Fueling for Performance

Nutrition Strategies for Training & Competition

A Presentation to the College Swim Coaches Association
May 24, 2006

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Nutrition Education in College Coaching

Talk to your coaching staffs about nutrition.

Talk to nutritionists about nutrition.

- **Review CO$T of Swimming**
- **Glycogen, Insulin Response & Recovery**
- **Pool & Open Water Strategies**
- **Dietary Supplements**
- **Resources**

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Fueling for Performance is…

- Always having a full tank of gas.
- Getting the most economical fuel.
- Fueling at the right times and places.

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The Basic Nutrients are:

- Carbohydrate
- Protein
- Fat
- Vitamins
- Minerals
- Water

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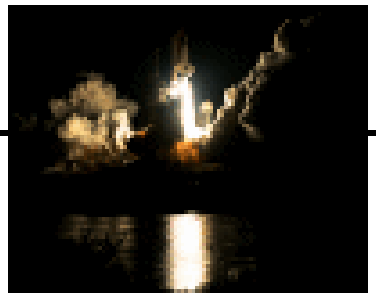
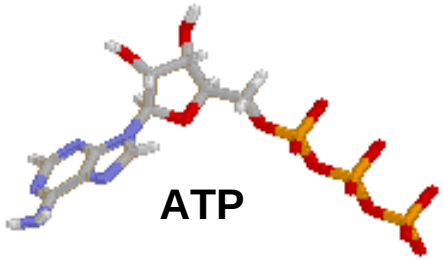
Calories … … … Energy … … … Exercise





Carbohydrate	**4 kcal/gram**
Protein	**4 kcal/gram**
Fat	**9 kcal/gram**

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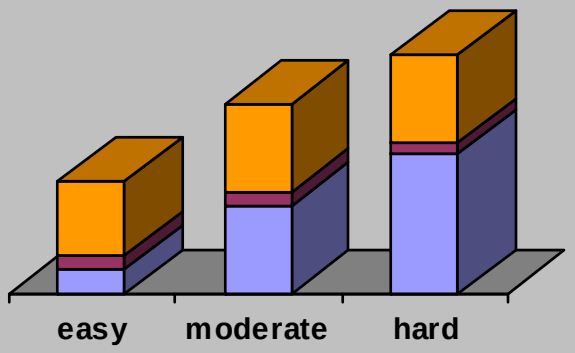
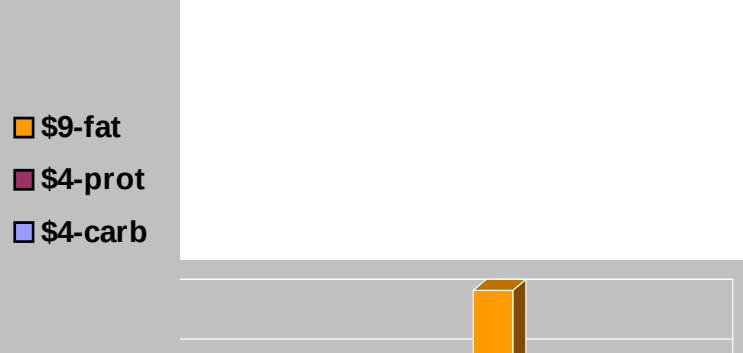
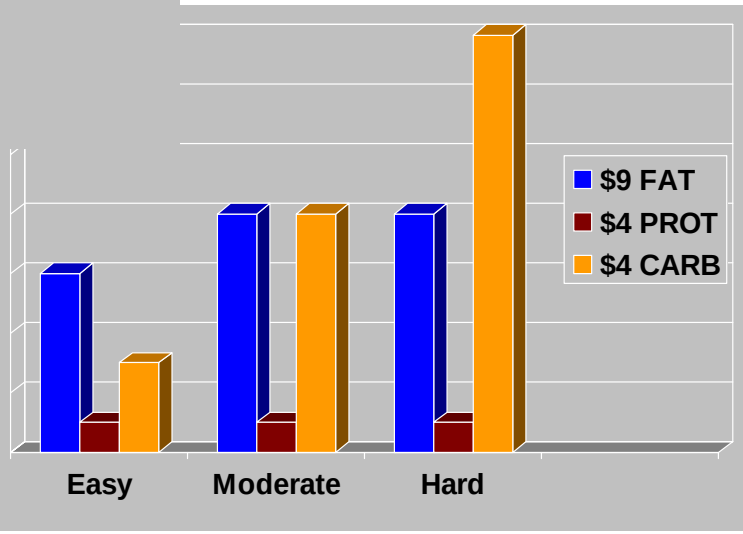
The Energy “CO$T” of Swimming

Figure 1. Fuel Sources During Swimming.







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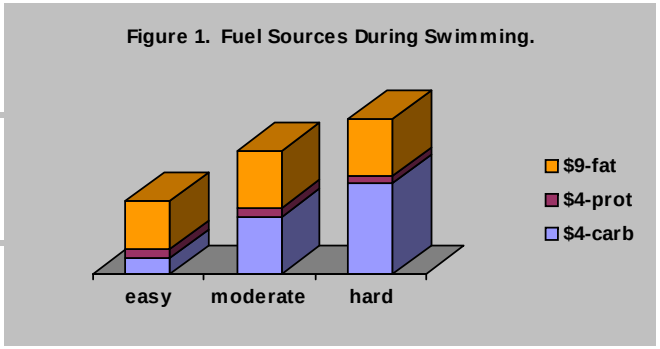
The Energy “CO$T” of Swimming



- The total energy required increases with exercise intensity.
- There is never just one fuel source, but rather a combination of three whose relative contributions vary with exercise intensity.
- Protein’s contribution to total energy requirements is small, relative to carbohydrate and fat (extreme cases excepted).
- The contribution of protein and fat to total energy requirements remains constant, despite changes in exercise intensity (extreme cases excepted for protein).
- The contribution of carbohydrate to total energy requirements increases with exercise intensity.
- At low intensities, fat is the dominant fuel source, but not the only one, while at high intensities, carbohydrate is the dominant fuel source, but not the only one.

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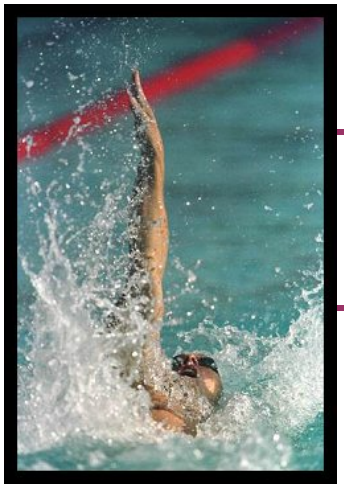
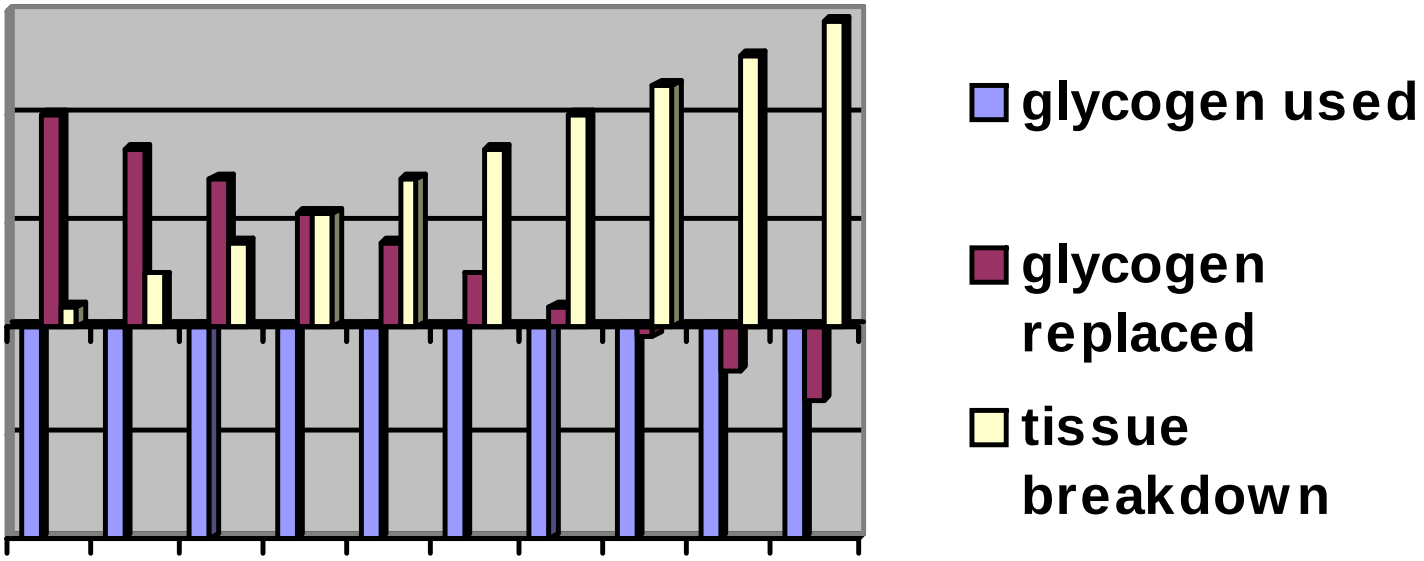


Nutrition, Glycogen, and Recovery

Coaches Quarterly 10(1), Spring 2004

Figure 2. Long-term failure to replace glycogen leads to tissue breakdown.



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(+) Stress vs (-) Stress

S&S of Poor Nutritional Recovery

There is a direct link between fatigue and glycogen depletion.

Training (chronic/long-term)

- “lead legs”
- “can’t keep up”
- elevated resting HR
- elevated HR on typical sets

Racing (acute/immediate)

(usually on back end of meet)

- lower post-race peak lactate
- diminished recovery
- feelings of fatigue
- elevated resting HR
- longer post-race HR recovery

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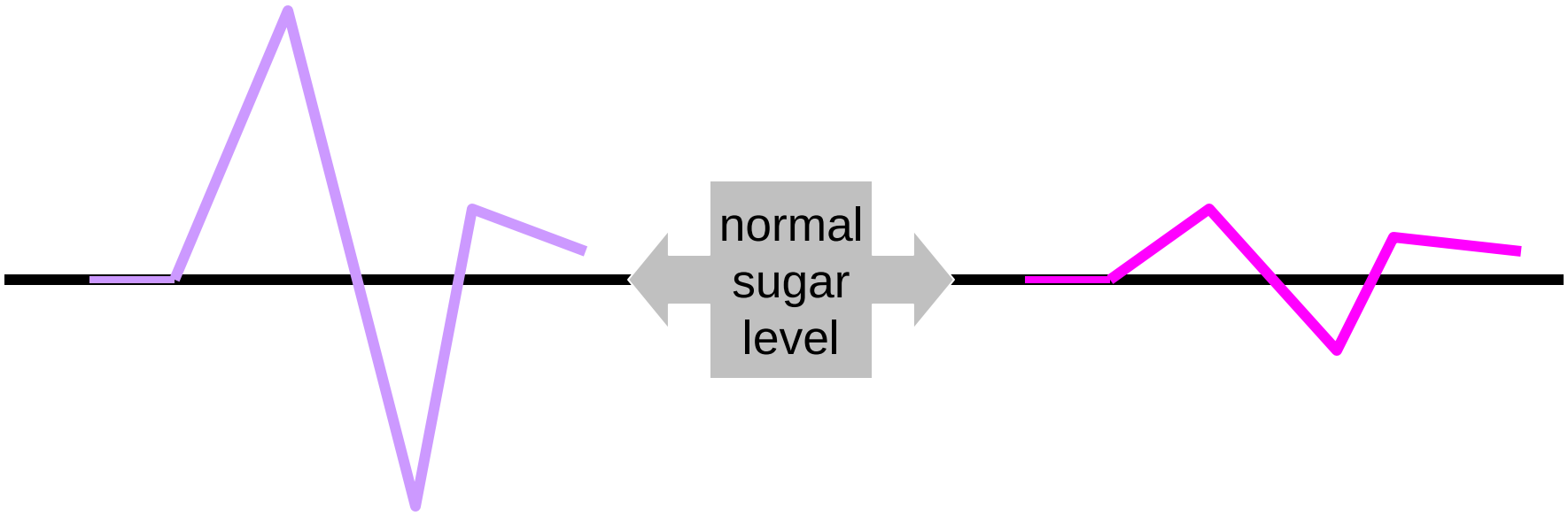
Performance = Timing and Recovery



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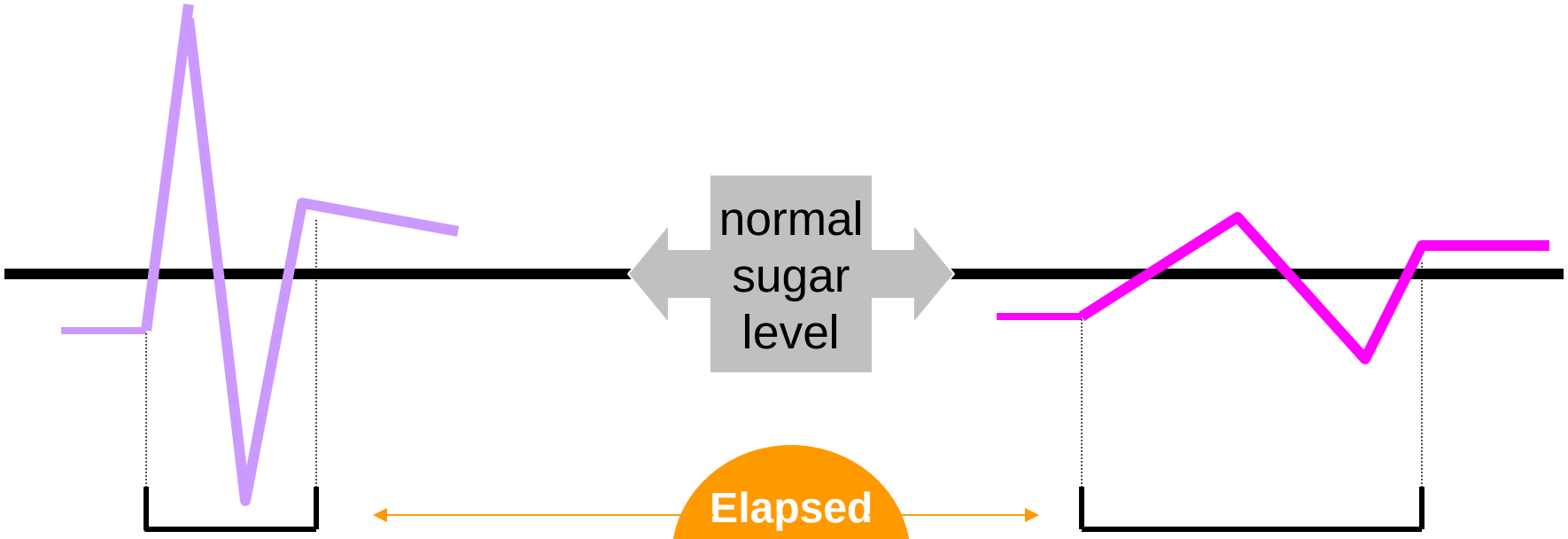
The Insulin Response

“Carbohydrate” “Blood sugar” “Insulin”



High GI
or large serving
or CHO only

Low GI
or small serving
or mixed

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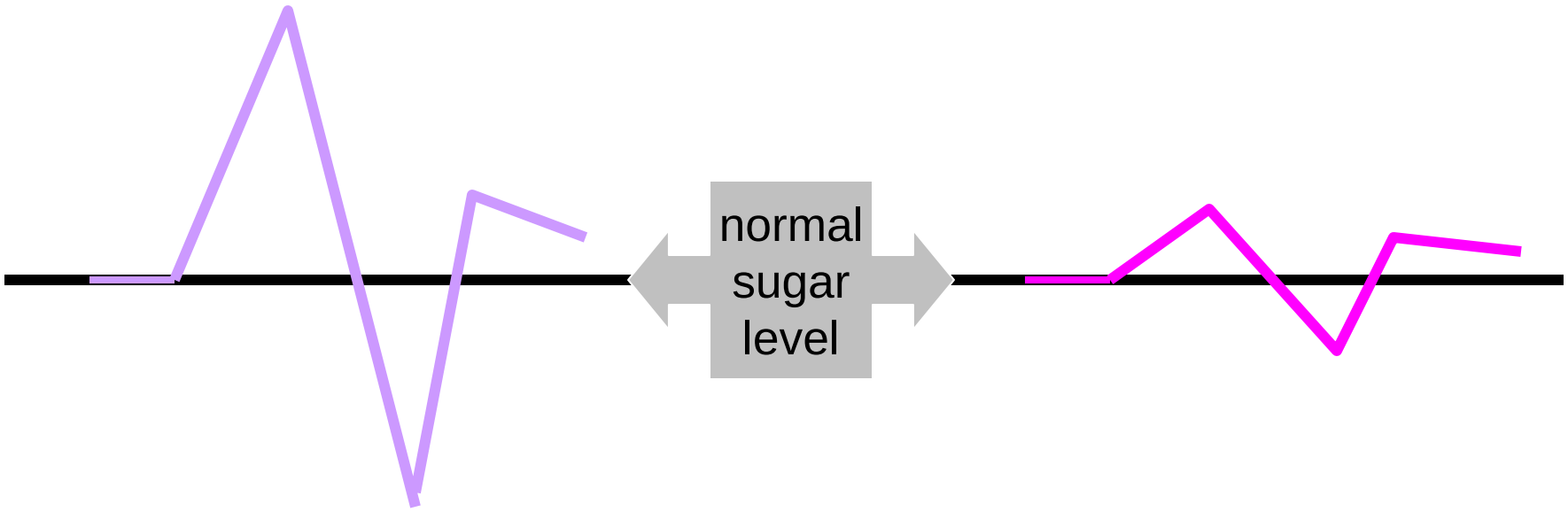
Eat Early and Often.

The first 2 hrs post-workout are the most critical.
Glycogen repletion can occur 2-3x faster than normal.



Bigger Meals
(3 per day)
Insulin Spikes

OK post-workout

Smaller Meals
(5-6 per day)
Insulin Steady

Preferable during day

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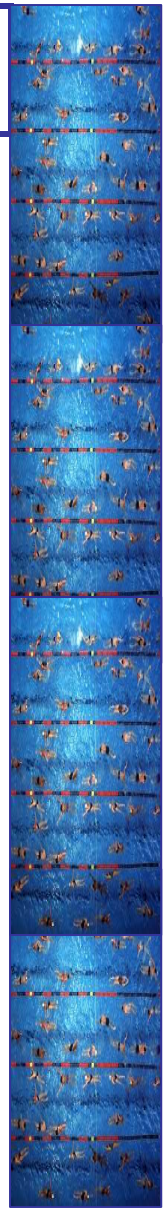
Remember…

- There is a limit to the amount of glycogen that can be stored at one time.
- Remaining blood sugar may be stored as fat.
- A good reason to eat smaller amounts of carbohydrate (small meals and snacks) at more frequent intervals.
- A good reason to eat high-carbohydrate foods that also contain some protein, fat and/or fiber (each of these lessens the glycemic response).
- The exception to this storage limitation is the two hours immediately following a tough workout.



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"After exercise, the dietary goal is to provide adequate energy and carbohydrates to replace muscle glycogen and to ensure rapid recovery. If an athlete is glycogen-depleted after exercise, a carbohydrate intake of 1.5 g/kg body weight during the first 30 min and again every 2h for 4 to 6h will be adequate to replace glycogen stores. Protein consumed after exercise will provide amino acids for the building and repair of muscle tissue. Therefore, athletes should consume a mixed meal providing carbohydrates, protein, and fat soon after a strenuous competition or training session."

(ACSM, ADA, Dietitians of Canada Joint Position Statement on Nutrition and Athletic Performance, 2000, p 2131)

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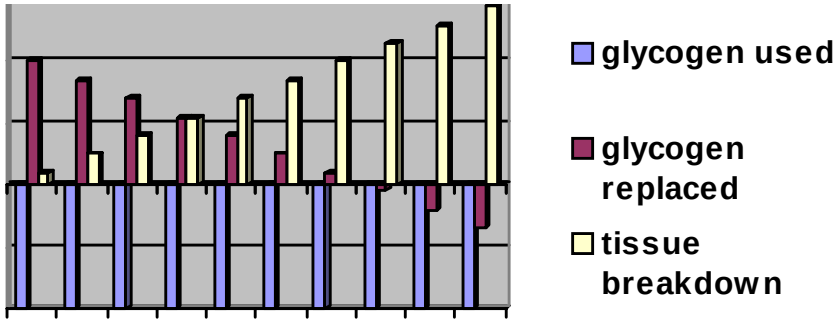
Adequate Nutritional Recovery

Maintains energy. ~ Limits tissue breakdown.
Especially during periods of high volume/high intensity.

<u>Carbohydrate:</u>
1.2-1.5 g/kg/hr
up to 5 hrs post-workout
glycogen re-synthesis, spare protein

<u>Protein:</u>
1.0 g/gram 4 carb grams
up to 5 hrs post-workout
glycogen storage, anabolic state



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Consider ONE of the following immediately after workout or racing, then another item an hour later:

Body Weight (lbs)	Carbohydrate Required to meet 1.2 g/kg	DRINK Examples (good anytime, but particularly for race days)	BAR Examples (good anytime, but particularly for race days)	OTHER Food Examples (good anytime, but particularly for home training days)
120-150	65-85 grams	35-50 oz Gatorade®* OR 35-50 oz Powerade®* OR 2 cans Carnation Instant Breakfast ™ OR 1.5 cans Boost ® OR 1.5 cans Ensure™	1.5 PowerBars® OR 1.5 PowerBar Harvest® bars OR 1.5 Clif® bars OR 2 50g pkgs PowerBar® Bites	2 cups apple juice* or cranberry cocktail* OR 2 servings of low-fat yogurt OR 1 cup dried apricots OR 1.5 PBJ sandwich
160-200	85-110 grams	50-65 oz Gatorade®* OR 50-65 oz Powerade®* OR 2.5 cans Carnation Instant Breakfast ™ OR 2.5 cans Boost ® OR 2.5 cans Ensure™	2 PowerBars® OR 2 PowerBar Harvest® bars OR 2 Clif® bars OR 3 50g pkgs PowerBar® Bites	2/3 cup raisins* OR 4 cups grapefruit juice* or orange juice* OR 2 medium bagels OR 4 slices watermelon* OR 1 bagel with peanut butter OR 2.5 cans Ensure™
>200	115+ grams	65+ oz Gatorade®* OR 65+ oz Powerade®* OR 3 cans Carnation Instant Breakfast ™ OR 3 cans Boost ® OR 3 cans Ensure™	2.5 PowerBars® OR 2.5 PowerBar Harvest® bars OR 2.5 Clif® bars OR 3.5 50g pkgs PowerBar® Bites	8 kiwi fruits* OR 2 cups canned fruit salad* OR 2 PBJ sandwich plus 1 serving yogurt

*(*indicates carb-only food)*

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Reminder: The values in this table are presented as guidelines only. While replenishing in 30-minute intervals may be a little better in terms of keeping insulin levels elevated, a swimmer will still benefit from taking a “full dose” every hour instead.

Body Weight in lbs (kg)	**Carbohydrate Required (g) to meet Intake of 1.2 g/kg**	**Amount of Common Commercially-Available 6% Carbohydrate Bottled Sports Drink**	**Food Examples (for every 30 minutes)**
120 (54.5)	65 (33 g/30min)	37 oz/hr	1 cup apple juice
130 (59.1)	71 (36 g/30min)	41 oz/hr	1 serving low-fat yogurt
140 (63.6)	76 (38 g/30min)	44 oz/hr	½ cup dried apricots
150 (68.2)	82 (41 g/30min)	47 oz/hr	1 cup cranberry cocktail
160 (72.7)	87 (44 g/30min)	50 oz/hr	1/3 cup raisins
170 (77.3)	93 (47 g/30min)	53 oz/hr	2 cups grapefruit juice
180 (81.8)	98 (49 g/30min)	56 oz/hr	1 medium bagel
190 (86.4)	104 (52 g/30min)	60 oz/hr	2 slices watermelon
200 (90.9)	109 (55 g/30 min)	62 oz/hr	2 cups orange juice
210 (95.5)	115 (58 g/30min)	66 oz/hr	4 kiwi fruits
220 (100.0)	120 (60 g/30 min)	69 oz/hr	1 cup canned fruit salad

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Body Weight	Carbohydrate Required to meet Intake of 1.2 g/kg	Amount of Common Commercially-Available 6% Carbohydrate Bottled Sports Drink	Food Examples (per hour)
120-150 lbs	65-85 grams	35-50 oz/hr	2 cups apple juice or cranberry cocktail OR 2 servings of low-fat yogurt OR 1 cup dried apricots OR 2 cans Carnation Instant Breakfast
160-200 lbs	85-110 grams	50-65 oz/hr	2/3 cup raisins OR 4 cups grapefruit juice or orange juice OR 2 medium bagels OR 4 slices watermelon OR 1 bagel with peanut butter
+200 lbs	115+ grams	65+ oz/hr	8 kiwi fruits OR 2 cups canned fruit salad OR 3 cans SlimFast

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Recovery Foods Comparison Chart

	Food Item	Amount	Carbohydrate (g)	Protein (g)	Ratio CHO:Prot	Fat (g)	Calories (Kcal)	Vit A (ugRE)	Vit C (mg)	Vit E (mg aTE)	Sodium (mg)	Potassium (mg)			
Solid Foods	Bagel w / Peanut butter	1w / 2 tbsp	49	16	3.1	17	399	0	0	3	558	345			
	Yogurt w / Grapenuts	8oz w / 1/2 cup	58	13	4.5	4	309	0	2	0	242	556			
	PBJ (white bread)	1 sandwich	44	12	3.7	18	375	0	1.5	3	415	287			
	PBJ (wheat bread)	1 sandwich	46	13	3.5	18	384	0	1.5	3.5	451	370			
	PowerBar (basic)	1 bar (65 g)	45	10	4.5	2	230	0	60	9	90	150			
	PowerBar Bites	1 bag (50 g)	32	8	4.0	5	200	0	54	9	190	160			
	Clif Bar (non-iced)	1 bar (68 g)	48	8	6.0	3.5	230	333	60	10	110	210			
Liquid Nutrition	Milk (2%)	8oz	12	8	1.5	5	122	0	2.4	0.2	122	376	Milk-based	lactose	casein
	Milk w / Chocolate Syrup	8oz w / 2 tbsp	24	9	2.7	5	172	0	2.4	0.2	170	407	Milk-based	lactose, sucrose	casein
	Carnation Instant Breakfast	1 can (10 fl oz)	37	12	3.1	2.5	220	450	30	2.5	230	610	Milk-based	lactose, sucrose	milk
	Boost	1 can (8 fl oz)	41	10	4.1	4	240	250	60	10	130	400	Lactose-free	sucrose,fructose	milk
	Ensure	1 can (8 fl oz)	40	9	4.4	6	250	250	30	2.5	200	370	Lactose-free	sucrose,fructose	soy,whey,milk
	SlimFast	1 can (11 fl oz)	40	10	4.0	3	220	350	60	10	220	600	Milk-based	sucrose,fructose	milk
	Gatorade Nutrition Shake	1 can (11 fl oz)	54	20	2.7	8	370	?	?	?	280	560	?	??	??
	VitA, VitC, VitE values based on 1997-1998 Dietary Reference Intakes (DRI) for Adult Males														
	(Vit A 1000 ug RE, Vit C 60 mg, Vit E 10 mg aTE)														

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Individual Energy Requirements

First, covert your weight to kg: _____ lbs / 2.2 = _____ kg

	Low 6 g/kg-carb 1.4 g/kg-prot	High 10 g/kg-carb 1.8 g.kg-prot	Recovery 1.0 g/kg-carb for up to 3 hrs	Foods:
Carb total			---	
Carb recovery	---	---		
Carb remainder			---	
Protein total			---	

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Example:

140 lbs / 2.2 = 63.6 kg

	Low 6 g/kg-carb 1.4 g/kg-prot	High 10 g/kg-carb 1.8 g.kg-prot	Recovery 1.0 g/kg/hr-carb for up to 3 hrs	Foods:
Carb total	382	636	---	
Carb recovery	---	---	64	
Carb remainder	318 (382 – 64)	508 (636 – 128)	---	
Protein total	89	114	---	

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Recovery Nutrition Tips & Reminders

Start the replenishment process IMMEDIATELY! The “window of opportunity” for maximizing glycogen repletion starts to close as soon as exercise stops…it lasts for about 2 hours.

Pulse the system. Try to eat something substantial *every hour* versus waiting for the large meal or eating only every 3-4 hours.

Adjust post-exercise fuel intakes accordingly. Focus on maximizing glycogen repletion when practices are exhaustive. You might not need to replenish as long when workouts are not as intense.

Most replenishment periods should continue for at least 2 hours, but may last as long as 5 hours if the workout was completely exhaustive.

Something is better than nothing. If you just can’t meet the 1.0 g/kg/hr for at least two hours recommendation, consuming *some* carbohydrate fuel immediately after workout will do more to help prevent chronic or long-term glycogen depletion than consuming nothing at all.

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Meet Day Fuel
(2-3 days prior to meet)

- Reduced training load.
- Focus on replenishing glycogen stores.
- Keep protein and fat intake consistent.

Meet Day Fuel
(within 24 hrs of meet)

- Fuel for the day, not the race.
- Keep energy/blood sugar levels stable.
- Schedule meals to enhance recovery.
- Consider timing.
- Solids and liquids, depending on race schedule.

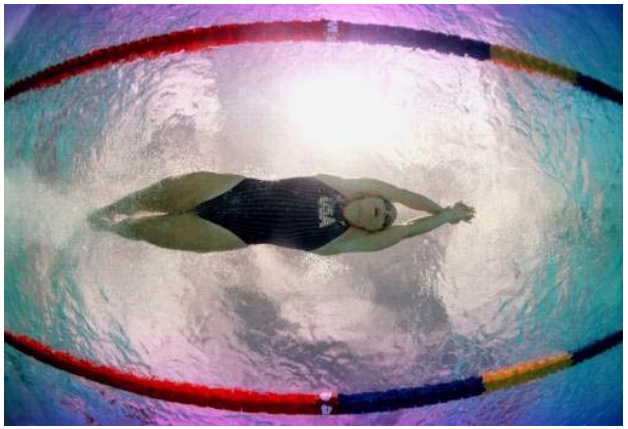
Meet Day Fuel
(night before and morning of)

Night Before

- High-carbohydrate snack.
- WATER/FLUIDS (2 full water bottles).

Breakfast

- 250 kcal about 1 hour before meet.
- High-carbohydrate.
- WATER/FLUIDS (one full water bottle).



Meet Day Fuel

<u><1 hour to race</u>

– easily digestible, high-carb, low reacting drinks/foods

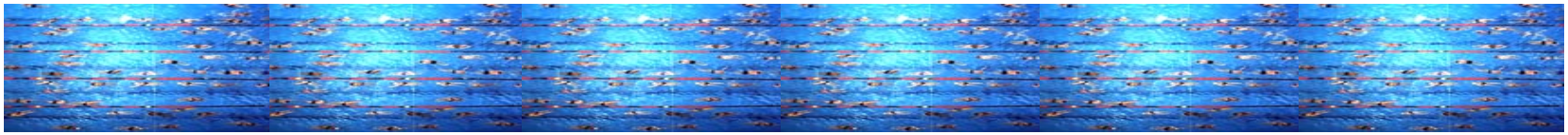
<u>2-4 hours to race</u>

– solid, carb-dense, moderate- to high-reacting foods/drinks

<u>>4 hours to race</u>

– solid, carb-dense, high-reacting meals

Sample Prelims Menus…



normal sugar level

Mini Wheats w/ milk Raspberries Orange juice	Pancakes w/ blueberries Banana Grapefruit juice	Bagel w/ peanut butter Blueberries Orange juice
Warm-up Yogurt	Warm-up Nouriche	Warm-up Carnation Instant Breakfast
Race 1 Carnation Instant Breakfast Active Recovery	Race 1 Ensure Active Recovery	Race 1 Chocolate Milk Active Recovery
Race 2 Carnation Instant Breakfast Active Recovery	Race 2 Ensure Active Recovery	Race 2 Chocolate Milk Active Recovery
PowerBar	PBJ	Yogurt w/ Grapenuts
Shower	Shower	Shower
Lunch	Lunch	Lunch

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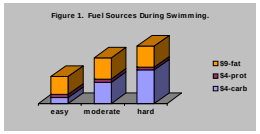

How Does Energy CO$T Impact Fueling?

Fueling During Workout or Race

- Time starts when the gun goes.
- Drink every 10-15 min for bouts >60 min.
- ¼ to ½ cup.
- Eat every 45-60 min for bouts >60 min.
- Equivalent of 1 gel or ½ energy bar.
- Water and gels okay for bouts <90 min.
- Gatorade and mixed foods for bouts >90 min.

Fueling During Recovery

- Time starts when activity stops.
- Drink and eat within the first 30 minutes.
- 1-2 cups of preferred fluid (except soda, coffee).
- 1 energy bar, bagel, Ensure or equivalent (see Tables).
- Try to eat a mixed meal within 1 hr of the initial snack.
- Try to eat a snack or small mixed meal each hour for 3 hours.
- Focus on variety, color and hydration.
- Focus on *RECOVERY*.

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Maughan's Rules of Dietary Supplements for Athletes

1. If it works, it's probably banned
2. If it's not banned, then it probably doesn't work
3. There may be some exceptions

Health & Contamination Risk Chart for Dietary Supplements

WARNING: *Lack of regulation in the supplement industry opens the door for supplement contamination that may result in adverse health effects and/or positive drug tests. Athletes are subject to sanctions even if a positive test is the result of a contaminated supplement.*

Major Brands** of Basic Multi-vitamins or Iron pills or carbohydrate-electrolyte drinks or nutritional bars

****"Major Brands" means reputable well-established companies that do not also make products containing prohibited substances.**

*Lower risk does not equal "zero" risk. There is evidence linking various YELLOW and ORANGE risk products to positive doping results.

-Mega-dose pills (more than 300% of daily requirement)
-Herbal products and products containing herbal additives (not listed as **RED**)
-Protein powders/shakes
-Creatine
-Amino Acid mixtures
-"Proprietary" ingredients
-YELLOW risk products made by companies that manufacture any **RED** risk products.

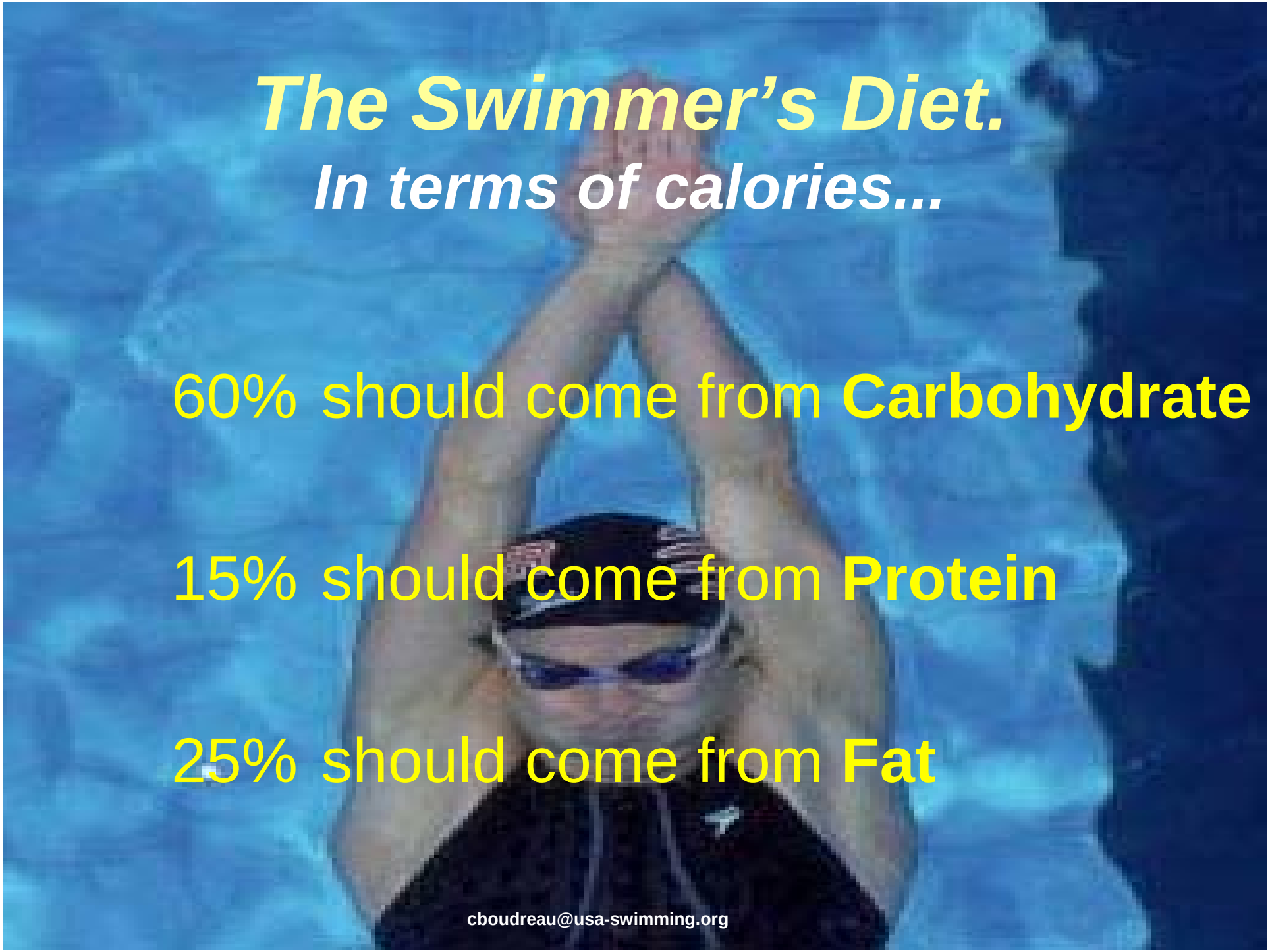
Anything with the words:

-"Andro-" or "Nor" **(Prohibited!)**
-Ephedrine or Ma Huang or Guaranna **- (Prohibited!)**
-"Anabol" or "Diol"*** or "Test"***
-"Reduces water retention"***
-"Energizer" or "Energy"***
-"Weight Loss"***
-"Muscle Builder" or "Stack" or "Stak" ***
****Likely to be or contain prohibited substances.**

Avoid products from companies that manufacture any of the above or any other prohibited substances.

Along with the US Anti-Doping Agency (USADA), USA Swimming considers dietary supplements "take at your own risk," placing full responsibility for any effects and repercussions on the athlete. The ultimate decision to use a dietary supplement is the sole responsibility of the athlete and one that should not be made in haste. All athletes are advised that the use of dietary/nutritional supplements is completely at the athlete's own risk, even if the supplements are "approved" or "verified." If you take dietary/nutritional supplements you may test positive for a prohibited substance, which is not disclosed on the product label. This would result in a doping violation. Please visit www.usa-swimming.org and www.usantidoping.org for important information regarding the risks of taking dietary supplements and the regulation of supplements in the United States. This chart was prepared by USA Swimming, 1 Olympic Plaza, Colorado Springs, CO (719) 866-4578.

For health reasons, athletes who have not completed puberty should not use any product with an ORANGE or RED risk.



The Swimmer's Diet.

In terms of calories...

60% should come from **Carbohydrate**

15% should come from **Protein**

25% should come from **Fat**

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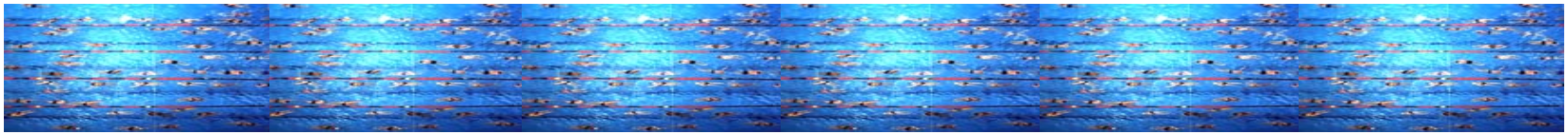
Nutrition Foundations…



Eat a Variety of Foods from all Food Groups.

Eat Colorful Foods…Including *Recovery*.

normal sugar level

Eat Early and Often…Including *Recovery*.

Drink Early and Often…Including *Recovery*.

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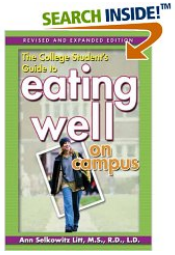
Resources…

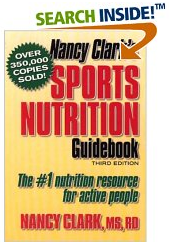
Nutrition Tracker

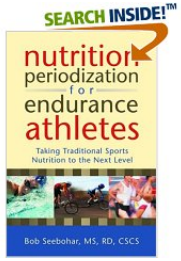
USA Swimming Sports Medicine & Science

www.usaswimming.org I Coaches I Nutrition
www.usaswimming.org I Swimmers

Online Directory
www.usaswimming.org I Coaches I Nutrition







The College Student's Guide to Eating Well on Campus (Ann Selkowitz Litt)
How to Grill – The Complete Book of BBQ Techniques (Steven Raichlen)
Nancy Clark's Sports Nutrition Guidebook (Nancy Clark)
Nutrition Periodization for Endurance Athletes: Taking Traditional Sports Nutrition to the Next Level (Bob Seebohar)

Coaches Quarterly (CQ) Special Editions:

--Disordered Eating (2003)
--Dietary Supplements (2005
--Exercise and Illness (2006)

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To inspire and enable our members to achieve excellence in the sport of swimming and in life.

Good Luck!

Swim Fast!