

- 481 Altitude and Athletic Performance. L. G. C. E. Pugh. *Nature* 207, 1397-1398 (Sept. 25, 1965).

The decision to hold the 1968 Olympic Games in Mexico City at an altitude of 7,500 feet above sea level has aroused interest in the effects of altitude on athletic performance. The performances of runners in the 1955 Pan American Games in Mexico City were compared with those of runners in the 1956 Olympic Games held in Melbourne. The times of the first three competitors in the finals of each event were averaged, and the differences between the altitude and the sea-level results were plotted against distance on a one-way logarithmic scale. The results reveal a linear relation between decrement in performance at altitude and log distance. Time increases ranged from 2.62% over 800 meters to 14.9% in the 10,000 meter event. Times at altitude were better than at sea level over 100 meters and 400 meters, but not over 200 meters. It was predicted that increase in time taken for a race lasting six minutes would be about 8%. The results in this study are in accord with the predicted value.

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- 482 Plasma Catecholamines at High Altitudes. F. Moncloa, Maria Gómez, and A. Hurtado. *J. Appl. Physiol.* 20, 1329-1331 (Nov. 1965).

High altitude native residents and newcomers to a low ambient pressure (36 hours after arrival) have normal plasma levels of adrenaline and noradrenaline in the fasting condition. Thirty minutes after the intravenous injection of insulin the high-altitude residents show increase of epinephrine greater than in men living at sea level. These results are interpreted as a consequence of the lower glucose values observed at high altitudes.

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- 483 Some Responses of Humans to Thermal Radiation. C. W. Suggs. *J. Appl. Physiol.* 20, 1000-1005 (Sept. 1965).

The effects of thermal radiation on heart rate, ventilation rate, and oxygen consumption rate were investigated at various conditions of dry-bulb temperature, air velocity, and exercise. Ventilation rate and oxygen consumption rate were essentially independent of thermal radiation under all the environmental conditions investigated. However, heart rate increased appreciably with increases in thermal radiation provided the environment was already warm or hot. In the range between 70 and 100°F. dry bulb, a 7° increase in mean radiant temperature was found to elicit the same average increase in heart rate as a 1°F. increase in dry bulb. For a cool environment the response tended to be reversed with the heart rate decreasing as the environment was made more comfortable by the addition of thermal radiation. Exercise shifted the point at which this reversal occurred toward lower temperatures.

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- 484 Skin and Subcutaneous Temperature Changes During Exposure to Intense Thermal Radiation. J. A. J. Stolwijk and J. D. Hardy. *J. Appl. Physiol.* 20, 1006-1013 (Sept. 1965).

Radiometric measurements have been made of the skin temperature changes occurring during irradiation of the body by high-intensity thermal radiation with square-wave pulses. A quartz lamp bank provided a source color temperature of 2,650°K. and a uniform (about 5%) irradiance of 0.16 cal./sec. per sq. cm. over areas of 40 x 30 cm. A spring-operated focal-plane shutter controlled exposure times from 2-120 sec. with a rise time of 0.01 sec. The radiometer, mounted between the quartz lamps so as to view the skin from normal incidence, had a 96% response time of 0.1 sec. and a precision of about 0.1°C. When corrections were made to allow for far infrared radiation reflected from the skin, the radiometer gave accurate measurements of skin temperature during the periods of irradiation. Experimental values of skin temperature rise were compared with those calculated by the finite differences method for various skin layers using the best available values for optical and thermal properties of each skin layer. During the initial 10-15 sec. of irradiation, theoretical and experimental values were in agreement, indicating passive response of the skin to thermal radiation. Subcutaneous temperatures, calculated from surface temperature data, indicated a high degree of penetration of the radiation 0.2-0.4 mm. below the skin surface.

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- 485 Assessment of Industrial Heat Stress. A. Henschel, et al. *Am. Ind. Hyg. Assn. J.* 27, 13-16 (Jan.-Feb. 1966).

The problem of assessing the thermal impact of an industrial situation is complex because of the multiplicity of other stresses which may be present in the environment. To define the problem requires, as a minimum, data on the climatic environment of the work, the demands of the job, the daily work-rest regimen, the heat exposure history, the health and nutritional status, the state of body hydration, and the non-working physical environment and activities of the individuals. A study of industrial heat stress conducted by the Division of Occupational Health, U.S. Public Health Service incorporated a simple standard laboratory type heat-work test along with an exhaustive study of the men at the work site. The physiological responses of the men to the standard tests were significantly correlated with the responses on the job and reflected the magnitude of the on-the-job environmental stress.