Part 4: Endurance Sport Nutrition

Figure 28. Use aid stations for refueling and brief rests. Do not miss the opportunity to fill your waterbottles.

Consume More

Consider for a moment a typical American workday: You work three hours in the morning, have a 15-minute coffee break, take 30 to 60 minutes for lunch, and work for four hours in the afternoon, with another 15-minute break. You consume 700 calories for breakfast and 1,500 calories during lunch and work breaks. You drink many glasses of water, coffee, or other fluids.

Doesn't it make sense that when you are exercising, you need even more calories and water? Of course! —Yet so many of us train or race until we drop without drinking enough and fueling our bodies.

The priorities for nutrition during long rides are water, calories, and sodium.

For events under an hour, no special nutrition may be needed. For most events over an hour, concern yourself mainly with fluids and calories. For long-distance events over most of a day or longer, sodium should also be considered.

Practice Eating on the Bike

Although it may not be necessary to consume calories during shorter training sessions, it is crucial in long-distance events. You must practice eating, even in shorter training sessions, to allow your gastrointestinal tract to adapt to the process of eating while exercising.

Nutrition Losses

Fluid Loss

Sweat rate depends upon work rate and climate—heat and humidity. When working hard in hot, humid, and sunny conditions, it is easy to lose a couple of quarts or liters per hour.

For events longer than one hour, or one-half hour in the heat, water replacement is important. Although carbohydrates or electrolytes may not be necessary for energy or balancing mineral losses, they aid hydration by increasing the rate of water uptake by the gastrointestinal tract. They also increase palatability: Fluids that taste better encourage drinking. Chilled fluids also help encourage drinking and are absorbed more quickly.

Aim for 8 ounces of fluids every 15 minutes in the heat. That's about one quart every hour. Although you may lose more, it is doubtful that drinking more will be helpful because your body probably cannot process more than that.

Depending upon the event, most cyclists *must* carry waterbottles or hydration systems (e.g. CamelBak)—the time distance between aid stations is too great to rely on them for hydration.

Calorie/Energy Loss

It is typical to use 2,500 to 3,000 calories during a century; twice as much in a double century or an ACE event.

Some of this energy must come from the body's stores of carbohydrate (glycogen) and fat. Some energy needs can be met by consuming calories while exercising. Depending upon your size, your body can use up to 300 ingested calories per hour. As a rule, try to consume this many calories for every hour you exercise.

"Energy bars" and "gels" do work, but after many hours become tiresome for most athletes. If not racing, cyclists do well to stop periodically and eat "real food" —especially early on in a long ride.

Leftover breakfast items such as French toast or pancakes, fig bars, bananas, and Pop-Tarts (perfectly packaged for jersey pockets) are favorites for short stops.

The harder you work, the less you are able to tolerate solid food. Carbohydrates-in-solution are a convenient way to get calories. Typical sport drinks and diluted fruit juice have 100–125 calories per 16-ounce bottle.

More than 400 calories per bottle can be obtained and tolerated with a few specialty sports drinks that contain glucose polymers or maltodextrins.

Read more about maltodextrins on page 83.

Figure 29. ACE events require many calories. A short mid-ride sit-down meal helps give you the calories you need, and provides a welcome riding break.

Sodium

Sodium, found naturally in many foods and in table salt, is the electrolyte priority for the long-distance athlete. A low concentration of sodium in the blood is associated with weakness, fatigue, seizures, and occasionally death.

The average American ingests two to five grams of sodium a day. An overall general diet high in sodium is associated with high blood pressure in an important minority of the population who are "salt-sensitive." Restaurant foods tend to be high in sodium. Many athletes consciously watch their sodium intake and keep it low. This is not necessarily a good strategy for most endurance athletes.

The body loses about one gram of sodium per quart of sweat. After a gallon of such loss, the average total daily intake of sodium may be inadequate to meet demands, and the blood sodium may drop.

In temperate weather conditions, this may take 4 or 5 hours. In high heat and humidity conditions, sodium depletion can occur in just a couple of hours.

In many athletes, low sodium problems first occur in "target" long-distance events—because these events may last 50% longer than the longest previous training session.

Many athletes who are sodium depleted are also dehydrated. However, those with low blood sodium are often relatively less dehydrated than their competitors who have blood levels closer to normal.

The reason is that all athletes tend to rehydrate, or partially rehydrate, with fluids that have a lower sodium concentration than intestinal fluids and blood. Those who drink the most tend to dilute sodium the most and have lower blood concentrations. For long-distance athletes, it is reasonable to plan on an intake of up to a maximum of one gram (1,000 milligrams) of sodium per liter of fluid loss. This is about one-half teaspoon of salt.

The best way to get extra sodium is by eating salty foods. The night before longer rides, add some salt to your pasta meal or have high sodium foods such as pizza, pretzels, or soup. Tomato juice and V-8® are high-sodium fluids. Low-fat pretzels and saltines are often a good choice for athletes at rest stops. Even foods like cookies or bread, which you may not think of as "salty foods," have more sodium than most sports drinks. The sodium content of selected products is listed in the table on page 82.

Salt tablets do not appropriately stimulate thirst and are not generally recommended.

There is another reason for consuming some salt. It helps the body rehydrate.

Protein, Vitamins, Minerals and Other Electrolytes,

Although protein, vitamins, minerals and other electrolytes in addition to sodium are required during the course of a day, these nutrients have relatively little , if any role, during exercise.

For a detailed discussion about protein, as well as every vitamin and mineral, see Nutrition for Sports, listed in Appendix G on page 126.

Examples of Meals and Foods

Your choices should emphasize carbohydrates. For exercise in the heat, eat more salt than usual.

Night Before Long Training Sessions or ACE™ Events

800 to 2,000 calories
150 to 250^{+} grams of carbs (2 to 4 grams/kilogram body weight)

- Salad
- Pasta, easy on the Alfredo sauce.
- Bread
- Fat-free milk
- Fruit

Breakfast Before Long Training Sessions or ACE™ Events

600 to 1,500 calories
120 to 210^{+} grams of carbs (2 to 3 grams/kilogram body weight)

- Fruit: Orange, apple, banana, fruit salad, other.
- V-8®
- Fat-free or reduced-fat milk, juice, tea, coffee.
- Choose two to four items:
  - ✓ Big bowl cereal and fat-free or reduced-fat milk
  - ✓ Big bowl of oatmeal (if instant, 2 packages)
  - ✓ 2 slices of toast (add jam, peanut butter, etc. to taste)
  - ✓ Bagel
  - ✓ Muffin
  - ✓ Pancakes and syrup (just a little, or no, butter)
  - ✓ Waffles and syrup (just a little, or no, butter)
  - ✓ Leftovers (e.g. spaghetti or pizza)

During Long Training Sessions

300 to 750 calories per hour
60 to 120 grams of carbs per hour
Eat solid foods early—before exercise intensity or duration makes such foods more difficult to tolerate.

- Standard carbohydrate drinks (100 to 150 calories per 16-ounces)
- High carbohydrate drinks (200 to 600 calories per 16-ounces)
- Energy bars and gels
- French toast and jam
- Pop tarts
- Bananas
- Fig bars, cookies, muffins
- Candy bars (Milky Way—least fat—30%)
- Bagels
- Sandwiches, hold the mayo
- Pretzels, saltines

Figure 30. The world-famous Carson rest stop serves up ice cream. Multi-task: Snack while you wait for the porta-pottie. Tour of the California Alps—Markleeville Death Ride.

After Long Training Sessions

If training the next day:
300 to 750 calories per hour for 2 hours.
60 to 120 grams of carbs per hour
Minimum 500 calories over 2 hours.

- Carbohydrate or recovery drinks
- V-8®
- Sandwiches, hold the mayo
- Pretzels, low-fat chips
- French toast and jam
- Energy bars and gels
- Bananas
- Fig bars
- Bagels

During ACE™ Events

300 to 750 calories per hour
60 to 120 grams of carbs per hour

Eat solid foods early—before exercise intensity or duration makes such foods more difficult to tolerate.

Many events, such as *The Tour of the California Alps—Markleeville Death Ride*, provide excellent aid stations and a sit-down lunch. If a sit-down lunch is provided, unless you are a top racer, sit down!

Soups (salty), baked potatoes, sandwiches, pasta, yogurt, and well-ripened fruits are all excellent choices. Though fats can slow digestion, the calories and salt present in chips, Fritos, and other snacks often makes them appropriate choices.

At other events, support is limited, and you will rely on the same items you carry on self-supported long training sessions.

- Standard carb drinks (100 to 150 calories per 16-ounces)
- High carb drinks (200 to 600 calories per 16-ounces)
- Energy bars and gels
- French toast and jam
- Pop tarts
- Bananas
- Fig bars, cookies, muffins
- Candy bars (Milky Way—least fat—30%)
- Bagels
- Sandwiches, hold the mayo
- Pretzels, saltines

Convenience Store Ideas

- Prepared whole-wheat turkey or chicken sandwiches
  Don't add the mayo on the side
- "Wraps"
- Low-fat muffins
- Yogurt
- Ice milk or frozen yogurt
- Fresh fruit
- Pretzels
- Fat free or reduced fat corn chips or potato chips
- Bagels, raisin bread
- Apple pies (higher in fat than perhaps ideal, but taste great!)

Fast-Food Ideas

- Pancakes
- English muffins
- Chicken sandwiches, hold most of the sauce
- Salads, easy on the dressings
- Baked potatoes
- Tostados
- Burritos
- Pizza, chose lower fat toppings
- Burger, (whopper) hold the mayo. About 400 calories, 30% fat.

Standard Carbohydrate Drinks

Product	Source	[Carb]	Cal/16 oz	Na/16 oz
Gatorade Endurance Formula	SG	6	100	400
Gatorade	SG	6	110	220
Revenge	MF	6	100	95
Powerade	FM	8	145	<110
AllSport	F	8	145	110
10-K	SGF	6	110	110
Endura	FM	6	110	92
HydraFuel	GFM	7	128	50
Cytomax	FG	5	92	106
Gookinaid	G	12	220	140
Coca-Cola	FS	11	200	12
Diet Drinks		0	0	10
Orange Juice	FS	10	183	12

Table 7. Standard carbohydrate drinks.
Source: Fructose, Glucose Sucrose, Maltodextrin
[Carb] = Percentage concentration of carbohydrate solution
Na/16 oz = Sodium in milligrams in 16 ounces of solution

High Carb Drinks

Product	Source	[Carb]	Cal/16 oz	Na/16 oz
Extran	MG	25	575	0
Carboplex	M	24	440	0
Carbo Power	MF	18	330	100
Ultra Fuel	MGF	21	385	0
ProOptibol 105	GF	19	350	0
Cyberchage	GMF	21	385	20
Carbo Fire	GMF	24	440	80

Table 8. High-carbohydrate drinks.
Source: Fructose, Glucose Sucrose, Maltodextrin
[Carb] = Percentage concentration when carbohydrate solution when digested
Na/16 oz = Sodium in milligrams in 16 ounces of solution

Sodium Content, Selected Products

Product	Serving Size	Sodium (Na), mg
Chicken noodle soup	8 ounces	1,100
Baked beans, canned	8 ounces	1,000
Pasta sauce	6 ounces	1,000
Dill pickle	1	925
Tomato juice	8 ounces	900
V8® juice	8 ounces	620
Pretzels	1 ounce	500
Gatorade Endurance Formula	8 ounces	200
Muffin, corn, small	1-1/2 ounces	300
Cookie, chocolate chip	2 ounces	250
Ketchup®	1 tablespoon	190
Cheddar cheese	2 ounces	175
Bread	1 slice	159
Gatorade	8 ounces	110
Most sports drinks	8 ounces	50
Gels	1	25 to 50

Table 9. Sodium content, selected products.

Maltodextrin Nutrition

This brief, specialized article is primarily about one source of calories—maltodextrins.

Calorie/Energy Loss

As stated above, it is typical for cyclists to use 2,500 to 3,000 calories during a century. Typical sport drinks and diluted fruit juice have 100–125 calories per 16-ounce bottle. This usually works out to about a 6% sugar solution.

Beverages do not usually have more calories than this because solutions of higher concentration are difficult to digest; more than 6% solutions are associated with cramps, diarrhea, and other gastrointestinal problems.

A few specialty sports drinks that contain glucose polymers or maltodextrins provide more than 400 calories per bottle and are generally easily tolerated. An example is the proprietary product Extran.

Better Maltodextrin?

Most commercially available high-carbohydrate sports drinks and gels contain maltodextrins mixed into proprietary formulas for taste and color. Other ingredients, for example vitamins or herbs, may be added—generally for marketing purposes.

These formulas sometimes have problems with dissolvability, palatability (taste), caking, or sludging.

You can make you own great solution inexpensively.

You can purchase a wide variety of pure maltodextrin products in 50-pound bags from commercial grain processors. The cost usually is less than $1.00 per pound or one-tenth that of proprietary products. The bag generally has a shelf life of two years.

Maltodextrin is relatively tasteless; it has minimal sweetness. You can add a little lemonade, fruit juice, Kool-Aid, soda, to your own made-up solution for your personal favorite taste.

Like many proprietary products, some commercial maltodextrins, especially those sold through beer-brewing stores, will cake.

Agglomerated products (processed to yield crystal clumps) are dustless and free-flowing. They are easy to handle. Agglomerated maltodextrins have excellent dispersability and dissolution characteristics, quickly forming clear solutions when mixed with water.

The product that I use (MaltrinQD 500[5]) can dissolve 3 cups (24 fluid ounces) of powder into 2 cups (16 ounces) of fluid—not that I use that amount. This works out to about 1,000 calories per bottle.

If I am planning on taking in only one 16-ounce waterbottle per hour, and no snacks, I mix one cup of maltodextrin in a 16-ounce bottle. This yields about 300 calories. I do not do this often.

If I plan to eat snacks, I usually reduce the amount of maltodextrin to about half this amount. I do this commonly.

If it is hot, I will drink two or more waterbottles per hour. Again, I will mix one-half a cup of maltodextrin, or less, in a 16-ounce bottle. This works our perfectly—as it is hot I'll tolerate a lower concentration than when it is cooler—but I'll still be able to average 300 calories of carbohydrates per hour because I'll be drinking more.

Summary: Buy Your Own Maltodextrin

It is cheaper, easier to handle, and with better taste. You can split a $100 order (100 pounds)—generally enough for four riders for a year.

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[5] Product reference: Maltrin product information: http://www.varied.com/food/maldescr.html
Maltrin ordering, US West coast:
E. T. Horn Company. Tel: 800-442-4676
web site: **www.ethorn.com**
Maltrin ordering, US non West coast:
J. M. Swank Company, Inc. Tel: 800-593-6375
web site: **www.jmswank.com**

Event Nutrition Summary

Pre- and Post-Endurance Event Nutrition

- Supper: Pre-event meal high in carbohydrates. If planning to exercise for more than 4 hours, or 2 hours in high heat and humidity, add salt to foods.
- Breakfast: Aim for at least 1,000 calories. If planning to exercise for more than 4 hours, or 2 hours in high heat and humidity, add salt to foods.
- At the event: Have easily digestible fluids and calories available in case of a start delay.
- After the event: Consume 50 grams, or 200 calories, of carbohydrates within the first half-hour and another 200 calories of carbs within the first 2 hours after exercise—especially if riding the next day. Replace lost fluids and salt commensurate with losses.

Event Recommendations

- Aim for at least 8 ounces of fluids, every 15 to 30 minutes, depending upon the heat.
- Have carbohydrate-in-water solutions (e.g. sports drinks), rather than plain water.
- Carry two waterbottles. Alternatively, use a hydration system (e.g. CamelBak).
- Try to consume at least 300 calories per hour of exercise.
- For multi-hour events, consider preloading glycogen.
- For multi-hour events in conditions of heat and humidity, consider preloading with a salty diet, and during the event consume salty foods, and sodium-rich solutions and gels.

Part 5: Equipment

Here is a brief list of equipment issues for ACE™ rides:

Safety

Proper fit, installation, reliability, and maintenance of equipment are essential for rider safety and performance. Equipment must be clean, adjusted, and lubricated. Lightweight or aerodynamic equipment should not be used if safety is sacrificed. All riders should familiarize themselves with basic maintenance. No matter who works on your bike, you must check it and be confident of its safety.

The basic principles of bicycle equipment safety are that the wheels and other parts should be tightly fastened to the frame, the wheels should be sound, the tires should be properly inflated, the brakes and gears should work, and the drive train should move freely.

Aerobars help performance in flat solo events. They add unnecessary weight when climbing, and are a safety hazard in groups. Do not bring aerobars to the ACE™ rides.

Reliability Important

Do not save "race-day" equipment. Try out everything ahead of time and make sure it all works. Do not save a few grams with lightweight bolts prone to failure. If you get a "tune-up" do it two weeks ahead of time, in case adjustments are needed.

Use Standard Equipment

Use commonly available parts and accessories.

Sure, some aero-wheels with internal nipples are a little faster, but if a spoke breaks, tech support is not likely to be able to help.

Be Comfortable

Bike and Bike Position

Although super high-pressure narrow tires, stiff rims, radial spokes, aero rims, and stiff frames improve performance in some circumstances, they are examples of bicycle components that contribute to rider fatigue.

Climbing is improved with a shorter, higher stem and more upright position than used by the typical road racer. Many bike stores position the handlebars so that the tips are horizontal. Adjust your handlebars so that the tips point slightly below horizontal—this will allow a more comfortable hand-on-the-hoods climbing position whether sitting or standing.

Other

Sunscreen. Eyewear (sunglasses). Cycling gloves. Wind jacket. Cycling computer.

Small Gears

Make sure you have easy gears. Smaller gears save your muscles. Although you may average a higher cadence over the course of a climb, you want to be able to spin a cadence of at least 50 rpm on the steeper pitches.

Although you may be able to push bigger gears for short periods on training rides, if you do not have easy-enough gears during your event you may not finish an event you otherwise can.

Of course, steeper climbs require easier gears. Although some ACE™ rides have grades no steeper than 4%, most have 6% to 8% climbs. *The Tour of the California Alps—Markleeville Death Ride* has many pitches of 10%. A few short sections are steeper.

Almost every strong rider needs at least a 39-27 on ACE™ rides. That means 39 teeth on the small chainring and 27 teeth on the largest cog on the rear wheel. This gearing may be enough for riders who can sustain climbing rates greater than 3,500 feet per

hour up 10% grades. There are generally few such riders in recreational ACE™ events.

Smaller gears are recommended for most riders.

Consider gearing your road bike with:

- A triple chainring. Commonly supplied with a 30-tooth inner chainring. 24, 26, and 28-tooth inner chainrings are also available. Shifting may be marginal with a 24-inner chainring, and fair with a 26-chainring.
- A compact crank that allows for a 34-tooth inner chainring, rather than the standard 39.
- Mountain bike cogs and perhaps a mountain-bike rear derailleur (not yet available for 10-speed).
- A combination of a smaller chainring and larger cogs.

For information about derailleur capacities, see *Appendix B: Rear Derailleur Capacities* on page 118.

Gearing Math

Climb at about 2,000 feet per hour up 10% grades? Let us do the math:

2,000 feet up climbing per hour up a 10% grade means you are riding about 20,000 feet along the road per hour, or about 333 feet per minute.

A 28-inch wheel travels 28/12 feet x π x cadence x gear ratio per minute.

Therefore, for a 10%-grade-2,000-foot-per-hour climber, cadence x gear ratio = 45.

To keep a cadence above 50 rpm on a 10% grade you need a gear ratio of less than 0.9.

I suggest a 30-34. That is a 30-tooth front chainring (generally the smallest chainring of a road triple) and a 34-tooth rear cog. This is a gear ratio of 0.88.

To make this set-up, you need a triple chainring and a mountain bike cogset.

Perform the ACE™ Gearing Test

Although you may occasionally allow your cadence to drop to as low as 50 rpm on the steepest pitches, in general you would like to have the option to be able to keep cadence above 70 rpm and your heart rate under 75% on long grades.

Do the ACE™ gearing test: Ride up a long grade similar to ones you will face during your ACE™ event. Can you keep cadence over 70 rpm and heart rate under 75% of max? If not, you need easier gears.

The Tour of the California Alps—Gearing Recommendations

Finishing Time	Gearing at Least Chainring-Cog
8 to 10 hours	39-29, 36-27, or 34-25
10 to 12 hours	39-34, 36-32, 34-29, or 30-27
12 hours or more	30-34, 28-32, 26-30, or 24-27

Table 10. Gearing based on finishing times. Chainring teeth of 34 or 36 imply a compact crank. Chainring teeth of 24 to 30 imply a triple. Cog teeth of 29 imply Campy. Cog teeth of 30 to 34 imply mountain bike cogsets.

Gearing Summary

I often hear riders complain that they did not have easy enough gears. No one has ever complained to me that they had too easy gears. Even if you end up having a “bail-out” gear you never need, so what? There are plenty of other gears you will probably never use. Like that 53-12.

You are not a wimp to have easy gears—you are smart.

Rims

Although deep-dish aero-rims may have some advantages for riding at speed on level-ground, they are often heavier than standard lightweight road wheels. They are also difficult to handle when descending with crosswinds.

Check Tires

Replace old, worn, or cut tires two weeks before the event. Inflate tires to recommended pressures at altitude within a day of the ride.

Check Cables, Brakes, and Derailleurs

Replace worn or frayed cables two weeks before the event. Check brake pads and derailleurs.

Lubrication

A little dab will do ya—make your drive train more efficient and allow you to ride more easily.

Lose Needless Weight

Do not laugh. I have known people to ride epics like this with kickstands. Every pound is twenty seconds for every hour of climbing. An extra 10 pounds can add half an hour to your time.

Be Prepared

Bring tool bag, spare tubes, tube repair kit, tire removal tools, and a pump. Carry some of your own energy food. Have emergency money and ID. A clear garbage bag weighs almost nothing and can save you if the weather turns cold or rainy.

Part 6: Medical Problems[6]

Saddle Soreness

Sores of the buttocks and groin area are a common occupational hazard for the bicycle rider. Many causes can be avoided. Specific treatment is available if saddle sores do develop.

Crotchitis is dermatitis: irritation or inflammation of the crotch. Redness, itching, and pain are problems in this area.

Classic Saddle Sores

Classic saddle sores are inflamed and/or infected hair follicles (folliculitits, furuncles, and carbuncles) and glands (sweat and sebaceous).

Causes

- Infection
- Pressure and jarring
- Friction and shearing forces

Saddle Sore Theory

There are two prevalent theories as to the origin of classic saddle sores.

The first has to do with infection and blocked glands. Bacteria get into glands and cause saddle sores. Therefore, treatment is directed at reducing the level of skin bacteria and preventing pore blockage.

6 Adapted from *Bicycling Medicine*, published by Simon & Schuster, 1998.
The topics in this part are discussed for informational purposes. This information is not a substitute for professional care. Seek help if problems are more than mild, if you are uncertain about self-treatment, or if problems do not respond promptly.

The second theory has to do with (a) pressure and jarring and (b) friction and shearing forces. According to this theory, increased saddle pressure (which often arises through increased miles) prevents small blood vessels from bringing blood to the skin and the skin gets less nutrients. This causes a breakdown in the skin's defenses, pore irritation, and blockage. Trapped bacteria may proliferate. A saddle sore develops.

Predictably, saddle sore incidence increases with increasing volume. Saddle sores are also more common after long easy rides: when riders do not push down hard on the pedals, they sit heavier on the saddle.

Riders who always get saddle sores on the same cheek may find that their leg on that side is shorter. The buttock of a shorter leg gets more bumping and bruising.

Other Types of Saddle Soreness

Dermatitis/Crotchitis

Skin inflammation of the crotch, is a topic unto itself, discussed in detail below.

Ischial Tuberosity Pain

This is pain in the area of the pelvic bones that bear your weight on the bicycle seat. The ischial tuberosities are the "sitting bones."

Pain in this area occasionally progresses to bursitis, tuberositis, or ulceration.

Chafing

- Thigh. Chafing of the inside of the upper leg is common in cyclists. It occurs because of friction caused by the repeated rubbing of the inside of the thigh during the up and down motion of the pedal stroke.

  Many cyclists note that the inside of their shorts pill and wear with friction. When this happens to your inner thighs, redness and discomfort are the results. Dampness of cycling shorts related to sweat production and the lack of breathability of the

shorts' material may make the problem worse.

- Vaginal area. The mucous membranes are delicate and sensitive. They do not have the protective hardness of skin. Many seats, positions, and riding styles expose these tissues to pressure, jarring, friction, and shearing.

  Chafing near the urethra can cause urinary tract symptoms and infection.

Skin Ulceration

Skin that is missing its topmost surface layers and denuded is ulcerated. This is sometimes an extreme result of chafing or pressure.

Hemorrhoids

Dilated veins near the anus. Active hemorrhoids external to the sphincter of the anus may contain blood clots and be painful. Folds of hemorrhoidal tissue may trap moisture and be itchy.

Although generally not thought to be caused by cycling, sitting on a saddle may increase discomfort or irritation.

Relatively Rare Problems

- Subcutaneous nodules: These are a specific type of lump found in high-volume male cyclists near the scrotum, sometimes called "extra testicles."
- Tailbone abscess: A genetic predisposition to a blocked pilonidal sinus may be aggravated by cycling and become infected. Surgical treatment is often advised.

Dermatitis/Crotchitis

Many cases of crotchitis are related to a combination of factors. In addition to the causes of classic saddle sores outlined above, the following worsen crotchitis:

- Warmth and moisture
- Hygiene and irritants
- Allergies
- Yeast overgrowth
- Vaginal infections
- Medical problems, including dermatitis

Warmth and Moisture

Warmth and moisture aggravate most cases of crotchitis.

Warmth also increases skin friction and predictably worsens friction and shearing related saddle soreness.

Avoid traveling to races or rides in your car already wearing your bike shorts. Change into bike shorts when you arrive. Use bike shorts with a breathable, moisture-wicking crotch. Change out of moist or wet bicycling shorts as soon as possible after riding. Wear loose-fitting shorts or a skirt. Wear breathable fabrics and cotton underwear. Avoid tight-fitting non-breathing underwear, or wear no underwear. Pantyhose is an enemy of the crotch.

Allow ventilation to cool and dry the area. Avoid sitting on non-breathing surfaces such as plastic and leather. Use a car seat cover with air holes if your car has vinyl or leather seats.

Baby powder may help keep you dry. It also reduces friction and shearing forces.

Hygiene and Irritants

Stool is a powerful irritant. Clean yourself properly.

Overzealous hygiene can be just as much of a problem as lack of hygiene. When you are irritated, wiping, and rubbing can cause chafing and further irritation. Since this area always has some bacteria, and since irritated skin is prone to worsen and become infected, overzealous wiping must be avoided.

Avoid wiping affected areas with rough toilet tissue.

Wipe from front to back. Women: Do not carry bacteria toward your vagina and urethra. Not only will this worsen crotchitis, but urinary tract infections and vaginal infections may result as well.

Avoid local irritants such as harsh soaps.

If crotchitis extends to areas you need to wipe to keep clean, consider using softer-quality bathroom tissue, facial tissue, or gentle

medicated over-the-counter products such as Tucks.

Moistened toilet paper or plain water are also alternatives. Clean, and then pat—not wipe—dry.

Allergies

Many products may cause skin allergies.

Riders may be allergic to certain laundry products.

Some riders use perfumed or chemically treated products such as sprays, sanitary napkins, or lubricating oils to which they may be allergic.

To help with saddle sores near the crotch, riders may use tapes or pads to which they may have a tape allergy. This worsens saddle sores into saddle sores plus crotchitis.

If you suspect a laundry product allergy, try a fragrance-free laundry detergent, use a double-rinse cycle, and if you use a dryer fabric softener, make it fragrance-free.

Yeast Overgrowth

Yeast overgrowth is commonly called jock itch or crotch rot. Warmth, moisture, and friction, discussed above, are the principle causes.

Over-the-counter antifungal creams and powders may help reduce yeast overgrowth.

Occasionally irritated skin can also be helped by over-the-counter cortisone cream, although cortisone sometimes worsens yeast overgrowth. Long-term use of cortisone creams thins the skin and is a bad idea.

Vaginal Infections

The extra moisture related to a vaginal infection may worsen crotchitis. Treating the cause of the underlying vaginal discharge may help improve crotchitis.

Occasionally infections such as herpes cause crotch irritation. In turn, crotch irritation can also promote or exacerbate herpes outbreaks in people who harbor the virus.

Infected or otherwise blocked sweat or other glands may develop into crotchitis if friction worsens these conditions.

Medical Problems

Riders with skin conditions such as psoriasis or other eczemas may have flare-ups in this area related to friction and other general factors listed above.

Occasionally other medical problems such as lactose intolerance or pinworms are the cause.

Prevention of Saddle Soreness

The best treatment is prevention.

Some general measures will help almost all causes of saddle soreness.

Some treatments may improve some cases but may make other cases worse. It may therefore be important to determine the cause of your saddle soreness.

Pressure and Jarring

A more comfortable ride reduces the causes of most saddle soreness. Even without specific saddle soreness problems, the hints below provide a more enjoyable ride.

Frame and fork. Construction methods and materials may allow for more or less comfort. Comfort is often sacrificed for responsiveness or cost. Butted tubes are more comfortable than straight-gage tubes. Relaxed, shallow touring seat-tube angles are more comfortable than those of steep-angled time trial bikes. Straight-bladed forks tend to transmit road forces more directly than raked forks.

- Wheels. Tightly-tensioned spokes give a harsher ride.

  Use wheels with a 3-cross spoking pattern. The trend of modern wheels to be radially laced may marginally reduce wind resistance. However, these stiffer wheels do not have give.
- Tires. Avoid narrow, high-pressure tires. Unless you are time trialing, a wider tire with about 100 psi is more comfortable.

  If you are 150 pounds, although you can certainly ride 19 mm

200-psi tires, you will be much more comfortable on 23 or 25 mm tires inflated to 100 psi.

- Seatpost. Use a seatpost with an offset seat clamp. Binding the saddle directly above the seatpost is not as comfortable as the traditional offset clamp.
- Saddle. It may take a few tries to find a saddle shape that fits your anatomy.

  Use seats that provide enough padding or support and spread the support over as wide an area as is compatible with your anatomy.

  A cutout center section may reduce or eliminate pressure and irritation on the centerline of the crotch.

  Terry saddles work well for many riders, especially women.

  Severe cases may require drastic measures—cutting or paring your seat may be necessary to keep riding.
- Pad. Whether it be more padding on the saddle, a neoprene saddle cover, or gel shorts, padding helps reduce jarring.

  Do not confuse cushy with support. Those big wooly saddles do not usually work for longer rides.

  Padding elsewhere also helps. Handlebar tape and glove padding makes your upper body more comfortable, allows you to ride more relaxed. This translates to reduced tension and pressure on your rear end.
- Adapt. Do not suddenly and drastically increase your weekly mileage.

Friction and Shearing Forces

- Emollients. Friction can be minimized by using an emollient skin preparation, such as Vaseline, or an anti-yeast cream. Avoid pore-blocking emollients on the scrotum or vulva.
- Layers. A seat cover or pad fitted over your saddle, or two pairs of cycling shorts may reduce friction and shearing forces and function in the same way as a sock in a shoe.

  However, if crotchitis is related to warmth and moisture, Vaseline or doubling up on your shorts may make things worse.

Bicycle Position

- Frame geometry. Most bicycles are sized for men, making the top tube stem length too long for most women even if the frame fits otherwise. This puts extra pressure on the crotch. Make sure your bicycle position is not too stretched out.
- Seat angle. A slight nose-down position may help, especially for time trial events or criteriums when you are in an aerodynamic position and putting a lot of pressure on the crotch.

  A minority of women prefer a nose-up position so that the saddle presses more on the pubic bone and less on the soft tissues around the vagina.
- Vary your position. Move around frequently; get off that saddle when you can.

  Stand up on your pedals to relieve crotch friction and pressure.

  When climbing, stand up periodically.

  When descending, put weight on your pedals and get off your crotch. This allows moving air to cool and dry your crotch while you relieve pressure.

  If you are riding tandem, be sure to take frequent crotch breaks by getting out of the saddle at stop signs and stoplights and by standing out of the saddle with your partner at least every 15 minutes.

Crotch Hygiene

- Keep yourself dry. Modern synthetics wick away moisture and are softer on the skin than traditional leather chamois. Do not continue to wear wet sweat-drenched shorts after riding. Change into loose shorts that allow air to circulate. After bathing, allow your crotch to dry completely before putting on tight-fitting shorts or cycling shorts. Powder in your shorts can prevent chafing that may lead to irritation and infected blocked glands (although powder may be linked to some cervical problems in

women).

- Keep yourself clean.
- Have a hot bath after rides. Hot-water soaks increase blood circulation to the crotch, allowing faster recuperation.
- Always wear clean cycling shorts. Avoid wearing the same shorts two days in a row without laundering. Soiled shorts not only have more bacteria, they do not breathe as well as freshly laundered ones.
- Avoid cycling shorts that are pilled or with seams in areas that either rub the inside thigh or upon which pressure is placed.
- Avoid shaving above the short line to the groin. This often results in "red spots," caused by irritation and infection.

Self-Treatment

- Apply all the preventative measures described above.
- Modify your training. You do not have to stop cycling but you may need to back off. It is not the time to increase mileage. A couple of years ago when I had some bad saddle sores, I modified my routine. Tuesday was hill sprints, Wednesday long hill climbing, and Thursday hill intervals—all done out of the saddle and off my sores.
- Soak in a comfortably hot bathtub three times a day for 15 minutes. Hot-water soaks increase blood circulation to the inflamed area, allowing more of the body's healing factors access to the area.
- For classic saddle sores or ischial tuberosity pain, pad your skin with padded tape or moleskin. You may want to reduce the tackiness of moleskin by first applying it to something other than your skin. Leave some tack so that it will still stick, but not so much that it pulls your skin and hair off when you remove it later.
- Another possibility is to take a couple of Band-Aids or a layer of moleskin and cut out a small hole for the sore—effectively padding around the sore and taking pressure off the sore itself.
- The extra padding of a second pair of shorts worn over the first may help reduce jarring or friction related saddle sores. However, two pairs of shorts may worsen dermatitis/crotchitis.
- A padded seat cover may help.
- A different seat may help.
- Suspension may help. Rear-end suspension or beamed seat tubes reduce saddle pressure.
- A modification of seat position—nose up or down, forward or back, up or down—may help.
- An emollient, such as Vaseline, may help friction-related problems.

  Use emollients such as Vaseline or Bag Balm on the buttocks. Avoid pore-blocking emollients, such as Vaseline and Bag Balm in the gland-rich areas of the scrotum or vulva.
- Try Bag Balm, originally a veterinary product. The active ingredient, 8-hydroxyquinoline in petrolatum, increases the thickness of the skin.
- Topical cortisone, antifungal and antibacterial creams may occasionally help. Long-term use is not recommended.
- Shimming the shoe of the shorter leg may help if saddle sores are related to leg length discrepancy.

Medical and Surgical Treatment

- Eczema may require prescription cortisone creams.
- If hemorrhoids may it difficult to sit down, minor surgery may be necessary.
- If the area around the sore is infected, it may require surgical drainage or antibiotics.
- Uninfected sores that remain as painful, swollen, hard lumps can occasionally be treated with a cortisone injection.
- Occasionally surgery may be required to remove chronic cysts.

Bicycle Seat Discomfort

Both men and women may have problems finding a comfortable saddle—although women have more trouble than men do.

Most of us are aware that the shape of a woman's pelvis is different from that of a man's. In fact, there are three or four common shapes to the pelvises of women, and some women do have an android shape similar to that of men. For this reason, the shape of a saddle that will provide the most comfort is an individual affair. Whereas most men will find the same kinds of saddles comfortable, this is not the case for women. You will probably need to try saddles of different shapes to determine the type that best matches your anatomy.

Seats: padding or no padding, gel-filled or not? The answers to these questions depend upon your riding style and the type of riding you do. Some saddles, such as the Terry, have a wide acceptance with many women. Some thin seat covers, such the one made by Pearl Izumi, allow an extra layer between you and the saddle to absorb rubbing, preventing your own anatomy from being chafed.

Sometimes problems of seat comfort are related to the general fit of a bicycle. Most bicycles are designed for men. Most bikes are sized with too long a top tube. This too-stretched-out position can make the seat uncomfortable near the pubic bone.

Seat position traditionally has been with the nose of the saddle pointed slightly up or level. Some women need the nose pointed just slightly down in order to be comfortable and avoid irritation of the urethra—the tube that carries urine from the bladder. The time-trialing position is the worst for most women. Improved flexibility may allow you to rotate your pelvis as you ride, reducing pressure on your pubic area while at the same time allowing you to bend over and achieve a more aerodynamic position.

Genital Numbness

What We're Talking About

Many men find that their penis feels numb or has a pins-and-needles sensation during or after riding. The penis may feel "asleep," swollen, or "not there." Usually just the shaft of the penis is the problem, but sometimes the numbness may extend to the scrotum and the base of the genitals. Women similarly may experience numbness in the genital area. The problem is worse for longer rides, and worse after time trialing or riding for prolonged periods bent over in the drops or aero bars.

Causes

The cause is pressure on the pudendal nerve. The nerve becomes compressed between the bicycle seat and the symphysis pubis of the pelvic bone. Debate exists whether the nerve itself is being compressed, or the small blood vessels that feed the nerve. Regardless, the effect is a disturbance in the functioning of the nerve and the tissues it supplies.

Treatment

The best treatment is prevention. The usual cause is riding bent over for too long. Take rests from this position. Stretch, and get the pressure off your genitals every five minutes by standing on the bike or otherwise changing your position.

Use a seat position that points the nose of the saddle down a little bit more or lower the height of the seat. A padded or different saddle may be helpful—perhaps a differently shaped saddle with a different width. Padded bicycling shorts may help.

Long-Term Complications

Occasional nerve disturbance in this area usually resolves rapidly when pressure is relieved. Most riders regain normal sensation within minutes. Sometimes as much as twenty-four hours is required for the nerve to return to apparently normal function. Rarely more than a day is required. The longer it takes the nerve to return to normal, the more damage is being done. Some small but real risk does exist for permanent damage unless you correct the problem.

Men: This problem has nothing to do with the ability of your body to produce testosterone, the male hormone. It has nothing to do with your ability to produce sperm. However, a numb penis is sometimes an “unfeeling” penis. Some men may have a problem with obtaining an erection, whereas others who achieve orgasm rapidly may find sexual relations improved because the reduced sensation helps them last longer.

Regardless, a numb penis should be avoided as much as possible because of the possibility of permanent nerve damage.

Neck Pain

What We’re Talking About

Pain in the back of the neck that may or may not travel upward and cause headache. See a doctor whenever neck pain is associated with loss of sensation, loss of power or pain in your arms. Pain in the front of the neck or in the jaw associated with exercise can originate from the heart. See a doctor if you experience this kind of pain.

Causes

Neck pain can be a result of strain or overuse. The pain may travel to the back of the head and become more generalized. If nerves are involved, it may travel to the arms. It is usually due to one of these causes:

Muscle strain and/or spasm.

- Arthritis—usually wear-and-tear/degenerative arthritis, or osteoarthritis. Strain on the vertebral joints from misalignment, often secondary to disc degeneration, also causes pain.
- A bulge or herniation of an intervertebral disc. This may cause pain that travels to the arms. If you have arm symptoms associated with neck pain, see a doctor.

In younger cyclists, neck pain is usually due to muscle strain. In older cyclists, a combination of muscle strain and degenerative changes is often responsible. Degenerative—wear-and-tear—changes are aging-related, not cycling-related.

Cycling-related neck strain is often associated with long rides. As primary muscles tire, form or technique worsens. Riding big gears tires primary muscles faster than smaller gears. Tendons, ligaments, accessory muscles, and joints bear loads normally born by primary muscles. This can cause strain or sprain with pain and/or swelling.

Position on the bike can be a factor. Cyclists lacking flexibility may find the aerodynamic bent-over racing position uncomfortable. Anything that forces the rider to increase stretch in the neck may cause neck pain. For example, women tend to ride bikes with top tubes that are too long for them, since most bikes are designed for men. Women have relatively longer legs and relatively shorter reaches.

Jarring from rough mountain bike riding can be a factor. Road rides are worse for riders who forget to look around.

Neck pain may additionally be non–cycling-related, arising from:

- Muscle tension due to stress, anxiety, depression, or fatigue
- Poor posture

Treatment

On the Bicycle

If your problem is due to long rides:

- Allow for a gradual increase in endurance riding. Increase the length of endurance rides no more than 10% per week.
- Consciously relax your upper body—back, elbows, and neck—every few minutes. Changing hand positions will change neck position and in turn reduce strain.
- Ride with a higher cadence—use smaller gears.
- Stretch your neck on the bike. Look around—do not focus only on the pavement directly in front of you.
- A helmet is a must for safety—but make sure yours is lightweight.

If your problem comes from craning of your neck on the bike:

- Ride with a more upright posture.
- Ride on the hoods or tops of the handlebars. Avoid the drops. Use a more upright bar.
- Reduce the distance you need to stretch. Raise or shorten the stem. Use narrower handlebars. Get a bike with a shorter top tube.

If your problem is due to jarring:

- Use wider tires.
- Use lower tire pressure.
- Get a gel saddle.
- Use padded gloves and pad handlebars or grips.
- Use a suspension system.
- Ride a mountain bike on road rides.
- Consider a recumbent bike.

Off the Bicycle

R.I.C.E. Discussed in Bicycling Medicine.

Strengthening. Strengthening the neck muscles may help. Do not work on these muscle groups while you are still injured. Isometric neck exercises are helpful: use your hand to resist the motion of your head up-and-down and side-to-side. Shoulder shrugs are helpful.

Stretching. Helps some people. Voluntary range of motion exercises may help increase the flexibility of your neck. Avoid active range of motion exercises with machines, weights, or forcing your neck into positions—they may result in injury.

NSAIDs. Anti-inflammatory pain medicines are useful and are discussed in more detail in *Bicycling Medicine*.

Surgery. Usually the last-resort treatment. A surgical emergency may exist if the nerves being pinched in the neck interfere with muscle sensation or power elsewhere in the body.

Chiropractic Manipulation. Symptomatically helps some people with pain, although many traditional physicians dispute its effectiveness.

Low Back Pain

What We're Talking About

Low backache that makes riding uncomfortable. Pain that forces you to slow down or get off the bike. See a doctor whenever back pain is associated with loss of sensation or power in your legs.

Causes

Back Strain

Acute low back pain can follow strain or overuse. The pain may travel to the buttock or thigh, but if nerves are not involved, it does not travel below the knee. It is usually due to:

- Muscle strain and/or spasm.
- Arthritis—usually wear-and-tear/degenerative arthritis, or osteoarthritis. Strain on the vertebral joints from misalignment, often secondary to disc degeneration, also causes pain.
- A bulge or herniation of an intervertebral disc. This is discussed more under "Nerve Compression," below.

In younger cyclists, back pain is usually due to muscle strain. In older cyclists, a combination of muscle strain and degenerative changes is usually responsible.

Cycling-related back strain is often related to long rides, big gears, or hill work. Big-gear riding and hill climbing—especially on long grades—results in back pain because riders tighten their back muscles to get more power.

Riding big gears also tires primary muscles faster than smaller gears. As primary muscles tire, form or technique worsens. Tendons, ligaments, accessory muscles, and joints bear loads normally born by primary muscles. This can cause strain or sprain with attendant pain and/or swelling.

Position on the bike can be important. Cyclists lacking flexibility may find the aerodynamic bent-over racing position uncomfortable.

Anything that forces the rider to increase stretch may cause back pain.

Jarring from rough riding can be a factor.

Chronic low back pain may additionally be due to non–cycling-related factors, such as:

- Leg-length difference
- Swayback
- Deconditioning and poor posture
- Muscle tension—due to stress, anxiety, depression, or fatigue

Nerve Compression—"Pinched Nerve"

The spinal cord travels down inside the spine, or vertebral column. The vertebrae are cushioned, one from the other, by discs composed of fiber-like and jelly-like material. The spinal nerves exit between the bones of the spine, or vertebrae. Sometimes the nerves are pinched by a disc, which has been squeezed out of position between two vertebrae, or by the bones themselves.

The spinal nerves of the lower back form the sciatic nerve, which travels down the buttocks area and the back of the thigh. The various component spinal nerves then travel to various parts of the leg.

Nerves have pain sensors; other sensory fibers; and motor, or muscle-moving, fibers. The progression of severity of pinched nerves is usually pain, sensory change, and muscle weakness, in that order. Sensory changes include a pins-and-needles sensation, tingling, and areas of numbness.

When a nerve is being pinched, symptoms may occur along the area supplied by the nerve. Pain that radiates from the buttocks down the back of the thighs is commonly called sciatica. Pinched nerves in the back are the most frequent, but not the only, cause of sciatica. Occasionally the nerve is pinched in a buttock muscle, the piriformis, rather than in the spine.

Obtain a consultation with a physician whenever you experience sensory change or muscle weakness.

Treatment

On the Bicycle

If your problem is due to excessive exercise load:

- Allow for a gradual increase in endurance riding. Increase the length of endurance rides no more than 10% per week.
- Ride with a higher cadence—use smaller gears.
- If big gears are in your training program, allow yourself to adapt to them slowly.

If your problem is due to hills:

- Reduce hill mileage and then adapt to increased mileage slowly.
- Shift your position every so often from seated to standing. Consciously relax your back every few minutes when climbing.
- Take a rest break at the side of the road on long climbs. Enjoy the view!

If your problem is a too stretched-out position on the bike:

- Reduce stretch by assuming a more upright posture. Ride on the hoods or tops of the handlebars.
- Reduce the distance you need to stretch. Raise or shorten the stem. Use narrower handlebars. Get a bike with a shorter top tube.

If buttock pain or sciatica is related to nerve pressure in the piriformis muscle:

- Get a gel-filled or a more compliant saddle.

If your problem is due to jarring:

- Use wider tires.
- Use lower tire pressure.
- Get a gel saddle.
- Use a rear suspension system.
- Ride a mountain bike on road rides.
- Consider a recumbent bike.

Off the Bicycle

R.I.C.E. Discussed more fully in *Bicycling Medicine*. Studies show that even the worst strains require, at most, a few days of bed rest. Mild strains may disappear as soon as you are off the bike. Ice or heat may help.

Strengthening. Strengthening the back and abdominal muscles may help. Do not work on these muscles while you are still injured. Climbing or gradually increasing mileage will often adapt the body sufficiently. Bent knee sit-ups, crunches, back extensions, pelvic tilt exercises, and rowing strengthen the back and abdominals.

Stretching. Helps some people. Back flexion exercises are most helpful. In individuals who have lost the normal curve, giving a flat back, extension exercises are more useful. Hamstring stretching relieves some of the need for the back to bend, and can help.

NSAIDs. Anti-inflammatory pain medicines are useful and are discussed in *Bicycling Medicine*.

Orthotics. A heel lift or cleat shim may help if a leg length difference exists.

Surgery. Usually the last-resort treatment. A surgical emergency exists if the nerves being pinched interfere with bowel or bladder function, or if rapidly progressive leg weakness occurs.

Weight Loss. Lessens back pain in many who are overweight.

Chiropractic Manipulation. Symptomatically helps many with back pain, although many traditional physicians dispute its effectiveness.

Posture Hints for Low Back Pain

- Sit or stand using a footrest to bend the knee and hip of one leg.
- Lie either curled up on your side, or on your back with pillows under your knees. Do not lie on your belly. When rising from a lying position, roll to your side and push yourself up with your arm.

- Bend from the hips and knees; avoid bending from the waist.
- Carry or lift only what you can handle with ease.
- Turn and face the object you wish to lift.
- Hold heavy objects close to your body.
- Avoid lifting heavy objects higher than your waist.
- Avoid carrying unbalanced loads.
- Avoid sudden movements.
- Change positions frequently.
- Work with tools close to the body. Avoid long reaches when raking, hoeing, mopping, or vacuuming.
- Sit down to dress. Bend your leg when putting on shoes and socks; do not bend from the waist.
- Wear low heels.

Cyclist's Palsy

Ulnar Neuropathy

What We're Talking About

Pain, tingling, numbness, and weakness in the hand along the course of the ulnar nerve. The symptoms usually manifest themselves in the pinky and ring fingers, and are worse during riding or for several hours after. Although this problem usually improves after riding stops, it can lead to permanent nerve injury if ignored.

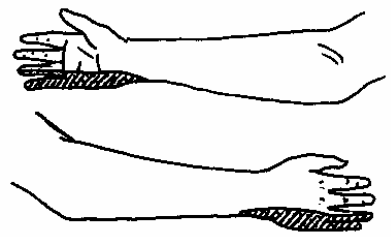

Figure 31. Ulnar nerve pathway in the hand.

Causes

The ulnar nerve in the heel of the hand (the fleshy part of the hand below the pinky) is compressed.

Cycling-related causes include:

- Extended saddle time. The longer you are in the saddle, the more time other factors act to press on the hand.
- Rough terrain; jarring of the hands while gripping the handlebars.
- Improper hand position. Too much time on the tops with the heel of the hand pressed against the bar.
- Too much pressure. Weight distribution too far forward puts more pressure on the hands, wrists, and arms.

The affected hand is usually the one that stays on the handlebar—the one that does not reach for the water bottle.

Treatment

On the Bicycle

Keep pressure off the heel of the affected hand when riding:

- Reduce mileage:
  Readapt slowly.
- Prevent jarring:
  Use padded or gel gloves.
  Use padded, even double, handlebar tape; or padded grips.
  Use wider tires and/or lower tire pressure.
  Try suspension.
- Improve hand position:
  Reposition your hands frequently.
  Relax your hands, wrists, and upper body.
- Reduce pressure:
  Avoid placing pressure on the heel of your hand.
  Vary your position.
  Raise the stem height.
  Check that your seat is not too far forward.
  Use a shorter stem.
  Avoid tilting the saddle down.
  Use a shorter top tube.

Medical Treatment

NSAIDs. May be helpful, but the best approach is to get pressure off the heel of your hand when riding. Read more about anti-inflammatories in *Bicycling Medicine*.

Knees

What We're Talking About

Knee problems are common in cyclists.

We are talking about overuse injuries—knee problems related to the repeated and constant stresses of riding over time—which are one of the most frequent reasons cyclists seek medical advice.

Some knee problems are the result of sudden injuries related to trauma: a bicycle crash, or the sudden tearing of a cartilage or ligament. Sudden injuries, injuries with significant local swelling (water on the knee), knee clicking, knee instability, and knee collapse are not discussed here. Torn ligaments, torn menisci, and fractures generally require prompt professional medical attention.

Significant local redness or warmth may indicate an infection and requires prompt medical attention. Those with a history of gout or other forms of arthritis are advised to seek medical attention. The different kinds of knee arthritis are not discussed in this book.

With proper positioning, cycling helps many knee problems.

Bicycle Position Adjustment for Knee Pain

The basic position considerations are seat position and foot position.

The seat may be:

- Too low or too high.
- Too far forward or too far back.

The feet may be:

- Too far apart or too close together.
- Too toed in or toed out.
- Too far forward or too far back in relationship to the pedal axle.

When the problem is the distance between the feet, correction may be made by:

- Changing the cleat position.
- Using a different length of bottom bracket axle.
- Using cranks with a different offset.
- Using a shim between the pedal axle and the crank.

Foot rotation may be a factor:

- Pedal flotation allows the foot to rotate on the bicycle pedal. This freedom of motion has helped many riders for whom the fixed-cleat position has contributed to knee strain.
- Too much float may also be harmful; a limitation of flotation may allow some overuse injuries to improve.

Knee Location as a Clue to Treatment

Knee complaints can usually be identified as being in the front (anterior), inside (medial), outside (lateral), or back (posterior) of the knee. Internal (within) derangements of the knee are mostly left out of this book—they generally require orthopedic consultation.

Even without understanding the root of the problem, knowing where the knee hurts makes it possible to recommend certain bicycle-position changes.

These are outlined in Table 11 below.

Location	Causes	Solutions
Front of knee	Seat too low	Raise seat
(Anterior)	Seat too forward	Move seat back
	Climbing too much	Reduce climbing
	Big gears, low rpm.	Spin more
	Cranks too long	Shorten cranks
Inside of knee	Cleats—toes point out	Modify cleat position—toe in
(Medial)		Consider floating pedals
	Floating pedals	Limit float to 5 degrees
	Exiting clipless pedals	Lower tension
	Feet too far apart	Modify cleat position—closer
		Shorten bottom bracket axle
		Use cranks with less offset
Outside of knee	Cleats—toes point in	Modify cleat—toe out
(Lateral)		Consider floating pedals
	Floating pedals	Limit float to 5 degrees
	Feet too close	Modify cleat position—apart
		Longer bottom bracket axle
		Use cranks with more offset
		Shim pedal on crank 2 millimeter
Back of knee	Saddle too high	Lower saddle
(Posterior)	Saddle too far back	Move saddle forward
	Floating pedals	Limit float to 5 degrees

Table 11. Knee Pain Causes and Diagnosis

Achilles[7] Tendonitis & Bursitis

Where is the Problem?

The gastrocnemius and soleus muscles merge near the heel to form the Achilles tendon. It attaches to the tuberosity of the calcaneus bone.

Figure 32. Achilles tendonitis/bursitis. Picture of the back of a right heel. The red dotted line shows the Achilles tendon. The red oval outlines the area where the Achilles tendon inserts into the calcaneus. This is the most common location of Achilles tendonitis or bursitis pain.

Achilles Tendonitis Causes

Excessive stretch from unaccustomed activity usually causes the problem.

This most often results from a new shoe or cleat, especially when the net consequence is that the extension of your leg has been increased. For example, if you are used to the Shimano clipless system and change to Speedplay, the shoe–pedal distance is reduced. This means you will need to lower your seat. If you do not, excess stretch occurs, and you are at risk for Achilles tendonitis.

Somewhat paradoxically, a seat that is too low can also cause a problem. In an attempt to get more power, the rider may drop the back of the foot on the downstroke, placing excessive and repeated stretch on the Achilles tendon.

If you have unequal leg lengths, the shorter leg is more likely to have an Achilles tendon problem.

A cleat too far forward or positioned so that the foot is toed in can occasionally cause this problem. A forward positioned cleat results in a forward pedal pivot point that may result in increased ankle motion and Achilles strain. Soft or flexible soles may also contribute to the condition.

Faster cadence tends to be associated with more riding “on the toes” and less Achilles motion. Slower cadence tends to result in more motion of the ankle and stretching of the Achilles. An increase in volume may be associated with shortening of the calf muscles and increased stretch of the Achilles.

Therefore, an increase in riding, especially an increase in relatively low-cadence climbing volume, may be a precipitating cause.

Muscles shorten when cold. Therefore, cold weather riding, especially when the back of the sock gets wet and keeps the ankle cold, also causes the problem.

Riders who start wearing two pairs of cycling shorts (perhaps to reduce saddle soreness), or thick tights over shorts, or begin using a seat pad effectively increase their saddle height and put more strain on the Achilles.

Therefore, an early season climbing endurance training camp,

[7] **Achilles Heel: The Myth**
According to Greek mythology, Achilles was the son of Thetis and Peleus, the bravest hero in the Trojan War. When Achilles was born, his mother tried to make him immortal by dipping him in the river Styx. As she immersed him, Thetis held him by one heel and forgot to dip him a second time so that the heel she held could get wet too. Therefore, the place where she held him remained untouched by the magic water of the Styx; that part stayed mortal or vulnerable. Achilles fought heroically against the Trojans, but was killed by Paris, who shot an arrow into his heel. Paris's hand was guided by Apollo who took revenge for the death of his son.
To this day, any weak point is called an “Achilles heel.”

with cold or wet weather or both, is a classic set-up for Achilles problems.

Achilles Tendonitis Treatment

Achilles problems can be easy to treat if treatment is started early. Achilles problems may become chronic and last on-and-off for years if you persist in riding with Achilles pain.

Prevention & General Treatment

- Adapt to training volume, intensity, and climbing.
- Lower the saddle by a couple of millimeters if block training for several days, if temporarily using a seat pad, or if wearing double shorts.
- Keep the Achilles area warm with folded-over socks, oversocks, or overboots. Wear longer socks than standard cycling socks and fold the top down making a double layer around your ankle. Not necessarily considered fashionable, but effective. Oversocks and overboots that go over the cycling shoe and cover the ankle are best.
- If it is cold, use full-length leg warmers or tights—not the ¾ length variety that exposes your ankle and lower calf.

On the Bicycle

- Ride only if you are pain free.
- Reduce hill mileage. Hills are harder on the Achilles tendon.
- Reduce the stretch on your Achilles tendon.

  For most riders, this means lowering the saddle a few millimeters or using a heel pad.

  You can buy heel pads commercially, or make your own quarter-inch thick 2” x 2” pad out of cardboard or newspaper.
- Check cleat position. Consider moving cleats rearward.
- Consider strapping your Achilles tendon with athletic tape to prevent excessive stretch.

Off the Bicycle

If this injury is associated with another activity, that activity may need to be modified.

For example, if you have switched to a lower heel on your walking shoe, a heel pad or lift may help. Cut back on walking or hiking, especially up hills.

If you are a runner: Reduce mileage, especially uphill running. Correct biomechanical issues.

Medical Treatment

- R.I.C.E. Rest and hot or cold compresses may be helpful. I prefer heat.
- Stretching. Important once your problem improves, not while it is painful.
- Orthotics: Can help this problem.
- NSAIDs. May be helpful.
- Cortisone: Never. Do not get a cortisone injection here—it weakens the tendon and may cause rupture.
- Surgery. A last resort.

A B C

Figure 33. Achilles stretches. A. On a stair. B. Straight leg stretches gastrocnemius component of Achilles. C. Bent knee stretches soleus component of Achilles.

Achilles Bursitis Cause

The heel counter (back part) of an offending shoe irritates the posterior calcaneal bursa.

Achilles Bursitis Treatment

Prevention

- Adapt to new shoes by using them initially only for short rides. Increase use over at least 10 rides before using new shoes on endurance or intensity rides.
- Choose overboots with zippers positioned off-center, rather than directly over the Achilles, as in Figure 34.

Figure 34. Overshoes. The off-center zippers reduce posterior calcaneal bursa irritation.

Treatment Essential

Avoid the offending shoe, or cut out the offending heel counter.

Medical Treatment

- R.I.C.E. Hot or cold compresses may be helpful.
- NSAIDs. May be helpful.
- Cortisone: Occasionally helpful. Do not get a cortisone injection if the problem is tendonitis—it weakens the tendon and may cause rupture.
- Surgery. A last resort.

Forefoot Problems

Cyclists often experience burning, pain, and/or numbness in the ball of the foot or the toes. Occasionally there is associated itching of the sole of the foot.

Pressure is the usual cause.

Causes

Cycling-Related

Burning, pain, or numbness in cyclists' feet is usually caused by pressure around the foot.

Shoes that are too tight, shoe straps cinched too tightly, or old-style pedal-cleat systems with toe straps that are too tight are the usual causes.

The problem may be seasonal: it is worse in warm or hot weather.

High mileage, climbing, and big gears all increase the volume or intensity of pressure and make things worse.

An improperly positioned cleat, worn cleats, or worn pedals may contribute to the problem.

Sometimes the cause is a medical condition such as arthritis or diabetes.

From a medical point of view, the problem is generally metatarsalgia—pain from the metatarsal bones; or from a neuroma—a swelling of the nerve between two metatarsal heads.

Metatarsalgia

Tenderness is usually under the second metatarsal head. Sometimes it is under the third metatarsal head.

Callous may be present on the skin.

Metatarsalgia may be associated with a Morton's foot: here the second or third toes (those next to and one over from the big toe) are longer than the big toe.

Figure 35. Metatarsalgia. Tenderness is under the second or third metatarsal head. Note: This is half a toe width different from neuroma below.

With this situation, hammertoes (scrunched up deformed toes) commonly develop, and axial (longitudinal) pressure forces the metatarsal toward the sole.

Neuroma

The swollen nerve is usually between the third and fourth metatarsal heads. Less commonly, it is between the second and third metatarsal heads.

Neuroma pain may also be associated with numbness of the webspace of the toes on either side of the involved nerve.

Where the problem is a neuroma, the pedal pressure may squeeze the nerve toward the top of the foot. The circumferential pressure of the fastened shoe may squeeze the nerve between the metatarsal heads toward the sole of the foot. With each stroke, the nerve is pushed up and down between the metatarsal heads and may then become more irritated.

Figure 36. Neuroma Tenderness is between the third and fourth, or second and third metatarsal heads. Note: This is half a toe width different from metatarsalgia above.

This results in a vicious circle. It creates an enlarged nerve that is more prone to injury through repeated friction.

This movement up and down between the metatarsal heads may also be felt as a palpable click during examination of the foot by an astute examiner and is a diagnostic sign of a neuroma: the Muldor click.

Treatment

- Relieve the pressure
  Allow the foot more room in the shoe: Loosen your toe straps, loosen your shoes, wear a thinner sock, or buy wider or larger shoes. When you stop for lunch or take a rest stop—even if only for a few minutes—take off your shoes and wiggle your toes.
- Check your feet
  Where hammertoes exists, buddy tape the hammer toe to the next toe to help keep it straight (there are also splints and other devices sold in drug, grocery, shoe, and foot-specialty stores to do this). Make sure your shoes have enough room for your toes.
- Check your shoes
  An irregularity of the sole (occasionally a manufacturing defect) may press on the ball of your foot. Look for cleat bolts that are pushing through the sole, causing it to be uneven.
- Check for pedal and cleat wear
  Worn cleats or pedals may allow the foot to roll outward on the downstroke. This may exacerbate up/down neuroma cycle described above. Replace them.
- Move your cleats
  Occasionally, the problem relates to cleat position. Usually the cleat needs to be placed farther back, although solutions differ.
- Change pedal systems
  Too little or too much pedal/cleat/shoe contact may contribute to the problem. Generally, more contact is better.

- Try foot exercises
  Two include walking on the outsides of your feet—up to 10 minutes a day total time and picking up objects with your toes—up to 100 times a day.
- Pad your metatarsals
  Metatarsal padding is commercially available.
- Orthotics
  Shoe inserts can spread the pressure, may help. Cycling-specific orthotic are longer than running orthotics. Cyclists who also run may need to correct a pronation problem.
- Last resorts
  Cortisone injection and surgery are available for these problems.

Summary

Almost all riders experience cycling-related forefoot problems. Trigger factors—long rides, hilly rides, big gears, hot conditions, and shoes that are too tight—contribute to these problems. Simple treatments will improve or solve the problems for most riders.

Muscle Cramps

What We're Talking About

Cramps are involuntary muscle contractions or spasms, often sustained and painful.

Muscle cramps can and do affect almost all riders. What can be done to help prevent this problem, and what can be done once cramps occur?

What Causes Cramps?

There are probably many causes of cramps. No one is certain why cramps occur in any individual. Although it is clear that cramps occur within muscles, it is likely that a neurologic reflex (involving anterior horn cells, firing at rate up to 300 per second, much higher than occurs with voluntary contraction of muscle) maintains most cramps.

Some of the more likely causes are:

- Unaccustomed sudden hard exertion or inadequate conditioning. Note that a bicycle position change can result in unaccustomed muscle use.
- Fluid and electrolyte imbalance. This is probably more of a problem in the local muscle cell area than a reflection of overall body electrolyte imbalance or dehydration. Some of the electrolytes implicated are sodium, magnesium, potassium, and calcium.
- Temperature changes. Not being used to cold or hot weather.
- Low blood sugar.
- Glycogen loading. Too much stored carbohydrate in muscle. Too much rest or too many days off the bike.
- Fatigue.
- Accumulation of waste products, such as lactic acid.
- Lack of flexibility.

- Benign nighttime leg cramps, unknown cause, more common in older masters.
- Medical situations, problems or diseases (e.g. thyroid disease, amyotrophic lateral sclerosis, pregnancy, glycogen storage disease, patients on hemodialysis, tetanus, stiff-man syndrome, strychnine poisoning).
- Medications can cause cramps through fluid and electrolyte imbalance, and well as through other mechanisms (e.g. diuretics, or water pills, commonly used to treat high blood pressure; withdrawal from benzodiazepines such as valium)
- Over-the-counter supplements. These can cause cramps through fluid and electrolyte imbalance, and well as through other mechanisms (e.g. creatine has been associated with cramps in some studies).

Prevention

- Train specifically. If you are targeting a long-distance event, incorporate long rides into your training. If you are a racer and will have surges and jumps in your races, train that way.
- Allow time for acclimation if you are traveling.
- Eat a diet rich in carbohydrates, calcium, potassium, and magnesium.
- If riding long or hard in the heat, add sodium to your diet.
- Target-event glycogen loading (high-carbohydrate diet, little or no exercise for a few days before the event) can improve performance. Cramps are less likely if you ride moderately an hour or two the day before your target event.
- Be adequately hydrated before and during rides and races.
- Eat during long rides.
- Review your medications with your physician.

Treatment of Cramps

- Stretch the opposing muscle. If you have a cramp in your quadriceps muscle, stretch your hamstrings. This may interrupt the neurological mechanism of the cramp.
- Stretch or massage the cramp. You may be able to do this while continuing to ride. For a calf cramp, stand on your extended affected leg, pedal at the bottom of the stroke, and drop our heel. For a quadriceps cramp, unclip the shoe of the affected leg, ride with one hand, and use the other hand to pull your shoe up toward your buttock.
- Concentrate on relaxing the affected muscle.
- Apply hot or cold packs. Either may help.

Eye Problems

What We're Talking About

- Scratchy, red, or otherwise irritated eyes.
- Runny eyes.
- Occasionally, a bug or other foreign matter in the eye.

All-day riding exposes the eyes to drying winds, sweat, pollens and other allergens, dust and other pollutants, and bugs. Altitude air is especially dry.

Wind causes the eyes to increase tear production and run. Tears may flow down the cheeks. Tears are also drained through tear ducts into the nose; as a result, the nose may become congested or run.

Treatment

Protect your eyes with eyewear—sunny or not. Wraparound clear glasses or sunglasses provide the best protection. If you already wear glasses, you may find oversized lenses more helpful at keeping out wind and irritants than regular or small lenses.

Cool compresses to the eyes can be very soothing. Over-the-counter eye decongestants such as Visine or Murine can get the red out, but they worsen eye dryness. Use artificial tears instead.

Contact lens wearers and those whose eyes are dry for other reasons may find a commercial tear or wetting solution helpful.

Eyewear Features to Look For

- UV protection. Eye problems such as cataracts and pinguecula—thickening of the inner white corner of the eye—have been linked to ultraviolet light. You are looking for at least 85% UV block, if not 100%.
- Shatterproof. "Unbreakable lenses." Polycarbonate provides fantastic impact resistance with only slightly less optical quality than glass.
- Light reduction. Clear lenses are fine for dark, cloudy days; when it is bright, your eyes will be a lot more comfortable with sunglasses.

Bug in the Eye

Usually natural tearing will wash the bug to the inside lower corner of your eye. Wiping the corner gently usually rubs it away. Dabbing a corner of moist tissue paper may draw the bug out. Do not rub the cornea, the front, seeing part of your eye.

If tearing does not bring the bug to the lower inside corner of your eye, it may be trapped under the upper lid. Carefully dabbing it at this location will usually stick it to the tissue and remove it. Do not dab over the cornea.

The bug may feel as if it is still there if the cornea has become scratched.

If your eye is in spasm and shut, if you cannot see properly, if you get a persistent scratchy feeling every time you blink, if pain persists a couple of hours, or if you are not sure, see a doctor.

Part 7: Training Schedules

Suggested Training: Overview

The following are training guidelines to help you to complete your target altitude-climbing-endurance event.

The minimum level will probably be sufficient if the weather is great—though you may finish with the last 20% of participants.

The moderate level training targets should allow you to finish in the middle of the pack.

The top 20% of riders will likely have large training volumes.

The professional level is just that—the level of professional bicycle racers. Although you may see some very talented amateurs, there probably will not be any true professionals in your field.

Climbing rates are based on a 100-mile event with 10,000 feet of climbing and a 10-hour time limit.

Keep in mind that depending upon your background, you may not have the base fitness to train the larger volumes. More is not necessarily better if you do not have the capacity to adapt to larger volumes.

The single-day climbing volume targets are the most important training priority.

Mileage

Single Day

- Minimum 60% target event on three training occasions
- Moderate 70% target event on three training occasions
- High 80^{+}% target event on three training occasions
- Pro 100% target event on three training occasions

Week

- Minimum 133% target event on three training weeks
- Moderate 175% target event on three training weeks
- High 200% target event on three training weeks
- Pro 250% target event on three training weeks

Climbing Volume

Single Day

- Minimum 60% target event on three training occasions
- Moderate 70% target event on three training occasions
- High 80^{+}% target event on three training occasions
- Pro 100% target event on three training occasions

Week

- Minimum 125% target event on three training weeks
- Moderate 150% target event on three training weeks
- High 175% target event on three training weeks
- Pro 200% target event on three training weeks

30-Minute Maximum Climbing Rate

- Minimum 2,000 feet per hour (1,000 feet)
- Moderate 3,000 feet per hour (1,500 feet)
- High $4{,}000^{+}$ feet per hour ($2{,}000^{+}$ feet)
- Pro $5{,}000^{+}$ feet per hour ($2{,}500^{+}$ feet)

All-Day Sustainable Climbing Rate

- Minimum 1,600-1,800 feet per hour
- Moderate 2,000-2,400 feet per hour
- High $2{,}500^{+}$ feet per hour
- Pro $4{,}000^{+}$ feet per hour

Your Weekly Training Schedule

Plan carefully. You have only a limited amount of time, and must judge how to fit in the various kinds of training that you need.

Weekly Needs

Let us consider what you need as far as training to ride more than 100 miles and 10,000 feet of climbing in one day.

- Once a week you need a long, endurance ride.
- After establishing a base, you need an interval, or above-pace riding day.
- In addition to your hill work on your long endurance ride, you need one day during the week of hill work, or of at least partial hill work.
- You need a rest day, possibly two. Not necessarily off the bike—perhaps a fun social day of riding without stress.
- Many of you will benefit from a strength and stretching program.

General Principles

- Interval days and endurance days are your hardest days.
- You cannot go hard every day. You *can* build up to riding hard 2 days in a row.
- Intervals make you faster and stronger overall.
- The best way to be a good hill climber is to climb hills.

Specific Training Goals

- To gain the endurance you need, ride at least three days with 60% of the climbing, and at least three weeks of 150% of the one-day climbing during the six weeks before your event.
- To make the time cuts you need to complete many ACE™ events, most riders must be able to climb 2,000 feet per hour while keeping your heart below 75% of maximum in training. If you are a fast descender or can keep lunch stop and breaks very short, you may be able to complete the event climbing at only 1,800 feet per hour.

Fitting It All In

There are many different methods of establishing your weekly training schedule. There is *no right* way. Here is one general plan:

Assuming you work Monday through Friday, make your long-endurance day Saturday. This is the most important ride of the week. In case of a weather, mechanical, or other problem, it is possible to have Sunday as back-up.

Ride half your Saturday mileage on Sunday.

Put a rest day before the tough long Saturday ride. Perhaps a "tune-up" day on Fridays. This will add some volume to your training week and help ensure that your bike is working well for the important Saturday rides.

The other tough training days are interval days. Put them in the middle of the week to allow maximum recovery between interval and long endurance riding.

Specific plans incorporating these principles are found on the next two pages.

Figure 37. The Saturday long climbing ride, perhaps in a group, is usually the most important training day.

Summary

Saturday	Long ride in hills
Sunday	Moderate ride
Monday	Off or short, easy day
Tuesday	Moderate or intervals
Wednesday	Moderate
Thursday	Moderate or intervals
Friday	Off or short, easy, tune-up

6-Weeks to Go

Death Ride Training Schedule

Here is a training plan for the final six weeks before an ACE™ event, in this case *The Tour of the California Alps--Markleeville Death Ride*—129 miles and 16,000 feet of climbing.

The minimum plan to make five passes in good weather assumes a base training level of about 150 miles per week for April, and about 200 miles per week for May.

The plan to make five passes in the top 20% of five-pass finishers assumes a base training level of about 200 miles per week for April, and about 250^{+} miles per week for May.

The essential features of these plans are several long-endurance weekend rides and one or two above-pace interval-type workouts during the week.

The long-endurance climbing weekend rides are the most important training priority.

The schedules incorporate a volume-overload long-weekend, such as *Near Death Experience*.

For shorter or longer ACE™ events, proportionate miles and climbing.

5 Passes in Good Weather

	M	T	W	T	F	S	S	Summary
6 Weeks To Go—Volume Overload Weekend/NDE								
Miles	0-25	30	0-25	20	40	80	40	210-260
Climb	0	1	0	1	4	10	4	20
Effort	E	M	E	E	M	M	M	
5 Weeks To Go—Relative Recovery Weekend								
Miles	0-25	0-30	20	30	0-25	70	40	160-240
Climb	0	0-3	1	3	0	8	4	16-19
Effort	E	H	E	M	E	M	M	
4 Weeks To Go—Long Weekend								
Miles	0-25	30	20	30	0-25	90	40	210-260
Climb	0	3	1	3	0	10	4	21
Effort	E	H	E	M	E	M	M	
3 Weeks To Go—Long Weekend								
Miles	0-25	30	20	30	0-25	90	40	210-260
Climb	0	3	1	3	0	10	3	20
Effort	E	H	E	M	E	M	M	
2 Weeks To Go—Relative Recovery Weekend								
Miles	0-25	30	20	30	0-25	80	40	200-250
Climb	0	3	1	3	0	8	4	19
Effort	E	H	E	M	E	M	M	
1 Week To Go—Event Week								
Miles	0-25	30	20	0	20	130	0	200-225
Climb	0	3	1	0	0	16	0	20
Effort	E	M	E		E	M		

Table 12. 6-weeks-to-go schedule based on just making 5 passes.

5 Passes in the Top 20%

	M	T	W	T	F	S	S	Summary
6 Weeks To Go—Volume Overload Weekend/NDE								
Miles	0-25	30	50	20	50	100	50	300-325
Climb	0	3	5	1	4	11	4	28
Effort	E	M	M	E	M	M	M	
5 Weeks To Go—Relative Recovery Weekend								
Miles	0-25	0-40	70	40	0-25	75	50	230-330
Climb	0	0-4	5	4	0	8	4	18-22
Effort	E	H	M	H	E	M	M	
4 Weeks To Go—Long Weekend								
Miles	0-25	40	50	40	0-25	105	50	285-335
Climb	0	4	2	4	0	13	5	28
Effort	E	H	M	H	E	M	M	
3 Weeks To Go—Long Weekend								
Miles	0-25	40	70	40	0-25	110	50	310-360
Climb	0	4	5	4	0	13	4	30
Effort	E	H	E-M	H	E	M	M	
2 Weeks To Go—Relative Recovery Weekend								
Miles	0-25	40	50	40	0-25	80	50	260-310
Climb	0	4	2	4	0	8	4	22
Effort	E	H	M	H	E	M	M	
1 Weeks To Go—Event Week								
Miles	0-25	30	50	0	20	130	0	230-255
Climb	0	3	2	0	0	16	0	21
Effort	E	M	E		E	M		

Table 13. 6-weeks-to-go schedule based on finishing in top 20% of riders.

18-Week ACE™ Program

There are many ways to incorporate altitude-climbing-endurance training within the framework of weekly, monthly, seasonal, or annual programs.

The following is a program for a targeted event of 120 miles with 10,000 feet of climbing.

It assumes a base level fitness sufficient to (1) finish a relatively flat century (less than 4,000 feet of climbing) in less than 8 hours and (2) climb 2,500 feet over 12 miles in less than 2 hours.

I have also incorporated a 13-week high-intensity climbing stationary trainer program in these workouts. You can create your own intensity workouts from the information on stationary training given earlier in this book, or you can perform the 13-week program detailed in my companion book *High-Intensity Training for Cyclists*, referenced on page 126.

I have incorporated an intensity program for a number of reasons:

(1) Many recreational riders have the requisite endurance to complete an altitude-climbing-endurance event such as *The Tour of the California Alps—Markleeville Death Ride* or the *Colorado Triple Bypass*; but many cannot finish the event within time cutoffs.

(2) Many riders do not have easy access to hills. By incorporating a program on a *front-wheel-elevated* stationary trainer, riders can effectively climb more than 2,500 feet during each 2-hour session.

(3) Many riders simply do not have the time during the week to efficiently get in climbing miles. Once again, by incorporating a program on a *front-wheel-elevated* stationary trainer, riders can effectively climb more than 2,500 feet each 2-hour session.

Week	M Miles/ Climb	T Miles/ Climb	W Miles/ Climb	T Miles/ Climb	F Miles/ Climb	S Miles/ Climb	S Miles/ Climb	Total Miles/ Climb
Effort	Easy	Hard if HIT	Easy	Hard if HIT	Easy	Long	Easy	
1	0-25 <2	30 0-3	20-50 0-2	30 0-3	0-25 <2	30 2-4	25 <2	120 6
2	0-25 <2	30 1-3	20-50 0-2	30	0-25 <2	40 3-4	25 <2	140 8
3	0-25 <2	30 2-4	20-50 0-2	30 2-4	0-25 <2	50 4	30 <2	140 8
4	0-25 <2	HIT 1A 2-4	20-60 0-5	HIT 1B 2-4	0-25 <2	50 5	30 <2	160 10
5	0-25 <2	HIT 2A 2-4	20-60 0-5	HIT 2B	0-25 <2	60 5	30 <2	160 10
6	0-25 <2	HIT 3A 2-4	20-60 0-5	HIT 3B 2-4	0-25 <2	60 6	35 <2	180 12
7	0-25 <2	HIT 4A 2-4	20-60 0-5	HIT 4B 2-4	0-25 <2	70 6	35 <2	180 12
8	0-25 <2	HIT 5A 2-4	20-60 0-5	HIT 5B 2-4	0-25 <2	70 6	35 <2	180 14
9	0-25 <2	HIT 6A 2-4	20-60 0-5	HIT 6B 2-4	0-25 <2	70 7	40 <2	200 14
10	0-25 <2	HIT 7A 2-4	20-60 0-5	HIT 7B 2-4	0-25 <2	80 7	40 <2	200 16
11	0-25 <2	HIT 8A 2-4	20-60 0-5	HIT 8B 2-4	0-25 <2	80 7	40 <2	200 16
12	0-25 <2	HIT 9A 2-4	20-60 0-5	HIT 9B 2-4	0-25 <2	80 7	45 <2	220 18
13	0-25 <2	HIT 10A 2-4	20-60 0-5	HIT 10B 2-4	0-25 <2	90 8	45 <2	220 18
14	0-25 <2	HIT 11A 2-4	20-60 0-5	HIT 11B 2-4	0-25 <2	90 8	45 <2	220 20
15	0-25 <2	HIT 12A 2-4	20-60 0-5	HIT 12B 2-4	0-25 <2	100 8	50 <2	240 20
16	0-25 <2	HIT 13A 2-4	20-60 0-5	HIT 13B 2-4	0-25 <2	100 8+	50 <2	240 20+
17	0-25 <2	30 2-4	20-60 0-5	30 2-4	0-25 <2	90 8+	40 <2	240 18+
18	0-25 <2	30 2-4	20-60 0-4	0-25 2-4	0-25 <2	EVENT 120/10		180

Table 14. 18-week ACE™ program. Target event is 120 miles with 10,000 feet of climbing. Climbing is in 1,000s of feet. 13-week HIT program incorporated. HIT*x* refers to the workouts in the companion book *High-Intensity Training for Cyclists*, available through arniebakercycling.com.

Tapering for Events

Tapering is reducing volume and/or intensity of training prior to competition.

Most riders and coaches believe in the value of tapering for events.

Here is why, and here is how:

Why Taper?

Optimal event-day performance is a balance between being (1) recovered and rested, physically and mentally eager to race and (2) detrained—loosing fitness from too little training.

The idea is to arrive at the event with all systems primed.

Tapering is reducing volume and/or intensity of training prior to competition. Multiple studies have shown that this improves performance.

Most coaches recommend reducing overall volume and volume of intensity, but keeping interval intensity high. That is to say: ride less, perform fewer intervals, but keep interval quality for the intervals performed.

Volume reduction may be 20% to 60%.

Balancing Training and Detraining

Consider these key points:

1. Glycogen energy stores take at least two days to be replaced after exhaustive aerobic exercise. More likely three.

   Exhaustive aerobic exercise occurs with a one-hour time trial at 90% of maximum heart rate or a two-hour ride at 85% of maximum heart rate.
2. No exercise in the 48 hours before events is associated with glycogen overload and muscle cramps in some athletes.
3. Muscle power is reduced by strength training for at least two weeks after maximum workouts. More likely three.

   Strength training includes weight work, one-legged riding, big-gear work, and anaerobic efforts.

   Eccentric exercise is especially damaging to muscles. Eccentric exercise occurs when muscles lengthen under tension. This is characteristic of some weight work and unaccustomed high-cadence work.

   General cycling is not an eccentric exercise. General running is. For this reason, runners may need more of a taper than cyclists.
4. Endurance lasts for at least 10 days. More likely two weeks.
5. It takes at least a week to recover from an unaccustomed long ride.
6. Maximum aerobic capacity lasts for a few days. Perhaps a week.

How to Taper

The key points provide the basis for the following recommendations:

1. The last endurance ride should be 7 to 10 days before the event.
2. Avoid exhaustive aerobic exercise for at least three days prior to the event.
3. Maximum weight work and maximum on-the-bike strength work should be avoided for at least three weeks before the event.

   Avoid unaccustomed eccentric exercise.

   Accustomed on-the-bike strength work can be continued until one week before the event but at no more than 75% of previous maximum power.
4. Continue aerobic intervals until 3 to 7 days before the event. Reduce the number of intervals by one-third.
5. Rest or active rest (easy riding) two days before the event.
6. Warm-up the day before your event to near event intensities.

Tapering Summary

For many cyclists an effective taper turns out to be simply missing one workout and shortening another.

Following these suggestions should help you arrive at your event well-rested, fit, and ready to do your best.

Final Words: Clipped From: Rider Prep, deathride.com

The Death Ride is a Tough Ride for Serious Cyclists!

Riding 129 miles and 16,000 feet in one day is NOT easy! Keep in mind that the course in located on the eastern side of the Sierra Nevada mountains at elevations between 5,000' and 8,732'. It is remote, mountainous pine and sagebrush-covered country. Temperatures can be very HOT or very COLD, sometimes both in the same day. The weather can be DRY or WET, or both, as you climb from valley to pass. Blistering heat and bone chilling thunderstorms are not uncommon on the same day!

You Must Be Prepared and in Good Shape!

Ride many, many miles, and climb many hills on your bike seat before riding the Death Ride! We suggest you ride a few Centuries with hills, such as the Sierra or Comstock, prior to the Death Ride. Drink lots of water before and during the ride, as dehydration is the leading problem encountered on the Death Ride. Eat and drink a lot and do it before you need it!

Approved Helmets are Mandatory and Must Be Worn At All Times!

You must also wear your 3 Death Ride numbers and have your Death Ride water bottle to gain access to the ride. These will be checked by course marshals and law enforcement! No exceptions are made!

Your Bike Must Be in Top Working Order!

Be sure you have good brakes and good tires. You must be able to control your bike and your speed on serious downhills, with possible wet and/or rough pavement. Carry extra tubes, pump, tools, good rain or cold weather gear, identification, sunscreen, lip balm, and extra water bottles.

Recommended Gearing for Climbing!

We suggest a 39 on front and a 28 on back or triple. We do not recommend aerobars or child carriers!

Ride Safe, Stay on Your Side of the Road, Ride Single File, Obey All Laws, and Be Attentive!

Even with part of the course is closed to vehicles, the California Motor Vehicle Code applies to the open portion of the ride. Riders who flagrantly violate the law will be cited and may be prohibited from riding in future Death Rides!

Note!

While we have tried to outline the necessary information for you to have a safe ride, please remember that the Death Ride can be dangerous! Be careful! Watch out for mud, rocks, cows, cattle guards, deer, other riders, and other hazards. Your safety is your responsibility. You ride at your own risk!

Appendix A: Training Log

Training logs are valuable. They help document your workouts, show where you have been and help motivate you to train for where you want to go.

Training logs can be simple or complicated. For most of the riders I coach, as well as for myself, I find a single line of information generally provides the information I need. If it takes more than a minute to update, compliance can be a problem. For structured interval workouts, it is valuable to keep detailed records in a specific workout log.

The training-log table on the next page is an abbreviated form of the Excel file I use for myself and the riders I coach.

Each row represents a day. Although it does not take long to complete each day's line, not all riders will want to use all the columns.

The bottom row sums monthly totals.

The first columns sum weekly totals for training miles, training hours, and weekly climbing.*

The day of the week is noted next to the day of the month. In this example, the first of the month is a Tuesday.*

Daily miles and hours are recorded in the 6th and 7th columns.

Intensity of the workout is noted in the 8th column, generally as hard, medium, or easy. Hard workouts are structured interval workouts and races. A ride with a few intervals might be a medium+. If structured intervals or a race occurs, that is noted in the 9th column.

Daily climbing, in thousands of feet, is recorded in the 10th column.

Check marks in the next columns indicate if a heart rate recording or specific workout log is associated with the day's training.

The group ridden with, the type of ride, and the location are recorded in subsequent columns.

The 16th and 17th columns are checked if specific on- or off-the-bike strength training or stretching took place that day.

Subsequent columns are for comments, hours of sleep, sleep quality on a 1-5 scale, perceived recovery on a 1-5 scale, resting heart rate, mood in the morning on a 1-5 scale, and energy riding on a 1-5 scale.

Body weight is recorded about once a week.

A final column for cross-training or other recording completes the table.

* For clarity, the "Day" boxes and the weekly total boxes in the training-log table have gray entries. Download a blank training log that you can use for your own record keeping from arniebakercycling.com.

Monthly Training Log Name Month Year

Week Volume, Miles	Week Volume, Hours	Week Climb	Day	Date	Volume, Miles	Volume, Hours	Intensity	Intervals or Race?	Climb, K Feet	HRM?	SWL?	Group	Type	Location	Strength	Stretch	Comments, Result	Hours Sleep	Sleep Quality	Recovery	Resting HR	Mood in AM	Energy on Ride	Weight	Run / X-Train / Other
					AM/PM	AM/PM	AM/PM																		
			TU	1																					
			WE	2																					
			TH	3																					
			FR	4																					
			SA	5																					
SUM	SUM	SUM	SU	6																					
			MO	7																					
			TU	8																					
			WE	9																					
			TH	10																					
			FR	11																					
			SA	12																					
SUM	SUM	SUM	SU	13																					
			MO	14																					
			TU	15																					
			WE	16																					
			TH	17																					
			FR	18																					
			SA	19																					
SUM	SUM	SUM	SU	20																					
			MO	21																					
			TU	22																					
			WE	23																					
			TH	24																					
			FR	25																					
			SA	26																					
SUM	SUM	SUM	SU	27																					
			MO	28																					
			TU	29																					
			WE	30																					
			TH	31																					
SUM	SUM	SUM			SUM	SUM			SUM																

Table 15. Monthly training log. A more sophisticated training log is available from arniebakercycling.com.

Appendix B:
Rear Derailleur Capacities

Derailleurs must be designed to clear the biggest cog (lowest gear, maximum sprocket size). Road derailleurs will not reliably clear more than 29 teeth. The derailleur will generally be too close to the cog teeth and the top jockey pulley will rub on the cog.

In order to work with triple road chainrings (for example, 30-39-52) and mountain bike cogsets (for example 12-34), rear derailleurs must be able to take up the chain slack resulting from the difference in the front chainrings (front difference) as well as the added slack from the cogs (capacity = front difference and cog difference).

For example, 30-39-52 chainrings have a 22 front difference. 12-34 cogsets have a 22-cog difference. The derailleur capacity must be 44 in order for the derailleur to be able to take up the slack.

Many derailleurs can accommodate a couple of teeth more than their ratings.

You can improve the ability of a road derailleur to accommodate cogs with more than 25 teeth by screwing in the B-tension adjustment bolt. Shortening the chain may also help you use the lowest (biggest) cogs. However, it then may be physically impossible to shift to the largest chainring. Not that a savvy rider would cross-gear. However, after 8^{+} hours in the saddle, even high-IQ riders are not too savvy. If you make this mistake, a mechanical disaster may result. Better not to have the option. Use a mountain bike derailleur.

Here is a partial listing of some popularly used rear derailleurs.

Product	Max Sprocket	Front Difference	Capacity
Shimano Road			
Dura-Ace	27	14	29
Dura-Ace Triple	27	23	38
Ultegra	27	14	29
Ultegra Triple	27	22	37
105	27	14	29
105 Triple	27	22	37
Shimano Mountain Bike			
XTR-GS	34	11	33
XTR-GS	34	22	42
Deore XT-GS	34	22	33
Deore LX	34	22	43
Deore RD-M510-L	34	22	43
Campagnolo Road			
Record Short Cage	26	14	27
Record Med Cage	29	23	36
Record Long Cage	29	23	39
Chorus Short Cage	26	14	27
Chorus Med Cage	29	23	36
Chorus Long cage	29	23	39
Centaur Short Cage	29	14	30
Centaur Med Cage	29	23	37
Centaur Long Cage	29	23	40
SRAM Mountain Bike			
SRAM 9.0	34	22	45

Table 16. Rear derailleur specifications.

Appendix C: Markleeville ACE™ Secrets

Jackie Johnson's Tips

At recent *Near Death Experience* training camps for *The Death Ride* participants, *Jackie Johnson*, ride co-coordinator, has had these tips for riders.

1. Popular rides sell out. Know how to register early.
2. Come ready to ride—physically and mentally. Do not plan on fixing things at your hotel or on the start line.
3. Pack everything. Clothes: Anticipate that the weather may be cold and raining, or hot and humid.
4. Do not use new equipment. Brings spares if you have esoteric equipment.
5. Get there at least the day before.
6. If you can pick up your race packet the day before, do so.
7. Know ahead of time where there is good parking. For *The Death Ride*: Drive to Turtle Rock. Keep going. Park just past Turtle Rock.
8. If a flexible or staggered start, be ready to ride in the early waves. For Markleeville, plan on starting by 5:30 AM.
9. Avoid congested parking areas if you can.
10. Do not be afraid to ask for help.
11. If your vehicle is parked along the route, as is common for *The Death Ride*, use your own vehicle as a stash for an ice chest, and other equipment. Change your socks and shorts, wash your face, and otherwise freshen up. Consider an endurance day favorite: chilled Frappuccino.
12. For most rides with cut-off times, such as *The Death Ride*, cut-off times are usually serious and enforced.
13. Safety: Watch your speed on descents, especially narrow or twisty passes such as Ebbetts at *The Death Ride* where slower riders are ascending while you are descending. Find out ahead of time about potholes, cattle grates, or other hazards.
14. Ride safely to the right at all times so that this becomes subconscious; at the end of ACE™ rides, you may not have much consciousness left.
15. Where there are controlled intersections, such as the intersection at Woodfords in *The Death Ride*, police are often present to enforce controls and will ticket riders who do not stop.
16. Bathroom lines can be a problem. Check with the promoter. There are often relatively little used commodes. For example, in *The Death Ride* there are extra bathrooms at Pickett's, the campground at Ebbetts, behind the Chamber of Commerce in Markleeville, just past Hangman's' bridge, and at the intersection of Pickett's and Monitor. Lines are longest at the tops and bottoms of climbs.
17. Stay a little out of synch with the masses for rest stops—lines will be shorter and your stops will be faster.
18. Many rides require rider registration and special identification. At *The Death Ride*, it is a waterbottle.
19. If you need all the time, you can to finish an event, keep in mind that some promoters will turn a blind eye to starting a little early. Check. It is okay to start 15-20 minutes early at *The Death Ride*.
20. If starting before dawn, use lights.
21. If you start early, keep in mind that rest stops may not be ready and traffic controls not yet in place.
22. When you start in the dark, it may be difficult to remember to preapply sunscreen.

23. Some riders benefit from a timer to remind them to eat or drink.
24. Most riders do not drink enough.
25. Consider taking your favorite sport drink powder and mixing it with water. Water is always available at rest stops. Your favorite sport beverage generally is not.
26. Plan to drink enough to urinate at least every two hours.
27. Have fun, smile, talk to fellow riders.

Figure 38. Use the rest stops. Keep breaks short and efficient.

Rider Tips

Riders have contributed the following tips.

1. At least a week before your event, make a list of everything you will need. Include a flashlight—it might be dark when you arrive at the start.
2. The night before: Review your list of what you are bringing for your bike. Plan what you will have in your car if you intend to stop at it during the ride. Plan what to have in your car for after the ride—at least some clothes, washcloth, towel. Lay out what you will need: clothing, sunglasses, and sunscreen. The event organizers will tell you where they want body or bike numbers placed. Do as they ask and do it the night before.
3. Before leaving your hotel room. Make sure your sunscreen is on, and wash your hands.
4. Before leaving your vehicle: Check your list. Start your bicycle computer, using a flashlight to see if necessary. Do not forget your sunglasses.
5. Rest stops: Many riders do well with a block of time for a lunch rest, especially those not pacing who need to get blood flow to their gastrointestinal track before they can eat. Otherwise, keep stops very short, but eat. Apart from one good stop for lunch, rest stops waste time for most riders. Many find it hard to get going again.

   The best riders stop for less than 30 minutes—cumulative time not riding.
6. Lunch: Sandwich line is too long? Get lots of soup, salty snacks, potatoes, soda.
7. Riding solo? Climb at your own pace, but look for others to help you out on headwind flat sections.

Appendix D:
Death Ride Deadlines
The "Just-Made-It" Schedule

The Tour of the California Alps—Markleeville Death Ride is officially 129 miles and 16,000 feet of climbing. There are five major passes: The front and back sides of Monitor, the front and back sides of Ebbetts, and Carson Pass.

Like many ACE™ rides, there are official time cut-offs.

These time cut-offs are not based on riders completing five passes. Rather, the cut-offs are based on road closures and openings.

At *The Death Ride*, the only official cut-offs that have relevance to riders attempting all-five passes are the cut-offs for beginning the climb up Carson Pass at Woodfords and half-way up the pass at Pickett's Junction.

On the next page is the schedule you must keep to just finish the event.

The basis for this schedule is a climbing intensity of roughly 1,650 feet per hour, the absolute minimum for this ride. Although officially 16,000 feet, my calculations show the ride to be about 500 feet less.

Most riders on this schedule should have 30-34 gearing: a 30-tooth front chainring and a 34-tooth rear sprocket.

This schedule leaves very little time for fixing mechanical problems. It assumes you are a relatively good descender. There are only five minutes of grace time to get to Woodfords, the critical cut-off.

If you cannot pace and make the early cut-off times, you are not going to make five passes. Consider slowing down, enjoying the views, and riding fewer passes.

Riders on this tight a schedule should consider leaving 20 minutes earlier or more, with lights, to have more of a buffer.

Climb Segment	Feet	Time, Min	Feet/Hour
Turtle Rock Park South	331		
Monitor	2,632	95	1,662
Monitor	3,257	120	1,628
Ebbetts	3,050	110	1,663
Ebbetts	1,642	60	1,642
North	781		
Carson	3,139	160	1,177
South to Turtle Rock Park	659		
Total	15,491		

Table 17. Calculation of major pass climbing segment time based on a climbing intensity of approximately 1,650 feet of climbing per hour on the first four passes. Flatter sections reduce the climbing rate on Carson Pass.

Nutritional Schedules

It is recommended that a 70-kilogram (154-pound) rider consume up to two standard water bottles per hour when riding in the heat and ingest at least 300 calories per hour. Heavier or lighter riders can proportion these recommendations.

Possible schedules to meet these nutritional needs based on *The Death Ride* rest stops are also included in the "Just-Made-It" table on the next page.

In this schedule, many of the rest stops are at the summits. By eating here, you can partially digest your food on the descents. Moreover, the views are great. Bear in mind that the summits are often very busy, and food and port-potty lines may be longer.

The fluid schedule of 25 standard waterbottles is a little less than 2 bottles per hour. The caloric schedule just meets with the 300 calories per hour recommendation.

You Are At	Miles		Climb		Up	Down	"Flat"	Rest/ Buffer	Elapsed Cumulative		Real Time	Possible Fluid Schedule		Possible Caloric Schedule	
	Segment	Total	Segment	Total	Minutes	Minutes	Minutes	Minutes	Minutes	Hours:Min		16 Ounce Bottles			
Breakfast														Breakfast	1,500
Start Turtle Rock Park											**5:30 AM**	2		Maltodextrin bottles	400
Monitor Turnoff	7.5	7.5	331				40		40	40	**6:10 AM**				
Monitor Summit #1	8.7	16.2	2,632	2,963	95				135	2:15	**7:45 AM**				
Rest Monitor Top								10	145	2:25	**7:55 AM**	2		1.5 Sandwich PBJ	300
Monitor Back Bottom	9.5	25.7				20			165	2:45	**8:15 AM**				
Monitor Summit #2	9.8	35.5	3,257	6,220	120				285	4:45	**10:15 AM**	1	Bottle handoff	Maltodextrin	200
Rest Monitor Top								10	295	4:55	**10:25 AM**	4		0.5 Bagel PBJ	200
Monitor Front Bottom	8.0	43.5				20			315	5:15	**10:45 AM**			Potatoes	150
Ebbetts Summit #1	13.8	57.3	3,050	9,270	110				425	7:05	**12:35 PM**			Cookies	200
Rest Ebbetts Top								10	435	7:15	**12:45 PM**	2		Maltodextrin	200
Ebbetts Back Bottom	5.4	62.7				10			445	7:25	**12:55 PM**			Crackers, fruit	200
Ebbetts Summit #2	4.3	68.0	1,642	10,912	60				505	8:25	**1:55 PM**				
Ebbetts Front Near Bottom						20			525	8:45	**2:15 PM**	1			
Lunch Stop Departure	11.0	79.0						30	555	9:15	**2:45 PM**	5	Coke, soup, water	Soups	200
Vehicle near Turtle Rock Park							30		585	9:45	**3:15 PM**			Sandwich+	750
Leave Vehicle								15	600	10:00	**3:30 PM**	2		Fruit	150
Woodfords	13.5	92.5	781	11,693			25		625	10:25	**3:55 PM**	1		Coke	150
Pickett's Junction	6.0	98.5			70				695	11:35	**5:05 PM**	1	Lemonade, water		
Carson Summit	9.8	107.3	3,139	14,832	90				785	13:05	**6:35 PM**	4		Coffee Sugar Drink	50
Rest Carson Top	0.7	108.0						15	800	13:20	**6:50 PM**			SoBe	200
Woodfords on Return	14.5	122.5				35			835	13:55	**7:25 PM**			Lemonade	100
Finish Turtle Rock Park	4.2	126.7	659	15,491			20		850	14:10	**7:40 PM**			Ice cream, snacks	800
Totals	126.7	126.7	15,491	15,491	545	105	115	90	850	14:10		25			5,750
					9:05	1:45	1:55	1:30							

Table 18. The "Just-Made-It" Schedule. Markleeville Death Ride deadlines and nutritional fluid and caloric schedule suggestions. If you anticipate being this close to making it, consider starting early.

Appendix E: Famous Climbs

Death Ride Climbs				
Climb	**Gain Feet**	**Distance Miles**	**Average Grade**	**Elevation Finish**
Carson	3,139	9.8	6.2%	8,573
Ebbetts, Front Side	3,050	13.8	4.3%	8,731
Ebbetts, Back Side	1,642	4.3	7.3%	8,731
Monitor, Front Side	2,632	8.7	5.8%	8,314
Monitor , Back Side	3,257	9.8	6.4%	8,314
Other California Climbs				
Climb	**Gain Feet**	**Distance Miles**	**Average Grade**	**Elevation Finish**
Crystal Lake	3,495	11.5	5.8%	5,045
Glendora Mt.	2,398	8.5	5.4%	3,467
Mt. Baldy	4,615	12.6	7.0%	6,260
Mt. Hamilton	4,300	19.0	4.4%	
Mt. Palomar, South Grade	4,211	11.2	7.2%	5,255
Mt. Tam	1,976	12.5	3.0%	5,045
Montezuma	3,400	11.0	5.9%	4,000
Old La Honda	1,260	3.3	7.3%	1,683
Other US Climbs				
Climb	**Gain Feet**	**Distance Miles**	**Average Grade**	**Elevation Finish**
Haleakala, HI	10,002	35.8	5.4%	10,004
Larch Mt. Oregon, WA	4,429	14.5	4.7%	4,337
Mt. Charleston, NV	4,750	17.2	5.3%	8,450
Mt. Evans, CO	7,100	29.2	4.7%	14,264
Mt. Graham, AZ	5,689	20.0	5.5%	9,000
Mt. Mitchell, NC	4,790	20.2	4.6%	6,591
Mt. Washington, NH	4,727	7.7	11.9%	6,287
Sandia Crest, NM	5,730	28.0	3.9%	10,639
Pro Tour Climbs				
Climb	**Gain Feet**	**Distance Miles**	**Average Grade**	**Elevation Finish**
Alpe d'Huez, France	3,656	8.1	8.2%	5,839
Alto de l'Angliru	4,107	7.7	10.3%	5,150
Col de Fauniera, Italy	5,348	15.7	6.6%	7,926
Col de Galibier, North, France	6,611	21.8	5.8%	8,677
Col de Glandon, France	4,462	11.4	7.5%	6,312
Col de l'Iseran	6,708	29.1	4.4%	9,086
Col de Madelaine, France	5,033	12.1	8.0%	6,509
Col dell'Agnello, Italy	5,830	19.6	5.7%	9,015
Col du Aubisque, France	5,045	23.8	4.1%	5,606
Col du Tourmalet, France	4,605	11.3	7.8%	6,937
Hautacam, France	4,183	9.6	8.4%	5,036
Mont Ventoux, France	5,312	13.7	7.5%	6,263
Passo dello Stelvio, Italy	6,040	16.0	7.3%	9,045
Passo di Gavia, Italy	4,671	16.0	5.6%	8.587
Puerto de Navafria, Spain	2,083	7.2	5.6%	5,832
Sestrieres, Italy	3,001	13.5	4.3%	6,675
Simplon Pass, Italy	5,741	24.9	4.4%	6,578

Table 19. Death Ride, California, US, and professional tour climbs. Although gain, distance, and average grade all contribute to climbing difficulty, numbers can be deceiving. For example, the front side of Ebbetts Pass has several miles of shallow grade and many later sections over 10%. For more climbs, see: http://www.cycle2max.com/ and http://www.cyclingcols.com/.

Appendix F: Training Glossary

***ACE Event*—**Hilly centuries+—one-day events over 100 miles with more than 10,000 feet of climbing.

***Aerobic*—**With oxygen as a fuel source. Implied intensity is below anaerobic level. Implied level of work is low enough that buildup of lactic acid is avoided and exercise can be continued for prolonged periods.

***Anaerobic*—**Without the presence of oxygen. Implies a high level of work intensity that can only be maintained for relatively short periods of time. A very short energy production system—that of creatine phosphate—can supply energy need for about 10 seconds without the production of lactic acid. Other anaerobic efforts result in high levels of lactic acid.

***Anaerobic-Endurance*—**The ability to maintain near-sprint speed for up to several minutes. Sometimes called speed-endurance. The ability to tolerate high lactic acid levels is implicit.

***Bonk*—**The exhaustion point in endurance events related to depleted carbohydrates.

***Cadence*—**Revolutions per minute of the legs.

***Cardiovascular*—**Referring to the heart and blood vessels.

***Creatine Phosphate*—**A chemical in cells that can briefly replenish ATP and thereby produce energy for very short (up to 10 seconds) events.

***Duration*—**Length of time spent performing an interval. If work is continuous, volume and duration are the same.

***Endurance*—**Ability to last.

***Fartlek*—**"Speed play," unstructured intervals.

***Fast-Twitch*—**Muscle fiber type characterized by a fast response to nerve stimulation. This type of muscle fiber tends to be useful in strength or power activities such as sprinting. Also called Type II muscle fiber.

***Glucose*—**A simple sugar. Used by the body for energy.

***Glycogen*—**A complex sugar. A form of storage energy in the body.

***Hammer*—**Hard sustained effort.

***Intensity*—**Load or speed of work.

***Interval*—**Period of work.

***Interval Workout*—**Hard training efforts interspersed with recovery or relief periods. The length of the interval normally is from just a few seconds to several minutes. The length of the interval, intensity of effort, gear (or workload) and cadence emphasize different aspects of fitness. Short efforts at high workloads tend to emphasize fast-twitch muscle strength. Efforts of a few minutes emphasize speed-endurance. Longer intervals emphasize lactic acid tolerance.

***Isolated Leg Training, ILT*—**Training technique of riding with one leg.

***Lactic Acid*—**A product of the body's metabolism. Normally the blood contains less than one millimole of lactic acid per liter. Efforts up to time-trial threshold may result in levels of up to four to eight millimoles per liter. Levels higher than this cannot be sustained for prolonged periods of time.

***Lactic Acid Clearance*—**The ability to clear, or metabolize, lactic acid.

***Lactic Acid Tolerance*—**The ability to tolerate high lactic acid levels.

***Leg Speed*—**How fast one can turn the cranks.

***Neuromuscular*—**Relating to the connection that occurs between nerve and muscle. Often used in the context of coordination, leg speed, or skills

***Noodling*—**Easy or recovery riding.

***Periodization*—**Training different aspects of fitness at different periods of time.

***Power*—**Work performed per unit of time.

***Recovery*—**Period of training time when not working hard—rest or relative-rest period. Many athletes view training as work. Work is only part of the equation: TRAINING = WORK + RECOVERY.

***Repetitions*—**The number of times a task or interval is repeated.

***Set*—**In training, a group of repetitions.

***Skill Workout*—**Workouts without intensity designed to acquire neuromuscular co-ordination skills or techniques.

***Slow-Twitch*—**Muscle fiber type characterized by a slow response to nerve stimulation. This type of muscle fiber tends to be useful in endurance activities. Also called Type I muscle fiber.

***Snap*—**The ability to accelerate quickly.

***Specificity*—**Training principle that states you specifically improve those characteristics of fitness that you train.

***Speed*—**Quickness, how fast one can go.

***Speed-Endurance*—**Anaerobic-endurance. The ability to maintain near-sprint speed for up to several minutes. The ability to tolerate high lactic acid levels is implicit.

***Sprint*—**Acceleration (and usually maintenance) of very-high speed.

***Strength*—**Force that can be applied. Physiologists sometimes define strength as one-rep maximum—the maximum weight or force that a muscle can generate once. This is really a fast-twitch, or anaerobic-muscle measure. Maximum muscle force has a lot to do with pure sprinting.

***Strength-Endurance*—**Slow-twitch muscle strength. Aerobic-muscle strength.

***Surge*—**Moderate acceleration from one tempo to a faster tempo or threshold pace. Not as abrupt as a jump or attack.

***Tempo*—**Pace. Normally implies moderately hard, steady riding or running below time-trial threshold or race pace.

***Time-Trial Threshold*—**Maximum pace for efforts of 20 to 60 minutes in duration. Anaerobic threshold, lactic acid threshold, and ventilation thresholds, terms physiologists use, are all at lower levels.

***Training Effect*—**The body's response and adaptation to physical demands.

***Volume of Training*—**Total time of intense training. If training is continuous, volume and duration are the same.

***VO_2 Max*—**The maximum uptake of oxygen a person can utilize to produce energy. A measure of the ability of muscles to use oxygen. An important determinant of fitness and success.

***Wind-up*—**To accelerate up to speed. Less abrupt than a jump, or attack.

Appendix G: ABC Publications

The following subjects of this book are available as separate handouts from http://arniebakercycling.com. Additional material is sometimes provided in the handouts.

Handouts

- ACE™ Tips
- Achilles Tendonitis & Bursitis
- Climbing & Descending
- Dealing With High Altitude
- Endurance Sport Nutrition
- Fitness Elements
- Focus & Breathing
- Forefoot Problems
- Heart-Rate-Based Training
- Isolated Leg Training
- Maltodextrin Nutrition
- Motivation
- Muscle Cramps
- Pacing
- Six Climbing Positions—Road Cycling
- Saddle Soreness

Enjoyed this Book?

Readers of this book have also frequently ordered the following available from http://arniebakercycling.com:

Books

- Bike Fit
- High Intensity Training (HIT) for Cyclists
- Nutrition for Sports
- Psychling Psychology—Mind Training for Cyclists

Handouts

- Aerobic Training
- Century Training, Schedules, and Event Tips
- Lumberjack Pacing
- Maltodextrin Nutrition
- Overtraining
- Power-Based Training
- Recovery
- Stationary Training
- Tips to Lose Weight
- Training and Fitness Standards of Excellence
- Training Logs
- Warm Ups for Racing
- Work of Breathing
- Workout Series Handouts (Stationary Trainer Workouts)

Slide Shows

- Annual Plan—Planning Your Training Year
- Heart Rate Training
- Maltodextrin Nutrition
- Stationary Training