cold atmospheres compensation by increased metabolism becomes inadequate. The body temperature falls and the reflex irritability of the spinal cord is markedly affected. The organism may finally pass into an unconscious state which ends in death.

A moderate amount of variability in temperature is known to be beneficial to health, comfort, and the performance of physical and mental work. On the other hand, extreme changes in temperature, such as those experienced by passing from a warm room to the cold air out-of-doors, appear to be harmful to the tissues of the nose and throat which are the portals for the entry of respiratory diseases.

Experiments show that chilling causes a constriction of the blood vessels of the palate, tonsils, throat, and nasal mucosa, which is accompanied by a fall in the temperature of the tissues. On re-warming, the palate and throat do not always regain their normal temperature and blood supply. This anaemic condition favors bacterial activity and it probably plays a part in favoring infection with common colds and other respiratory diseases. Lowered resistance may also be related to a diminution in the number and phagocytic activity of the leucocytes (white blood cells) brought about by exposure to cold and by changes in temperature.

Sickness records in industries seem to strengthen this belief. The *Industrial Fatigue Research Board* of England[19] found that with the workers exposed to high temperatures and to changes in temperature, namely, steel smelters, puddlers, and general laborers, there is an excess of all sickness, the excess among the puddlers being due chiefly to respiratory diseases and rheumatism. The causative factor was not the heat itself but the sudden changes in temperature to which the workers were exposed. The tin-plate millmen who were not exposed to chills, since they work almost continuously throughout the shift, had no excess of rheumatism and respiratory diseases. On the other hand, the blast-furnacemen, who work mostly in the open, showed more respiratory sickness than the steel workers. This experience in British factories is well in accord with the findings in American industries[20,21]. According to these data the highest pneumonia death rate is associated with dust, extreme heat, exposure to cold, and to sudden changes in temperature.

In the ordinary dwelling not equipped with a fan system during the winter season, air movement is likely to be minimal and the only air movements affecting comfort are those due to cold walls or convective heating. Below an air temperature of 77 F, for the clothed, semi-reclining body, sweat secretion is at a minimum and, even with high atmospheric humidity, all the moisture available is evaporated. Under conditions of low air movement, and with a relative humidity of 30-35 per cent, the evaporative heat loss is only 1.5 Btu per square foot of body surface greater than with a relative humidity of 75-80 per cent. This is the equivalent of decreasing the air temperature by less than 1 F.

[19]Fatigue and Efficiency in the Iron and Steel Industry, by H. M. Vernon (*Industrial Fatigue Research Board* Report No. 5, 1920, London).

[20]Iron Foundry Workers Show Highest Percentage of Deaths from Pneumonia (*Statistical Bulletin*, Metropolitan Life Insurance Co., New York, N. Y., 1928).

[21]The Pneumonia Problem in the Steel Industry, by D. K. Brundage and J. J. Bloomfield (*Journal of Industrial Hygiene*, 14, December, 1932).

RELATION OF AIR CONDITIONING NEEDS TO METABOLISM

The major objective of heating and ventilation is to balance heat losses from the human body. The basic factor is human metabolism. The desirable environment, from the standpoint of heat loss, depends directly on the heat produced in the body and this heat may be five times as great

TABLE 4. RELATION BETWEEN METABOLIC RATE AND ACTIVITY

ACTIVITY	HOURLY METABOLIC RATE FOR AVG PERSON OR TOTAL HEAT DISSIPATED, BTU PER HOUR	HOURLY SENSIBLE HEAT DISSIPATED, BTU PER HOUR	HOURLY LATENT HEAT DISSIPATED, BTU PER HOUR	MOISTURE DISSIPATED PER HOUR	
				Grains	Pounds
Basal	291	145	145	979	0.140
Seated at Rest	384	225	159	1070	0.153
Reading Aloud (Seated)	420	225	195	1316	0.880
Standing at Rest	431	225	206	1390	0.199
Hand Sewing (Seated)	441	225	216	1458	0.208
Knitting 23 stitches per minute on Sweater	462	225	237	1600	0.229
Dressing and Undressing	468	225	243	1640	0.234
Tailor	482	225	257	1740	0.248
Singing	486	225	261	1762	0.252
Office Worker Moderately Active	490	225	265	1790	0.256
Light Work Standing	549	225	324	2187	0.312
Typewriting Rapidly	558	225	333	2248	0.321
Ironing with 5 lb iron	570	225	345	2329	0.333
Dishwashing—Plates, Bowls, Cups and Saucers	600	225	375	2530	0.362
Clerk Moderately Active Standing at Counter	600	225	375	2530	0.362
Book Binder	626	225	401	2710	0.387
Shoemaker	661	225	436	2940	0.420
Sweeping Bare Floor 38 Strokes per Minute	672	229	443	2990	0.427
Pool Player	680	230	450	3040	0.434
Walking 2 mph, Light Dancing	761	250	511	3450	0.493
Light Metal Worker (at Bench)	862	277	585	3950	0.564
Painter of Furniture (at Bench)	876	280	596	4020	0.575
Carpenter	954	307	647	4367	0.624
Restaurant Serving	1000	325	675	4556	0.651
Pulling Weight	1041	335	708	4745	0.677
Walking 3 mph	1050	339	711	4750	0.679
Walking 4 mph, Active Dancing, Roller Skating	1390	452	938	6330	0.904
Walking Down Stairs	1444	467	977	6595	0.942
Stone Mason	1490	490	1000	6750	0.964
Bowling	1500	490	1010	6820	0.974
Man Sawing Wood	1800	590	1210	8170	1.167
Swimming	1986	.....	.....	.....	.....
Running 5.3 mph	2268	.....	.....	.....	.....
Walking 5 mph	2330	.....	.....	.....	.....
Walking Very Fast 5.3 mph	2580	.....	.....	.....	.....
Walking Up Stairs	4365	.....	.....	.....	.....
Maximum Exertion Different People	3000-4800	.....	.....	.....	.....

when a man is exercising violently as when he is reclining and at rest. Therefore, there is no absolute optimum of air temperature or other environmental conditions, which will meet all cases. With moderate relative humidity and minimum air movement, an air temperature of 80 F has been found ideal for the lightly clothed subject at rest in a semi-reclining position. In factories where light work is performed in summer time, the ideal has been found to be about 76 F. For children