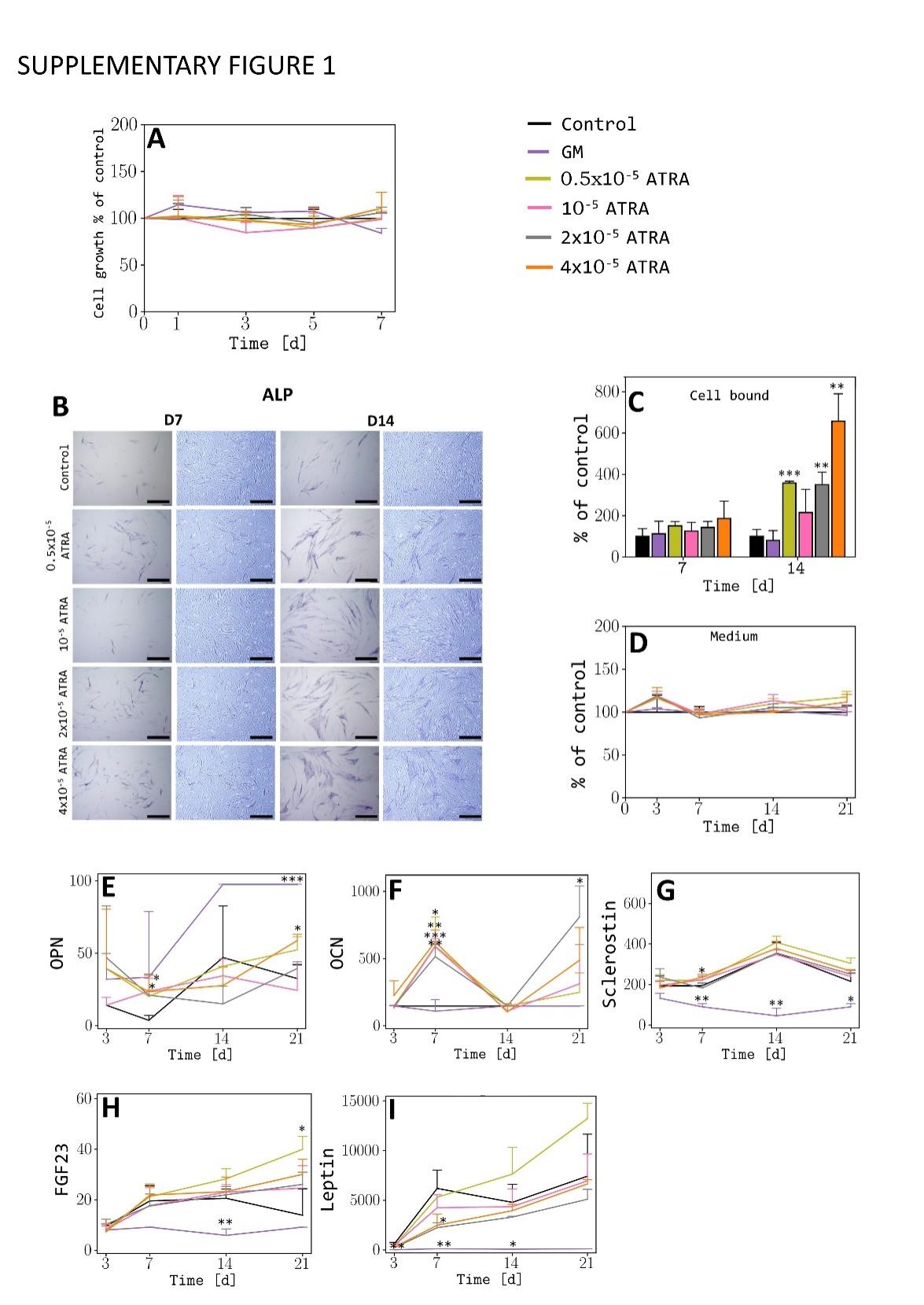
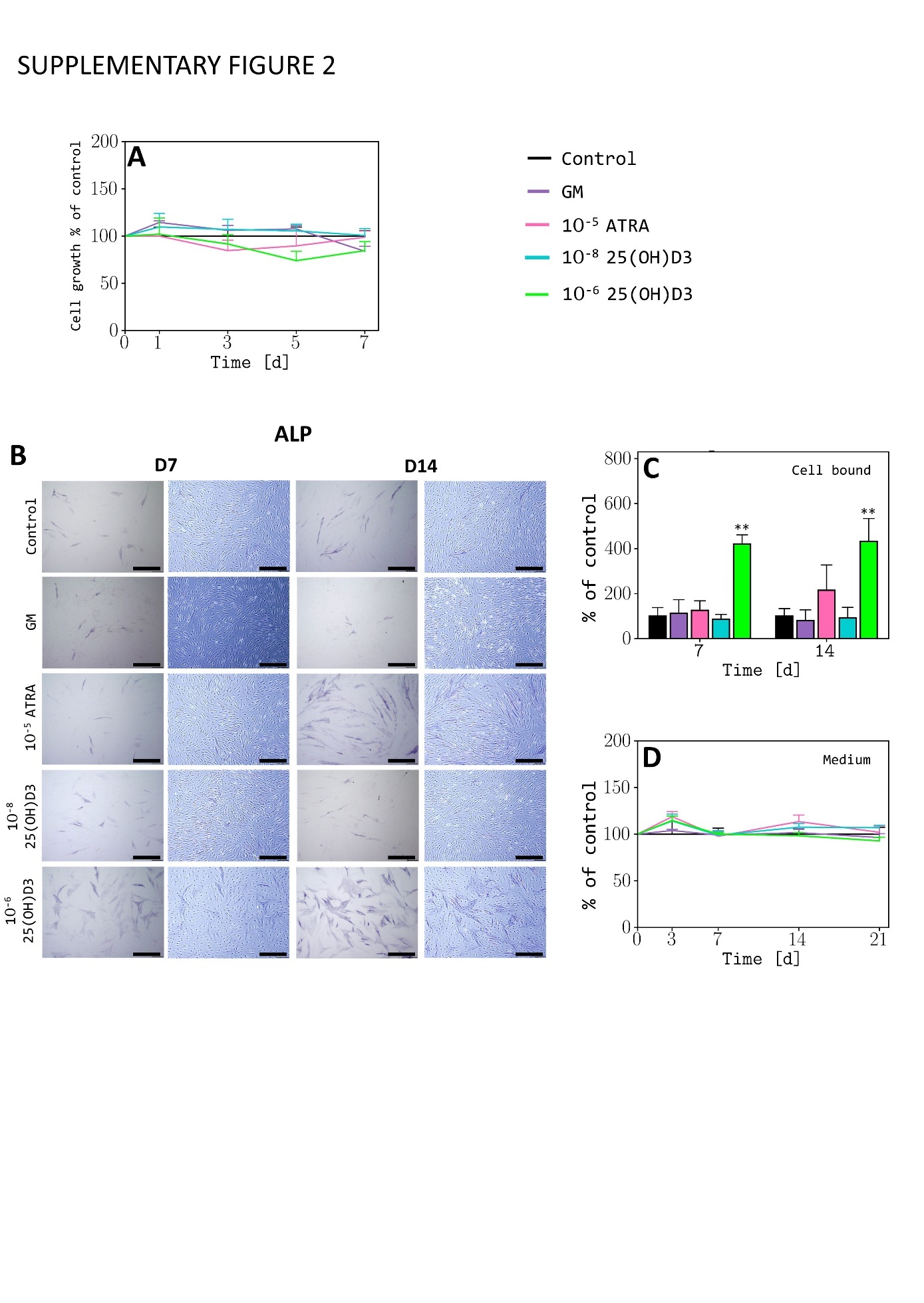
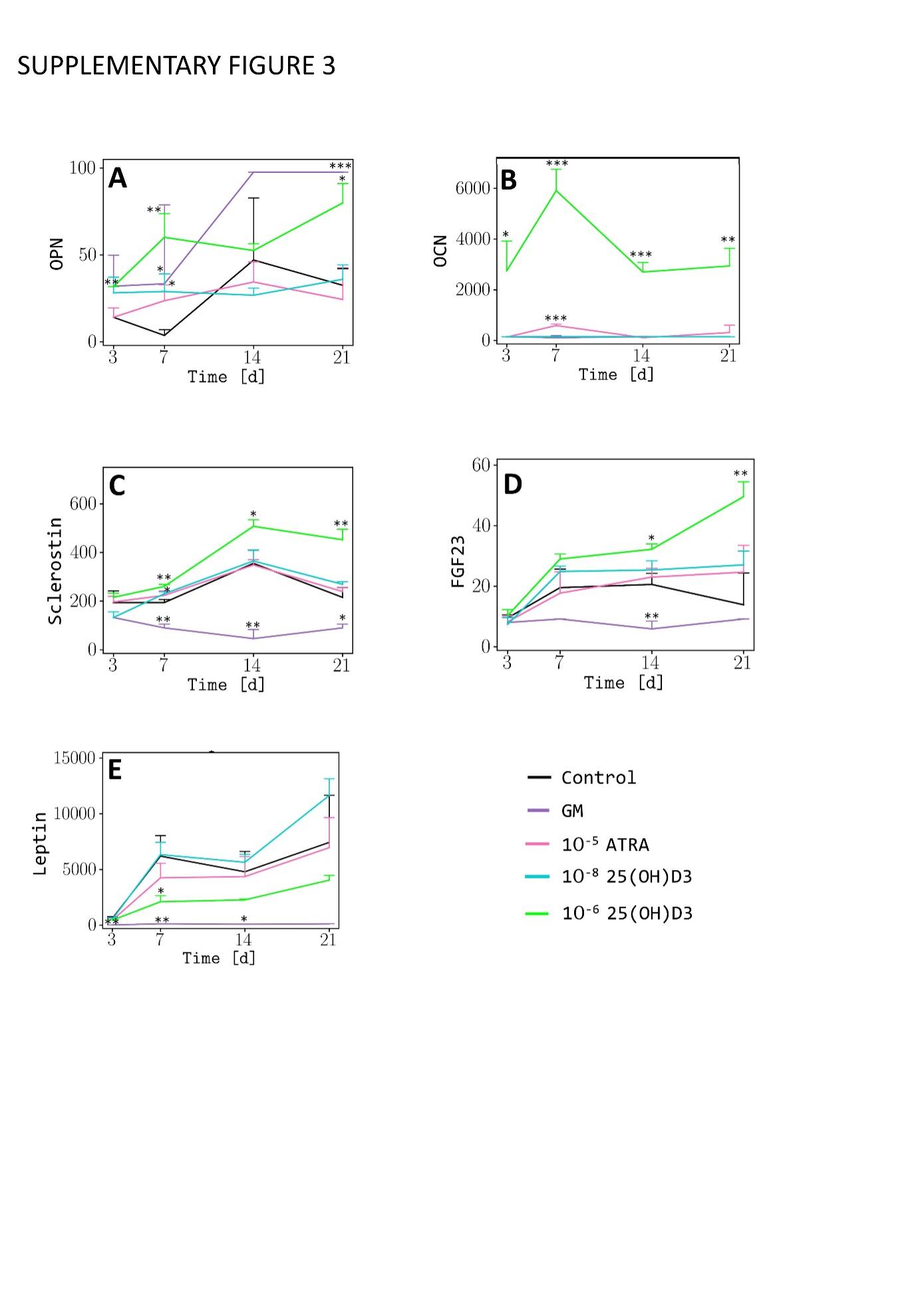
**Supplementary data**



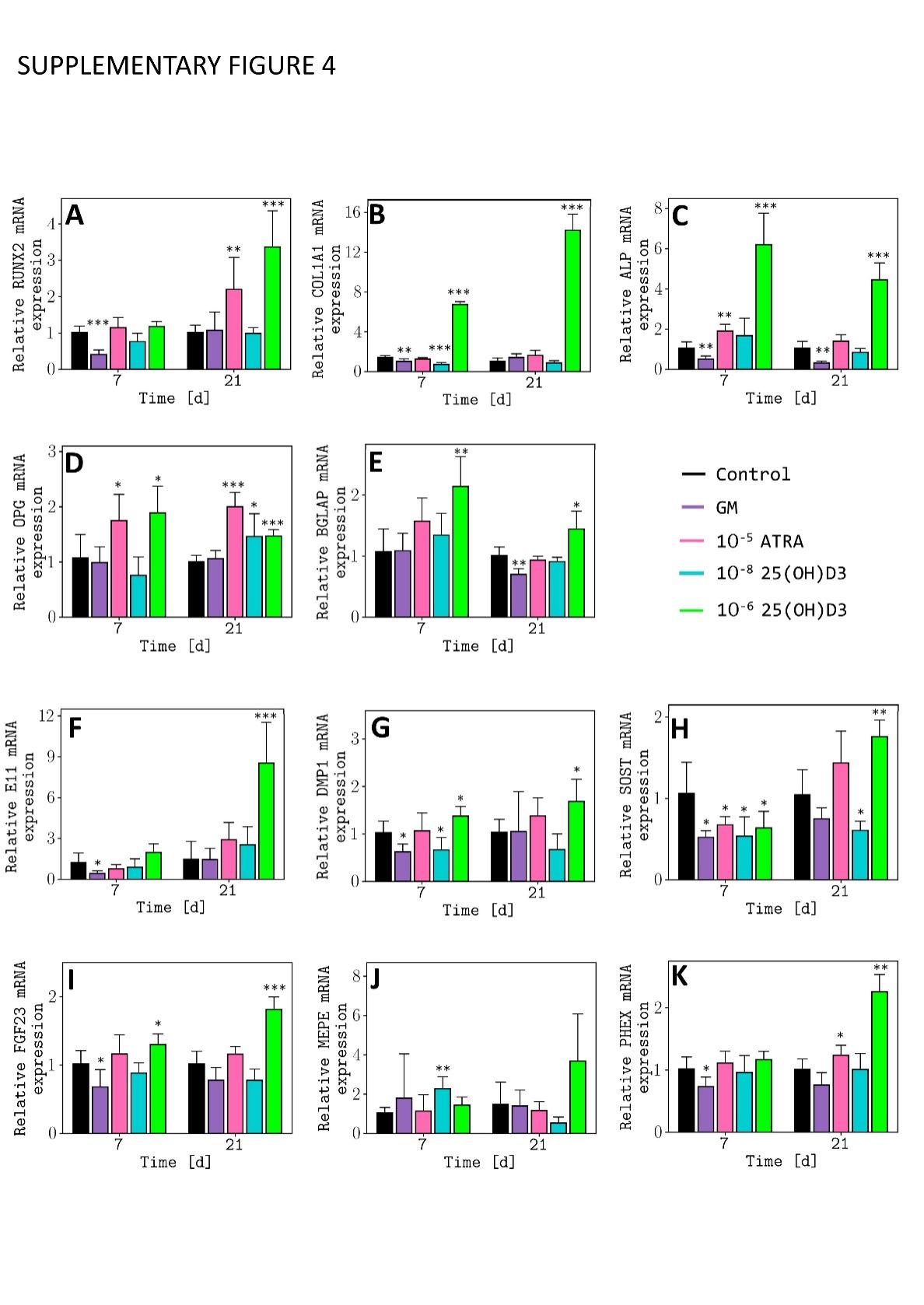
**Figure S1.** Effect of different concentrations of ATRA on hOBs. **(A)** show the growth of hOBs on day 1, 3, 5, and 7. **(B)** illustrate the cell bound ALP activity in hOBs at day 7 and day 14. **(C)** show the quantitative expression of cell bound ALP activity in **(B)**, and **(D)** demonstrate the ALP in medium at day 3, 7, 14 and 21. **(E-I)** show the expression of osteoblast and osteocyte markers (OPN, OCN, sclerostin, FGF23, and leptin) in hOBs cultured up to 21 days with different concentrations of ATRA. The data is calculated in % of control **(A, C and D)**, and in concentration (pg/ml) **(E-I)**. Values are presented as the mean ± SD. Significance \*p ≤ 0.05, \*\*p ≤ 0.01, and \*\*\*p ≤ 0.001.



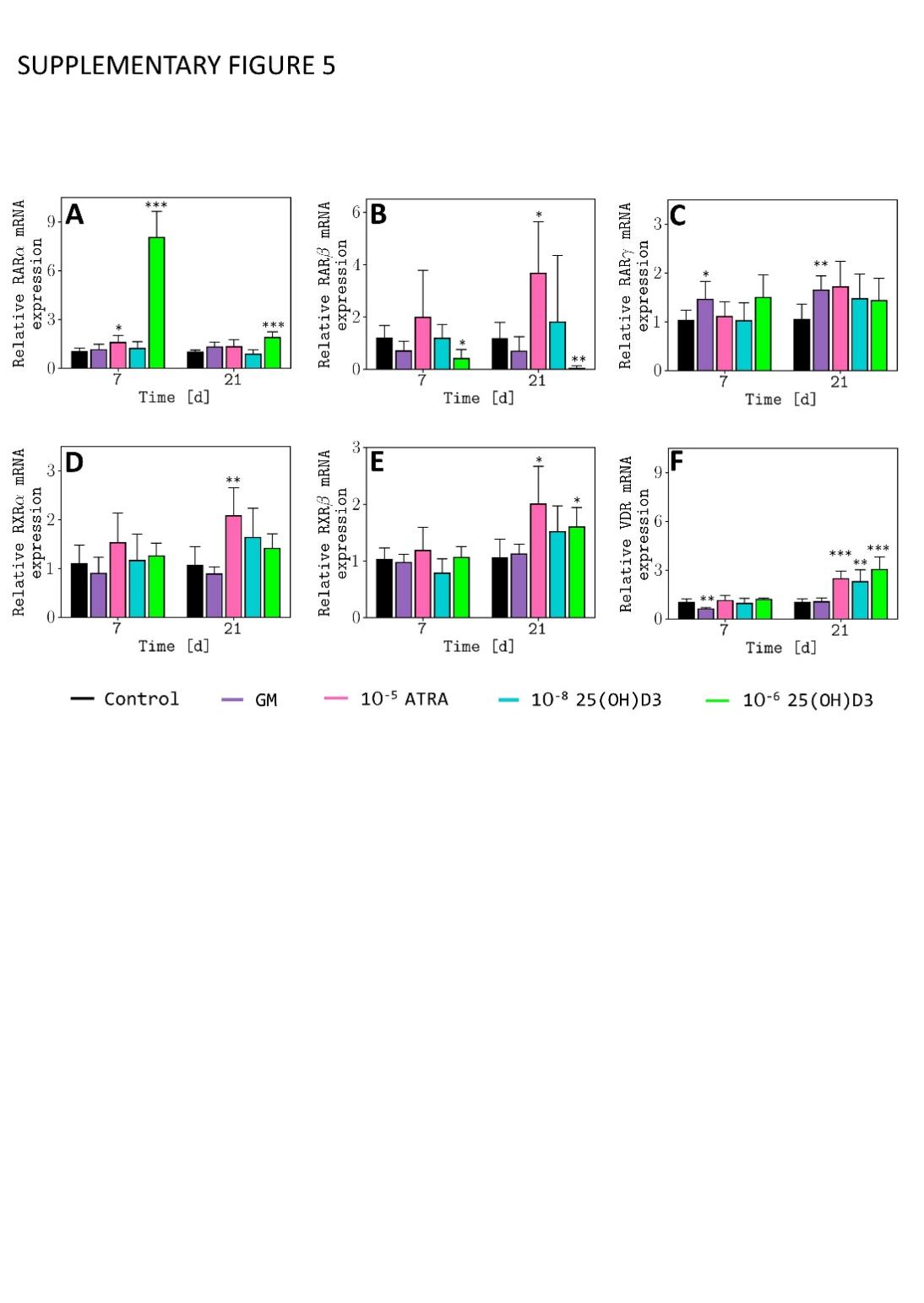
**Figure S2.** Effect of 25(OH)D3 and ATRA on ALP activity. **(A)** show the growth of hOBs on day 1, 3, 5, and 7. **(B)** Illustrate the cell bound ALP activity in hOBs at day 7 and day 14. **(C)** shows the quantitative expression of cell bound ALP activity in **(B)**, and **(D)** demonstrate the ALP in medium at day 3, 7, 14 and 21. **(B, C and D)** also include duplicated images/ data from control and 10-5 ATRA in Figure S1 to demonstrate the effect of control and 10-5 ATRA along with 10-8 and 10-6 25(OH)D3 on hOBs. The data is calculated in % of control. Values are presented as the mean ± SD. \* p ≤ 0.05 and \*\* p ≤ 0.01. Scale bar 500 µm.



**Figure S3.** Level of osteoblast and osteocyte markers in cell culture medium. OPN **(A)**, OCN **(B)**, sclerostin **(C)**, FGF23 **(D)**, and leptin **(E)** show the expression of osteoblast and osteocyte markers in hOBs cultured up to 21 days with 25(OH)D3 and ATRA. Data is presented in concentration (pg/ml). Values are presented as the mean ± SD. Significance \*p ≤ 0.05, \*\*p ≤ 0.01, and \*\*\*p ≤ 0.001.



**Figure S4.** Relative expression of osteoblast markers: *RUNX2* **(A)**, *COL1A1* **(B)**, *ALP* **(C)**, *OPG* **(D)** and *BGLAP* **(E)** and osteocyte markers: *E11* **(F)**, *DMP1* **(G)**, *SOST* **(H)**, FGF23 **(I)**, MEPE **(J)** and PHEX **(K)** in hOBs cultured at 7 and 21 days with 25(OH)D3 and ATRA. mRNA expression was normalized to *GAPDH*, and is presented as relative to control. Values are presented as the mean ± SD. Significance \*p ≤ 0.05, \*\*p ≤ 0.01, and \*\*\*p ≤ 0.001.



**Figure S5.** Relative mRNA expression of RARα **(A)**, RARβ **(B)**, RARγ **(C)**, RXRα **(D)** RXRβ **(E)**, and VDR **(F)** in hOBs cultured at 7 and 21 days with 25(OH)D3 and ATRA. mRNA expression was normalized to GAPDH and is presented as relative to control. Values are presented as the mean ± SD. Significance \* p ≤ 0.05, \*\* p ≤ 0.01, and \*\*\* p ≤ 0.001.