**Supplementary materials**

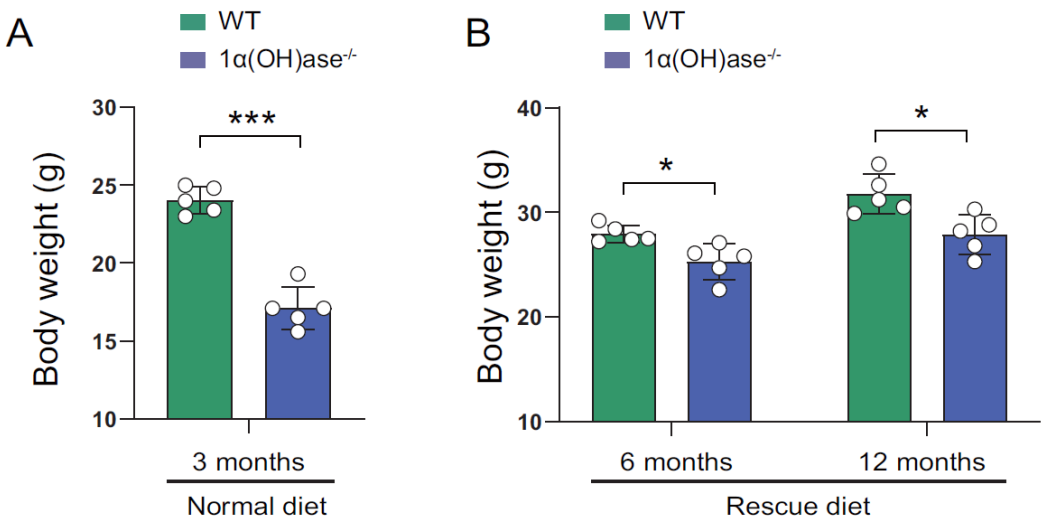


**Figure S1. Body weight of WT and 1α(OH)ase$^{-/-}$ mice**
(A) Body weight of 3-month-old WT and 1α(OH)ase$^{-/-}$ mice fed a normal diet. (B) Body weight of 6- and 12-month-old WT and 1α(OH)ase$^{-/-}$ mice fed a rescue diet. *: p< 0.05, ***: p< 0.01.

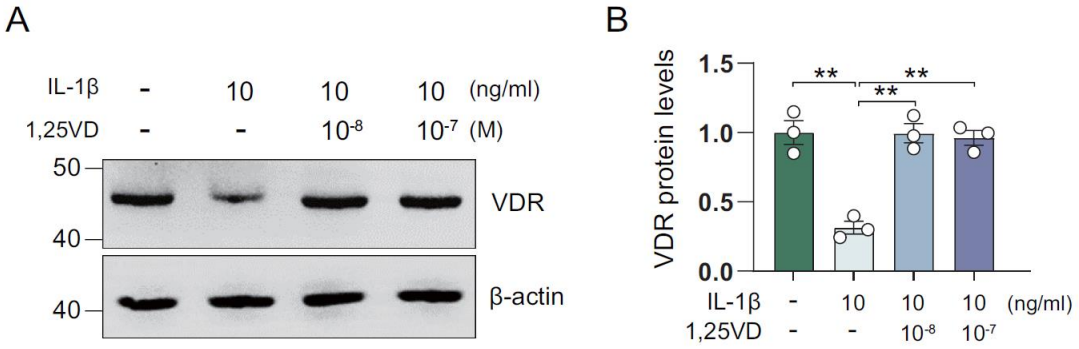


**Figure S2. VDR protein levels were decreased upon IL-1β stimulation, and increased upon 1,25(OH)$_2$D$_3$ treatment in human articular chondrocytes in vitro**
(A) Western blot detection of VDR in human articular chondrocytes treated with IL-1β in the presence or absence of 1,25(OH)2D3. (B) Quantification of (A). n=3 wells per condition. *: p< 0.05, **: p< 0.01.

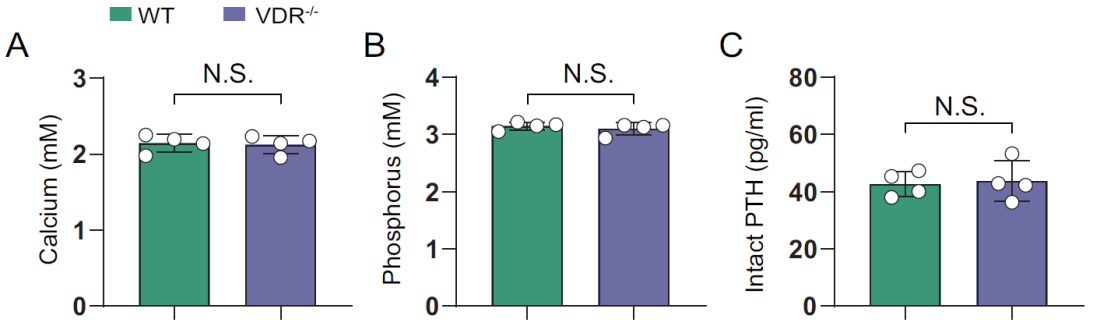


**Figure S3. Serum calcium, phosphorus and intact PTH levels in WT and VDR$^{-/-}$ mice**

(A) Serum calcium, (B) phosphorus and (C) intact PTH levels in 6-month-old WT (n=4) and VDR-/- mice (n=4) on the rescue diet (RD). N.S.= not significant.

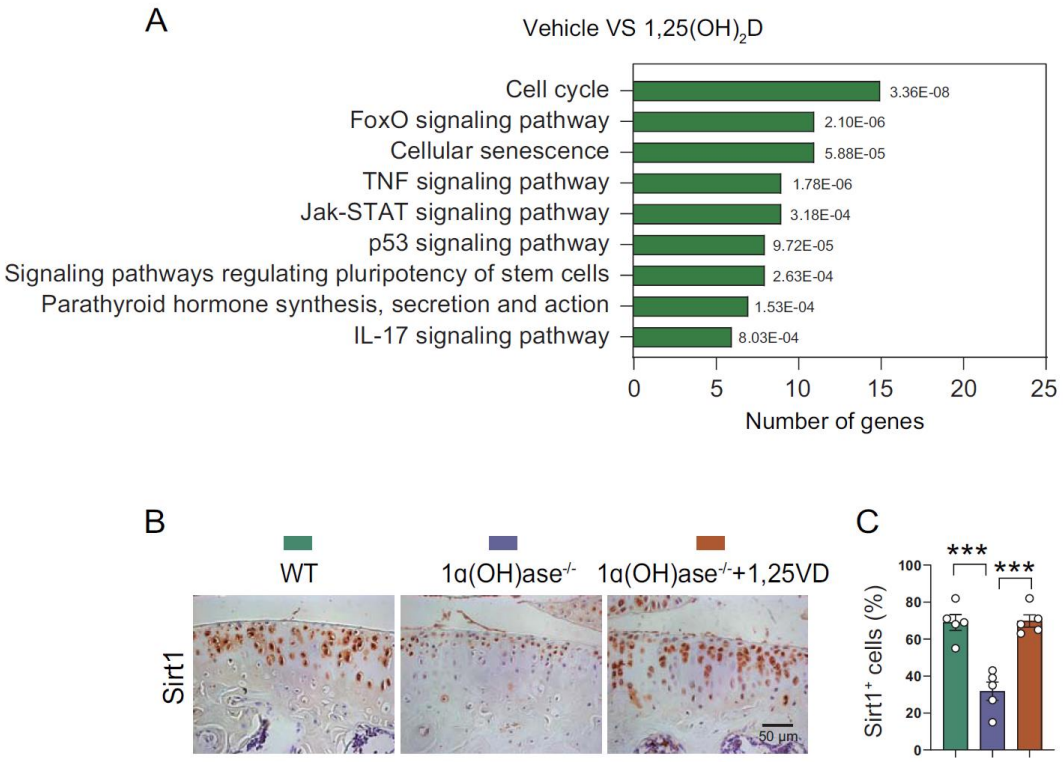


**Figure S4. Differentially expressed pathways involved in 1,25(OH)$_2$D$_3$-treated human articular chondrocytes in the presence of IL-1β**

(A) KEGG enrichment analysis of pathways involved in 1,25(OH)$_2$D$_3$-treated human articular chondrocytes in the presence of IL-1β. P-value was labeled in red. n=3 wells per condition. (B) Representative micrographs of sections from wild-type and 1α(OH)ase$^{-/-}$ mice without or with 1,25(OH)2D3 treatment were immunostained for Sirt1. n=5 mice per group. (C) Quantification of Sirt1+ cells. ***: p<0.001.

**Supplementary Table 1. Primers used for quantitative real-time PCR**

| | | Forward | Reverse |
|---|---|---|---|
| **GAPDH** | Mouse | AGGTCGGTGTGAACGGATTTG | TGTAGACCATGTAGTTGAGGTCA |
| **IL-6** | Mouse | GCTACCAAACTGGATATAATCAGGA | CCAGGTAGCTATGGTACTCCAGAA |
| **IL-1α** | Mouse | CGAAGACTACAGTTCTGCCATT | GACGTTTCAGAGGTTCTCAGAG |
| **IL-1β** | Mouse | GCAACTGTTCCTGAACTCAACT | ATCTTTTGGGGTCCGTCAACT |
| **Mmp3** | Mouse | ACATGGAGACTTTGTCCCTTTTG | ACATGGAGACTTTGTCCCTTTTG |
| **Mmp13** | Mouse | CTTCTTCTTGTTGAGCTGGACTC | CTGTGGAGGTCACTGTAGACT |
| **p16** | Mouse | GAAAGAGTTCGGGGCGTTG | GAGAGCCATCTGGAGCAGCAT |
| **p21** | Mouse | CCTGGTGATGTCCGACCTG | CCATGAGCGCATCGCAATC |
| **Sirt1** | Mouse | GCTGACGACTTCGACGACG | TCGGTCAACAGGAGGTTGTCT |
| **collagen II** | Mouse | GGGAATGTCCTCTGCGATGAC | GAAGGGGATCTCGGGGTTG |
| **collagen X** | Mouse | TTCTGCTGCTAATGTTCTTGACC | GGGATGAAGTATTGTGTCTTGGG |
| **Aggrecan** | Mouse | CCTGCTACTTCATCGACCCC | AGATGCTGTTGACTCGAACCT |