

NEUROGENESIS

The window of fate

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During development of the CNS, the generation of particular cell types from progenitor cells requires the tight regulation both of developmental transcription factors and of the progenitor cells' ability to respond to these factors (cell competence). Essentially, the transcription factors have a short window of opportunity — while the progenitors are competent — in which to govern their fate. However, it is not known whether competence is specific to individual transcription factors, or whether various factors can share a common competence window. Now, Cleary and Doe have begun to tackle this question, using the well studied NB7-1 neural progenitor cells of *Drosophila*.

The NB7-1 neural progenitor cell produces a series of ganglion mother cells (GMCs), each of which then

divides to produce two neurons.

The first five GMCs (GMC1–5) give rise to motor neurons (of the type U1–U5, respectively) and thereafter GMCs give rise to interneurons. The particular fates of the motor neurons are decided by the sequential expression, in NB7-1, of four transcription factors: Hunchback (HB), Krüppel (KR), PDM1/PDM2 (PDM) and Castor (CAS). HB specifies U1 and U2 neurons, KR specifies U3, PDM specifies U4, and PDM and CAS together specify U5.

Although HB and KR expression is only necessary for the first three motor neuron types (and, therefore, for the first three divisions to produce GMCs), Cleary and Doe investigated how long NB7-1 remained competent to both. They delivered pulses of either KR or HB to NB7-1 just before the birth of each GMC and then looked for the production of U1, U2 or U3 motor neurons. They found that both factors could induce their respective neurons up to the fifth division (production of GMC5), after

which competence to both was lost. This therefore indicated that HB and KR share a window of competence.

In further experiments, the team prolonged the expression of HB and KR, and showed that, by doing so, it was possible to prevent the production of U4 and U5 cells. The authors' interpretation of this finding was that by the time HB or KR expression had stopped, the production of U4 and U5 neurons was no longer possible — PDM and CAS had essentially missed their window of opportunity.

Together, Cleary and Doe's findings indicate that all four transcription factors share the same competence window (lasting five GMC divisions). It remains to be discovered which mechanisms define this window and what, after five divisions, closes the curtains on competence.

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ORIGINAL RESEARCH PAPER Cleary, M. D. & Doe, C. Q. Regulation of neuroblast competence: multiple temporal identity factors specify distinct neuronal fates within a single early competence window. *Genes Dev.* **20**, 429–434 (2006)

