is the completely randomized design. This design can be used to compare any number of treatment levels. When two treatment levels are used, the statistical test employed in the analysis is equivalent to a test by means of a $t$ ratio for uncorrelated groups. The general features of the design can be illustrated by the microwave radiation example cited earlier. Let $b_1$, $b_2$, and $b_3$ stand for treatment levels 0, 20,000, and 40,000 microwatts of radiation, respectively. Fifteen albino rats are assigned to the three treatment levels by means of a table of numbers. Food consumption of the rats assigned to each treatment level is indicated by $X_{ij}$, where $i$ designates the $i$th rat in treatment level $j$. Table 1.4-2 shows the layout of a completely randomized design. The *average* food consumption of rats in each treatment level is designated by $\bar{X}_{\cdot j}$. The dot in the subscript indicates the variable over which summation has occurred. In this example, treatment means are obtained by summing the scores over the $i = 1$ through 5 rats. The average food consumption for all 15 rats is designated by $\bar{X}_{\cdot\cdot}$ .

**TABLE 1.4-2 Completely Randomized Design**

| | *Treatment Levels* | | | |
|---|---|---|---|---|
| | $b_1$ | $b_2$ | $b_3$ | |
| | $X_{11}$ | $X_{12}$ | $X_{13}$ | |
| | $X_{21}$ | $X_{22}$ | $X_{23}$ | |
| | $X_{31}$ | $X_{32}$ | $X_{33}$ | |
| | $X_{41}$ | $X_{42}$ | $X_{43}$ | |
| | $X_{51}$ | $X_{52}$ | $X_{53}$ | |
| Treatment means = | $\bar{X}_{\cdot 1}$ | $\bar{X}_{\cdot 2}$ | $\bar{X}_{\cdot 3}$ | Grand mean = $\bar{X}_{\cdot\cdot}$ |

Here conclusions concerning the effects of microwave radiation are restricted to the three treatment levels and to the 15 rats included in the experiment. Edgington (1966) recently emphasized that random assignment of subjects to treatment levels is essential if an experimenter wishes to draw statistical inferences concerning treatment effects from nonrandomly selected subjects.* Because of the importance of the principle of random assignment, an experimenter should always describe his technique for assigning subjects to treatment levels.

Associated with every experimental design is a mathematical model that purports to include all sources of variability affecting individual scores. To the extent that the model accurately represents these sources of variability, the experimenter can evaluate the effects of a treatment. The linear model for a completely randomized design is

*Few experiments in the behavioral sciences are carried out with randomly selected subjects. When a random sample is used, the population sampled is likely to be so specific as to be of little interest.