Theorem 2.1.6
Let $u, v \in \Sigma^*$. Then $(uv)^R = v^R u^R$.

Proof The proof is by induction on the length of the string v.

Basis: $length(v) = 0$. Then $v = \lambda$ and $(uv)^R = u^R$. Similarly, $v^R u^R = \lambda^R u^R = u^R$.

Inductive Hypothesis: Assume $(uv)^R = v^R u^R$ for all strings v of length n or less.

Inductive Step: We must prove, for any string v of length $n + 1$, that $(uv)^R = v^R u^R$. Let v be a string of length $n + 1$. Then $v = wa$, where w is a string of length n and $a \in \Sigma$. The inductive step is established by

$$
\begin{aligned}
(uv)^R &= (u(wa))^R \\
&= ((uw)a)^R && \text{(associativity of concatenation)} \\
&= a(uw)^R && \text{(definition of reversal)} \\
&= a(w^R u^R) && \text{(inductive hypothesis)} \\
&= (aw^R)u^R && \text{(associativity of concatenation)} \\
&= (wa)^R u^R && \text{(definition of reversal)} \\
&= v^R u^R. && \blacksquare
\end{aligned}
$$