optimal health, make sure you are consuming 25 - 35 grams of fiber in your diet each day.

Carbohydrates are the primary fuel for muscle contraction, and they are the most important nutrient for cycling. One of the main reasons is because the energy from carbohydrates is released three times faster than the energy from fat. Carbohydrates are made up of molecules of **glucose,** and are stored in the body as **glycogen**, although these stores are limited. During light and moderate exercise, carbs supply about one-half of the energy requirements. Additionally, the continual breakdown of some carbs is required to use fat for energy in aerobic metabolism. **These reasons are why the carbohydrate is the most important fuel to public safety cyclists!**

The two types of carbohydrates are simple and complex. **Simple carbohydrates**, or **sugars**, are single and double molecules of glucose. **Examples** include table sugar, hard candy, fructose or the sugar in fruit, lactose or the sugar in milk. Many energy bars and sports drinks contain simple carbs as their energy sources because of their rapid availability to the working muscles. **Complex carbohydrates** are longer chains of glucose molecules and are normally found in foods with additional nutrients. Some common **examples** include pasta, potatoes, rice, and bread. Complex carbs are important to public safety cyclists as well, because they are

quickly digested and available to the working muscles. If not completely used, they are stored in the muscles as glycogen for future use. If the muscles are completely replenished, about 75% of the carbohydrates leftover are stored as fat, the other 25% are used to convert the carbs to fat.
For a physically active adult, the recommended daily intake of carbohydrates is about **60%**, which equals about 1200 calories/day or 300 grams/day for a 2000 calorie diet. Everyone is different however, and must figure their own personal carbohydrate requirements through experimentation. Since every agency has different job descriptions for their public safety cyclists, each person must take into consideration the amount of energy he or she is expending while utilizing a bicycle during the tour of duty. For example, if the primary expectation is to make numerous business contacts every day, and the geographic area is six square blocks, the cyclist probably won't have to increase his or her normal daily carbohydrate intake. On the other hand, if the cyclist's primary duties are responding to calls for service in an area that is four square miles and usually very busy, he or she may have to increase the intake of carbohydrates substantially.

Proteins are made up of long chains of amino acids. Your muscles are made up of protein strands. Your body is able to synthesize some amino acids (nonessential amino acids) but not others (essential amino acids), so it is important that you ingest those that cannot be produced by your body through your daily eating habits. Protein is important for building and repairing muscles, blood cells, hair, fingernails, and other bodily tissues. Protein is also essential for synthesizing hormones. It is not a significant source of energy for working muscles, but it can be used when carbohydrates are not adequately available such as in a state of starvation, or during exhaustive physical activity. Higher protein requirements are usually associated with weight lifting, body building, intense anaerobic training, and endurance activities. The extra protein aids in muscle tissue repair, and as an additional source of energy during prolonged endurance activity.
Protein-rich foods may include beef, pork, fish, poultry, dairy products such as milk and yogurt, tofu, beans, egg whites, peanuts and other nuts, grains, dried peas, soy, whey, and lentils. The Recommended Dietary Allowance (RDA) is 0.8 grams of protein for every kilogram of body weight, or **0.36 grams per pound of body weight**. This would equate to ingesting 54 grams of protein each day for a 150 pound cyclist. For more active cyclists the RDA is higher, or between **0.45 grams and 0.68 grams of protein for every pound of body weight.** For a 150-pound cyclist this would equal 67 - 102 grams of protein every day. Some body builders even double the RDA and consume 0.7 - 0.8 grams per pound of body weight, however care should be taken to avoid excess protein consumption by those who don't need it. The human body does not have the capacity to store a lot of excess protein, so the excess must be filtered and excreted through the kidneys and the urinary tract. Kidney disease is certainly a possibility when they are working overtime on a regular and prolonged basis. Proteins also require substantial amounts of water to process, and dehydration can result from eating unnecessary amounts of protein.

Fats
Even though excess fat slows us down and looks undesirable to us, our bodies need a certain amount for normal functioning. Fat is an essential part of the entire nervous system including the brain. It aids in the transport of fat-soluble vitamins (A, D, E, and K) and is also used as a form of energy in activities up to the anaerobic threshold. It acts as padding to our internal organs, and as insulation to our bodies from the elements. A male requires about four percent of essential fat for these functions, and a female about twelve percent. This equals about six fat pounds for a 150-pound man, and 15 fat pounds for a 125-pound woman.
Fats are categorized in one of three areas: Saturated, monounsaturated, and polyunsaturated. Saturated fats are usually solid at room temperature, and are found in animal fat, butter, margarine, coconut and palm oil. Monounsaturated fats are found in olive and canola oil, and polyunsaturated fats are found in most vegetable oils such as safflower and corn oil. **Saturated fats contribute to heart disease and some cancers, and the unsaturated fats are less harmful.** Generally, there is no need to supplement the public safety cyclist's diet

with additional fat, and the **average diet should include no more than 25%**. This equates to 500 calories/day, or only 55 grams of fat/day. Compare this to a fast food meal which can have as many as 97 fat grams and 2000 calories in one sitting!

FIGURING YOUR OWN DAILY CALORIE REQUIREMENTS

Your basal metabolic rate (BMR) or your "metabolism" is the minimum amount of energy that your body requires to survive. Many factors will determine your own BMR such as the amount of lean muscle tissue, body fat percentage, height, surface area, gender and age. In general, women tend to have a 5 to 10% lower BMR than men, due to the fact that women have a higher body fat percentage than men. Muscle is metabolically more active than fat, and requires more energy just to survive within the body.

Since the 19th century, we have known that a person's metabolism while at rest was proportional to the surface area of the body. To get an idea of how many calories your body requires each day (at rest), you can use a simple technique shown below. Once you have estimated your own BMR, you must also add the requirements of the physical activity you do throughout the day to get an approximation of your actual metabolic requirements. This amount this will vary from day to day depending on the amount of physical activity, and from person to person depending on body type.

MEN:
BMR (in calories) = 1.0 x (0.45 x body weight in pounds) x 24 hours

WOMEN:
BMR (in calories) = .9 x (.45 x body weight in pounds) x 24 hours

EXAMPLE: Officer Arrestem is a **170 pound male**.
BMR = 1.0 x (.45 x 170) x 24 hours
= 1836 calories each day.

Remember that Officer Arrestem requires 1836 calories each day at rest. Any activity he does beyond sitting on the couch with the remote requires more calories. For example, if he went to the gym and ran, he would burn an additional 125 calories for each mile that he ran.

Calorie requirements are highly individual, but the average American male between the ages of 23 and 50, weighing 155 pounds, can expend about 2700 calories per day. Likewise, the average American woman who is between the ages of 23 and 50 and who weighs 120 pounds, may expend about 2000 calories each day. (Food and Nutrition Board, National Research Council, RDA, 8th rev. ed., National Academy of Sciences, Washington, D.C., 1980). Officer Arrestem, having a body fat percentage of 16%, and being a very active police cyclist, can expend as much as 3500 calories each day. A moderately active female EMS cyclist weighing 140 pounds and having a body fat percentage of 23% can burn 2200 calories in a day.

THE BOTTOM LINE TO REDUCING BODY FAT

The bottom line to losing fat is to have a calorie deficit by the end of the day, but not through a starvation diet which will lower our metabolic rate and put our bodies in a state of "ketosis". If weight is lost very quickly, it is usually water and protein, and also means that you are probably not eating enough. Your body thinks it is starving so it starts using your protein (muscles) for fuel.

The proper way to create a calorie deficit is through increasing aerobic activity and eating slightly less than what we require each day. By limiting our calorie deficit to 300 - 500 calories each day, we can gradually drop the fat pounds without shocking our system and entering the counterproductive "starvation" mode. By lifting weights we can also benefit from a higher metabolic rate due to increased muscle mass.

Remember that one pound of fat contains 3500 calories, so taking fat off permanently is nothing to be impatient over. It takes time and effort, and should generally stay within one or two pounds per week. This could equate to something as simple as an hour of moderate cycling each day!

LEARN TO READ LABELS

Reading food item labels can be the one thing which helps you in watching your nutrient intake based on the disbursement you have chosen. Remembering that **proteins and carbohydrates contain 4 calories per gram**, and that **fat contains 9 calories per gram**, will make calorie-counting much easier.

Example: Paramedic Savem has determined that he requires 2500 calories per day, based on his own body, and the type and duration of his daily activity. Because of these factors, he has also decided to consume 60% carbohydrates, 25% protein, and 15% fat. Since food labels usually list grams, Paramedic Savem must convert his chosen percentages into grams per day.

Carbohydrates = 60% of his 2500 calorie intake: Multiply 2500 by .6 = 1500 calories per day from carbohydrates.

Convert calories to grams by dividing 1500 by 4 calories per gram = **375 grams per day of carbohydrates**

Protein = 25% of his 2500 calorie intake: Multiply 2500 by .25 = 625 calories per day from protein

Convert calories/day to grams/day by dividing 625 by 4 calories/gram = **156 grams per day of protein**

Fat = 15% of his 2500 calorie intake: Multiply 2500 by .15 = 375 calories per day from fat

Convert calories/day to grams/day by dividing 375 by 9 calories/gram = **42 grams per day of fat**

Paramedic Savem can easily keep track of his nutrient intake by remembering these three numbers: 375 grams of carbohydrates, 156 grams of protein, and 42 grams of fat.

Food Pyramid

Remember the Food Pyramid! It's an easy visual guide to eating healthy. It basically boils down to this:

Servings:	**Food groups:**
Sparingly	Fats, Oils, and Sweets
2-3	Protein (Meat, Poultry, Fish, Eggs)
2-3	Dairy (Milk, Yogurt, Cheese)
2-4	Fruit group
3-5	Vegetable group
6-11	Complex Carbohydrates (Bread, Cereal, Rice, Pasta)

Packing a Lunch

Packing your own lunch is the best option, because you plan and pack exactly what you will eat for the day. Just about any kind of food can be purchased as a **"low fat"** or **"fat free"** item at the grocery store. We can make low **cholesterol** and low **sodium** choices as well. Remember though, that the bottom line is **calories**, and just because something is "low fat" doesn't mean you can eat three times as much. Oftentimes fat free items replace the missing fat with sugar to make it taste better, and you end up eating more calories than had you eaten the fatty version! **Watch the labels!**

Another advantage to packing your own lunch is that you can nibble all day, creating a more constant level of blood sugar throughout. Numerous studies have shown that consuming several smaller meals/snacks each day is better for you than three big squares. One reason is that you maintain a more consistent blood sugar level in your blood. When you are very hungry, you have low blood sugar and feel fatigued. You eat a big meal which satisfies your hunger, but also creates high blood sugar. Your body senses a lot of sugar in the blood so it releases insulin to force the sugar into storage and you are left feeling tired and lethargic (nap time). When you are not able to snack and you feel extremely hungry, you may also be more prone to choose the quick and easy snacks which are usually high in fat and cholesterol.
If you brought your own lunch, you already have healthy choices immediately available. Try to eat your first meal within an hour of getting up, and eat every three or four hours after that. With each meal, consume just enough to keep you satisfied for a few hours. One method might be to divide your total calorie requirements for the day by five, and eat five meals per day at those calorie amounts. For example, if Officer Becker has determined that she requires 2000 calories per day, she might eat five smaller meals of 400 calories each.

Eating Out
If you don't have the time or energy to pack your own lunch, chances are good that you will eat at a fast food restaurant. Sometimes we have no choice but to eat out. This can be very bad especially if we are hungry, we are provided with 30 minute lunch breaks, and the restaurants that are open after midnight are very limited. If you investigate the restaurants in your district and become familiar with the **business hours** and **menu**, you'll be one step ahead. Avoid the places which offer mostly fried foods. Choose restaurants which offer pasta, bread, potatoes, juices, and salads. In general, order foods that are **baked, broiled** (dry, without butter or oil), **roasted or steamed**, and lean towards the low fat **poultry** and **fish** items. Sausage, duck, and prime rib are high fat meats and should be avoided. When ordering your meal don't be afraid to ask how items are prepared or to make special requests. Don't assume your waiter is on the same menu: you may order a chicken breast salad thinking you're doing really well, and when it arrives you find out that the chicken breast is breaded and deep fried, the salad is drowning in buttermilk dressing and loaded with cheese, bacon bits, olives and croutons! You might as well order hot dogs! Order your **potato, bread or rolls** dry and use fat free dressing instead of butter and sour cream. Trim all of the visible fat from your meat portion, request the gravy or sauce on the side and use it sparingly. Order the broth-based **soups** rather than the fat-filled creamy chowders. Order marinara or red pasta **sauce** rather than a cheese, oil, or cream sauce. Request your **vegetables** to be steamed and with no butter or sauce (or have it served on the side and use sparingly). **Chinese** food is perceived to be healthy when most of the time it is cooked in generous amounts of oil. Speak up when ordering and request little or no oil. Ask about MSG and try another restaurant if you can't order your food without. Finally, **dessert** doesn't have to be full of guilt, just choose items such as fruit, low-fat frozen yogurt, or sherbet.

Caffeine and public safety personnel
Almost all of us drink it, right? We like the taste, we like the "boost", it helps us through a long night shift, some of us are just addicted. Some of us drink coffee before we work out because we perform better. Wait a minute..... Perform better? Cyclists who took 2.5 grams of caffeine per pound of body weight, exercised for 29% longer during high intensity cycling (Trice and Haymes, 1995). This was believed to be caused by the fact that caffeine stimulates the removal of fat from storage and into the bloodstream where it can be used as energy, thus reserving the stores of glycogen in the working muscles. Today, it is believed that caffeine causes a reduced perceived exertion because of the stimulating effect it has on the brain. Other studies show no significant effect of caffeine on exercise performance.
Bad caffeine habits are more likely to harm your health than the benefit you get from an energy boost from caffeine. Caffeine can cause diarrhea, irregular heart beat, and fibrocystic breast disease. Caffeine addiction

can lead to headaches, irritability, nervousnous, and jittery muscles. If you drink too much, you should cut back and make sure you are drinking enough water as well. If you don't drink it at all, don't start.

ENERGY SYSTEMS OF THE BODY

The muscles in your body run on molecular fuel called adenosine triphosphate (ATP). Muscles cannot contract without ATP, and it is produced in your body using the food that you consume. Your body re-synthesizes ATP in three ways, two of which are **anaerobic** and the other **aerobic**.

Anaerobic means "without oxygen", and is experienced when you sprint to a call in a high gear, or when you are fight with a suspect. **Aerobic** means "with oxygen" and is experienced in less intense situations such as low speed patrolling through the downtown area.

Aerobic System

When you are riding an easy pace on patrol and you are able to converse easily with your partner, the majority of the ATP for your working muscles is being produced aerobically, or with adequate oxygen. The by-products of aerobic metabolism, **carbon dioxide and water,** are easily eliminated by breathing and sweating. Because the aerobic system relies on a continual supply of oxygen, it is strongly linked to your **cardiorespiratory system**. Because there are many biological steps to produce ATP, the aerobic system is slower but produces more ATP than the anaerobic system. This is why the aerobic system allows you to work at a lower intensity for longer periods of time.

When your body is in the "aerobic mode" it uses both muscle glycogen (carbohydrates) and fat as fuel, but as time goes by you gradually switch from using mostly glycogen to using mostly fat. Carbs are still required to burn fat, however, because it is **chemically impossible to change fat into glucose.** Consequently, when the carbohydrate store within your body is completely exhausted, the muscle output dramatically decreases, and you don't have a choice but to stop whatever you are doing. Now all you can do to recover is eat and rest. This is why you may **"bonk"** or **"hit the wall"** during extended periods of aerobic activity, such as running a marathon. This could also occur during consecutive days of heavy training, during starvation, with dietary elimination of carbohydrates (as advocated with high-fat, low-carbohydrate, high-protein, "ketogenic" diets), or if you have diabetes. In these conditions, the capacity for energy transfer is severely limited, despite the fact that fatty acids are readily available. Being in this state of body can lead to a condition called "ketosis" in which the acid quality of the body fluids can increase to potentially toxic levels.

Anaerobic Systems

The anaerobic systems are much aster at producing ATP for your working muscles, however they rely on the immediate stores of energy which are quickly depleted. For this reason, the anaerobic systems do not last very long. The two anaerobic systems are called the **ATP-PC System** and the **Lactic Acid System**.

ATP-PC System

The ATP-PC System (**A**denosine **T**ri**P**hosphate-**P**hospho**C**reatine) is the first system to by utilized, and lasts for only 5-10 seconds. ATP is stored in your muscles, and is made up of adenosine bonded with three phosphates; hence, **adenosine triphosphate**. These bonds which hold the phosphate groups to the adenosine contain a substantial amount of energy. When your muscles initially contract, a phosphate bond is broken off the ATP, and releases all of the energy it took to hold them together. This energy that is released is exactly what your muscles need to continue to contract and produce motion. The ATP then becomes **ADP**, or **adenosine diphosphate**, because one phosphate group was removed to release the energy for your muscles.

These immediate stores of ATP in your muscles last a very short time however, and are soon depleted. Here is where **phosphocreatine**, or PC, enters the picture. Phosphocreatine is also stored in your muscles in a limited supply, and is **creatine** combined with **phosphate**. It is quickly broken down to combine with the ADP leftover

from the first chemical reaction we just discussed. When this happens, the ADP becomes ATP (ADP + Phosphate = ATP) and is ready to be used as more energy for your muscles to continue their work! All of this takes place during the first 10 seconds of high intensity activity, because the supply of PC is also limited. After it is depleted, other energy sources will have to produce the ATP.

Creatine Supplementation

Only a small quantity of ATP is stored in the muscle cell, so it must be resynthesized at the rate at which it is used in order for movement to continue. Because ATP cannot be supplied through the blood, it must be resynthesized within the cell inself. To do this, creatine phosphate is stored within the cell and is considered the high energy phosphate "resevoir." The cycling of creatine, to creatine phosphate, and back to creatine, is very important to the process of supplying energy to the muscles. By understanding these complex chemical reactions that your muscles must go through to produce explosive and powerful movement, it is not hard to see how **creatine supplementation** might benefit those training and performing in high intensity activities.

Creatine is not an anabolic steroid, it is not a drug, and is not a banned substance. It is a naturally occuring compound within your body. Creatine doesn't build your muscles for you, but it allows **you** to work your muscles at an intense level for a longer period of time--**it helps you to build your own muscles.** In other words, you can't take creatine, sit back and watch your muscles grow. You have to do the work!

Scientific research has shown that creatine supplementation leads to an increase in muscle strength, muscle size, and muscle energy which improves performance during brief, high intensity or intermittent activity. It also accelerates energy recovery between intense exercise bouts such as interval training, and may also reduce fatigue by reducing the build up of lactic acid. It basically allows you to train more intensely by delaying muscle fatigue (regeneration of ATP).

Your muscles have **two sources** for creatine. The first source is that which is made within the body, and the second source is that which we get from our diet. Animal muscle such as meat and fish has been found to be the richest source of dietary creatine. In order to improve performance, however, supplementation is more practical due to the amount of food which would have to be consumed.

If your body is naturally high in creatine volume, supplementation will not result in delayed muscle fatigue as significantly as in a person with a lower amount of naturally occurring creatine. Short term **side effects** may include increased thirst, gastrointestinal distress, and some water retention. Since creatine supplementation has just recently become popular, more studies are needed to examine long term side effects. Consult a professional prior to supplementing your program with creatine.

Lactic Acid System

Once your immediate stores of ATP are depleted, your body must switch over to the Lactic Acid System. This system is also known as **glycolysis,** because the muscles continue to produce ATP through the breakdown of stored glucose (**glycogen**). Remember that glucose is sugar, or a simple carbohydrate. When it is stored, it is called glycogen. When it is flowing through the veins it is called **blood glucose**, or **blood sugar**. Glucose (Carbohydrate) is the **only nutrient** whose stored energy can be used to generate ATP anaerobically. Blood glucose and stored glycogen must supply the main portion of energy for ATP resynthesis. During light and moderate exercise, carbs supply about one-half of the energy requirements. Additionally, the continual breakdown of some carbs is required to use fat for energy in aerobic metabolism. **These reasons are why the carbohydrate is the most important fuel to public safety cyclists!**

Lactic Acid is a by-product of glycolysis, and if it is not recycled quickly enough due to a longer period of intense activity, the excess lactic acid begins to build up and cause a burning sensation in the working muscles. This eventually leads to fatigue and muscle failure unless the activity is reduced to an aerobic level again. The point at which the lactic acid begins to build is called the **anaerobic threshold (AT)**, **lactate threshold**, or the **onset of blood lactate accumulation (OBLA).** The lactic acid system lasts about three minutes until the immediate stores of glucose are depleted and the excess lactic acid causes enough discomfort in the person to make the activity stop or slow. As public safety cyclists, we must make a conscious effort to stay below our anaerobic threshold to avoid muscle failure when we arrive at the scene and step off the bike.

Training to improve survivability on the job

In a sudden threat situation, you may not have the luxury of realizing you are well beyond your AT, and **most** physical altercations do not approach or exceed three minutes. When dispatched to an emergency call and you're a mile away, however, you can pay attention to your body and stay below this threshold. When you feel your quadriceps, calves, and hamstrings start to burn, you are accumulating lactic acid and you have exceeded your AT. **When you reach this level, turn it down a notch and stay below your AT so that you know you will be able to dismount without falling (muscle failure), and you will be able to take care of business when you arrive.** When you are on foot, chasing a suspect who is obviously faster than you, the suspect usually sprints. Now you know that he is accumulating lactic acid, and he will soon reach exhaustion. Instead of sprinting after him, run at your AT or just below, and see how you do.

You can train your muscles to **tolerate lactic acid build-up**, and you can train to **improve or raise your AT.** This means that you will be able to operate at a higher intensity for longer periods of time, and the benefits to public safety personnel are obvious. To do this, you must tax the system that you want to improve, in this case your lactic acid system. One way to do this is to drive the lactic acid level very high through intense exercise, then rest at twice the length of time you spent working. For example, if you sprint as hard as you can on your bicycle for one minute, you would then ride at an easy pace for two minutes. This will help you to gradually improve the level of your AT. To train your muscles to tolerate lactic acid, you could lower the intensity level slightly, but lengthen the time of exertion and shorten the time of rest in between. Ride for one minute and rest for 30 seconds to one minute. Repeat as long as possible, so the level of lactic acid gradually increases, forcing you tolerate the build up, and to perform while lactic acid accumulates.

You can raise the point at which blood lactate accumulates by as much as 20 - 30%, which can mean the difference between you or the suspect becoming exhausted first!

THE AGING PUBLIC SAFETY OFFICER: POWER AND ENDURANCE

As the age of the public safety officer gradually and continuously rises, the age of the average offender stays the same. If we do not put effort into keeping our bodies fit and healthy, the advantage gradually and progressively shifts further towards the young offender. According to the 1999 FBI "Officers Killed in the Line of Duty" statistics, officers were on the average, 15 years older, 35 pounds heavier, and 3 - 5 inches taller than the suspects who killed them. That 35 pounds isn't always muscle. Because we are usually older than those who kill us, we should pay particular attention to our fitness levels as we age. There are some fitness factors that cannot be helped as age progresses, but some deterioration can be substantially slowed with proper fitness habits. Some components of your fitness can even improve with age.

Power

Studies have shown that **maximum strength is attained by the age of 30**, in both males and females. This peak **steadily declines** thereafter, 16% by the age of 40, and a total of 20% by the age of 60, and 45% in the

later years of life. (Clarke, 1973 & Montoye, 1977). At age 50, police officers specifically, consistently show a dramatic decrease in power.

Aging brings with it **metabolic and physiologic changes** that are the cause of this gradual loss of power. These changes include a steady decrease in total muscle mass, which is primarily due to the reduction in muscle fiber size and quantity. There is a decrease in the ability of the motor neurons, which "fire" to make the muscles contract, and the speed at which the nerves conduct these impulses to the muscles declines as well. Together these factors add up to slower reaction time, reduction in the size of the muscle (atrophy), and an overall decrease in the ability to produce power.

Fortunately, these **aging effects can be slowed** by living a lifestyle which includes strength training all along. If you make a habit of working and toning muscles during your lifetime, you can minimize the loss of electrical conduction within your nerves, you can minimize atrophy, and minimize the loss of power. Even if you have not done this and you decide to start late in life, you will benefit by slowing and minimizing these changes. In both cases you will still lose some power, but the amount that you lose will be much less than had you not done any strength training at all.

Endurance

Endurance is a different story. Physiological changes which result from a lifetime of endurance training can actually **improve with age**. This is especially true in cycling, since the majority of our riding is done in the aerobic zones, and our aerobic system is closely linked to our cardiovascular system. Your body responds to cardiovascular training by building new networks of vessels to handle the demand, which makes it more efficient at transporting nutrients to your working muscles, transporting by-products, and taking waste products away. Other improvements continue to take place as aerobic training continues with age, and as a result you can experience success in aerobic activities late into your life.

HEART RATE

Your heart is the pump that makes it all happen. Without your heart pushing your blood through your veins, you would not be able to get the precious nutrients to your working muscles. As your activity level and energy demands increase, your heart rate also increases to meet these demands. By paying attention to your heart you can get a pretty good idea of how hard you are working.

Resting Heart Rate

Individuals who are more fit have healthier and more efficient hearts. The heart of a fit person is able to pump more blood per stroke (stroke volume), so it doesn't have to beat as often and thus works less per hour, per day, and over the course of a lifetime. Therefore, the resting heart rate **(RHR)** of a very fit individual is usually lower than that of an unfit person. Just as your cycling performance can improve with training, so can your heart fitness. **To determine your RHR, feel and count your pulse for 60 seconds before you get out of bed in the morning.**

Maximum Heart Rate

The most accurate way to determine your maximum heart rate (MHR) is with an exercise stress test conducted in a laboratory setting with sophisticated equipment. Since that is not a practical solution for us, we will use the general formula of subtracting your age from 220:

MHR = 220 - AGE

Target Heart Rate or Training Heart Rate

Your target heart rate (**THR**) is a percentage of your MHR, and varies according to your goals. Since we have already determined that a more fit person will have a lower resting heart rate (RHR), we will incorporate the RHR into the equation as well using the Karvonen formula:

THR = RHR + %(MHR - RHR)

In other words, you are first subtracting your resting heart rate from your max, then calculating the percentage you desire to work at, and finally adding your resting heart rate back on. This is a more accurate formula than just taking a percentage of your max, because it accounts for your current fitness level via your resting heart rate.

Heart Rate Training Zones

You can exercise at different intensity levels to achieve certain goals. If your goal is to improve a specific performance, you generally must exercise at 70% of your maximum heart rate, but that may not be everyone's goal. Here is a general guideline to determine your exertion level:

If you are warming up, cooling down, or it is a recovery day for you:	**50 - 60%**
If your goal is to burn some fat but not at a strenuous pace:	**60 - 70%**
If your goal is to burn more fat and improve your aerobic endurance:	**70 - 80%**
If your goal is to train at your AT, or improve your AT level:	**80 - 90%**
If your goal is to train in or improve your anaerobic system:	**90 - 100%**

Example: Officer Wayne is a police cyclist, and would like to improve his anaerobic threshold while cycling, because he wants to be able to respond more quickly to emergency calls. He is 32 years old, and his resting heart rate is 60.

Calculate Maximum Heart Rate: 220 - 32 = 188

The heart rate training zone for anaerobic threshold is 80 - 90%: THR = RHR +% (MHR-RHR)

80% THR = 60 + .8(188 - 60)
= 60 + .8(128)
= 60 + 102
= 162

90% THR = 60 + .9(188 - 60)
= 60 + .9(128)
= 60 + 115
= 175

So Officer Wayne now knows to train at a level of intensity which keeps him in this heart rate zone of between 162 and 175. **To take your heart rate** while you are riding or working out, count your beats in 10 seconds and multiply by 6. Take the heart rate at the radial pulse or carotid artery.

F.I.T. Principle

For training to improve performance and to improve fitness levels, the Cooper Institute's "F.I.T. Principle" can be used:

Frequency:	Train 3 - 4 times per week
Intensity:	Train within the desired target heart rate zone
Time:	Train at least 20 - 60 minutes per exercise session

Heart Rate Monitors

Utilizing a heart rate monitor can help you train in your desired zone. A common error is to train too strenuously so the benefit of lower intensity recovery days is missed. Heart rate monitors can be worn at work under the body armor and uniform with little discomfort. Paying attention to your heart rate is the most practical way to measure your stress level of physical exertion while cycling at work, and it is the most practical

way to estimate your fitness level. A heart rate monitor is easy to use and inexpensive for basic models. You can purchase monitors which are programmable for training zones complete with alarms when you leave your desired zone. You can purchase monitors which also have normal watch functions including date, timers, and alarms. There are monitors which record your heart rate over a period of time, such as while sprinting to a call, or conducting a building search. There are even monitors which will download all of the recorded information into a computer just by pointing the monitor at your computer screen! Heart rate monitors can be an effective tool in improving your training efficiency and performance on the street.

Heart Rate and Performance While Under Stress: Applying Siddle research

Why should I be cognizant of my pulse while I am searching a building which has been broken into? While I am providing emergency medical aid to an unresponsive patient? Mental performance, as well as physical performance are influenced by stress. Stress can chemically induce a significant spike in the heart rate, as well as continuous elevated heart rates. Learning to control your level of stress in critical situations will increase your chances optimal performance, of surviving and winning. Your heart rate is a measurable indicator of your stress level in these situations.

Studies have shown that your performance will improve as your heart rate rises, up to a certain point. After that point however, your skills start to deteriorate (Inverted-U Theory)

Your **fine motor skills** (requires "bulls-eye accuracy and hand-eye co-ordination such as threading a needle) start to deteriorate at about **115 beats per minute.** Your **complex motor skills** (involves three or more steps or moving components, or involves non-symetrical moving components) start to deteriorate at about **145 beats per minute**. At **150 beats per minute**, your **gross motor skills** (simple, major muscle movements) are actually enhanced. At **175 beats per minute** you may start to lose your rational thinking and you may experience perceptual distortions such as tunnel vision, slow motion time, and memory loss for some parts of the incident. You may also experience hyper vigilance (irrational behavior/panic), or you may freeze. As public safety personnel, this is not where we want to be! Taking into consideration all of your fields of performance, not only your physical skills but also your vision and cognitive performance, your **optimal performance** range will usually be within the **115 - 145 range.**

Below is an actual example of a police officer's the heart rate pattern recorded with a heart rate monitor (Polar S810) during realistic simulation training, and downloaded into a computer for analysis. The officer's heart rate spiked from 81 to 149 within 45 seconds, and to 168 within 110 seconds.

Fortunately, you can bring your own heart rate down through **tactical breathing exercises** which should be practiced on a regular basis. In one heart rate study cited by Bruce Siddle, police entry teams were conducting room clearing exercises and engaging multiple targets while wearing heart rate monitors. Officers who had heart rates over 150 beats per minute were shooting with a 30% accuracy level. Those whose heart rates were below 115 beats per minute were shooting with 70% accuracy, and those with heart rates of 130 beats per minute were scoring 97%. Practice tactical breathing to decrease your stress level and increase your performance before you get out of the patrol car, after you step off the bicycle, before you make an entry, after you have moved to cover, or whenever you are suddenly in a high stress situation.

You can also manage more effectively the "175 zone" through **realistic training**, which equates to **experience**. The more you experience a certain or similar event, the less stressful it is for you the next time. For example, what did you remember after your first fight? After your most recent fight? How about your very first felony stop versus your most recent? Chances are, you remembered much more about your most recent fight, and felony stop, because you had gained experience in a similar situation in the past. We can't go out and pick fights with people just to gain experience, but we can obtain the same benefits of experience through realistic training.

WARM-UPS, COOL-DOWNS, AND STRETCHING

Warm muscles are happy muscles, and less injured muscles. Try to warm before stretching. **Low intensity activity** prior to stretching will bring blood to your muscles and warm them up for the 6 - 10 hours that they will be working. A **cool-down** at the end of your shift can be done on your way to the barn, by cycling easily and slowly. If you like to sprint back to the station, take an extra loop around the station at a very slow pace. We cool-down rather than just stop because the lactic acid is removed more quickly by aerobic recovery exercise. After your cool-down, follow up with more stretching.

Stretching will improve your flexibility which is a key element of fitness. A longer muscle will provide a more powerful contraction as well. Stretching before and after physical activity will reduce your chance of injury and increase the range of motion of the muscles. For public safety cyclists it contains additional importance because our mode of transportation requires almost every muscle in our body to perform work. If we stretch before warming up, or if we start our tour of duty without first warming and stretching our muscles, we could end up on light duty with a strain (muscle tear) or sprain (connective tissue damage).

We have an advantage however, as we roll up on a call in which we will be required to exert ourselves, because we will have warm and well-stretched muscles from our ride to get there. When was the last time you saw a motorized officer get out of the car and stretch before going into a bar fight? Not that this would be practical or tactical, but this may be one of the reasons why the rate of injury is high among police officers.

In fact, the **most frequent type of police officer injuries** are not from being punched or kicked, but are **lower back injuries, muscle pulls, and muscle strains** (listed in order of

frequency). The injury patterns are usually related to individual levels of fitness, blaming **poor flexibility**, poor aerobic conditioning, and a lack of muscular exertion (while not working).

When you stretch, you should do so very **slowly** and **do not bounce**. Your muscles are equipped with a reflex which stimulates muscle contraction if they are stretched suddenly and substantially. This is a contraction that you can't control, and can result in a muscle tear. Stretch slow and easy. Stretch until you feel **resistance but not pain**, and hold the stretch for 30 seconds. Remember to breath as you stretch, don't hold your breath.
For cycling, you should stretch your neck, shoulders, back, arms, wrists, buttocks, abdomen, hips, legs, and ankles (everything!).
Some stretches are considered controversial, or **contraindicated.** Most are related to placing unnecessary stress on the vertebrae and knees.
Examples:
Hyperextension of the neck, full head circles (do not tilt your head back at all), standing toe touches, windmills, back arching, leg lifts (both at one time), sit ups with both legs straight, deep knee bends, duck walks, forward and side lunges, and hurdler stretch.

CYCLING INJURIES AND PHYSICAL COMPLAINTS

In the year 2000, the International Police Mountain Bike Association polled over 300 police cyclists on several issues. It was discovered that 67% had been injured at least once during bike patrol training, with 25% reporting some type of serious injury such as muscle sprains, tears, strains, dislocations, fractures and broken bones. Time lost from work ranged from a day to 11 months. The numbers dropped significantly when asked about on-duty injuries, with only 20% reporting injury. Half of these were minor scrapes and bruises while the other half were serious injuries such as being struck by motor vehicles, joint and muscle injuries, and broken bones.

Crash-Related Injuries

The best treatment for any type of injury is to **avoid crashing** in the first place. Let's face it though, we all crash at some point in our public safety cycling career. You can minimize the chance of a minor injury becoming a major one however, by practicing **tumbling exercises**. The clavicle (collar bone), forearms, and wrists are common cycling injuries because the cyclist tries to catch himself by putting his arms out as he lands. Instead, try to roll with the fall, and try to take the impact with the shoulders and back rather than the head and the arms. If you are unable to flip out of the pedal retention, you can stay with the bike and allow it to absorb most of the impact.

Don't shed the **body armor** because it's too hot. Body armor will not only protect you from a suspect's bullet or punches, but it will also protect you from some blunt trauma during a crash. Technological advances in body armor material have led to the manufacture of extremely light weight body armor that minimizes discomfort while riding a bicycle.

Gloves will also protect your hands from road rash, but don't wear them if you're not comfortable and proficient at your other, more important skills such as handcuffing,

deploying your baton, drawing your OC, shooting, re-loading, clearing malfunctions, and so forth. You can experiment with different types of shooting and riding gloves which may allow you to be proficient with your skills, yet keep the benefit of ulnar nerve protection and minor injury protection.

Wear a **helmet**. Obviously.

Road Rash: Clean the wound properly and apply antibiotic ointment and a dressing.

Blunt Trauma
Reduce the swelling potential with a cold pack, after the area is cleaned and dressed but before it has the chance to swell. Utilize the **R.I.C.E. Principle:** Rest, Ice, Compress, Elevate.

Overuse Injuries and injuries caused by improper equipment and/or technique
These injuries are almost completely under your control. If you are fit, maintaining the correct position on the bike, and wearing appropriate protective gear, you can prevent many overuse injuries and illnesses.

Sore Muscles
When you work your muscles hard, you may wake up the next day feeling stiff and sore. 48 hours after your activity you may feel the worst. This is not due to lactic acid as many people think, but may be due to one or more reasons: Microscopic tears may have developed in the muscles themselves, increases in the fluid pressure surrounding the muscles, muscle spasms due to insufficient stretching prior to activity, or tearing or overstretching the muscles' connective tissue. Properly stretch before you ride. Make sure you are drinking extra water, eating adequate protein, and eating adequate carbohydrates. This will allow your body to repair the damaged muscle tissue (protein), replace the water you lost and aid in repair, and to replenish your glycogen deficit (carbs). You can soak in a hot tub, take an anti-inflammatory such as ibuprofin, and stretch your sore muscles as well. Take the day off from training or riding and let your body heal. Visit the hot tubs or get a massage.

Muscle Cramps
Muscle cramps are not completely understood, but they most commonly occur in those who work their muscles to exhaustion. Commonalities include dehydration, lack of calcium, potassium, and sodium. If you experience muscle cramps, drink plenty of fluids until your urine is clear or pale yellow. Eat and drink additional dairy products such as yogurt and milk for calcium. Eat a banana and other fruits and vegetables which contain potassium. Add a little salt to your diet to maintain adequate sodium levels.

Sore Neck
Improper body position and a lack of stretching prior to cycling can cause a sore neck. You may want to try a shorter stem, or raise the one you have. While you ride, make sure to roll your shoulders and neck(down and to the sides, not to the rear) to prevent a static position for an extended length of time, and when safe to do so you can even rub your

neck with a hand to keep it loose. Keep your elbows loose to prevent shock transfer and fatigue. When cycling in cold weather, keep your neck warm with layers of clothing.

Sore Back

Most of the time, back pain from cycling is caused by overexertion or improper position on the bike. Try raising your stem, and moving your hand positions frequently using your bar ends. Be sure to stretch out properly prior to cycling. You can even stretch your back while riding by standing on the pedals and arching forward. Since many back problems are caused by a lack of overall torso strength, Incorporate abdominal-strengthening exercises in your work outs as well as back-strengthening drills. Anti-inflammatories, massages, and hot tubs can help as well. If your pain is persistent, stay off the bike and consult a physician, it may be injured or bone-related. In cold weather it is very important to properly warm up and stretch your back, as well as wear proper clothing to keep your back warm.

Sore, Numb, or Weak Hands

Your ulnar nerve runs along the inside of your forearm and palm to your ring and pinkie fingers. Having a "death grip" on the handlebars, not wearing padded palm protection, and improper body position (leaning too far forward) can lead to permanent injury to your ulnar nerve. Make sure the height and length of the stem is appropriate for your build, as well as the saddle position; height, fore/aft, and tilt.

Sore Butt

Pain caused by not being used to riding a great deal can be somewhat alleviated by your saddle choice. New ergonomically correct and gender-specific saddles have made many tours of duty more tolerable. This will not alleviate all of the soreness due to infrequent riding however, and the rest of the solution lies in desensitization (you just have to ride and let your ischial tuberosities or butt bones adapt). Anti-inflammatory and hot tubs work well to alleviate pain.

Saddle sores are a different story. A saddle sore is an infection caused by an irritation or chafing of the hair follicles, and usually starts as a small irritation or pimple. It usually goes away in a few days. In some cases however, it doesn't go away, but spreads to create larger and more painful boils which may have to be removed with surgery. To prevent saddle sores, wear chamois or synthetic-lined padded cycling shorts, and don't wear underwear. Wash the shorts after every ride, and wash yourself with antibacterial soap. Sports lubricants are also an option. If you do develop a saddle sore, take a few days off the bike and do not cover the sore with salves or ointments. Consult your doctor if it doesn't go away in a few days.

Sore Knees

Patella tendinitis and **chondromalacia** are common cycling overuse injuries. Riding with a saddle that is too high or too low, and trying to ride in too high a gear are major contributors to developing these conditions. If you are using clipless pedals, make sure they allow your foot to "float" a few degrees to reduce the stress on the ligaments in the

knees. In cold weather wear warm clothing and maybe an additional layer around the knees. Tights with wind-resistant front panels are good for keeping the knees warm. If your knee hurts on the outside and just above the kneecap, it may be your **iliotibial band**, or **IT**. The IT runs on the outside of the thigh, all the way up to your hip. Make sure your saddle is high enough and be sure to stretch the IT band before and after cycling. **Remember R.I.C.E.**

Burning or Numb Feet

Check your shoe width and make sure it isn't too narrow. Put a shock-absorbing insole inside the shoe. Loosen the tension on your laces or velcro closures. Wiggle your toes when you can to keep them loose. Wear appropriate shoes. Without cycling shoes or those with a very stiff sole, the foot will "bend" over the pedal when force is exerted. This strains the plantar fascia, which is the tendon running along the bottom of the foot. Over time a condition called **plantar fasciitis** can develop. Wear shoes with a stiff sole to distribute the force over the entire bottom of the foot, not just the area which pushes on the pedals. Use your pedal retention properly, by pedaling in a circle rather than only pushing down with your quadriceps. Pull up with your hamstrings as your foot reaches the lower half of your stroke.

Riding with a Cold

The best treatment for a cold is to warm and liquify your mucous so that movement to the outside is facilitated. Try spending time in a hot tub or wet sauna. Allow the cold to run its course and increase your fluid intake. Cycling with a cold is not detrimental to your health, but keep the pace down. If your symptoms progress or if a fever arrives, you need to rest and consult your physician. Relax, and allow your body to fight the infection indicated by the fever. When you're better, ease back into your riding.

Heat and Humidity

Our muscles produce heat when they work, and sweat is excreted to promote evaporation for cooling. When the air is dry, it is sometimes difficult to realize how much water we lose because it is quickly evaporated from our skin. When the air is humid, or high in water saturation already, the body's evaporation system is hindered because the ambient air around our bodies won't evaporate much of the water our bodies are excreting. When evaporation can't take place, the cooling process can't take place as well as it can in dry weather. Pay attention to the WBGT (Wet Bulb Globe Temperature) heat stress index, and follow the recommendations for the flag colors for each day (Green, Yellow, Red, Black).

When we sweat we lose water and electrolytes. When too much water is lost, our circulatory system is severely impaired in its ability to deliver nutrients, remove waste products, and to distribute heat to the skin to vaporize into sweat. This failure can lead to **heat exhaustion** and **heat stroke**. Know the symptoms of each and take the proper precautions. If symptoms appear, react appropriately. To prevent these conditions, take on plenty of cold fluids which contain carbohydrates and electrolytes, ride at a moderate pace, and pay attention to both your temperature and sweating. If you have a choice, stay out of the sun during peak hours. Wear clothing conducive to physical activity, which

wicks away moisture to aid in evaporation. Light colors reflect heat better than dark colors, but for police and security this may not be a tactical choice.

Intense Sunlight
As much as we love our sun, it can have damaging effects on our bodies if we spend too much time under the sun without proper protection. The tissue of the eye is especially susceptible to damaging UV rays emitted by the sun, and skin can develop cancer from prolonged and unprotected exposure. Wear 100% UV-rated eye protection, and sunscreen with a sun protection factor (SPF) of at least 15. Wear long-sleeves where the sun is especially intense, but keep in mind that clothing does not block all of the sun's damaging rays. If you have a choice, stay out of the sun when it is most intense. All rules apply on cloudy days too!

Riding in Cold Weather
Dress appropriately by layering up. Wear moisture-wicking clothing next to your skin, and wind-resistant material on your front side. Cover your head underneath your helmet, and be aware of wind-chill. Know the symptoms of frostbite and hypothermia, and know when to come inside. Drink plenty of fluids, avoid excess sweating, but keep moving as your muscles generate heat while they work.

OVERTRAINING
If you find that your quads and/or other cycling-specific muscles experience soreness day after day, first make sure that you are consuming enough carbohydrates to restore glycogen within your muscles. Make sure you are also consuming enough protein for your muscles to repair themselves. Finally, make sure you are consuming enough water to make the entire recovery process possible. If all of these things are being adequately cared for and your muscles are still sore, chances are good that you're overtraining, or overworking your muscles and they are not getting enough time to recover. If the choice is yours whether you ride each day, try taking a day off the bike in the middle of the week. If this isn't an option, try to designate an "easy day" during which you make a conscious effort to ride closer to 50-60% of your MHR rather than higher. Also make an effort to spin easily after a sprint, or for the last 20-30 minutes of your shift, to flush the waste products and recycle the by-products faster.

PRE-SELECTION STANDARDS
In the survey mentioned above, it was also discovered that at least three public safety officers including security personnel, suffered heart attacks and died while riding a mountain bike, either on patrol or during training. Alarmingly, only 23% of reporting officers were given any type of medical pre-screening prior to engaging in bike patrol training or riding on duty.

Cycling requires the body and the heart to do strenuous work at times, and those who participate must be physically able to do so without harming themselves. Proper pre-screening will identify those who have pre-existing conditions, and those that may not be healthy or fit enough to withstand the rigors of cycling on duty. At the very least, the pre-screening process should include a thorough medical exam to include a stress test or

other comprehensive cardiopulmonary exam, and an orthopedic exam with emphasis on the knees and back.

CONCLUSION

As public safety cyclists, we should be educate ourselves on the type and amount of food that we consume, versus how much we actually require each day, and tailor our eating habits accordingly. We should be familiar with how our bodies perform physical activity and how to train to improve our performance if we need to. We should engage in realistic training ensure adequate performance under stress, whether our own departments foot the bill or whether it comes out of our own pockets. We should be familiar with profession-specific issues that will assist us in preventing injury and keeping our performance at an acceptable level.

Fitness is important to police, fire, EMS, security, and all uniformed service professionals who utilize a mountain bike at work. Because of the strenuous cycling which may be required of these men and women choosing to serve their communities, an adequate level of fitness should be a top priority. These cyclists should be concerned not only with their abilities to perform their cycling functions, but also to perform their required duties once they arrive on-scene. This may go well beyond "just being strong," to handle an immediate physical threat. It also includes being heart-fit, because of the alarming rate at which these professionals are dying from cardiovascular disease prior to, and almost immediately after retirement. Fitness and wellness are a lifestyle which every uniformed service professional should take very seriously. If not for himself, then for his family, friends, co-workers, and citizens.

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