Definition \ An experiment $E$ is a data-generating process in which all possible outcomes can be listed before $E$ is performed.

Definition \ An event $E$ is a set of possible outcomes of an experiment $E$.

Examples \ Tay-Sachs disease $E$ = (the process by which the husband & wife end up with 5 children, each a T-S baby or not) \ $\sqrt{E}$ of interest is $E = \{ \text{at least 1 T-S baby} \}$
Definition: The sample space $\Omega$ is the set of all possible outcomes of an experiment $E$. Example: \( T \sim S \)

Let $T$ (T-s baby) and $N$ (not T-s baby)

Here $\Omega = \{ NNNNN, \ldots, TTTTT \}$

Since there are 2 possibilities for each baby \((T, N)\) and 5 babies, the number of elements in $\Omega$ is \( 2^5 = 32 \).

$\Omega$ is an example of a product space:

\[ \{T, N\} \times \{T, N\} \times \cdots \times \{T, N\} = \{T, N\}_5 \]
Here $E = \{ TNNNN, \ldots, TTTTT \}$. 

**Notation:** use $s$ to stand for 

Let's (the individual outcomes) of $\Omega$, the theory of 

probability we'll look at in this class was developed by Kolmogorov (1933) in an attempt to rigorize the hypothetical repeated process of throwing a dart at a Venn diagram (rectangle).

The rules of this dart-throwing were simple: 0 the dart must land somewhere inside (or on the boundary of) the rectangle $S$, which
Symbolically stands for the sample space, and \( \square \) all the points where the dart might land in \( S \) are "equally likely" (as yet, an undefined concept).

**Definition** The complement \( A^c \) of a set \( A \) in \( S \) is the set that contains all elements of \( S \) not in \( A \).

(You can see from the Venn diagram on p. 8 that the dart has to fall either in \( A \) or in \( A^c \), which we could also call \( \text{not } A \).)

Notation: \( \square \) is an element of \( S \).

\( \subseteq S \) means that \{ outcome \} is a subset of \( S \).
Definition: A set $A$ is contained in another set $B$ (write $A \subset B$) if every element of $A$ is also in $B$; can also say that $B$ contains $A$ ($B \supset A$).

Evidently, if $A$ and $B$ are events, $A \subset B \iff$ (if and only if) if $A$ occurs then so does $B$.

(Theorem) Consequences: If $A$, $B$, $C$ are events then (a) $A \subset B$ and $B \subset A \iff A = B$ and (b) $A \subset B$ and $B \subset C \Rightarrow A \subset C$.

Definition: The cardinality of a set $A$ (written $|A|$) is the number of distinct elements in $A$. 
Example (Troy-Sachs) \( |S'| = 32 \) (see 12)

**Definition**

The set of all subsets of a given set \( S \) is called the power set of \( S \), denoted by \( 2^S \); this notation was chosen because, if \( |S| = n \), then \( |2^S| = 2^n \) (in other words, if \( S \) has \( n \) distinct elements then there are \( 2^n \) distinct subsets of \( S \).

**Definition**

It's convenient to have a symbol for the set that has no elements in it: \( \emptyset \), the empty set.