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Refinement of the four-dimensional human heart atlas during the first trimester of gestation with rare and diverse cell states

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Congenital heart defects represent a significant, frequent health burden. Understanding their developmental origins promises improved diagnoses, prognoses and therapies. The French Human Developmental Cell Atlas (HuDeCA) consortium refines the cell identity atlas in human hearts from 8 to 12 post-conceptual weeks using single-nucleus/spatial transcriptomics and advanced imaging approaches. We integrate and validate both across our datasets and with existing atlases, using multiple technical approaches to establish varying levels of resolution. The gene expression networks deployed within individual cells at specific positions reveal semi-continuous identities, reflecting positional paracrine influences exerted by/on the many lineages of the first and longest-lived vital organ.