Olympic Science

'Psyching out' reaches high tech proportions

In the world of the "elite" athlete, a millisecond or a fraction of an inch can make the difference between a new world's record and a losing performance. It is this type of psychophysiological fine tuning that concerns many of the scientists present this week at the University of Oregon in Eugene attending the 1984 Olympic Scientific Congress. Some 2,500 physicians, physiologists, psychologists, nutritionists and others from 100 countries gathered at the meeting before heading 1,000 miles south to the Olympics in Los Angeles to witness the results of their work with the world's top athletes.

Abounding throughout the gathering were predictions of an eventual sub-3:40 mile and continued obliteration of world records in swimming, which several scientists suggest is "ten years behind" many other sports in terms of the development of the athletes' potential, and therefore is ripe for future record-breaking performances.

But with the athletes in the upper plateaus of sport becoming increasingly similar in size, speed and strength, sports scientists are placing a greater premium on the psychological factors that might give athletes the edge. Daniel M. Landers of Arizona State University, a member of the Olympic Committee's Sports Psychology Task Force, is in the forefront of such work. "We're producing better athletes at younger ages a little faster than we used to," Landers says. "Most young athletes have mastered the techniques of their sport, but not the mental concentration they need to perform at the tops of their games."

Toward this end, Landers usually keeps just a heartbeat, or a brain wave, away from his athletes. Landers, also sports psychologist for the U.S. archery team, has studied the stress responses of Olympic archers and rifle shooters and subsequently developed methods of improving their performances. In some of his latest work, presented at the meeting, Landers simulated the adrenal glands' response to competitive stress by injecting eight shooters with epinephrine (adrenalin). Then, before and during shooting, he measured their body sway, heart rate, muscle activity and brain wave activity, and compared them with shooters injected with a saline placebo.

"We found that those injected with epinephrine had increased muscle tension and somatic [but not emotional] anxiety," Landers says. Yet six of the eight shooters injected with epinephrine were able to maintain the high scores they had achieved without injection. They did this by relaxing their arms, changing breathing patterns and changing the timing of their "mental routine," which involved raising the gun to their shoulder somewhat later than normal to minimize the muscle tension effects. These relaxation techniques have already been applied to shooters in competitive situations and will be used in the Olympics.

In other studies, Landers and others have found that just before the release of an arrow — and in the case of sprinters, just prior to beginning the race — the elite athlete's heart rate drops by three to four beats per minute. At the same time, alpha waves, which reflect relaxation, become predominant in the left half of the brain. These two factors suggest that the athlete's intense concentration takes place in the right half of the brain and that the other half, along with the heart, is "turned down" as a result. These findings may be "turned around" to improve performance — younger athletes can be trained to produce alpha and slow their hearts, Landers suggests.

Landers and his colleagues have also looked at the everyday jogger, as well as competitive runners, and found that alpha is also involved in the oft-reported euphoria or "runner's high." Using electroencephalogram measurements, the researchers discovered that alpha, which also suggests "good feelings," increases in the brain's left half about halfway through the run and continues after finishing. If, however, a person pushes beyond his or her usual distance or time into the "maximal exercise" range, the alpha, after rising, drops about two-thirds the way into the run — what Landers calls the "push and fight" phase; alpha then climbs up again after the finish.

Most of these findings can be applied across a number of sports to help bolster concentration and performance, says Landers. In the past, the sports psychologist has used visual biofeedback displays of brain waves to improve the foul shooting of basketball players by helping them maximize their alpha wave output.

—*J. Greenberg*

Inventory of sports fatalities and injuries yields some surprises

Athletic coaches in the United States, at the professional, college, high school and even pre-high school levels, are well known for telling their athletes that they must "pay the price" to win. But what exactly is that price?

In what its authors call the first such wide-ranging study of its kind, researchers from the University of North Carolina (UNC) at Chapel Hill have compiled data on the actual number of deaths and serious injuries in U.S. college and high school sports. They have found that while the overall incidence of such "catastrophic" injuries does not seem to be extraordinarily high, certain sports present an unexpectedly high level of danger and warrant close study, with an eye toward implementing additional safety precautions.

"We've always known that football is a major problem [in incidences of injury], but as far as most other sports are concerned, we haven't really known what's been going on," UNC's Frederick O. Mueller said in an interview this week at the 1984 Olympic Scientific Congress in Eugene, Ore.

Mueller and colleague Carl S. Blyth reported to the congress that aside from football (which, Mueller says, has improved its safety record greatly in the last decade), the sports of most concern at the high school and college level are gymnastics, lacrosse and ice hockey.

In the surveyed years — 1982-83 and 1983-84 — the researchers found that among college participants, the rates of fatalities and catastrophic (resulting in permanent disability) injury per 100,000 were: 14.27 for gymnastics, 12.73 for ice hockey and 20.25 for lacrosse. This compares with rates of 9.33 for football, 6.63 for basketball, 3.55 for swimming and 6.83 for tennis and rates of 0.00 for cross-country, track, soccer, wrestling and baseball. Among high schoolers, the highest rates were in ice hockey, 4.16, lacrosse, 2.25, football, 2.38 and wrestling, 1.96.

During that same period, there were 57 fatalities — the most, 24, occurring among high school football players. The researchers also found what they describe as "an inordinate number (18) of heart-related fatalities [which] indicates an area for increased study and research." Mueller told SCIENCE NEWS that among the high-risk sports, lacrosse is perhaps ripest for a rules change. "We have to get the head out of the game," said Mueller, referring to the practice of hitting an opposing player with one's helmeted head. This not only can cause injury to the player who is hit but, perhaps more seriously, to the neck of the player who uses the head, he said. Mueller also added he was "surprised" at the relatively high incidence of neck injuries among high school wrestlers.

"All of this is aimed at prompting further study of the safety and training methods of these sports," Mueller says. The figures, compiled from National Collegiate Athletic Association and National Federation of State High School Associations data and other sources, "may be low" because of the newness of the survey, he says. The next few years, Mueller suggests, may yield higher and truer figures.

—*J. Greenberg*