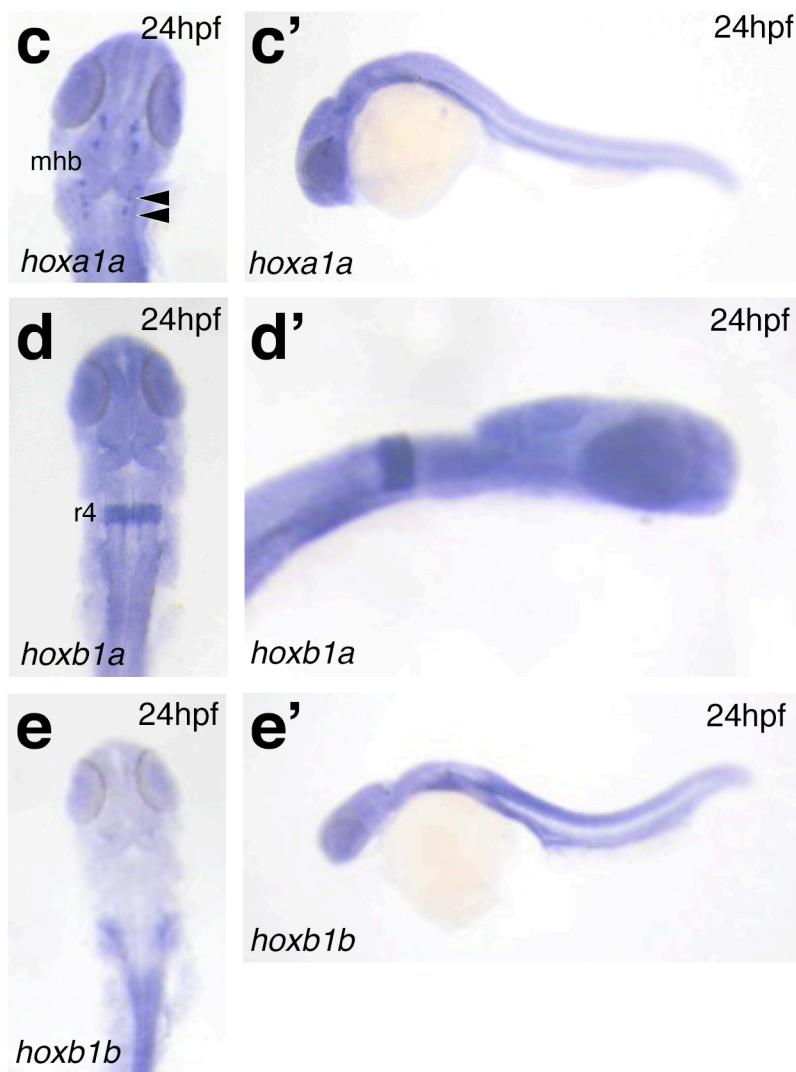
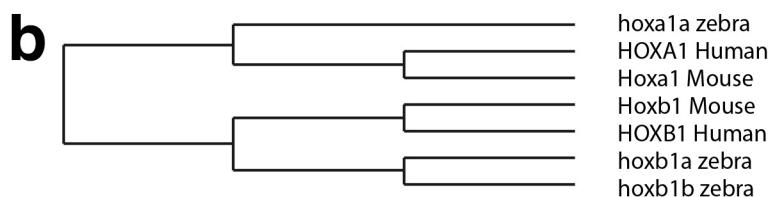


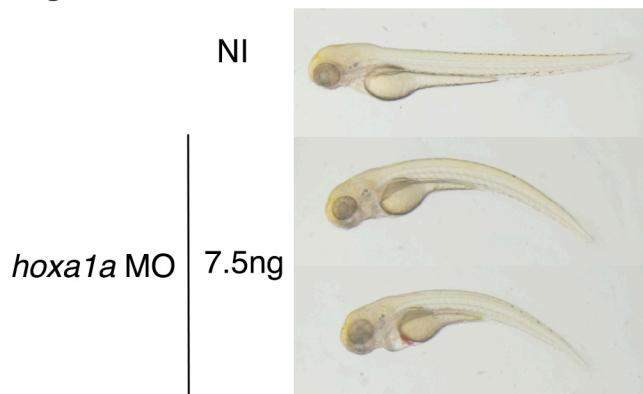
**a**

|              |  |     |
|--------------|--|-----|
| hoxa1a zebra | -----MS <b>TFLDFSSISGGGDGGSGGSCSVRAFHGDHGLSTFQSSCAVRINSCSGDERFMS</b>   | 55  |
| HOXA1 Human  | MDNARM <b>NSELEYPILSS</b> ---- <b>GDSGTCSARAYPSDHRTTFQ-SCAVSANS</b> CGGDRFLV   | 55  |
| Hoxa1 Mouse  | ---- <b>MNSFLEYPILGS</b> ---- <b>GDSGTC</b> SARAYPSDHGTTFQ-SCAVSANSCGGDRFLV  | 50  |
| hoxa1a zebra | NISS <b>QDV</b> ----- <b>INSQPOQAGSYQSPGTL</b> SITYS--- <b>AHPSYGTQSFCTGYNHAYLN</b>                                  | 104 |
| HOXA1 Human  | GRGV <b>QIGSP</b> -HHHHHHHHRHP <b>QPATYQTSGNL</b> GVSYSHSSCG <b>PSYGSQNFSA</b> PSPYALN                               | 114 |
| Hoxa1 Mouse  | GRGV <b>QI</b> SSPHHHHHHHHHHP <b>QATYQTSGNL</b> GISYSHSSCG <b>PSYGAQNFSA</b> PYGPYGLN                                | 110 |
| hoxa1a zebra | <b>QDV</b> ESSSVSF <b>PQCGPLVYSGNI</b> STTVQHRHHRHGYSSGNVHLHGQF <b>QYGSATYGNSSDQA</b>                                | 164 |
| HOXA1 Human  | <b>QEAD</b> VSGGY <b>PQCAPAVYSGNL</b> SSPMVQHHHHHQGYAGGAVGS--- <b>PQYIHHSYGQE</b> HQS-                               | 170 |
| Hoxa1 Mouse  | <b>QEAD</b> VSGGY <b>PPCAPAVYSGNL</b> STPMVQHHHHHQGYAGGTVGS--- <b>PQYIHHSYGQE</b> QQT-                               | 166 |
| hoxa1a zebra | <b>NLTFVAGCSNPLSPLHVPHDACCSP</b> PLSDGVPTG <b>QTFDW</b> MKVKRNP <b>PKTGKAGEYGF</b> GGQ                               | 224 |
| HOXA1 Human  | -- <b>LALATYNN</b> NSLSP <b>LHASHQEACRSP</b> ASETSSPA <b>QTFDW</b> MKVKRNP <b>PKTGKVEYGYLGQ</b>                      | 228 |
| Hoxa1 Mouse  | -- <b>LALATYNN</b> NSLSP <b>LHASHQEACRSP</b> ASETSSPA <b>QTFDW</b> MKVKRNP <b>PKTGKVEYGYVGQ</b>                      | 224 |
| hoxa1a zebra | <b>PNTVR</b> TNF <b>STKQLTELEKEFHFNKYLTRARR</b> VEIAASLQLNET <b>QVKIWFQ</b> NRMKQKKRE                                | 284 |
| HOXA1 Human  | <b>PNA</b> VRTNF <b>TTKQLTELEKEFHFNKYLTRARR</b> VEIAASLQLNET <b>QVKIWFQ</b> NRMKQKKRE                                | 288 |
| Hoxa1 Mouse  | <b>PNA</b> VRTNF <b>TTKQLTELEKEFHFNKYLTRARR</b> VEIAASLQLNET <b>QVKIWFQ</b> NRMKQKKRE                                | 284 |
| hoxa1a zebra | <b>KEGLLPKSL</b> SEQKD <b>GLEKTEDA</b> SEKS <b>PSAP</b> STPSP <b>SP</b> SP <b>VEAYSSN</b> --                         | 329 |
| HOXA1 Human  | <b>KEGLLPIS</b> PA <b>TPPGNDEKAE</b> EE <b>SEKS</b> SS <b>SP</b> CV <b>PSPGS</b> TS <b>SDT</b> LT <b>TS</b> H        | 335 |
| Hoxa1 Mouse  | <b>KEGLLPIS</b> PA <b>TPPGSDEKTE</b> EE <b>SEKS</b> SP <b>PSA</b> P <b>SP</b> AS <b>ST</b> SD <b>TL</b> TT <b>SH</b> | 331 |

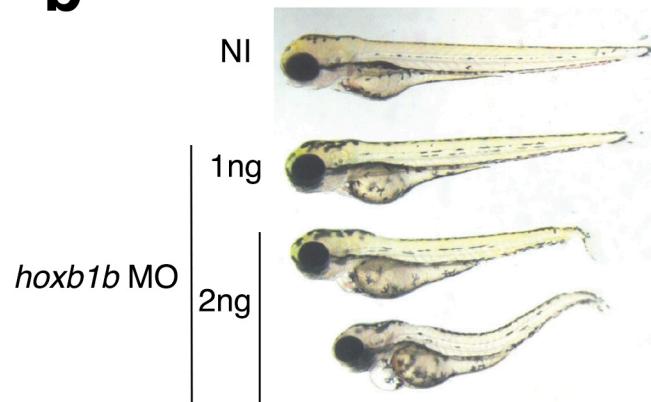


Extended data Figure 1

**a**



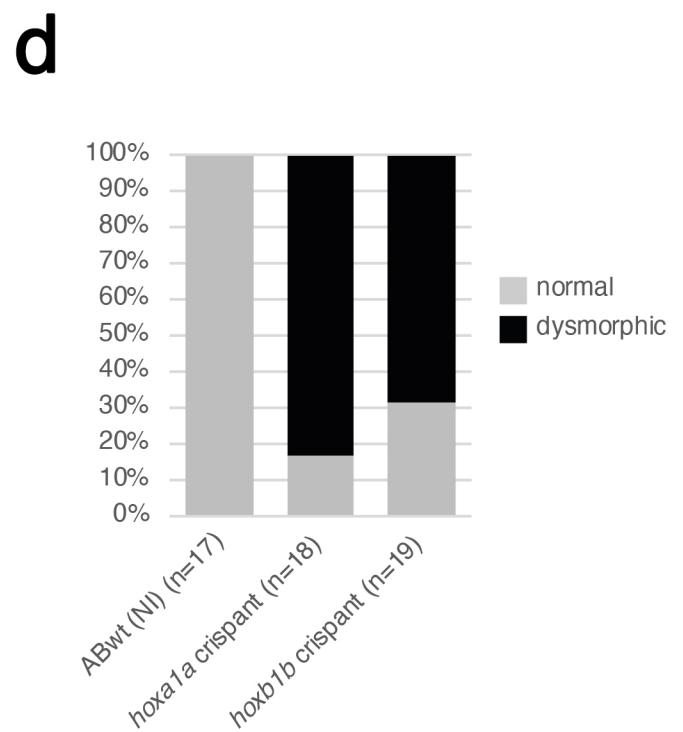
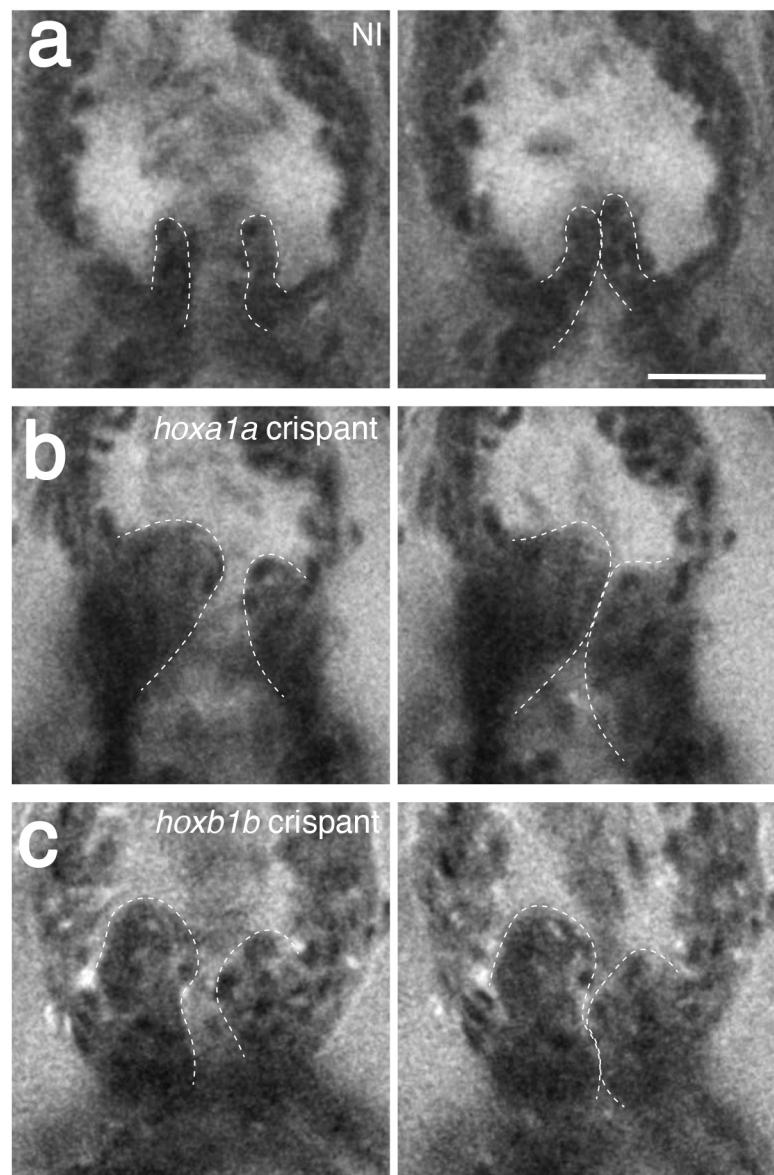
**b**



Extended data Figure 2

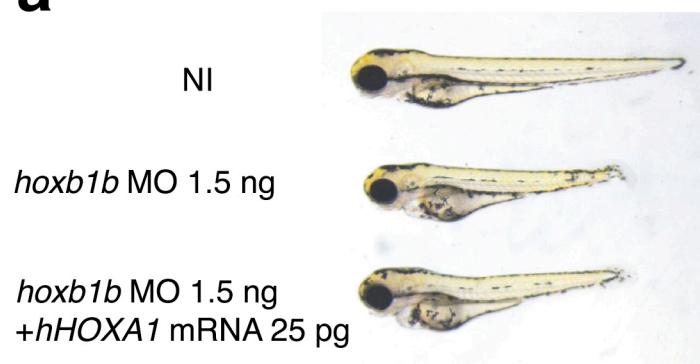
systolic

## diastolic

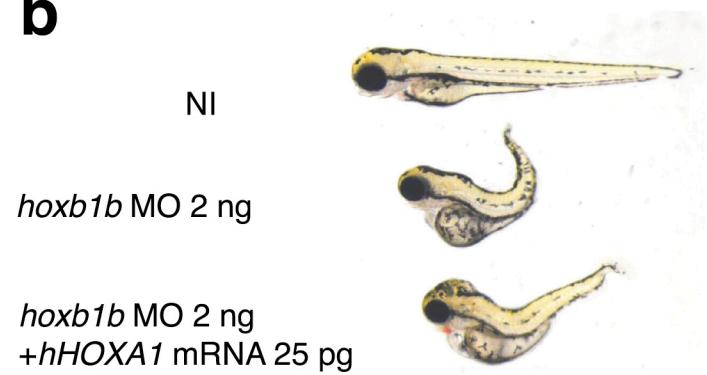


# Extended data Figure 3

**a**



**b**



Extended data Figure 4

**a**

NI

WT<sup>A</sup> 25 pg

+1His 25 pg

-3His<sup>Arg</sup> 25 pg-1His<sup>Arg</sup> 25 pg

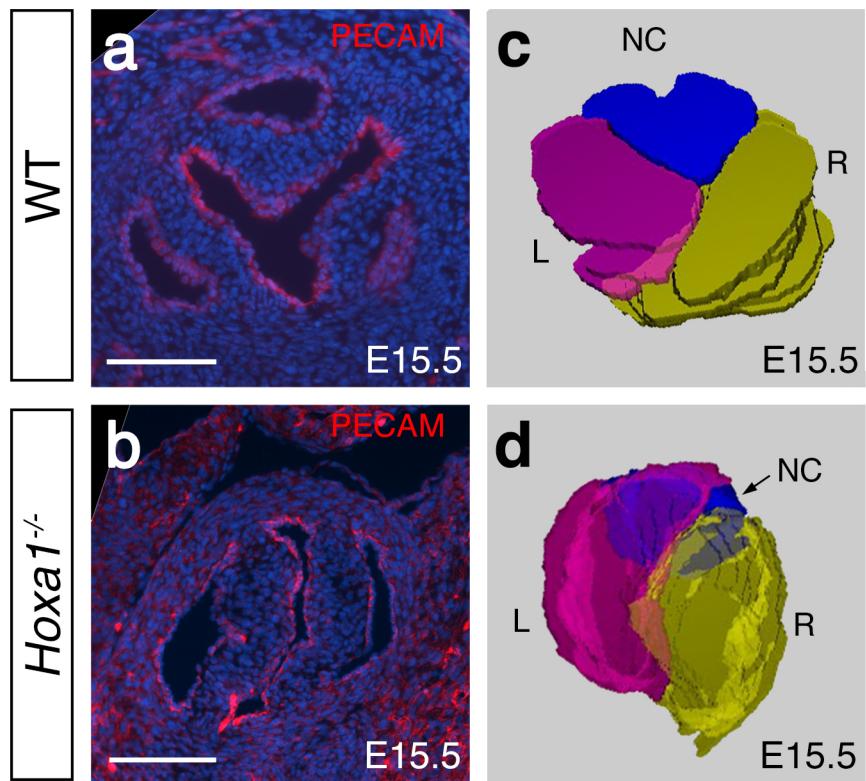
-1His 25 pg

**b**

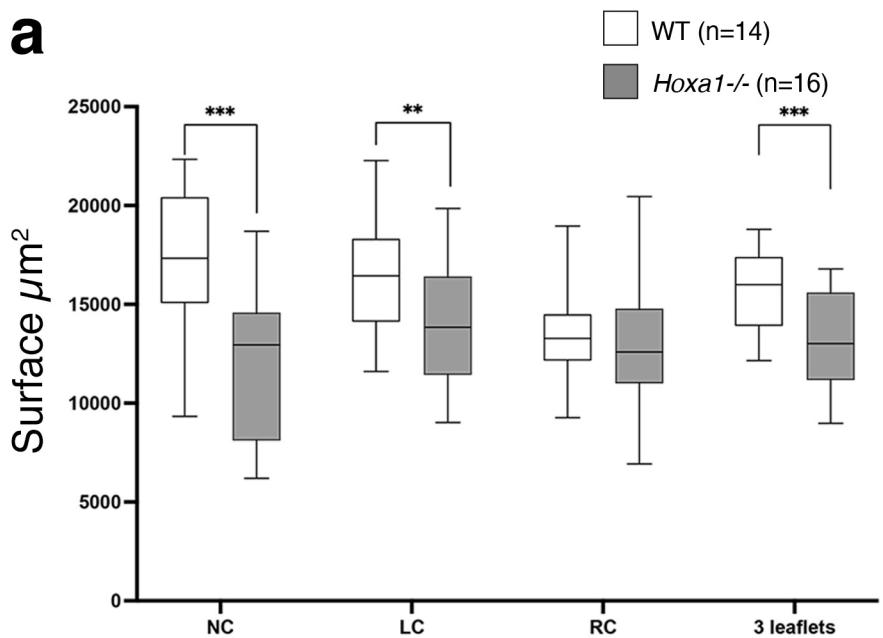
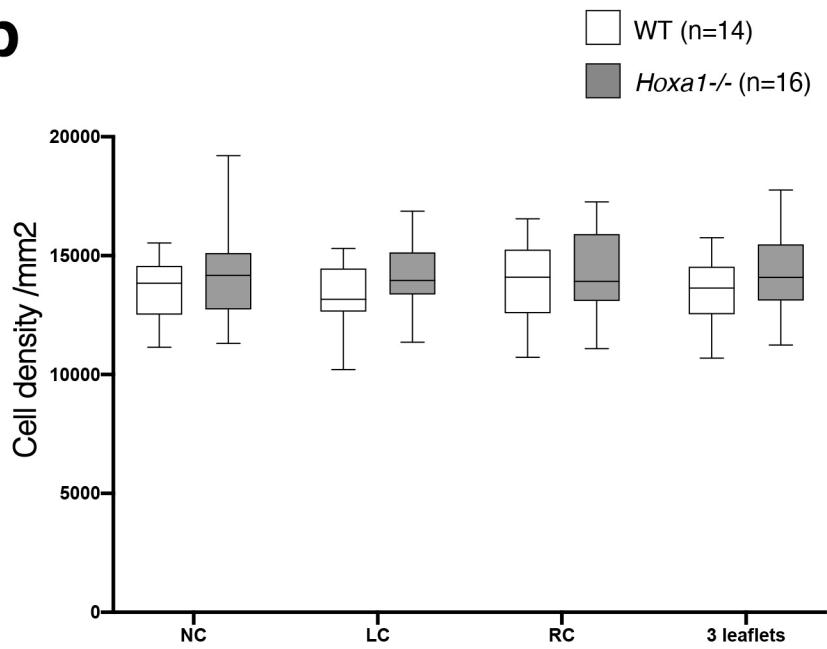
NI

-3His<sup>Arg</sup> 1 pg-3His<sup>Arg</sup> 5 pg-3His<sup>Arg</sup> 10 pg-3His<sup>Arg</sup> 25 pg

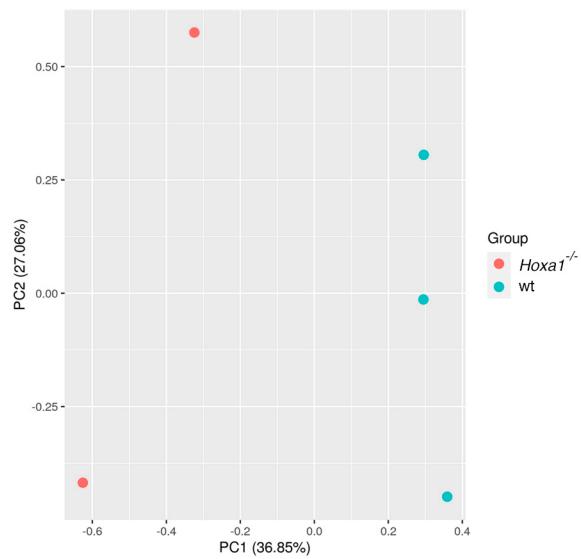
# Extended data Figure 5



Extended data Figure 6

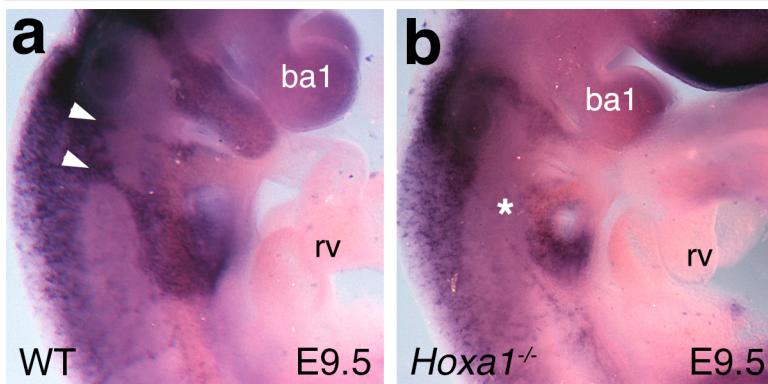
**a****b**

# Extended data Figure 7



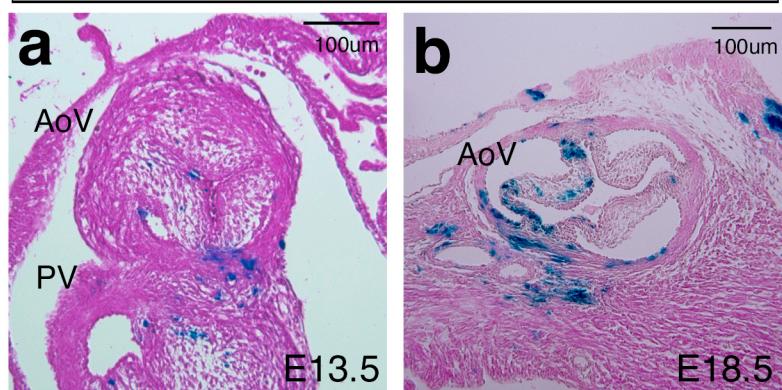
## Extended data Figure 8

*Crabp1*



Extended data Figure S9

*Hoxa1-enhIII-cre;R26R*



Extended data Figure 10