

CHAPTER 2: ERGONOMICS

“No matter how much pressure you feel at work, if you could find ways to relax for at least five minutes every hour, you’d be more productive.”

– Dr. Joyce Brothers

It is hard to know which is more shocking—the magnitude of the health problems associated with computers, or how easily and cheaply they can be prevented.

NATURE OF THE PROBLEM

The effects of computer-related health problems are cumulative, interrelated, and potentially devastating, but their symptoms are often disguised, misunderstood, or ignored until it is too late for easy solutions. Health concerns include:

- Repetitive Strain Injuries (RSI);
- Computer Vision Syndrome (CVS);
- musculoskeletal strains;
- stress;
- electromagnetic radiation (EMR);

and related other problems.

THE ECONOMICS OF ERGONOMICS

Ergonomics is the science of enhancing human performance while promoting well-being. Ergonomics tunes the tools to the physical needs of the worker. In an ergonomically designed workplace, **you** are the most important safety feature.

A properly designed work place sharply reduces health risks associated with computer use. Managers often see catalogs for exotic ergonomic devices and expensive workstations and conclude that the cost-benefit analysis doesn’t make sense—never mind that they haven’t quantified the benefits.

“It’s not the things we don’t know that gets us into trouble but the things we do know that ain’t so.”

– Artemus Ward

It’s odd that, in a world constantly clamoring about the rising cost of health care, so little attention is paid to prevention—especially when those benefits can be substantial. In *The Biomechanical Basis of Ergonomics*, E. R. Tischauer wrote that using the proper chair can increase a worker’s productivity by much as 40 percent, and many studies show increases in the range of 10 to 20 percent.¹

Still, an ergonomic workstation does not have to be expensive. Indeed, the simple techniques we will discuss have been shown to improve productivity significantly while decreasing health risks, at little or no cost.

REPETITIVE STRAIN INJURIES

Repetitive strain injuries (RSI) are epidemic among computer users. Of these, Carpal Tunnel Syndrome is the most notorious. The carpal tunnel is the passage in the wrist through which the nerves and tendons to the hand pass. When these tendons are strained, they react as any other muscle would: they become inflamed and they swell.

Unfortunately, there isn’t much room in this tunnel. As the muscles swell, they press against the walls of the tunnel, compressing nerves and blood vessels. This further aggravates muscles, causing more swelling. In the short term, the lack of circulation makes the victim’s hands feel cold, and pressure produces tingling or numbness in the fingers. The victim may experience stiffness, soreness or burning in the fingers, hands, wrists, elbows, or forearms. One or both hands may feel weak. In the long term, continued movements scrape muscle and nerve sheathing, producing nerve damage and extreme pain.

TREATMENT

If caught early—and it rarely is—Carpal Tunnel Syndrome is treated with rest. Typically the computer keyboard and mouse are off-limits for a couple months. Your doctor may

prescribe over-the-counter, nonsteroidal anti-inflammatory analgesics, such as acetaminophen (Tylenol®), ibuprofen (Advil®, Motrin®), or salicylates (aspirin) to relieve pain. Sometimes, the wrist is placed in an elastic splint that restricts mobility for two to four months.

As the condition worsens, anti-inflammatory steroids may be prescribed, and cortisone shots may be used in severe cases. These painful shots are a temporary fix, at best, because their effects wear off, and subsequent injections become less effective.

Extreme cases require surgery to smooth or enlarge the carpal tunnel itself. It is not always successful; approximately 10 percent of all surgeries result in permanent disability in one or more fingers.

WHO IS AT RISK?

Historically, people with circulation problems, such as diabetics, are at-risk, along with some professions, notably seamstresses, dental hygienists, and meat-cutters. Oddly, musicians and typists were not. This begs the question: if typists didn't get it, back in the days when you really had to really pound those manual typewriters, why is it such an epidemic now, with today's sensitive keyboards?

ARE KEYBOARDS SAFE?

In 1991 Nancy Urbanski sued Apple and IBM, alleging that their keyboards caused her repetitive stress injuries, that they were negligent for failing to place warning labels on their keyboards, and that they had not exercised "reasonable care" in their keyboard design.

On March 8, 1994, a jury found IBM not liable for Urbanski's injuries. (Apple had previously settled out of court.) In a similar case, Compaq was found not liable for injuries sustained by a legal secretary who had used its keyboards.

According to Tom Beerman, an IBM spokesman, "(The Urbanski) verdict is confirmation that IBM-designed keyboards are ergonomically safe."

INCREASED USE

Although studies do not support the broad claim that keyboarding, by itself, causes RSI, it's clear that its repetitive nature, unnatural stretching, and resultant fatigue aggravates existing conditions. The difference between computers and typewriters seems to be the sheer amount of unbroken repetition. If nothing else, typists occasionally had

to change the paper, which broke the repetition, as it exercised other muscles, enhancing circulation.

You may reason, as did IBM, that *any* tool can cause fatigue when used long enough, but that is the very nature of keyboarding.

ADDRESSING RSI

The risks of RSI are serious—and they can be virtually eliminated *by the user*.

USING THE MOUSE

Although there is only weak evidence to support the claim that keyboards cause RSI, the mouse is another matter. The mouse was intended to be moved with the entire arm. Most people, though, use only their wrist. Prolonged, highly detailed mouse work is strongly linked to RSI.

This doesn't mean you should eliminate mouse use, but you should curtail its use through the use. Simple keyboard equivalents enable you to keep your hands on the keyboard, which also increases productivity.

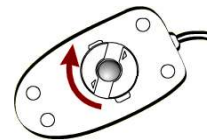


If you have a rolling mouse, keep its ball and rollers clean. The mouse should move freely in all directions. Dead spots dramatically increase strain on your hand and wrist. Allow plenty of room so that the mouse cord doesn't hinder your movements. To clean your mouse:

Step 1: Shut down your PC.

Step 2: Turn the mouse upside down.

Step 3: Remove the small cover, and remove the ball.



Step 4: With a cotton swab dipped in rubbing alcohol, gently clean the grime from the internal rollers.

Step 5: Clean the ball with a mild detergent and water.

Step 6: Dry it thoroughly before returning it to the mouse.

Using alcohol or household cleansers to clean the ball is not recommended because they can harden or deform the rubber.

CHANGE SENSITIVITY

Another way to reduce the repetition and stress of mouse operations is to change the mouse's sensitivity:

Step 1: From the Desktop, open My Computer, Control Panel, and Mouse.



Step 2: By selecting Sensitivity, you can change how far a subtle movement moves the mouse and how sensitive the buttons are to double-clicks.

Step 3: Click to save your changes and close the dialog.

ERGONOMIC MICE?

A variety of track balls and other pointing devices are sold as “ergonomic” devices. There is scant evidence that they prevent Repetitive Stress Injuries. Indeed some of them place even more stress on wrist movements.

WRIST POSTURE

The wrist should be straight, or bent down somewhat. **Do not type with the wrist bent back.** You may know that there are feet under the back of most keyboards to rotate them toward the typist. This is exactly the wrong idea. An ergonomic keyboard would have feet in the front, tipping the back down!

Padded wrist supports (\$10-20) can help prevent poor wrist posture. Many keyboards are now manufactured with built-in wrist supports. Some ergonomic designs feature “split keyboards” that permit more natural arm, wrist, and finger motions. Some have contoured keys to prevent over-reaching. Control keys, such as , , and , are sometimes relocated between the thumbs, in order to reduce stretching.

These keyboards look odd, but users quickly become accustomed to their natural feel. There is little evidence to support the theory that these keyboards prevent carpal tunnel syndrome, but they do keep you from aggravating an existing condition, and they clearly improve typing accuracy and speed.



Resting your arms or elbows on the armrests of a chair while typing can compress the nerves running under the elbow. In addition, it contributes to poor back posture.

AVOID POUNDING

Avoid pounding the keys. Sometimes this is a manifestation of stress. Sometimes it is merely a habit developed in the days of manual typewriters. In either case, overstriking the keys sends tiny shockwaves up the arm, aggravating finger, wrist, and arm pain.

You may be able to avoid keyboarding altogether through the use of voice recognition software. Although the field is in its infancy, effective programs exist that greatly enhance data entry with no keyboarding at all. It's not for everybody, but you should consider it.

WARM UP

An athlete avoids muscle strain by warming up and stretching before an event. The same idea applies to computer users. Regular flexing and stretching exercises are crucial. It is important to take a two-to-five minute health break every 20 to 30 minutes to restore circulation and vigor by gently stretching and flexing your fingers, hands, and wrists.

COMPUTER VISION SYNDROME

A variety of eye problems, ranging from eye strain to cataracts have been linked to working with traditional computer screens for extended periods. Symptoms include inability to focus, blurred vision, “scratchy eyes,” and headaches. Collectively, these symptoms are known as Computer Vision Syndrome (CVS).

TIRED EYES

Prolonged periods in front of a computer tend to tire and dry the eyes. Studies show that people sitting at computer screens blink their eyes, on average, 30 percent less often than others in the same environment, resulting in less tearing.

ADJUST THE MONITOR

A blurry screen isn't just a nuisance, it's a health hazard. When a screen is blurry, dirty, or—for any reason—hard to read, people tend to move closer. Sitting too close to a CRT increases eye strain, physiological stress, and bad back and neck posture.

Sit at least two feet—an arm's length—from your monitor. Sometimes a screen can be adjusted to improve focus.

If it can't, replace it; monitors are more easily replaced than eyes.

Electrostatic charges from monitors attract small particles from the air. Screens should be dusted regularly, and occasionally wiped with a damp cloth. (Many manufacturers apply special surface treatments and recommend not using cleansers.)

FIELD OF FOCUS

As you age, the muscles that focus your eyes lose their elasticity. It is a natural consequence of aging, and it gets worse if you don't occasionally exercise your eyes by changing the field of focus.

Reading from computer screens at a fixed distance for long periods impairs your ability to focus, even after you leave your PC. You should stop at least fifteen minutes prior to driving to allow your eyes to adjust. Eye exercises can restore natural lubrication, relax facial muscles surrounding the eyes, and force the ocular muscles to change their depth of focus.

EYE-CARE PROFESSIONALS

Some eye problems can be treated with glasses or contact lenses. Others can be corrected with vision therapy—exercises designed to strengthen various eye muscles. You should have regular eye exams, especially if you are over 40 or wear corrective lenses.

Be sure to tell your eye-care professional that you spend a lot of time in front of a monitor. How else would he or she know? The CVS phenomenon is new, and breakthroughs in lenses, eye drops, and therapies are occurring almost every day.

THE REFRESH RATE

In the early days, CRT monitors repainted the pixels on the screen 60 times per second—60 Hertz (Hz). This frequency was chosen because it is the same as household alternating current.

If you walk into a television show room, you may notice that it is disorienting, but you probably can't say exactly why. Next time, move your head slowly around the room. As you do, you will notice out of the corner of your eye that the screens seem to flicker—although they look fine, viewed straight on. That's because the refresh rate for television monitors—60 Hz—is close to the threshold of visual acuity. You may remember from your high school

biology that cones, those elements that detect color, are concentrated in the center of the retina, while rods, responsible for gradations of black and white, are along the periphery. That accounts for seeing flickering out of the corner of your eyes.

Some people may not detect flickering at all. For others, it may be a mild annoyance. Back in the 20th century, the rule of thumb was to set the refresh rate just beyond the user's threshold of acuity, usually about 72-75 Hz, reasoning that increasing the refresh rate beyond that needlessly taxed the video system.

Evidence began to accumulate, though, that, even when the flickering is imperceptible, it may produce severe headaches for those who work in front of a monitor for short even periods—45 minutes or so. In his book, *Visual Stress*, A. J. Wilkins makes the case that increasing the refresh rate can reduce eyestrain in all users.²

ADJUST THE REFRESH RATE

I recommend setting the refresh rate in the 90-95 Hz range, assuming that your monitor supports that rate. Many do not, and setting the refresh rate higher than the monitor allows can damage it. (Note also that this discussion of refresh rate does not apply to flat-panel monitors.) To adjust the refresh rate:

Step 1: Check your owner's manual to see what refresh rates your monitor will support.

Step 2: From the Desktop, open My Computer, Control Panel, and Display.



Step 3: On the Settings tab, click .

Step 4: Select the appropriate refresh rate from the drop-down list.

- Depending on your operating system and video adapter, the refresh rate setting may appear in different places; if it does not appear on the Monitor tab, check the Adapter tab.

Step 5: Click twice to save your changes and close the dialogs, and then close Control Panel.

STRESS

It's no secret that our computer-driven lifestyles elevate stress levels. Computers make it so easy to produce extremely high-quality results that people now routinely expect perfection. The high-tech gadgets that make it so easy to reach out to distant work—cell phones, notebook

PCs, pagers, PDAs, wireless Internet—allow that distant work to reach us, adding to our stress.

Doctors have long recognized that a sedentary life-style, social isolation, prolonged periods of unnatural sensory stimuli, and jobs requiring extreme precision puts one at risk for stress-related health problems. Today's computer environment—users staring at monitors for long periods on demanding projects, often working in isolation—would seem to be a perfect prescription for anxiety. Threats of layoffs and the state of the national economy pose special challenges to the information worker, working in a volatile segment of the economy.

In addition to psychological effects, such as feelings of anxiety, anger, frustration, and depression, stress has been linked to many physical problems:

- depressed immune systems;
- increased abdominal fat;
- impaired memory and learning;
- reduced glucose utilization and increased levels of blood sugar; and,
- high blood pressure.

According to the U. S. Department of Labor's Bureau of Labor Statistics, the average computer professional loses 25 days annually due to occupational stress. One study found that 23 percent of workers "were driven to tears by workplace stress."

SEDENTARY LIFE-STYLE

Before desktop computers, office workers spent a tremendous amount of time on their feet, walking to the file cabinet, to the mail, to the supply room, and so on. Today's labor-saving technology has created a new class of desk-bound workers who mail letters with a mouse click and file memos with the tap of a key. Exercising, eating right, and getting enough sleep are more important now than ever!

SENSORY STIMULI

Glare and blurry, dirty or overly bright computer monitors are not just vision problems—they also contribute to physiological stress. Indeed, most problems associated with eyes—glare, reduced tearing, and so on (see page 5)—induce stress.

Printers make a lot of noise, but not all noise is as obvious. Computers and their peripherals produce "white noise," in which the intensity is the same at all frequencies.

We get used to the noise, but it still affects our nervous systems. Steven Halpern noted that Mozart's Vienna was so quiet that fire alarms could be given verbally from the top of St. Stefan's Cathedral. "In twentieth-century society, the noise level is such that it keeps knocking our bodies out of tune and out of their natural rhythms. This ever-increasing assault of sound upon our ears, minds, and bodies adds to the stress load of civilized beings trying to live in a highly complex environment."

Other noise pollution cannot be heard at all. High frequency sounds, above the threshold of hearing, also contributes to physiological stress.

There are three watchwords for dealing with noise—eliminate, absorb, and shield. Eliminate the source when possible. The obvious thing to do is to turn off unneeded office machines.

Acoustic panels, baffles, wall hangings, and even plants can absorb high frequencies or shield the user from their sources. When possible, kill two birds with one wall hanging: a strategically placed acoustic panel or plant can reduce glare as it absorbs sound.

When device makes unintended noise, it's a sign that its components are aging or malfunctioning. That buzzing fluorescent ballast, humming transformer, rattling copy machine, and whistling monitor are all trying to tell you that they should be repaired or replaced.

High audio frequencies, the most stressful, are highly directional and easily reflected by glass or flat surfaces, like desktops, walls, hard floors, and ceilings. Ideally, offices would be designed with natural acoustic dampening. The reality is usually just the opposite.

A *bad* acoustic environment would be a small room with parallel, hard surfaces and lots of glass to let those high frequencies bounce around until they finally find someone's ears—a fair description of many offices. Newer offices are much more stressful than their counterparts of 50 years ago, which had larger areas, higher ceilings, and operable windows. Such is progress.

ISOLATION

Humans are social creatures. Information workers often work in isolation, communicating through faceless e-mail, chat, and other Internet clients. The physiological results of isolation are similar to those of smoking, high cholesterol, and hypertension. Combining a demanding job with prolonged social isolation is extremely stressful.

INCIVILITY

Simply being around people may not help. A June 2002 *U.S. News & World Report* survey reported that 89 percent of American workers identified incivility as a serious problem and 78 percent said it's getting worse. The cost to the economy of incivility, in the form of damaged public image, lost productivity, depression, high turnover rates, absenteeism, low morale, loss of customers, retaliatory acts, stress-related insurance and health-care costs, is astonishing, yet many managers are unaware of its nature and its consequences.

DEAL WITH STRESS

The best way to manage stress is to avoid it. This, of course, is easier said than done. Still, there are many simple and effective techniques for managing environmental stress. These techniques fall into two categories: treating the physiological symptoms and escaping the cause. Treating the symptoms might include:

- massaging your temples;
- a brisk walk or stretching; or,
- stretching your jaw and facial muscles, and forcing a yawn.

Escape is not limited to physically leaving the stressful environment. It also means getting away mentally and emotionally, such as:

- listening to relaxation tapes;
- talking to people, face-to-face; or,
- meditation or biofeedback.

Employers are often reluctant to confront inappropriate employee behavior. Still, they should both anticipate and respond to signs of incivility:

- check employee references for signs of inappropriate behavior, especially violence;
- establish and enforce a code of conduct in the workplace;
- thoroughly document incidents of inappropriate behavior;
- communicate the importance of civil behavior throughout the workforce, encouraging people to report inappropriate behavior;
- investigate all charges inappropriate behavior, being particularly sensitive to discovering patterns of abuse; and,
- deal firmly with behavioral problems. Reprimand them, transfer them, fire them, or refer them to

counseling or law enforcement, as appropriate—but don't ignore them.

Smaller organizations, in particular, are urged to identify counselors, anger-management courses, and other community resources for referrals.

MUSCULOSKELETAL AILMENTS

Sitting for prolonged periods with poor posture exacerbates problems associated with neck and shoulder ache, lower back pain, poor circulation, and fatigue.

ARMS

When seated at the keyboard, arms should hang straight down to your elbows, where your forearms should form a 90-105° angle from the vertical. Office desks are almost always too high for proper arm posture. As a result, your shoulders are bearing at least part of the weight of your suspended arms and slumped torso.

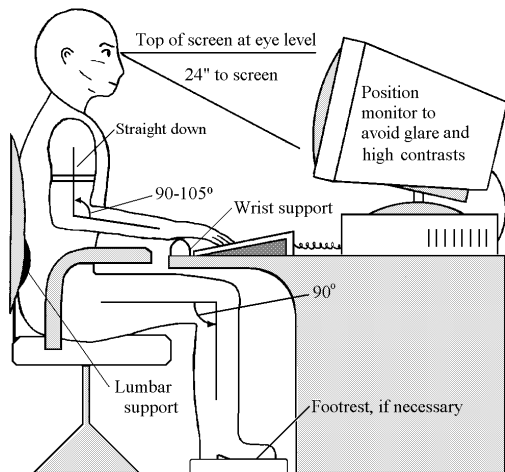
One option is to purchase a keyboard drawer (\$15-25) that mounts to the underside of the computer table. This lowers the keyboard, allowing your arms to hang properly. Obviously, you can also raise the height of your chair to achieve the proper arm angle.

LEGS

With the chair at the proper height with respect to your keyboard, you should sit comfortably with your feet flat on the floor or flat on a footrest, with knees at a 90° angle. Some may need a footrest; others may need to raise the keyboard. Sit straight and square in your chair. Lumbar supports (\$5-\$15) can be easily attached to your chair to prevent lower back pain.

LOWER BACK

Normally the lumbar multifidus muscles and the transversus abdominis support and protect the lower back. A study by the University of Queensland in Australia suggests that slumping in front of your PC deactivates these muscles, triggering chronic lower back pain. A European Space Agency study in Berlin showed that an absence of load on spinal support muscles can sometimes be just as debilitating as a physical injury. Reactivating these muscles may require months of exercise and therapy.³



EXERCISE

Periodically stretching your major muscle groups—arms, legs, shoulders, and back—prevents many posture-related problems. This can be done simultaneously with wrist and eye exercises.

People with poor circulation who spend long periods at the keyboard may be able to take their shoes off and roll a small ball around under their desks with their feet. Even this small activity enhances blood flow to the extremities.

ELECTROMAGNETIC RADIATION

All cathode ray tubes (CRTs)—the “picture tubes” used in desktop computer and television monitors—emit electromagnetic radiation (EMR) in the very low frequency (VLF) and extremely low frequency (ELF) bands.

MPR

Anecdotal evidence links these emissions to clusters of birth defects and leukemia. In July 1991, Sweden’s National Board for Measurement and Testing promulgated guidelines for EMR. Monitors that meet this standard, called MPR II, emit dramatically reduced levels of ELF and VLF EMR. (A previous standard, MPR I, addressed only VLF emissions.) A more restrictive standard, adopted by the Swedish Confederation of Professional Employees (TCO), addresses the entire computer.

MPR II, prescribes limits on electric and magnetic field emissions in the ELF and VLF ranges, as well as the elec-

trostatic field. A more recent and more restrictive standard, promoted by the Swedish Confederation of Professional Employees (TCO), was expanded in 1995 to address the entire computer. TCO ’95 includes guidelines for energy consumption, screen flicker, screen luminance and keyboard use.

		MPR II ⁴	TCO ’95 ⁵
Magnetic	ELF 5 Hz-2 KHz (Band I)	<= 2.5 mG	<= 2.0 mG
	VLF 2-400 KHz (Band II)	<= .25 mG	<= .25 mG
	> 400 KHz	none	none
Electric	Static Field	+/-500 V	+/-500 V
	ELF 5 Hz-2 KHz (Band I)	<= 25 V/m	<= 10 V/m
	VLF 2-400 KHz (Band II)	<= 2.5 V/m	<= 1 V/m
	> 400 KHz	none	none

Those who purport a causative link don’t agree whether a threshold exists or whether exposure to EMR at *any level* is bad. Thus, even screens meeting TCO ’95 aren’t necessarily safe.

RISKS & CONSEQUENCES

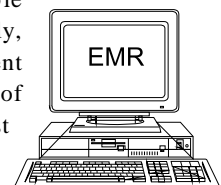
But before getting too alarmed, you should know that hundreds of scientific studies have tried to establish a causal relationship between EMR and health, and, to date, none have been successful. There is simply no solid scientific evidence that EMR causes cancer or any other medical problems.

Still, given the seriousness of the possible consequences, you may want to err on the side of caution if you are a member of a high-risk group, such as having a history of cancer in your family. Two approaches are recommended:

- reduce the intensity of your EMR exposure, and,
- reduce the length of time you are exposed to EMR.

EMR varies inversely with the square of the distance from its source. This means that EMR intensity drops off sharply the farther away you are from the screen. As a rule of thumb, you should stay 20-26”—an arm’s length—away from the screen, *regardless of whatever other precautions are taken.*

Anti-radiation screens are available that mount to the front of the screen. These often double as anti-glare devices. Unfortunately, front-mounting screens do not prevent emissions along the back and sides of the monitor, where EMR is most intense. Nor do they provide com-



plete protection, even in front of the screen. They reduce—but do not eliminate—the electrical and magnetic components of the VLF spectrum, but do not reduce ELF at all.

You can eliminate the problem entirely by using alternatives to CRT technology, such as flat panel screens found on laptops. They are relatively expensive and have inherent limitations, but they do not produce EMR.

SUMMARY

According to the Bureau of Labor Statistics in 1997, computer-related maladies cost \$30 billion per year in lost wages, lowered productivity, physical therapy, and medical bills. In only three years, that figure doubled—yet the cost of prevention is minimal. We begin with four simple, low-cost solutions:

1. Change your environment.
2. Change your habits.
3. Take charge of your health.
4. Add health breaks to your routine.

1. CHANGE YOUR ENVIRONMENT

Let's recap what you can do with your workspace:

Step 1: Position your chair and monitor so that glare from the screen is minimized.

Step 2: Sit no closer than two feet—a full arm's length—from the screen, and no closer than four feet from the back or side of others' monitors.

Step 3: Raise the seat (or lower the keyboard with a pull-out keyboard support) so that your arms hang straight down and your elbows form a 90-105° angle.

Step 4: Obtain a footrest, if necessary, so that sitting straight and square in your chair, your knees form a 90° angle, and your feet are flat on the floor or footrest.

Step 5: Raise the monitor so that the top of the screen is at eye level.

Step 6: Use lumbar support if you are prone to lower back trouble.

Step 7: Use a padded wrist support or an ergonomic keyboard to prevent poor wrist posture.

Step 8: Periodically clean the monitor screen and the mouse roller mechanism.

Step 9: Adding touches of nature—plants, flowers, a terrarium or aquarium—reduces stress in many people.

2. CHANGE YOUR HABITS

You must take charge of your health. An office equipped with a complement of adjustable chairs, ergonomic desks, adjustable monitor stands, and wrist supports is of no benefit if you are unable or unwilling to use them:

- learn keyboard short-cut keys to reduce mouse use;
- do not rest arms or elbows on the armrests of the chair while typing;
- warm up and stretch your hands and wrists before using your computer; and,
- do not pound the keys.

3. TAKE CHARGE OF YOUR HEALTH

Your job environment is changing, and your personal physical regimen must change with it. As your duties have become more sedentary, maintaining your general fitness has become more difficult. The three most important steps you can take to improve your general health are the same as they were a century ago:

- **Sleep.** Stressful work takes a lot out of you. People who work all day on a computer need as much rest as those who do hard physical labor.
- **Diet.** Because you are less physically active, you are not burning as many calories as before.
- **Exercise.** Most experts recommend a minimum of three 20-minute sessions of exercise weekly.

This is all very sensible, of course, whether you use a computer or not! (Most will ignore this advice, saying, "I already know how to take care of myself better than I do"—*but do so at your own peril.*)

Of course, regular physical check-ups and eye exams are essential. Your doctor cannot read your mind. Make sure that he or she knows that you spend significant time at a computer. You should see a health professional before you embark on any significant change in your fitness program.

4. HEALTH BREAKS

Add health breaks to your routine. Take a two-to-five minute health break every 20 to 30 minutes. This break should include a combination of body stretching, eye, and hand exercises, and stress-fighting techniques. Find the mix that is right for you and your situation.

ERGONOMICS ON THE WEB

Deborah Quilter's RSiHelp

<http://www.rsihelp.com>

Champion, Inc.

<http://www.frager.com/tips.htm>

MindTools™

<http://www.mindtools.com/smpage.html>

Stress Management - About.com

<http://stress.about.com/mbody.htm>

Stress Management for Patient and Physician

<http://www.mentalhealth.com/mag1/p51-str.html>

3. "Unused Back Muscles Switch Themselves Off," <http://www.newscientist.com/news/news.jsp?id=ns99996322>

4. MPR II measurements are taken at a distance of 50 cm (≈ 20 inches) around the monitor, at 3 levels of 16 points each.

5. TCO measurements are taken at a distance of 30 cm (≈ 1 foot) in front of and 50 cm around the monitor (except for Band II magnetic fields and the static field, which are measured at 50 cm in front of the screen).

ERGONOMIC PRODUCTS

There are hundreds of companies that manufacture and distribute products that are "user-friendly." Here are a few important Web sites:

atHome-atWork.com

<http://www.athome-atwork.com/>

eisys.com

<http://www.eisys-inc.com/Frame1.html>

Ergotect

<http://www.ergotect.com/>

Ergo-I-Am

<http://www.ergoiam.com/>

Ergomart

http://www.ergomart.com/monitor_arm/monitor_arms.htm

Ergonomic Office

http://www.ergotron-ergonomics.com/ergonomic_office.htm

Ergonomic Specialties

<http://www.ergospec.com/products/>

Ergon Products

<http://www.ergon-products.com/>

NOTES

1. Tichauer, E. R., *The Biomechanical Basis of Ergonomics: Anatomy Applied to the Design of Work Situations*, Wiley, London, 1978.

2. Wilkins, A. J., *Visual Stress*, Oxford University Press, 1995.