

Figure S1. Chd4 and Znf219 interact in HEK293 cells. Western blot showing Hek293 extracts co-transfected with Flag-Chd4 and Myc-Znf219 (input), and IP with anti-Flag showing *in vitro* interaction of both proteins.

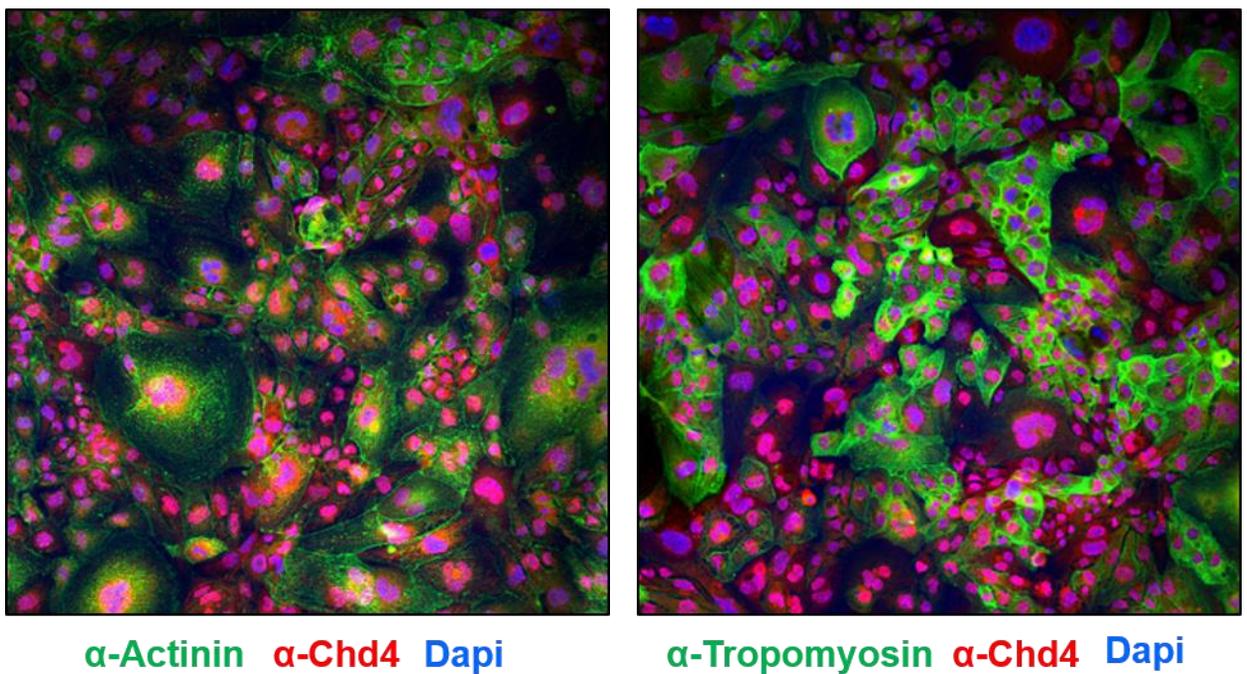


Figure S2. HL-1 cell line characterization. IF of HL-1 cells showing expression of the cardiac markers α -actinin (left) and tropomyosin (right, 84% \pm 4%) in green. Chd4 immunostaining is showed in red

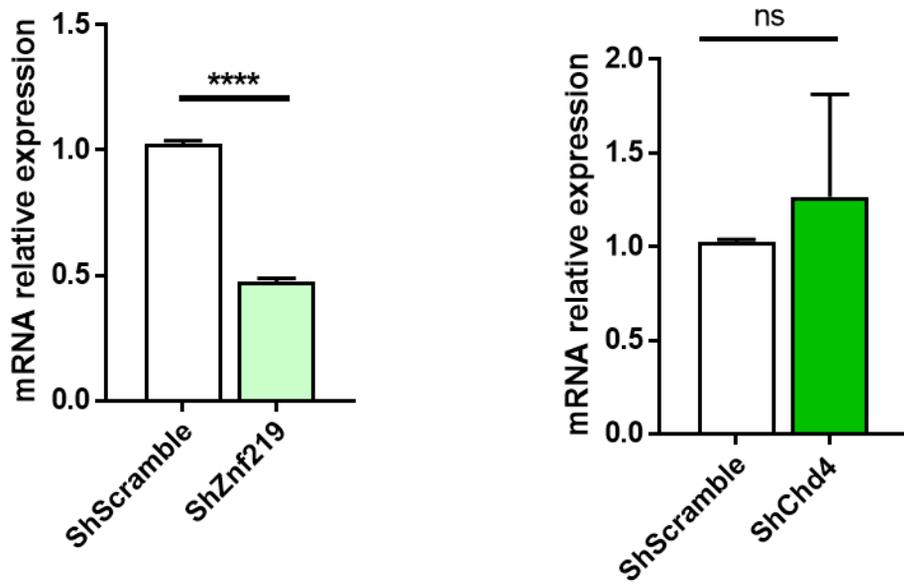


Figure S3. *Znf219* KD *in vitro*. qPCRs of HL-1 cells infected with shRNA for *Znf219* and *Chd4* of samples showed in Figure 2e. Left chart shows KD of *Znf219* with its corresponding shRNA. Right chart shows no *Znf219* KD when cells were infected with shRNA for *Chd4*. Cells infected with scrambled shRNA were used as control.

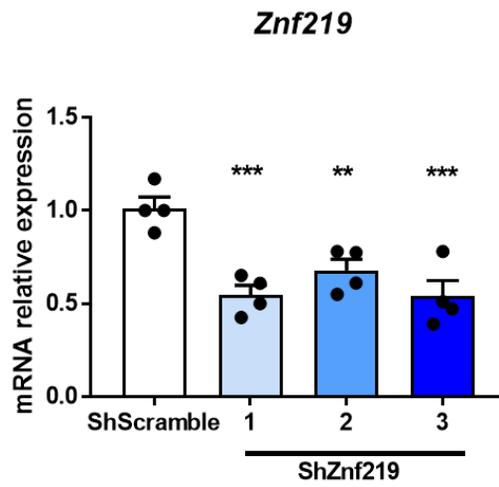
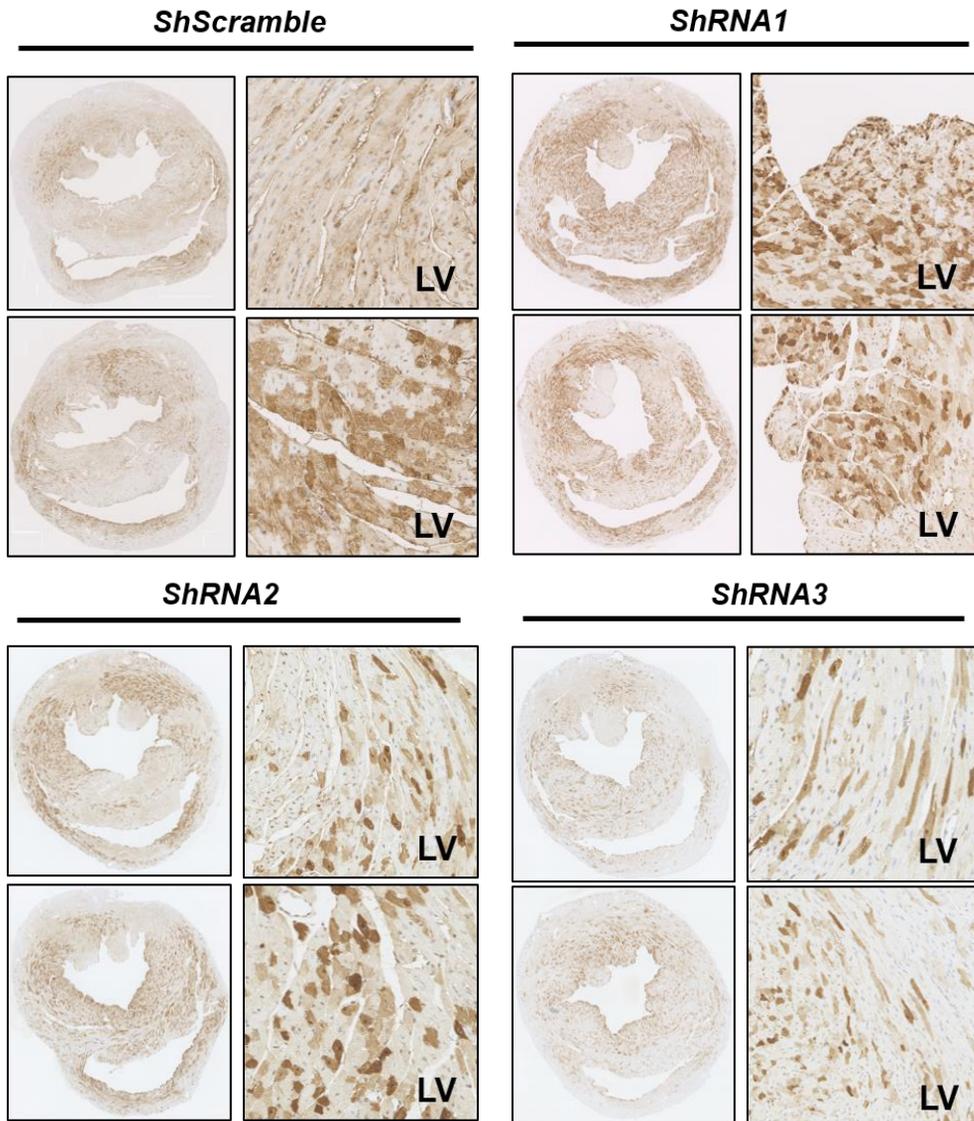
a**b**

Figure S4. *Znf219* KD *in vivo*. (a) WT CD1 PD1-2 pups were injected with 2×10^{11} viral particles/pup with AAV9-shRNA-*ShScramble* or AAV9-shRNA1-,2- or 3-*Znf219*. One month later, RNA from the hearts of these mice were tested for *Znf219* KD by qPCR. (b) Levels of infection were tested by IHC with α -GFP, showing good, but mosaic cardiomyocyte infection with all three shRNAs tested.

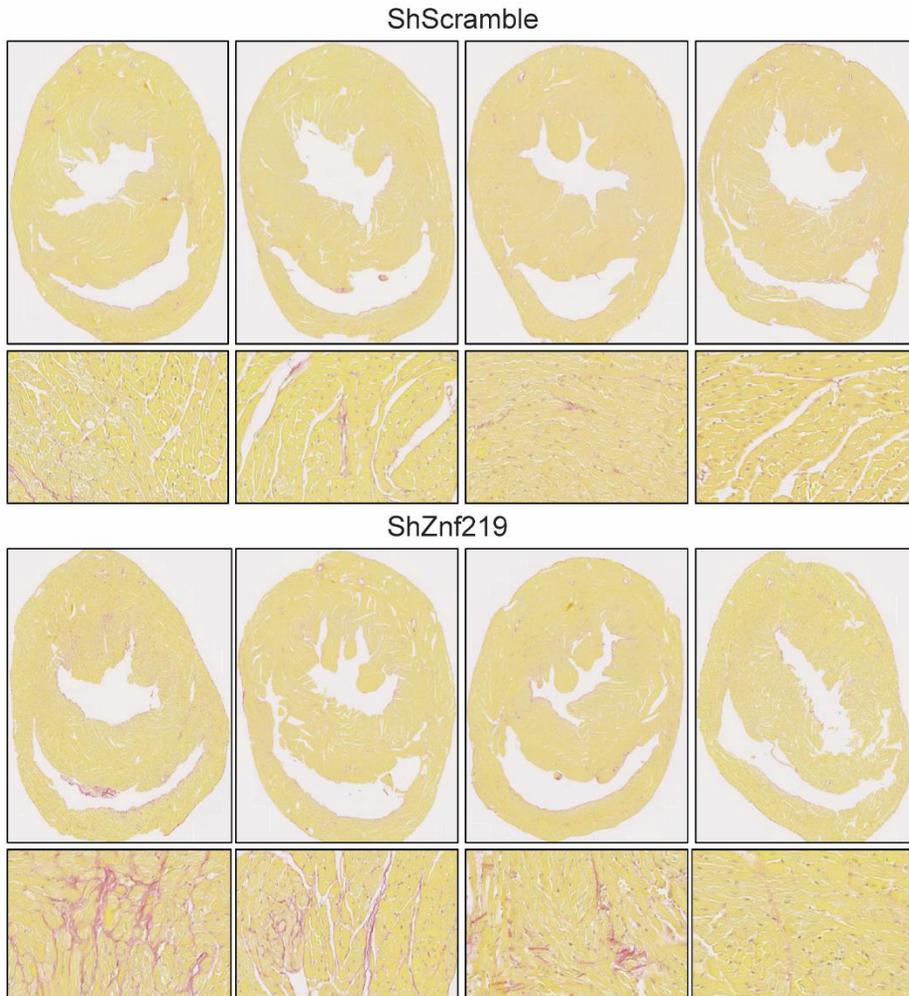
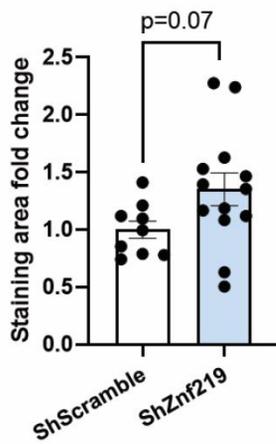
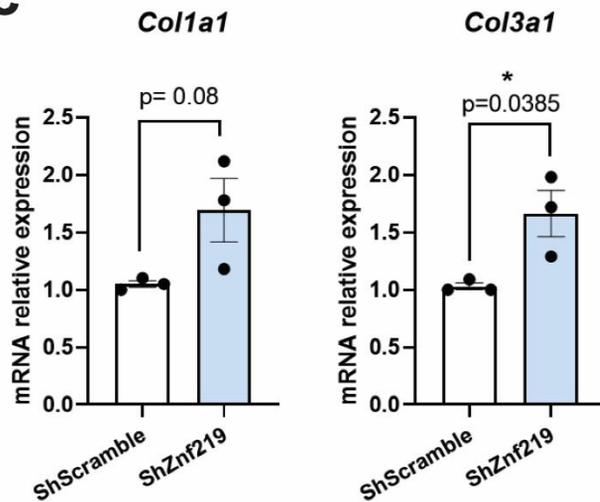
a**b****c**

Figure S5. *Znf219* KD hearts tend to increase fibrosis and collagen transcription. (a) Sirius Red staining of heart transversal sections of 4 representative 8 week old infected mice with AAV9-*shScramble* (upper), and 4 infected with AAV9-sh-RNA *Znf219*. (b) Quantification of fibrotic area in 9 sh-scramble infected hearts (white bar), and 13 sh*Znf219* infected hearts (blue bar). (c) *Collagen type I alpha 1 (Col1a1)* and type III alpha 1 (*Col3a1*) mRNA levels in shScramble or sh *Znf219* infected hearts (n=3).

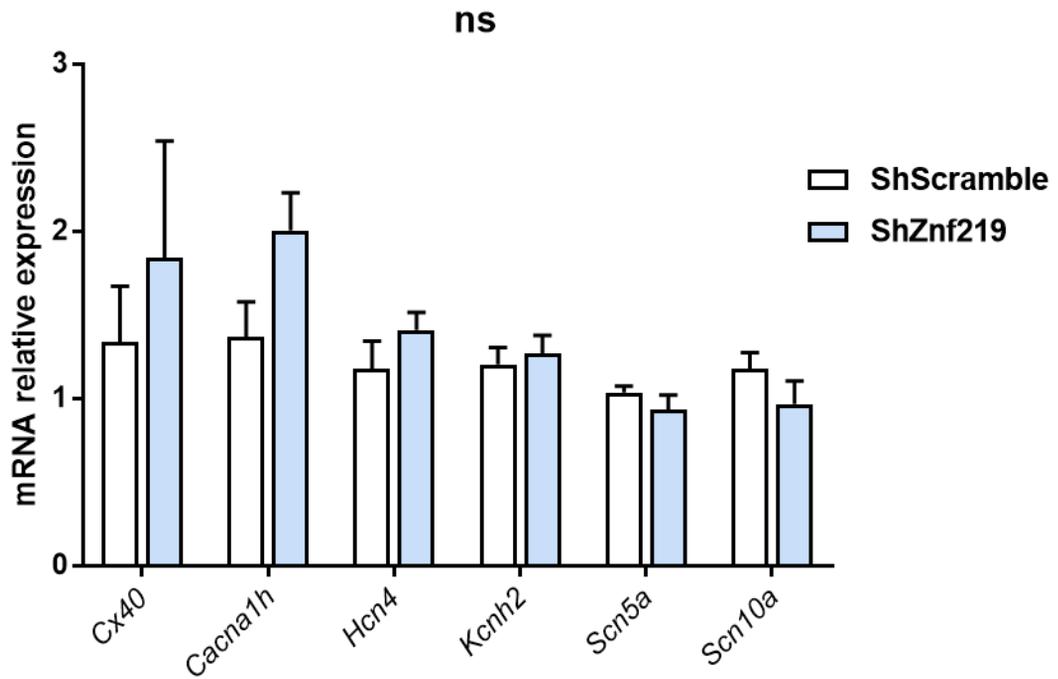
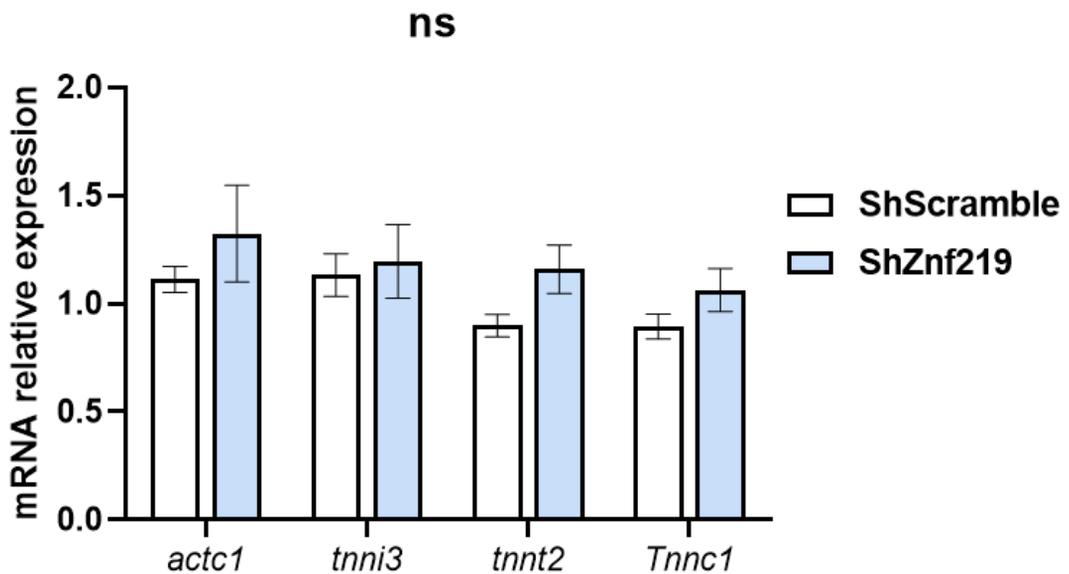
a**b**

Figure S6. Znf219 does not regulate ion channels transcription *in vivo* or cardiac genes. *Znf219* KD with *ShZnf219* does not affect mRNA expression levels of some sodium, potassium or calcium channels (a), or sarcomeric cardiac genes showed by qPCR (b). ns = not significant

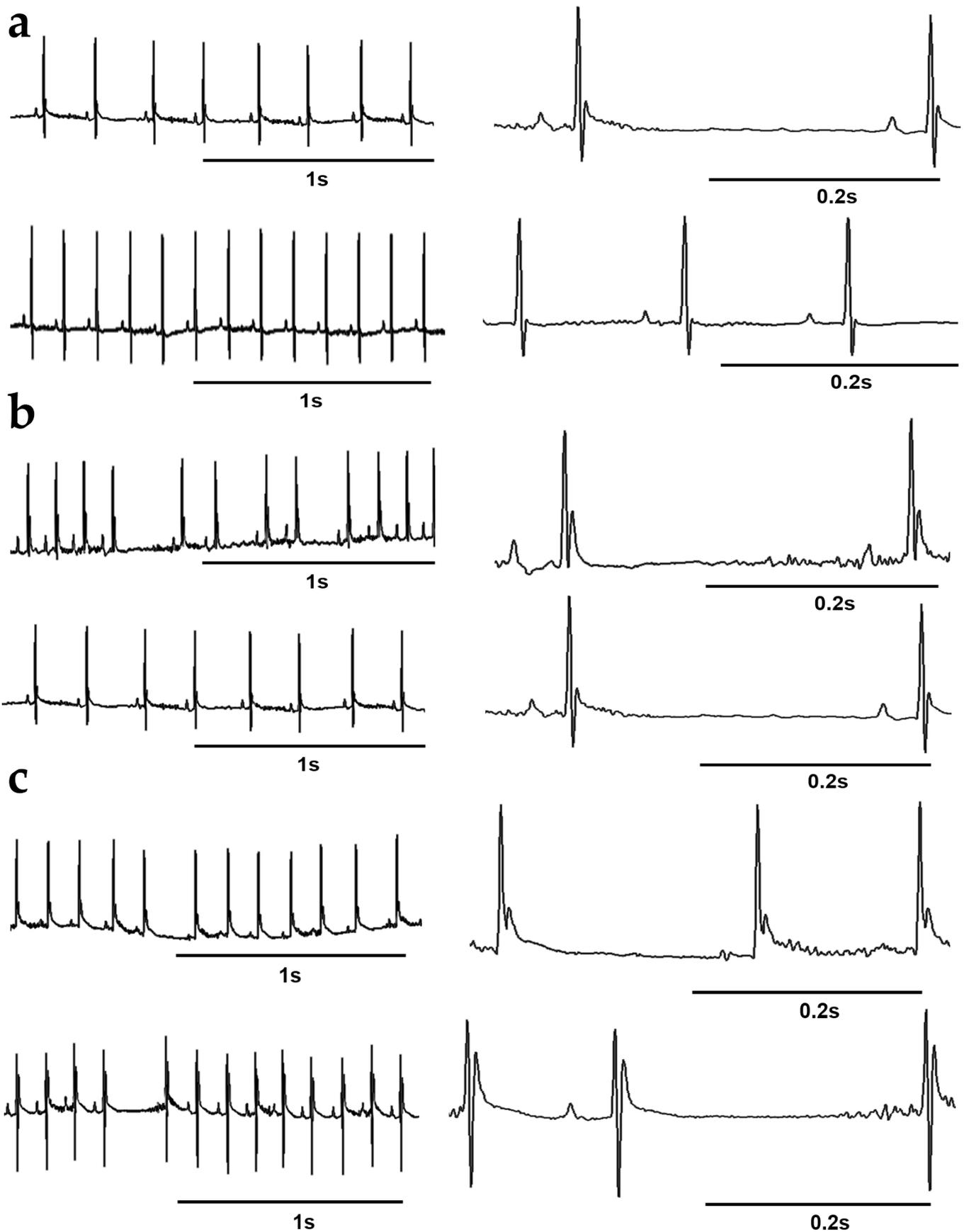


Figure S7. Representative ECGs. (a) ECGs of *ShScramble* 4 weeks old (upper) and 8 weeks-old infected animals (lower). (b) Representative arrhythmias of 4 week old animals infected with *ShZnf219* (n=2). (c) Representative arrhythmias of 8 weeks old *ShZnf219* infected animals (n=2).