Speed and testing aerobic thresholds aren't rowing. Masters rowing is not simply for those enjoying extended adolescence and uninjured bodies, nor does it include the gut-wrenching compulsive-obsessive, spitdripping, ergophile, row-til-you-puke crowd alone.
II THE IMPORTANCE OF PLANNING

"At each point in the course of the training program the most important task for both coach and members of the team is to determine and prescribe for the elimination of the team’s limiting factor."

Karl Adam

Karl Adam followed his own advice with near legendary results. Not only did he do it, but his planning methodology meant that for him and for his crews success and repeatable.
Sex differences:

- Maximum figures for women are about 70% to 75% of male
  \( V_{O_2} \) max figures in l/min.
- Women are about 80% to 85% of male \( V_{O_2} \) max figures when
  smaller size is accounted for by expression of \( V_{O_2} \) max in
  ml/kg-min.
- A \( V_{O_2} \) max decline with age may set in at a slightly older age
  in women compared with men (onset of female decline has
  been suggested to be delayed until after the child-bearing
  age).

Age trends:

- Peak \( V_{O_2} \) max is reached at 18-20 years in both sexes.
- From a peak at age 20, there is a fairly regular 5% decline
  per decade so that \( V_{O_2} \) max at age 60-70 years is 70% of the
  value at 20 years.
- A similar rate of decline appears to occur with age even in
  athletes who remain active.
- Range of \( V_{O_2} \) max at any age is 20-30%.
- It is possible to find examples where the \( V_{O_2} \) max of a 65-year
  old man is similar to that of a 25-year old woman. But given
  the range above, some fit (30%) women of age 40-50 years
  would equal unfit males (20% from average) of age 20 years.
are achieved in events which rely on power, are slower, have more heavily loaded movements, and have less complex movements of one or two limbs.

- **Body composition**: Strength training increases lean body mass and thus body weight. Athletes should be cautioned against development of irrelevant muscle mass in sports demanding a high strength-to-body mass ratio, such as jumping events, or in sports where extra energy expenditure is required to transport an irrelevant muscle mass.

- **Muscle soreness** is probably the result of very small tears of a very few muscle fibres or their connective tissues with resultant swelling (edema) sensed by pain nerve endings. As one neophyte exerciser said to his friend, "This certainly has increased my body awareness — parts of me I never knew existed hurt."

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**Average strength of many muscle groups as a function of age and sex.**

**Response to strength training: effects of age and sex.**

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Principles of Training Program Design

All training programs should be planned following these 11 principles of program design:

Frequency
1. Training (workouts) should occur frequently and be spread over a long period of time. Three times a week over a period of two months can be used as a guideline for this purpose. Crash training programs are like crash diets — they don’t work and they’re dangerous.

Overload
2. A training session must overload the athlete. This means that the exercise must be stressful enough to produce a physical change in your athletes’ bodies.

Specificity
3. Training effects are specific to the type of training stimulus used in the workouts. This means specific to the energy system, specific to the muscle group, and specific to the range of motion of the joint involved. What you train for is what you get.

Reversibility
4. Training effects are reversible. When workouts stop, aren’t often enough, or stressful enough, loss of training may occur. De-training must be prevented.

Progressions
5. The intensity of workouts must be increased in logical progression. As your athletes become more fit, it will take a higher level of stress to create an overload.

Monitoring
6. Training effects must be periodically monitored. This starts with the pre-training evaluation at which you determine where your athletes should start their programs. Evaluation continues on a regular basis, approximately every two weeks, until the program is over. This is how you check if your program is working.

Adaptability
7. Planning must be flexible and permit adjustment to individual differences. Results of periodic evaluation should be used both for motivation and individualization.
Seasonal planning means organizing yourself for the whole season. The key is to plan and then be flexible! Start with an overall plan for the progression of skills you will teach, strength training, energy training, pre-competition strategy and time for fun and relaxation. Then, feel free to make adjustments as the season progresses.

For good coaches, planning is a never-ending process. They plan and evaluate, plan and evaluate, plan and evaluate all season long. But, they start with a master plan.

Principles of Seasonal Planning
The master plan should be drawn up with the following principles in mind:

1. Identify your long-term and short-term goals for the season
   — when are the key competitions?
   — are there lead-up exhibitions or preliminary competitions that can be used as landmarks?
   — is there a timetable to get your athlete or team to their seasonal performance goal?
   — a simple chart of your major events for the year could be posted which includes key performance goals along the way.

2. Identify your training priorities
   — can you list these in order of importance?
     • energy training — aerobic
     • anaerobic lactic
     • anaerobic alactic
     • strength training
     • flexibility training
     • skill or pace training
       — skills
       — strategy
       — competitive conditions

3. Divide your season into three parts
   — pre-season
   — in-season (competitive season)
   — post-season

4. Allocate time, space and equipment according to your priorities within each part of the season
   • for example, if during pre-season, aerobic training is twice as important as strength training in your sport and you have the training facility three times a week (MWF), then Monday and Friday are aerobic training days and Wednesday is strength training.
   • for example, if in-season, skill training is three times as important as maintenance of aerobic training and you have the facility twice a week for two hours, allot 1-1/2 hours to skill training and 1/2 hour (at the end of practice) to aerobic training.
Seasonal Planning

1. Seasonal planning involves:
   • identifying long and short term goals
   • identifying training priorities — energy systems, skill
   strength and flexibility
   • planning for pre-season activities, in-season activities and
   post-season
   • determining equipment and facility usage

2. A well-planned team meeting for athletes (and parents where
   appropriate) is a useful way to begin a season.

3. Team try-outs require planning and an appreciation of the
   potential of younger, less experienced athletes.

4. Master planning involves consideration of the season as a
   whole, recognizing the need for continual evaluation and
   adaptation of the plan as the seasons progress.

5. Pre-season tips include:
   • administering pre-season questionnaires
   • use group goal-setting
   • do aerobic training before anaerobic lactic
   • do strength training before extensive skill training
   • use flexibility training
   • begin with simple skills
   • use periodic tests, especially self-tests
   • assess potential problems with competitive anxiety

6. In-season tips include:
   • administer mid-season questionnaires
   • assess goals with athletes
   • simulate competition-like situations in practice
   • use maintenance training more, the longer the season
   • allow one or two days for taper
   • have athletes use relaxation techniques, positive self-
     imagery and mental practice
   • provide additional emotional support prior to competition
   • hold a team party
Organizing An Anaerobic Training Program

1. Sport analysis should be used to indicate the type of anaerobic training most suitable to the sport: anaerobic alactic power = single explosive bursts with 3+ minutes between efforts; anaerobic alactic endurance = 10+ sec all-out activity or frequent repetitions of shorter bursts; anaerobic lactic power = 20 to 40 sec all-out; anaerobic lactic capacity = 90 to 120 sec all-out or frequent 30-sec repetitions.

2. Anaerobic alactic training methods include the following:
   - 10 sec E (or less); E:P ratio of 1:6 for anaerobic alactic power
   - 30 sec E (15 to 30); E:P ratio of 1:3 for anaerobic alactic capacity
   - 20 sec E (or less); E:P ratio of 1:1 myoglobin system for 10-to 15-sec events or repeated 10-sec events
   - an intensity of 90% best speed, or HR 10 beats/min below maximum during exercise, 180 minus age between repetitions, and 150 minus age between sets.
   - the number of repetitions should give total exercise volume of 60 sec in a set and the number of sets should give 2-8 min of total exercise; these guidelines should also be adapted to mimic the number of repetitions and sets found in the sport.

3. Anaerobic lactic training methods include the following:
   - 20 to 40 sec; E:P ratio of 1:6 for anaerobic lactic power
   - 90 to 120 sec; E:P ratio of 1:3 or 1:2 for anaerobic lactic capacity
   - an intensity prescribed using the same criteria as in 2, but using exercise at 60% of VO₂ max in the recovery phase to aid in lactic acid removal.
   - the number of repetitions should give a total exercise volume of 3 min in a set and the number of sets should give 10-12 min of total exercise; again, these guidelines should also be adapted to mimic the number of repetitions and sets found in the sport.
   - aerobic interval training to delay the onset of lactic acid accumulation.

4. Gains of anaerobic alactic training do not decline as quickly and are thus more easily maintained than are the gains from anaerobic lactic training.
1. The aerobic training program may be designed to increase VO₂ max for athletic involvement demanding a maximal rate of performance for 2 to 10 minutes or to increase the ability to perform over longer periods of time at submaximal intensity.

2. The aerobic training program should be prescribed individually based upon each individual's VO₂ max.

3. Intensity of the aerobic exercise is the key to the individualized prescription.
   - Athletes using continuous exercise should train at 70 to 75% of VO₂ max and progress toward 80 and 85%.
   - Appropriate intensity can be prescribed as a speed of running, and a repeat of the step-test enables progressive increments in the speed to be achieved.

4. Duration of a continuous aerobic training session should be 30 min or more.
   - The duration prescribed should also be in accord with the duration of the sport performance for which one is training.
   - Increasing duration, prior to increasing intensity, is recommended early in the training program, and as a guideline to reducing weight.
   - Increasing duration, rather than intensity, is a recommended procedure to achieve the ability to work for prolonged periods at submaximal intensities.

5. The minimal frequency of training recommended is every other day (3 times per week).
   - This guideline applies to the off-season, but it should also be recognized that hard training in the pre-season and competitive season should be attempted only on alternate days with lighter workouts between.

6. An aerobic training program of 12 weeks yields reasonable gains. Continuation of an aerobic emphasis beyond 12 weeks would depend on the importance of this energy system to the sport in question.

7. The mode of exercise should emphasize use of a large muscle mass (such as in running); the mode should emphasize specificity to the sport.
   - If the sport involves a small muscle mass, specificity in training should be supplemented with a large-muscle-mass activity to train the O₂ transport system.

8. Along with continuous training, interval aerobic training should be incorporated, particularly to accomplish the following goals:
   - to give specificity of training for any intermittent exercise sport;
   - to allow training sessions to simulate the intensity and pace of competition;
   - to recruit the fast-twitch fibres and improve their aerobic abilities;
   - to tax the muscle ability to utilize oxygen and to stimulate adaptations of the peripheral component of the aerobic system.

9. Aerobic interval training of two types is recommended: (i) a low-power-output program of E:2+ min and E:P ratio of 1:1; (ii) a high-power-output program of E <1 min and E:P ratio of 1:1.
Basic Principles of Strength Training

- **Overload** means that the development of increased muscular strength occurs only when the muscles are forced to contract against a greater load or resistance than is normally encountered. This is the threshold for gains in strength, but minimal overload will produce minimal strength gains, whereas maximal contractions (maximal overload) result in the greatest strength gains.

- **Progressive resistance** refers to the concept that, with gains in strength the resistance must be continually increased throughout the program (to continue to be greater than normally encountered or to continue to require maximal contraction). In an isotonic training program, the progressive increases in resistance (or weights) provide excellent feedback and motivation for the athlete.

- **Large muscle groups should be exercised prior to smaller muscle groups.** Thus, heavier loads should be dealt with first. A suggested order is (1) upper legs and hips; (2) chest and upper arms, (3) back and back of legs, (4) lower leg and ankles, (5) shoulders and back of arms, (6) abdomen, (7) lower arm and wrist.

- **Successive exercises should use different muscle groups or body parts** to allow recovery time for the muscle after use.

- **Exercise both the extensor and flexor muscles about the joint** (biceps — triceps, quadriceps — hamstrings, upper chest — upper back, abdomen — lower back, adductor — abductor of the thigh). Exercising only one of muscle group partners without the other leads to a strength imbalance about the joint, and subsequent muscle or joint injury is predictable.

- **Specificity** — Strength gains are highly specific to (1) the muscle group used, (2) the movement pattern, (3) the joint angle, and (4) the type of muscular contraction. Training programs should exercise the muscle groups used by the athlete and simulate as closely as possible the movement patterns involved in the sport, the velocity of contraction, and the type of contraction.

- As this suggests, the **neural adaptation** plays an important role in response to strength training.

- **Breathe when weightlifting!** — Do not hold the breath. Some recommend more specificity and suggest a deep expiration when lifting the weight and inspiration upon lowering the weight.
Physiology of Strength Training

There is a nearly perfect relationship between the cross-sectional area of an isolated animal muscle in the laboratory and the maximum force produced. In the intact human, the relationship remains strong. The cross-sectional area of the muscle which can be roughly measured by girth (or with more sophistication, girth minus amount of fat under the skin), is the best single predictor of strength. With strength training, the increase in muscle size is referred to as muscular hypertrophy.

- The muscular hypertrophy is due to an increased size of individual muscle fibres. Within each fibre there is an increase in the number of myofibril protein filaments. It is these protein filaments which slide across one another in muscular contraction. Thus, the increased number of protein filaments explains the ability of the muscle to exert greater force. Hypertrophy occurs predominantly in the fast-twitch fibres with strength training.

- Although slow speed training using isokinetics has been claimed to recruit and hypertrophy slow-twitch fibre, this theory seems to be disproven.

- The connective tissue of tendon and ligament also increases in size in response to a training program.

- It is also possible that muscle fibres split, in response to longer term training programs, resulting in a greater number of fibres (hyperplasia). Any conclusion on this possibility would be speculative at this time.

Although muscle size and strength are closely related, with training the increase of strength is greater than expected from the gains in size.

This observation implicates the nervous system as playing a role in the strength development. Probably through an ability to recruit more muscle fibre following training and to better synchronize its firing pattern. The exact mechanism to explain how neural adaptations result in a more forceful muscular contraction is a topic of current investigation.

Strength Training — Other Factors

- Age and Sex — The muscle strength of boys is only slightly greater than that of girls prior to puberty. Heavy weight training is not recommended prior to puberty, although “resistance training” through climbing, push-ups, gymnastics, etc., is done by children and is considered good practice. Children should refrain from use of heavy weights (such as the 1 to 6 repetition maximum idea) and rapid, high-tension eccentric contractions. Both may result in muscle and connective tissue injury; submaximal contractions can be encouraged.
Flexibility Training

Flexibility is defined as the range of movement about a joint and is specific to each joint. One may consider various types of flexibility:

- **dynamic active flexibility**, or the range of movement in a strong, fast muscular contraction such as seen in the hip flexion of a hurdler or shoulder extension of a swimmer;
- **static active flexibility**, or the range of motion in a slow, controlled muscular activity such as the back walk-over of a gymnast;
- **passive flexibility**, or the range of motion from application of an external force, as often encountered by the wrestler.

Limitations to Flexibility

- The muscle itself, as well as the sheath of fascia encasing the muscle, may account for much of the limitation in the range of movement, particularly in dynamic flexibility.
- The joint capsule itself and the ligaments also limit joint range of motion.
- In the extremes of joint movement, the tendons provide the limit.
- With even a few days of restricted movement (a cast), connective tissue (muscle sheath, ligaments, tendons) becomes dense, shortened, and resistant to stretching.

Flexibility training is important in increasing the range of motion to aid performance in the dynamic, static and passive types of flexibility as listed. Flexibility training is also advocated for any athlete to increase the range of motion where necessary to prevent joint injury. For example, on impact a greater range of motion allows more room to absorb the shock. Obviously, flexibility is also a required component in some sports of aesthetic impression (figure skating, gymnastics).

Training to increase flexibility has two aims:

1. reducing muscle tissue resistance by lowering muscle tension;
2. reducing resistance of connective tissue surrounding the joint by stretching and lengthening this connective tissue.

10. Flexibility training can be carried out alone or using a partner.
11. To train flexibility, follow these guidelines:
   - progress from general to specific
   - have your athletes stretch to their full range before extra help is used
   - stress injury prevention as a motivator
   - use slow, static stretching as a start-up
   - use isometric contractions of three to five seconds to build strength at stretched out positions
   - use dynamic flexibility as a secondary stage

12. All training programs should be adapted to meet individual differences. Age, sex and disability factors should be taken into account.
Liver glycogen, on the other hand, acts as a glucose reservoir for the blood. Whenever the blood glucose drops, glucose units from liver glycogen are added to the blood to maintain the vital blood sugar level.

The brain is particularly dependent upon glucose as a fuel. Thus when blood sugar levels drop below a certain level (hypoglycemia) the individual is somewhat impaired, and may feel light-headed, irritable or confused.

Carbohydrates are particularly important to athletes because they represent the preferred fuel of muscles during vigorous activity. In fact, there are many sporting situations where a lack of carbohydrate fuel for muscles may seriously impair performance. You and your athletes should make important dietary preparations for athletic events in order to ensure that the carbohydrate fuel reserves are sufficient.
4. Carbohydrates

Carbohydrates are very important in supplying energy to the body. Dietary carbohydrate is derived almost exclusively from foods of plant origin: grains (bread, pastries, macaroni, spaghetti), vegetables (potatoes, corn, beans, peas, etc.) and fruit (oranges, apples, bananas, berries). These foods contain carbohydrates in the form of starches or sugars such as sucrose (table sugar) or glucose and fructose.

The body can also get some carbohydrates in certain dairy products such as milk and ice cream. The sugar found in dairy foods is called lactose or milk sugar.

In addition to the above carbohydrate sources, many people derive a fairly substantial part of their carbohydrate supply from "artificial-type" foods where sugar is added. Candies, soft drinks and sweetened sauces are all sources of sucrose.

Sugar

When carbohydrate-containing foods are digested, the net result is the formation of the very simplest sugars such as glucose, fructose and galactose.

These simple sugars are absorbed into the bloodstream and transported to the various organs and tissues of the body — principally the liver, muscles, brain and nervous system and fat cells. The blood sugar level is always elevated shortly after a meal.

In the liver and muscle, the glucose removed from the bloodstream is either used immediately as an energy source or is stored. When needed, enzymes release the glucose units from the liver. The muscle glycogen is available to fuel the muscles whenever they contract vigorously.
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<td>1 : 44.6</td>
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<td>1 : 45.8</td>
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<td>1 : 51.0</td>
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<td>96%  1 : 34.8</td>
<td>176</td>
<td>81%</td>
<td>1 : 52.3</td>
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# Power Output Percentages & Heart Rate

**Name:** Mark Kinsman  
**Age:** 43  
**Velocity:** 5.05 m/sec

<table>
<thead>
<tr>
<th>500m Pace</th>
<th>Heart Rate</th>
<th>500m Pace</th>
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<td>195</td>
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<tr>
<td>109%</td>
<td>1:30.8</td>
<td>193</td>
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</tr>
<tr>
<td>108%</td>
<td>1:31.7</td>
<td>191</td>
<td>93%</td>
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<tr>
<td>107%</td>
<td>1:32.5</td>
<td>189</td>
<td>92%</td>
</tr>
<tr>
<td>106%</td>
<td>1:33.4</td>
<td>188</td>
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<td>1:34.3</td>
<td>186</td>
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<td>1:35.2</td>
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<td>1:36.1</td>
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<td>1:43.1</td>
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<tr>
<td>70%</td>
<td>2:21.4</td>
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</tbody>
</table>
NOVEMBER 13- 25.95

AI MO:
1) 22K ERG 2x11K 4 min rest, easy, Mike average splits about 1:58-2:00
   Mark 2:03
2) 70 min Ergo without break (2min max rest!), same splits

ALL TU
10min warm up/ 5 min cool down
2 sets of:
3min-1min paddle-2min-1min paddle-1min-1min paddle-2min-1min paddle-3min
rest 6 min between sets
SR: 20-23-26-23-20
splits Mike: 1:58-1:56-1:52 or faster by..... call if?
splits Mark: 2:02-2:00-1:56

ALL WED
10min warm up/ 5 min cool down
40 stroke paddle between. 5min rest between sets
x 20 strokes SR 34 average splits 1:32 Mike: 1:36 Mark
x 30 strokes SR 30 splits 1:36 1:40
x 20 strokes SR 26 splits 1:40 1:44

FU off

FRI
min or 2x11k ERGO (see MO)

SAT
min warm up, 5 min cool down
times 1000m
: goal splits 1:36 time :3:12-3:10
: splits 1:38-39 time: 3:16-3:18
10 min between. SR open

off
TRAINING SCHEDULE  Mark and Mike  JUNE/JULY 1995
Rowing on water or ERGO, I'll explain the weight training.

MO
5x10min, 2min rest, SR 20-22-24-22-20
TU
4x15min, 2min rest, 1. and 4. piece: 30 strokes on/6 paddle, 2. and 3. piece: 4min on/1 min off
SR 18-20-22-24
WE
5x5min, 3'-1'-1' SR. 24-26-28, rest 5min
THU
running 45'-60min. or weights (only with body weight)
FRI
12x30 strokes full power, SR 26 (4 start strokes, 30) 90sec rest
SAT
2x 1000m start +20 /body/sprint 10 min rest
SUN
off
MO
10x 5min, rest 1min. SR 20-16-12-8 piece #1,3,5,7,9,/SR 18-20-22-24 piece # 2,4,6,8,10
TU
6x 30 strokes, SR 15-20-25-30-25-20-15. 10 strokes paddle
WE
4x15min , SR 20-22, 1min rest, long row
THU
2 sets of 3x500m, only 1min rest SR 26, full power
FRI
5x10min, steady state, SR 20-24-20-24-20 SR switch every 2 min
SAT
2 times set of 750m /1min rest/500m/1min rest/250m/ 1min paddle
SUN
off
MO
running/ weight
TU
4x 15min , techn. drills,
WE
15 x 30 strokes , SR 22-24-26-......-36.....and down, 90 sec paddle between
THU
5x5min, SR 22, rest 1min, 2 sets
FRI
60 min steady state, SR 20-22 long row
SAT
2x1500m, SR 28-30-32 each 500m switch
SUN
off
MO
running 45-60 min
TU
4x15min, 2 min rest, SR 22-24-26-24-22 each 3 min switch
WED
new program 7.12.95