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Positional Information, in bits JULIEN DUBUIS, WILLIAM BIALEK, Joseph Henry Laboratories of Physics, Princeton University, ERIC WIESCHAUS, Department of Molecular Biology, Princeton University, THOMAS GREGOR, Joseph Henry Laboratories of Physics, Princeton University — Pattern formation in early embryonic development provides an important testing ground for ideas about the structure and dynamics of genetic regulatory networks. Spatial variations in the concentration of particular transcription factors act as "morphogens," driving more complex patterns of gene expression that in turn define cell fates, which must be appropriate to the physical location of the cells in the embryo. Thus, in these networks, the regulation of gene expression serves to transmit and process "positional information." Here, using the early Drosophila embryo as a model system, we measure the amount of positional information carried by a group of four genes (the gap genes Hunchback, Krüppel, Giant and Knirps) that respond directly to the primary maternal morphogen gradients. We find that the information carried by individual gap genes is much larger than one bit, so that their spatial patterns provide much more than the location of an "expression boundary." Preliminary data indicate that, taken together these genes provide enough information to specify the location of every row of cells along the embryo's anterior-posterior axis.

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