The Ras-Raf-MEK-ERK signaling cascade controls a number of cellular processes, including meiosis, mitosis, and postmitotic functions in differentiated cells. Extracellular-signal-regulated kinases (ERK1 and ERK2), which are also referred to in the literature as MAP kinases, are essential nodes in the aforementioned cellular processes, and disruption of the ERK signaling pathway is common in cancers, which has made ERK1/2 attractive targets in the pharmaceutical industry.

Genentech recently published **GDC-0994**, a potent and selective inhibitor of ERK1/2 kinases.

For this Team Challenge, you are part of a process chemistry team focused on meeting the multikilogram supply needs for clinical evaluation of **GDC-0994**, as well as the associated purity standards (>99.5 A% HPLC and >99% ee). Working with your team, propose an efficient, scalable, and stereoselective/specific route to access **GDC-0994**. You are not permitted to use a computer for this Team Challenge but may ask Keary regarding commercial availability of starting materials.

![GDC-0994 structure](image)

\[ \text{GDC-0994} \]