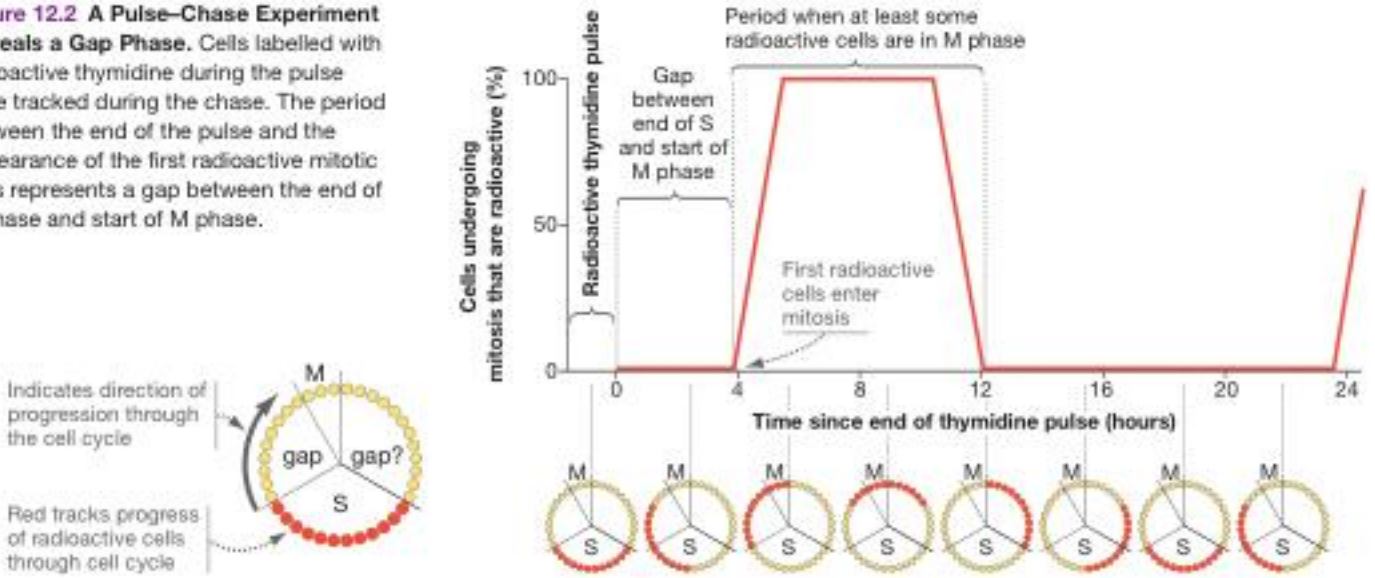

Figure 12.2 A Pulse–Chase Experiment Reveals a Gap Phase. Cells labelled with radioactive thymidine during the pulse were tracked during the chase. The period between the end of the pulse and the appearance of the first radioactive mitotic cells represents a gap between the end of S phase and start of M phase.

One striking result emerged early on: None of the radioactive cells started mitosis immediately. Because the cultures were asynchronous, at least some of the cells must have been at the very end of their S phase when they were exposed to the pulse. If S phase were immediately followed by M phase, then some of these radioactive cells would have entered M phase just as the chase began. Instead, it took several hours before any of the radioactive cells began mitosis.

The time between the end of the pulse and the appearance of the first radioactive mitotic nuclei corresponds to a gap between the end of S phase and the beginning of M phase. This gap is a period when chromosome replication is complete but mitosis has not yet begun. The graph in Figure 12.2 shows how cells labelled with radioactive thymidine can be tracked as they progress through M phase.

and an interphase consisting of the G_1, S, and G_2 phases. In the cycle diagrammed here, G_1 phase is about twice as long as G_2 phase, but their actual durations vary depending on the cell type and growth conditions.

Why do the gap phases exist? In multicellular organisms, cells perform their functional roles mostly during G_1 phase. G_1 is also the period when the cell "decides" to begin replication and transitions to S phase (as will be explained in Section 12.3). Before mitosis can take place, a cell uses G_2 phase to prepare for M phase. The time spent in both G_1 and G_2 allows the cell to grow and replicate organelles so it will be able to divide into two cells that can function normally.

Now let's turn to M phase. Once the genetic material has been copied in S phase, how is it divided between daughter cells?

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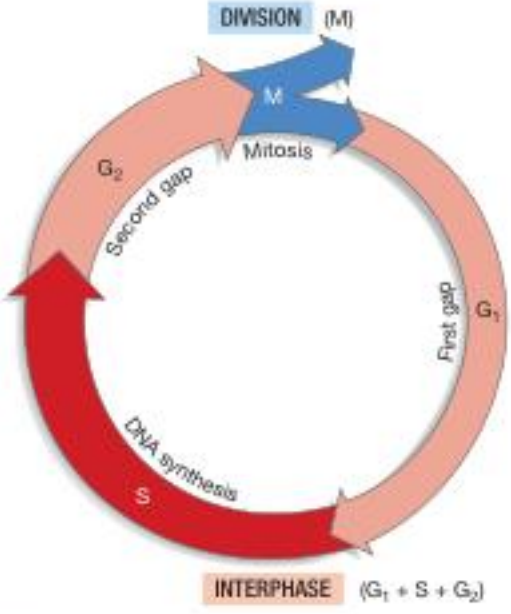

Figure 12.3 The Cell Cycle Has Four Phases. The duration of the G_1 and G_2 phases varies dramatically among cells and organisms.