How do we build current sources to bias our differential amplifiers?

*output $R = r_o$

Since $V_{BE}$ is the same in both BJT’s, $I_E$ must be the same.
CURRENT SOURCES

Improved current mirror with base current compensation

Widlar Current Source
CURRENT SOURCES

Suppose we want a 10\(\mu\)A current source on a chip using a 10V supply:

Large R’s consume lots of chip area! Expensive!
The output R for the Widlar is large: (pg. 655) \(R_o \sim [1+g_m (R_E || r_\pi)] r_0\)
CURRENT SOURCES

The output R can be improved by using a CASCODE.
CURRENT SOURCES

What price do we pay?
CURRENT SOURCES

Current mirrors with MOSFETs:

Similar to BJT
Small-signal:
CURRENT SOURCES

Overhead:
Convenient way to bias cascade: