

### 9.03 The Compaction Wave

Compaction in mammalian embryos occurs prior to blastocoele formation (Boerjan & te Kronnie, 1993), while amphibian cleavage waves occur prior to and during blastula formation. Compaction in mammals may thus provide a hint about the role of cleavage waves in amphibians:

"Immunofluorescence studies in the mouse embryo using an antibody directed against  $\text{Na}^+/\text{K}^+$  ATPase subunits indicated that the enzyme was located in the basolateral membrane of the trophectodermal cell at the time of cavitation (Watson & Kidder, 1988)... Amino acid transport in the mouse embryo changes dramatically with compaction... Until we have sufficient knowledge of the transport systems present, and at which point in embryogenesis these systems arise, we will be unable to correlate adequately ion and solute transport with the developmental processes" (Robinson & Benos, 1991b).

These events may correlate with changes in gene expression in mammalian embryos (Schultz et al., 1992; Watson, 1992). Similar ion transport changes occur in *Xenopus* during blastocoel formation and the midblastula transition (Han et al., 1991). These correlations suggest that compaction may also be a differentiation wave.

Am I right in considering compaction as a step of differentiation? "Yes, in that it involves the formation of  $\text{Ca}^{2+}$ -dependent cell junctions. There's some evidence for unique gene switch-on at the two-cell stage, and certainly there are differences between male and female embryos as early as the 4-cell stage (Mittwoch, Watt & Aplin, 1995; [cf. Pergament et al., 1994])" (James Cummins, p.c., 1995). Since "The transition from maternal to zygotic gene expression in the mouse occurs in the 2-cell embryo" (Henery et al., 1995), mammalian embryos are apparently past the 'midblastula transition' at the 2-cell stage (cf. Wiekowski, Miranda & DePamphilis, 1991; Nothias et al., 1995), arguing again that they may be differentiating even this early.

Of course, the separation of blastomeres into internal and external cells during compaction (Proposition 61) is probably an event of differentiation.