# The Wolverine Plan

## Training Plan of the University of Michigan Women's Rowing Team

### Prepared August, 2001; Tables Revised/Expanded June 2002

## Introduction

**Training** is distinct from "exercise" or "working out" in that the goal is to maximize performance in a particular sport or activity (as opposed to being active simply to promote good health, maintain acceptable body weight, etc. – admirable goals, but below the expectations of the serious athlete). A **Training Plan,** then, is a systematic and progressive program to allow an athlete to achieve her full potential in her chosen sport. What follows is a description of the Training Plan used by the University of Michigan Women's Rowing Team.

To understand how to get the most out of training, let us first review several core concepts exercise physiologists have identified as the Principles of Training, and consider their application to the sport of rowing. Most important is the *Overload Principle*, which tells us an athlete must challenge herself to stimulate further physiological adaptation. An untrained person can stimulate significant physiological improvement by exercising at a modest intensity for 20-30' at a time 3-4 times per week. But the elite athlete needs to train more frequently, for longer durations, and at greater intensities. A second very important concept is the *Specificity Principle.* This means an athlete must perform the greatest portion of her training doing the actual activity in which she competes – in this case, rowing. While occasional workouts doing cardiovascular activities such as running, biking, swimming, or stair climbing can supplement your basic training or provide a break from the monotony of rowing exclusively, we must recognize the limitations of cross-training. (As a side note, we recognize that *erging* is only an approximation of rowing *on the water,* and can't develop many of the fine technical skills required for success. At the same time, *as a training tool,* in some ways erging is actually superior in that it allows us to much more accurately quantify performance, which is critical to success as will be discussed below.) Another application of the Specificity Principle is that a rower must train to perform during a *2000-meter race.* Therefor the training for an event that lasts a little under seven minutes is different than for a 100m sprint or a marathon. A third Principle of Training is the *Reversibility Principle.* This means that training gains are *not permanent*. The outstanding performances of last year can not be duplicated or improved without continued effort this year. Athletes who stop training lose fitness, regardless of the reason (poor motivation, injury or illness, lack of time, etc.) How much and how fast varies depending on circumstances, but **any** reduction in training could make the crucial difference between winning and losing for the elite athlete. Finally, another Training Principle might be called the *Individual Differences Principle.* This recognizes that every athlete is genetically different and all athletes are not expected to respond to the same training program in the exact same way. Some athletes won't make the same progress over the course of the year as their teammates, and it won't be for lack of trying. However, the Training Plan will allow every athlete her best chance at reaching her own personal potential.

Your coaches consider the benefits of training so self-evident as to hardly require elaboration, so we'll confine ourselves to just a couple of comments relating training to success. If the team's ultimate goal is to win the National Championship, then we must recognize this goal will not be achieved without cost. A favorite metaphor is to think of the NCAA finals as an auction, where each team and each crew will "bid" for their place. Training represents the funds you have available to make your bid. A crew that has trained poorly will be out-bid early, perhaps starting the race at a fast pace but fading quickly as their limited funds expire. A crew that has invested wisely in their Training Plan and accumulated plenty of funds will be able to bid strongly early in the race, setting a fast pace in the first 600-700m while still having plenty of funds in reserve as the bidding increases in the middle of the race and into the final 200-300m. We want to show up at the line holding a sack of $100 bills in each hand, while our opponents are jingling a few coins in their change purse. But to accumulate that amount of funds requires a substantial amount of training. (Perhaps during a lengthy ergometer workout, you can envision dollar signs where the meters appear, like a

slot machine hitting a jackpot.) Still another metaphor is to imagine that when we race we are going to war, and superior training means we show up with bigger guns and more ammo.

Before looking at our Training Plan in detail, please consider a basic and unalterable truth: *training is essential for success.* This is a Law of Nature, like gravity. Your coaches have determined the amount of work necessary to give us a realistic chance to compete for a National Championship. This can't be negotiated. Still, athletes on occasion try. You can recognize how absurd the following conversation would be between a doctor and a very sick patient:

> Doctor: I'm sorry to report you have cancer, which is life-threatening and will require painful and
>
> debilitating treatment for a long time.
>
> Patient: But I have a husband and three young children and a part-time job, and I have so many
>
> plans right now!

Doctor: Oh. In that case, you just have a bad cold.

Yet some athletes apparently expect to have the following exchange with their coach:

> Coach: Here is the Training Plan we need to follow to give us a chance to win NCAAs. It means
>
> several hard workouts a week from September to May with little mental or physical rest.
>
> Athlete: But I have to study and I have a boyfriend and I want to hang out with my friends and I
>
> tend to get sick easy!

Coach: Oh. In that case, just train once in a while when you feel like it.

The point is, your coaches are only pointing out some physical truths, not setting policy for the Universe. If the goal is to win, the price can't be negotiated. The only thing that can be negotiated is the goal. We could train less and still beat a lot of crews. The decision you the athlete must make is, how many crews am I satisfied with beating?

## General Features of the Plan

Before getting a complete description of the workouts we will do, there are some general features of the Plan you should recognize. The first is, this is no magic formula and there are no clever gimmicks.

Some will be disappointed to learn the secret to success is simply lots of hard work, *which in the first place is no secret and in the second place anyone else can do too!* The Plan will help you organize and focus your efforts more efficiently, but athletes must accept that success or failure ultimately rests on your shoulders. Some find that a blessing and some a curse, but in one sense the Plan is simply a way for you to take ownership of your readiness to race.

Another feature of the Plan is that it doesn't vary much throughout the year. There are different levels of intensity for various workouts which range from short pieces at race pace and cadence, to much longer pieces at lower ratings and power outputs. But all workouts will be performed throughout all portions of the year in roughly the same proportions (with the exception of a little less race-pace work in September and October). This is different from some approaches to training, which might label the fall as a time for laying an "aerobic foundation", the winter as a period for "general conditioning", and the spring as a time for "specific race preparation". In fact, effective training should *always* be geared toward specific race

preparation. It is not possible to completely isolate and separate different aspects of physiology, training them separately and sequentially, expecting gains in one area to persist when moving on to another area. This would be analogous to expecting an infant to grow by first maturing its skeleton, then its muscles, and then its vital organs. In fact, their growths are interdependent and each must mature in conjunction with the others. (Some tissues do mature at slightly different rates, but there must be a certain proportionality, and the same is true for training.)

This Plan is meant to apply equally to all workouts, whether performed on the ergometer or on the water. Once the basic formats and instructions are understood, each workout may be performed in either environment. This allows a lot of flexibility when water conditions are unrowable. And while its nice to see athletes perform well on the erg, the ultimate goal is to perform well on the water. Towards this end, it is essential to perform the workouts consistently, with the same intensity for specific workouts when on the water as on the erg. Throughout the year, athletes cox'ns and coaches must learn to oversee or perform workouts in the prescribed manner.

The Plan features a fairly high volume of training, but note there will be no large or sudden increases in volume or intensity. The Plan is to systematically, progressively, and continually build throughout the duration of the season. This will minimize the risk of overtraining and minimize the need to taper before competition. (These topics will be discussed more fully later.) Individual workouts will rarely be perceived as exceptionally difficult or bordering on impossible. It *will* be a challenge to perform day after day, but an *attainable* challenge.

To make optimal progress, it is necessary to *monitor* progress and keep accurate records of all workouts. This will be addressed more fully with examples for specific workouts, but the basic message is clear: learn to keep detailed records of all your workouts. You will be asked to turn in results of your training regularly (on prepared forms that will be provided). Note these records are necessary for your coaches to determine if training is effective and whether the team or any individuals requires special attention. In addition, you are encouraged to keep personal records of your own. Get a notebook or training log where you can record all scores, as well as other information that may prove useful. This might include notes about your diet, sleep, emotions, etc. This may be entirely private and for your eyes only, or it may be something you would eventually want to review with a coach or trainer for insights into your performance. The training log could be thought of as a bankbook to record the funds you are putting away for your Championship auction.

The Plan recognizes that different athletes start the year at different levels of fitness, and progress at different rates. Furthermore, sports psychologists recognize that athletes perform better with specific and individualized goals (as opposed to general comments like "work hard" or "do your best"). You will be taught how to calculate specific performance goals (splits, meters, etc.) for various workouts. For some workouts, your goal will be simply to perform better (by any small amount) than your previous similar workout. You simply need to recognize that any progress is a step forward, and the progressive nature of the Plan recognizes that over the course of the year, a lot of little steps add up to huge gains. (While we don't specifically plan to take any backward steps, we recognize they do occasionally happen, and if they are not too frequent and not too large, we recognize that eventually the desired forward progress will be made.)

Finally, a few words about the *names* of the workouts. A distinct lack of imagination will be quickly noticed. The overall program is referred to simply as "The Training Plan", and different workouts are grouped into categories ranging from Level 1 (most intense) to Level 4 (long duration, low cadence). This is preferable to using terms such as "steady state", "anaerobic threshold", "lactate tolerance", etc. which are generally misleading or just plain wrong. Names that simply describe the workout rather than misidentifying physiological energy systems would be preferable, but as it turns out, "Short Intervals of 250-1000 Meters Duration Totaling Approximately 4000 Cumulative Meters At An Intensity At Or Below Race Pace" can be pretty awkward, so let's just stick with "Level 1".

## Details of the Plan

A typical week's training will consist of nine water and/or erg workouts of various types (supplemented by two lifting sessions). The entire Plan can be thought of as a pyramid, with the apex consisting of Level 1

workouts and the base made up of Level 4 workouts. The intermediate strata are composed of Level 2 & Level 3. The entire purpose of the Level 4 and other underlying levels is to support the apex, or Level 1. We will begin there and work our way down.

## Level 1

As prescribed by the Overload Principle (the fundamental Principle of Training), we must continually challenge ourselves to stimulate further improvement. Furthermore, according to the Specificity Principle, our training must be performed while doing the activity at which we compete, and periodically we should train *at the specific intensity* at which we compete. Therefor Level 1 workouts are the backbone of the Training Plan. These workouts are critical to develop true racing speed, and are performed at intensities of 95-105% of competitive 2K pace (expressed as m/s). But as effective as they are, they are very demanding and require significant recovery to realize their full benefits. As a result, we will only perform Level 1 workouts once a week (every other week in September and October). These workouts will only make up approximately 3-4 % of the total meters we row. The basic format is to row intervals as short as 250m to as long as 1000m (and rarely, slightly longer). The total number of meters in one workout should add up to about 4000. (This figure is determined simply by doubling the competitive distance of 2000 meters and seems to give the best overall results, but smaller distances totaling as little as 1500m can still be very effective if circumstances require a shorter workout.)

For reference, a typical Level 1 workout is **8 x 500m.** Other common variations include **4 x 1K** and a **4K Pyramid** (250m/500m/750m/1K/750m/500m/250m). The most important factor is to maintain the proper *high intensity* over the duration of the workout. The *minimum* (i.e., slowest) acceptable intensity for this workout at the beginning of the (fall) season is the average 500m pace from your personal best 2K test. In other words, if your best 2K to date is 7:15.0, your average 500m split is 1:48.8, and that would be the *slowest* pace at which you would complete the 8 x 500m (or other Level 1) workout. Go faster if possible, but don't attempt to force the pace too much. Let it develop naturally over the winter, and you will be encouraged to push the envelope more as spring approaches. The suggested goal pace refers to your *average* pace for the entire workout. There will be some fluctuation of pace from piece to piece, but fluctuations should not be too large. We will discuss pacing strategy for all workouts in more detail a little later, but the basic idea is to be consistent, and be smart, so you are able to finish strong.

Since all Level 1 workouts are performed using the Interval format (after all, how could you do a Continuous 4000 meters at 2K intensity?), it is also necessary to consider the *recovery* intervals that follow the work intervals. The distance and intensity of recovery intervals will be prescribed for each workout, just as the work intervals are. A key term to understand is the process of *active recovery* (distinct from *passive* recovery, which is simply becoming totally inactive). The idea is to finish a work interval, say 500m, and after a few seconds of catching your breath and recording your score, to immediately reset the monitor for the recovery distance (for Level 1 workouts, generally the same distance as the previous work interval). At a low rating (16-18spm), row at the designated minimum recovery intensity. (Consult the Level 4 Pace Chart to find your warm-up/recovery intensity based on your 2K PR.) Active recovery after high-intensity work promotes faster and more complete recovery and minimizes fatigue by increasing circulation and promoting the removal of metabolic waste products. This is critical when attempting to maintain high performance during high-intensity training. It is important to feel fairly recovered as each piece starts (though you may quickly lose that feeling as each piece progresses). Therefor, it would be better to recover a few seconds too many than too few when performing Level 1. However, it is important to be consistent from workout to workout so as to avoid artificially improving your times by extending your recovery periods. In general, you should expect to finish your last work interval about 40' after beginning your first interval when performing Level 1 workouts.

## Level 2

Level 2 workouts are similar to Level 1 in that they are fairly high intensity (~ 90-95% 2K intensity). The duration of each piece is a little longer (generally 1500m-3K) and the total meters for the workout almost twice that of Level 1 (usually 7.5K, give or take 500m). This would be ~ 6-8% of the training distance for one week. Typical workouts include **5 x 1500m; 4 x 2K;** and a pyramid of **3K/2.5K/2K**. We will do Level

2 workouts once per week (once every other week in the fall, alternating with Level 1). The minimum or slowest pace for Level 2 when beginning the season is roughly 2K PR pace * 1.08. For example, if your 2K PR is 7:11.0, your 500m split is 1:47.8. Convert this # to seconds and multiply by 1.08:

107.8 * 1.08 = 116.4, or 1:56.4/500m. You should be able to average this pace over the entire workout. As your fitness improves, simply note your performance on past workouts and attempt to improve during the season. Active recovery intervals will be prescribed for each workout, the recovery intervals generally being a little shorter than the work intervals (for example, 2000m work → 1500m recovery).

Level 2 workouts are perhaps the most psychologically demanding in the Training Plan. Anybody can punch it out for 500m, but to keep up the intensity for 2 or 2.5K takes guts. These workouts are crucial for training your mind as well as your body.

## Level 3

Level 3 workouts are generally continuous in nature (though occasionally the interval format is used), performed at a consistent pace for a total duration of ~ 12K. The intensity is ~ 85-90% of 2K velocity. The focus is on endurance more than speed, though a shorter Level 3 workout can approach Level 2 intensity. Level 3 workouts are typically performed 2-3 times/week, accounting for ~ 22-25% of total training meters. Sample workouts include **Continuous 12K** (beginning at shorter distances in the fall and progressing to even longer distances by spring); **2 x 6K** (with 7-8' recovery between pieces); and **15 x 3'** (with 1' recovery between pieces).

## Level 4

For someone just being introduced to the Training Plan, Level 4 workouts will require the most explanation. These workouts make up the greatest proportion of total meters rowed, accounting for ~ 65-70% of training volume. Intensity is generally ~ 80-90% of 2K. Level 4 workouts are unique and contain a few features the other Levels do not. In the first place, stroke rating is always strictly prescribed, whereas rating for Levels 1-3 vary somewhat from person to person. The ratings are fairly low, beginning at 16spm and occasionally reaching 24 or even 26spm, but most ratings will be in the 18-22 range. On the water or on the erg, these workouts can be used to develop timing & rhythm as well as conditioning, since all rowers must follow the same cadence. But the primary physiological benefit is to develop not only endurance, but also strength and *power per stroke.* Another important benefit is to develop a very accurate sense of pacing. Still another potential benefit that encompasses psychological as well physiological and neurological adaptation, is that by learning to produce a given power output at lower ratings, it should be possible to eventually produce the same power output using a higher rating, creating a decreased perception of effort. In plain English, that means that even though you are performing the same amount of work on the oar, it feels easier and you are more likely to hold the pace longer.

Another feature of Level 4 is that goals for 500m splits and distances covered in a given time period are very explicit and individualized. First, let's look at some sample workout formats and how an individual workout is structured. Level 4 workouts range from **40-70'** of continuous effort. Other variations include **2 x 40'** (with 6-7' recovery between pieces) and **4 x 10'** at a proportionately greater intensity (with recovery intervals of 3' 20"). Each piece will be subdivided into segments of either 10' or 6' length, so a 40' workout may be thought of as 4 consecutive 10' pieces with no recovery. Consult the chart labeled "Level 4 Sequence Formats" to see descriptions of various 10' & 6' segments. For example, two common sequences in the fall are referred to simply as "176" and "180". The numbers refer to the total strokes in the sequence and are a way of quantifying the overall intensity of the piece. The higher the number, the more difficult the sequence. The Sequence Format chart also explains the stroke rate changes during the piece. For example, "180" involves 4' @ 16spm, followed by a shift for 3' @ 18, then 2' @ 20, and finally 1' @ 22. In the fall, a 40' Level 4 workout may be described as "176, 180, 176, 180" and you would begin by completing a 176 sequence and segue immediately into a 180, then a 176, and finally another 180. The total # of strokes for this piece would be 712, and the average spm = 17.8. As the season develops and fitness improves, a 40' piece will become more difficult as sequences with more strokes are used (for example, "188, 200, 196, 200" = 784 total strokes, an average of 19.6 per minute). A typical rate of progression is to

add 4-8 strokes to a given time frame per workout, so 40' might go from 720 → 724, and 60' from 1092 → 1100.

So, each Level 4 workout is formatted by its ratings structure and quantified by total number of strokes. Another way of quantifying intensity that is specific to each athlete is pace (500m split) *per stroke rate.* This means that while everybody will be doing the same workout in terms of number of strokes, each person will be expected to cover a different distance for that given stroke total. The expected distance will be a function of each athlete's personal best for a 2K test. The first thing to do is calculate your 2K PR 500m pace, rounded to the nearest whole number. (Example: 2K PR = 7:11.3 → 500m pace = 1:47.8 → round off to 1:48.) Next, consult the chart labeled "Level 4 Pace Chart". Locate your 2K PR pace in the left-hand column, and read across to find your prescribed pace at various ratings. For example, if your 2K PR pace is 1:48, your 500m split when rowing at 16spm should be 2:15; at 18spm, 2:10; at 20, 2:06; at 22, 2:01; and so on. (Also note the minimum *warm-up/recovery pace* is designated at 2:32.) This does not mean that *every* single stroke you take at 16spm will show "2:15" on the monitor. For that matter, your stroke rating will occasionally vary slightly around an *average* of 16 (or whatever) during a particular segment of a particular piece. But it is important to become familiar with your paces as soon as possible, and develop as much accuracy and consistency as you can. The distance (total meters) you should cover during a given sequence, if you hit your goal paces exactly, can be determined by looking at the chart called "Level 4 Distance Chart". (There are separate charts for 10' and 6' sequences.) For example, if your 2K pace is 1:48, according to the Distance Chart you will cover 2288 meters during a 176 sequence and 2305 meters during a 180. You will be provided with a Record Sheet to record both your *goal* and *actual* meters for each segment of each workout. This will enable you and the coaches to chart your progress and see how consistent you are during specific sequences.

Since your 2K PR pace as well as your Level 4 goal paces and distances are all calculated with a certain amount of rounding off, your numbers may vary slightly from what is expected. But with a little practice you should be able to come very close to hitting the numbers you want. The most important thing is to develop consistency within the framework of your own workouts. As with all the workouts in the Plan, its okay to exceed your goals if it comes naturally, but don't feel obligated to force the pace beyond the goal. Baby steps, baby steps. If this is your first year on varsity and you are following the Plan for the first time, your rate of improvement will probably be greater than that of a senior. If you reach a point where your totals are exceeding the goal of the *next* 2K pace on the Pace Chart, you will be reassigned a new 2K pace for reference. Otherwise, you will probably keep the same 2K reference pace you use at the start of the season, even if your actual 2K PR improves (as it will!) during winter testing. But this will depend on the circumstances of the individual.

A couple other comments about Level 4:

Workouts are designed to be continuous, but 70' can be a long time and sometimes a workout will be interrupted. Of course, on the water it is unlikely you will be able to row 70' continuously without having to turn the boat. From a *physiological* standpoint, a brief interruption will not lessen the benefits of the workout. Just try to complete the sequence in progress, then turn without wasting time and resume rowing as quickly as possible. On the ergometer, it is *strongly* urged you row each piece continuously unless absolutely unavoidable (nature does sometimes call at an inopportune moment). If your workout should need to be interrupted, simply record the meters for each of the sequences already completed, take care of business, and then reset your monitor for the time remaining. Again, this is for *emergencies* only.

Nothing good will come of stopping a workout every time your butt itches or you want to change the CD in the boombox. We want to be mentally tough and able to focus for an entire workout, and every time you interrupt a workout before it's completed makes it that much easier to stop the next time.

Another point regarding Level 4 workouts is to reiterate the importance of developing consistency on the erg, and then applying that consistency to workouts performed on the water. On the water there is much less feedback regarding actual performance vs. your perception of effort. You want to be able to apply the same pressure to the oar at a given stroke rate, whether during the 1st minute or the 70th minute of a piece.

## Other Training Factors

**More About Stroke Rate:** Ratings during Level 4 are designated as part of the workout**,** but for Levels

1-3 athletes should select ratings most comfortable for them and allow ratings to develop naturally, without too much conscious thought. In general, ratings for Level 3 will probably be in the range of 24-28; Level 2, 26-32; and Level 1, 30-36. These numbers may be even higher at the end of the year as maximum fitness is reached. A general rule of thumb is if an athlete can reach her goal at a lower rather than a higher rating, good. That leaves more room to improve. If an athlete must row excessively high to reach her goal early in the season, there will be problems later. (Lack of strength is probably a factor and could be addressed specifically during other conditioning portions of the overall training season.) On the other hand, if an athlete's paces are stagnating during different workouts, she may need to consciously work on bringing the rating up. Finally, note that ratings on the ergometer don't translate exactly to ratings on the water (it should be easier to achieve higher ratings in a shell since the hull runs out under the crew during the recovery). But ratings on the ergometer should be in the general ballpark of ratings on the water for a given workout. An athlete who can do 8 x 500 on the erg at a 1:44 pace while rowing at a 22 is pretty impressive, but if she can't produce that power at a 36 while in an eight, she won't be helping anybody win races.

**About *Drag Factor* (Resistance):** The resistance encountered while using the Concept II ergometer varies as a function of the flow of air through the flywheel during the stroke (more air means a "thicker" fluid and more resistance). The airflow can be controlled by adjusting the damper to the right of the flywheel, and a setting of 3-4 is generally appropriate for female athletes. The optimal setting varies from person to person as a function of strength and overall fitness. A given flywheel damper setting does not always correspond to a given resistance, however, due to variations in individual ergs (dust in the fan, etc.) and variations in the environment (such as barometric pressure or wind). The erg monitor can numerically quantify the resistance by calculating the *drag factor.* (Simultaneously press "OK" and "Rest" and the drag factor will appear in the lower right corner of the monitor. Adjust the damper setting to get the desired resistance. For greatest accuracy, calibrate while pulling approximately a *2:15* split.) Generally, a number around *120* is appropriate for female athletes, but the ideal # would vary for any individual. Now, there is some concern that athletes may select a drag factor that is inappropriately high (creating an increased risk of injury) in an effort to maximize performance. Concern is especially great for Level 3 & 4 workouts, where low ratings and long duration create proportionally greater stress to tissues susceptible to injury. As a matter of policy, always adjust drag factor to ~ 115 for Level 4 and ~ 120 for Level 3. Levels 1 & 2 may be set at your discretion to maximize your performance, but use good judgment.

**Warm-Up and Cooldown:** To achieve optimal performance during a workout, it is important to prepare by warming up thoroughly before starting the workout. On the ergometer, this would mean a *minimum* of

8-10 minutes for a Level 4 workout, and 15-20' for Level 1. The shorter and more intense the workout, the longer the period of preparation. Include several minutes of low-intensity low-cadence rowing at your designated warm-up intensity, interspersed with an occasional power 10 or 20. After completing the warm-up, before starting the actual workout, you should be sweaty and breathing harder than at rest. Warm-up is necessary to give your circulatory system time to open up capillaries in the active muscle, to allow your heart rate and stroke volume to expand, to begin the sweating (cooling) process, to mobilize your energy stores and activate the necessary metabolic pathways, etc. Next to poor pacing strategy, probably the most common reason athletes under-perform during workouts or while racing is failure to properly warm up. Let's not sacrifice the benefits of so much hard work by ignoring so simple a process.

When the workout is completed, you should allow your body the opportunity to adjust gradually to the change in conditions. As discussed under *active recovery*, maintaining a modest intensity for several minutes after the workout will help minimize the fatiguing effects of the workout. The amount of time required is somewhat inversely proportional to the length of the workout. After a long Level 4 workout,

5' may be enough, but 15-20' may be required after a Level 1. This might include a low-number Level 4 sequence. Allow your heart rate and ventilatory rate to return to nearly resting levels before proceeding to stretching.

**Pacing:** This topic will be addressed in many ways at many times throughout the year, since it will have enormous impact on the overall success of the Plan and the outcomes of races. We should consider the

proper pace for a single piece, all pieces within a workout, all workouts within a week, all weeks within the year, etc. And most important, the proper pace to achieve maximum results for a 2000-meter race! In a nutshell, the most efficient and effective way to expend a finite amount of metabolic energy is to do so at a consistent output. For example, if you were truly capable of performing a 2K erg test in 7:00, the best strategy would be to settle *immediately* into a 1:45 pace and hold it until the test is completed. Setting off at an unrealistically fast pace results in the situation commonly referred to as "fly & die": the athlete pays for the rash act by being forced to endure a disproportionately greater accumulation of metabolically fatiguing byproducts, and the pace gradually fades (and fades and fades…) This is as painful for a coach to watch as it is for an athlete to experience. The opposite strategy would be to row conservatively in the beginning, gradually picking up the pace throughout the test. This allows the athlete to put the hammer down at the end, and would probably result in a faster time than the Fly & Die strategy. But it's not optimal because there is too big a deficit to overcome due to the slow start.

The ideal compromise, therefor, is to race at some consistent "optimal" pace. The trick is discovering *what* that pace is. That is a big part of what we will accomplish this year, both for individuals on the erg, and entire crews on the water. As the year progresses, we will move closer and closer to that ideal race pace and work on holding it consistently from beginning to end. Early in the season, as you begin performing workouts on the erg and recording scores, its perfectly acceptable (in fact, encouraged) to be a little conservative. Give an honest effort on your first piece of the day, but it should never be your fastest. For example, an athlete's first 8x 500m workout may look like this:

1:47.2, 1:47.0, 1:47.0, 1:46.9, 1:46.8, 1:46.5, 1:46.3, 1:45.1 (average = 1:46.6)

Next time, she would begin with the first pieces closer to the previous average, and attempt to bring the overall average down 2-3 tenths. The above performance is in contrast to an undisciplined athlete who might do something like: 1:44.5, 1:46.0, 1:46.6, 1:46.4, 1:46.9, 1:47.9, 1:52.4, 1:49.5

The more fit & experienced you become, the smaller the variation between pieces. We also want to minimize variation *within* pieces. Each 500m piece should begin with a couple rapid hard strokes to get the wheel spinning, then settle right into a consistent pace. It is not effective training to begin each piece at 1:39 and finish at 1:50, even if on paper you achieve your goal of 1:45. The concept of minimal variation between and within pieces also applies to Level 2 (e.g., 5 x 1500m), as well as sub-intervals within continuous pieces. You may be asked to record the 2K splits within a 12K piece, and the overall progression should be fairly even, with a slight trend toward getting faster, rather than a gradual decline or a bell-shaped curve. When doing a Level 4 workout, the distances for a given sequence (e.g., 180) should show the same pattern.

Poor pacing strategy during an erg test or race will result in serious under-performance. It is a sign either of inexperience or mental weakness (and you will have plenty of experience by the time the testing and racing portions of the season arrive). An athlete who is afraid of performing poorly on a test will often go out much too hard as a way of sabotaging her own test. The results will fall short of expectations, but at least she can say "Hey, I went for it!" This attitude is unacceptable. Going for it means going for *your* pace, not someone else's or some unrealistic and ultimately unattainable pace. True mental toughness means having the discipline to not be overcome by adrenaline at the start, and holding back just enough to settle into a pace that, if held, will end up challenging your will to live by the end.

To emphasize one of the points made earlier: our goal when racing is to set a fast pace at the start, hold it in the middle, and still finish strong at the end. In a true dogfight of a race, the victory will most likely go not to the crew who sprints the most, but who fades the least. By training effectively, we expect to have a lot of fight in the dog and to not be the crew that fades.

**Calculating Paces:** In most cases, you will not need to calculate any information pertaining to your workouts. An erg or a coach will do it for you. However, it's nice to be able to if necessary (for instance, you lose information from your monitor before recording it). Two helpful calculations are to determine the average 500m pace for a given distance or time, and to project time or distance from a given 500m pace.

To determine 500m pace from any workout, divide the total number of seconds by the total number of meters, then multiply by 500. Example: row 12K in 48:33.6. What's the average pace?

1. Total # of seconds = (48 * 60) + 33.6 = 2913.6
2. Total # of meters = 12, 000
3. 2913.6 ÷ 12,000 = .2428 → .2428 * 500 = 121.4, or **2:04.1**

Second example: row for 60', cover 13,098 meters. Average pace?

1. Total # of seconds = 60 * 60 = 3,600
2. Total # of meters = 13,098
3. 3600 ÷ 13,098 = .2749 → .2749 * 500 = 137.4, or **2:17.4**

To project *time* from pace, multiply *seconds per meter* by *total meters*. Example: I rowed 12K @ 2:04.1, but I lost the total time. How long did I row?

1. 2:04.1 = 124.1s/500m = .2482
2. .2482s/m * 12,000m = 2913.6s, or **48:33.6**

To project distance from pace, multiply *meters per second* by *total seconds*. Example: I rowed @ 2:17.4 for 60'. How far is that?

1. 2:17.4 = 500m/137.4s = 3.639m/s
2. 3.639m/s * 3600s ~ **13,100m** [some accuracy lost b/c rounding]

**Record Keeping:** As mentioned, accurate record keeping is essential to the Plan. It is necessary to be able to look at scores and chart individual and team progress. You will be provided with a Record Sheet prior to the start of each week of practice. (A sample is provided.) Be sure to record the specific information required: **time, distance,** or **pace.** For Level 4 workouts, you are asked to record your *goal* as well as your *actual* meters. Please be sure to properly set your erg monitors to record the designated *sub*-interval when necessary. The default intervals are 2:00 (time) and 500m (distance). If you are going to do 60' Level 4 with 10' sequences, begin by setting the monitor for 60' as normal. Then simultaneously hold down "OK" and "Time"; a flashing "2:00" will appear. Use the "Set Digits" keys to customize the sub-intervals to 10'. When this is accomplished, press "OK" a second time. The monitor should now show the total 60' time, and you are ready to begin. The same method is used to customize for distance. If you are rowing 12K and are asked to record paces for 2K sub-intervals, begin by setting "Meters" at 12K as usual. Then simultaneously hold "OK" and "Meters" till the flashing "500" appears, adjusting until the desired distance is set. Finish by pressing "OK" again. To recover the sub-interval information after completing the workout, press the "M" (for Memory) key until all information is recorded (use the "Display" key as usual to change the screen to "total", "pace", etc.) The last sub-interval appears first and information is presented in reverse order. You can scroll through as often as necessary. Even if you accidentally shut off the monitor or it shuts off on its own, you should be able to turn it back on and retrieve the information, as long as another workout has not been performed on that erg. You can recover partial information from an incomplete piece using the "M" key. If you must leave the erg in the middle of a long Level 4, for example, and want to record the sequences you have completed, begin by pushing "Off" to clear the screen, then "On" (all zeroes will be visible). Next push "M", and information for the last *complete* sub-interval will appear. Scroll back to record information for all completed sub-intervals. Please be sure to make a note on your Record Sheet that your workout was interrupted (we don't need to know the details), indicating where the break occurred.

A typical comment written on Record Sheets in the past has been, "The monitor wouldn't give me that information." It will if you set it and ask it correctly! Once you have completed a training week, you will

transfer all of your workout data from your personal sheet to the official team training log kept in the erg room. Please record your information *neatly, legibly,* and *promptly!*

It is assumed your recorded scores will be true and accurate representations of your workouts. The intent is to give you as much flexibility in performing workouts as is practical, and your coaches aren't interested in spending valuable time validating your scores. Nobody will question the scores you submit (unless an actual recording error is suspected). The Plan could not be implemented without trusting athletes to keep honest records of their training. It is likely that in the past an athlete or two has abused this trust and submitted a score for a workout that wasn't completed or altered the score of a completed workout. Ultimately that can only harm and not help the athlete. We do not plan to say any more on this subject.

**Overtraining & Taper:** O*vertraining* is a simple concept. While it is clear that physiological improvement cannot occur without a significant training stimulus, or *overload*, it is equally clear that too much overload can impair rather than improve the athlete. This is most likely to happen when training volume and/or intensity increase in large increments, allowing insufficient time for adaptation. Athletes who are inactive for extended periods of time and jump into a full-scale training program by attempting to do the same workouts they did when in a properly conditioned state are inviting injury and symptoms of overtraining. Two solutions are to 1) not get too far out of shape (maintain some conditioning during the off-season), and 2) progress training volume & intensity at a reasonable rate. Our Training Plan is designed around the cornerstone philosophy of constant but gradual increases in workload, and you have been given fairly explicit guidelines about the minimal level of fitness necessary to begin training in the fall. Furthermore, while it is easy to recognize symptoms of overtraining such as lethargy, irritability, sickness, weakness, etc. it is important to recognize these symptoms sometimes have other causes. Symptoms that are attributed to overtraining may in fact be due to such factors as *under-recovering* or *poor nutrition*. Failing to get adequate sleep or to eat the right foods at the right times can have a serious negative impact on an otherwise well-designed training program.

One ongoing measure the coaches will use to assess the likelihood of overtraining is to monitor progress during training. If one athlete is struggling, that athlete can be counseled to help her deal with whatever difficulties she may be having. If the *entire team* is consistently having trouble reaching its expected goals, it will be time to look at the overall Plan. This reinforces the need for complete, accurate, and prompt record keeping during training.

*Tapering* is the practice of reducing training volume & intensity prior to competition to ensure peak performance. While it is a common perception among athletes that a taper is necessary to allow maximal performance, this is not clearly supported by scientific research. The benefits of tapering are most evident in situations where athletes were clearly overtraining in the first place. In other words, the benefit is not so much the taper *per se*, but removing the negative effects of overtraining. In situations where training volume and intensity are properly controlled, the effects of tapering are less substantial. Now, this is not to say we won't taper before important tests and competitions. We will. Rest assured that we have your best interests at heart. But some athletes expect a vacation and are disappointed when all they get is a modest reduction in a pretty demanding schedule. The fact is the only noticeable reduction in training will occur during the week prior to NCAAs. And the benefits are probably far more psychological than physical.

**Strength & Flexibility:** A detailed discussion of these topics is beyond the scope of this document, and you will have access to other specialists and instructors on these matters. But it is worth emphasizing that these are important qualities for rowers, for allowing proper technique and maximal performance, as well as minimizing the risk of injury. Beyond a certain level or threshold, additional strength or flexibility will probably not increase performance, and proportionally we will devote much less time to their development. But lack of strength and/or flexibility may certainly limit performance, and athletes must give the same commitment to optimizing these qualities as to the rest of the Training Plan.

**Nutrition & Hydration:** It is also beyond the limits of this document to treat these subjects with the thoroughness they deserve, but a brief treatment will be made. A simple and easily comprehended model for proper eating is the *Food Guide Pyramid*, presented by the U.S.D.A. as a guide to daily food choices. This plan emphasizes the need for complex carbohydrates in the form of breads, cereals, rice, and pasta, as well as servings of vegetables and fruits. Also important but in lesser amounts are foods in the dairy and

meat/poultry/fish categories. Foods to be limited (not necessarily avoided entirely) are those high in fats, oils, and simple sugars. This model is appropriate for general health (avoiding heart disease, obesity, diabetes, etc.) as well as providing optimal fuel for the elite athlete.

If an athlete is training seriously, performing several strenuous workouts per week, it is unlikely she will need to be too concerned about how much she eats. This is especially true if she makes the right food choices. But do recognize that training is not a license to eat anything, any time. At the other extreme, some athletes compromise their performance by not eating enough, perhaps believing that eating too much will cancel out the benefits of hard work. Remember that food is fuel, and athletes need plenty of high-quality fuel. For anyone concerned about weight management, the proper way to think of food is as an investment in your ability to expend energy. By taking in the appropriate foods in the right quantities at the right time, you provide your body with the means of expending significant amounts of energy during a workout. Starving yourself, or limiting your body's access to fuel, seriously undermines your ability to expend energy during exercise. You become unable to meet your training goals and your metabolic rate is reduced.

One problem faced by serious athletes is figuring out *when* to eat. Timing of meals is a factor that has a significant impact on performance. The busy student-athlete trying to fit morning practice and afternoon workouts around classes, study time, work, etc. does not always prioritize meals, and this may compromise training. An important term to understand regarding nutrition and exercise performance is *glycogen*. This is a complex carbohydrate stored in muscle and is your body's primary source of fuel while training. A well-trained athlete burns plenty of fat as well, but *nobody* can perform without adequate amounts of glycogen in the muscle. This is why the bulk of your diet should be composed of carbohydrates: your body disassembles the cereals, breads, vegetables, etc. you eat and reassembles the glucose molecules into muscle glycogen. After 60-80' minutes of rowing, your muscle glycogen supply is nearly depleted. It is helpful to eat a high-carbohydrate snack as soon after a workout as possible, since your muscles are most efficient at restoring glycogen at this time. Sometimes athletes will not perform well because they are literally "out of gas", having failed to restock their muscle glycogen after the previous workout. It may also be helpful to have a small snack shortly before a workout, but there is a lot of individual variation regarding effects and tolerance. One thing to avoid is a snack of sugary, quickly digested foods in the 60' or so just before working out. If the meal is broken down too quickly, large amounts of glucose appear in the blood, triggering a large surge of the hormone *insulin,* which removes sugar from the blood. This results in what has been described as a "sugar crash", leaving you in a low energy state which is not conducive to a productive workout. Once exercise begins, the release of insulin is suppressed, so ingesting simple sugars 5-10' before exercise, or during exercise, is not likely to be a problem. Items like a banana, orange, commercial sports food, etc. may be helpful in supplementing your muscle glycogen stores during a long workout. (Be warned that sugary foods or drinks ingested during exercise may promote diarrhea.) The ability to tolerate foods before or during exercise without symptoms such as cramping or gastrointestinal distress is highly variable, so use caution when experimenting with your personal limits. A primary message here is you need to *plan* to eat right so that meals complement your training as advantageously as possible. This may mean preparing meals in advance to eat when possible, while riding the bus, while studying, during lecture (if appropriate), and so forth. Sometimes a week's worth of meals may be prepared on a Sunday afternoon to be available during the busy week. This is an overlooked but important example of *doing what it takes.*

*Hydration,* of course, means sustaining an intake of water adequate for maintaining blood volume and sweat capacity during intense training, despite sometimes hot and humid conditions. Most athletes are well educated regarding the dangers of poor hydration during strenuous workouts, and coaches are educated about the need to allow athletes access to water during practice. One aspect of hydration that is not stressed as much as it should be, is the need to be fully hydrated *before* practice. A well-trained athlete can easily sweat at 2-3 times the rate at which water can be absorbed, which means that a poorly hydrated athlete will run into trouble pretty quickly no matter how much water or sports drink is ingested. Make a conscious effort to drink water regularly, especially the 2-3 hours before a workout. Frequent trips to the bathroom are a small price to pay for health & performance.

## Qualities of a Champion

Pause now to reflect on what it will take to become a Champion. Training is a huge component regarding success in athletics and particularly rowing. If you remember the movie *Rocky,* a wonderful story that allows us to cheer for the underdog and imagine it is possible to accomplish anything, you must also remember it is essentially a fairy tale. Rocky Balboa is a second-rate out-of-shape club fighter who in the span of a couple of weeks, through sheer force of will, transforms himself into a championship contender. We will be championship contenders, but we can't just wish it to happen, or simply *want* it more than our opponents. It will come with months of solid preparation.

Let us stress once more that the Training Plan is only a guide to help you effectively channel your energies. It is nothing more than a piece of paper and is of no value if you the athletes are not willing to actually do the work. If you were willing to work hard, you would do pretty well even without this Training Plan. The coaches don't think of the Plan as a "secret weapon" and are not worried about sharing this information with others. We are confident in the ability of the athletes at the University of Michigan to implement the Plan and the values it represents more effectively than other teams we will face.

Let us think about what we mean when we say we are willing to "Do What It Takes". It takes relatively few all-out near-death experiences, with the exception of the season's final erg tests and the grand finals of Championship regattas. It DOES take a consistently strong effort day in and day out, all year long, despite holidays and exam periods and personal difficulties. It DOES take effort to not only accomplish your goals during workouts, but to create a lifestyle outside of practice to allow you to get maximum benefits from training. This means making the sacrifices required to get adequate rest, to eat right, and to avoid negative influences such as alcohol and other illegal or potentially harmful substances. This may mean attending fewer social gatherings, and will definitely mean establishing effective study habits. (Academic success parallels athletic success: continual preparation throughout the semester, not just the nights before big exams or papers are due.)

Hopefully the main point here is obvious. To be able to succeed while making the Supreme Effort during the Championship Final requires countless small efforts throughout the season. These are the little-appreciated but essential requirements of becoming a Champion.