

Supplemental Table: *GTPases expressed in osteoclasts: Summary of their regulators, effectors and functions as identified in other cell types*

GTPase in OC	TBC/RabGAP	RabGEF	Effector protein	Primary trafficking function 26, 29, 33	Other trafficking function
Rab1B ^{14, 26, 72}	TBC1D14 ⁶³ , TBC1D20 ^{37, 38, 55} ; USP6NL ³⁸	TRAPPI subunits (TRAPPC1, TRAPPC2, TRAPP2L, TRAPPC3, TRAPPC4, TRAPPC5, TRAPPC5A/B) ³⁵ ; TRAPPIII subunit TRAPPC8 ⁶³ ; DrrA ²⁴	Golgin84 ⁶³ ; p115 ^{22, 29, 46} ; GM130 ²⁹	ER to Golgi trafficking	Autophagy ^{46, 57}
Rab2B ⁷⁵	TBC1D11 ^{37, 38} ; TBC1D20 ^{37, 38} ; USP6NL ³⁸	NI	Bicaudal-D ^{34,43} ; GM130/p115 ⁴³ ; HOPS complex (subunit Vps39) ⁴³ ; golgin-45 ⁴³	ER to Golgi trafficking	NI
Rab3 ²⁶ A ^{72, 67} /B ^{72, 73} /C ^{31, 73} /D ^{14, 32, 74, 75}	TBC1D10B (A) ^{37, 38} ; USP6NL (A) ³⁸ ; RAB3GAP* ³⁴ (A) ¹¹⁸	MADD ³⁵ ; Rab3GEP ¹¹⁸ ; GRAB ^{35, 118}	Rabphilin3 ^{22, 34} ; Noc2 ²² ; RIM1 ²² ; RIM2 ²² ; SNAP29 (A) ⁵⁶	Exocytosis; Golgi to apical membrane trafficking	Secretory granules ⁷⁴ ; <u>Bone resorption (D)</u> ^{31, 32, 74, 75}
Rab4A ³¹ /B ^{14, 25, 72}	TBC1D11 ^{37, 38} ; RUTBC3 ¹¹⁸ ; EVI5L (A) ³⁸	NI	Rabaptin4 ²² ; Rabaptin5 ^{22, 33} ; Rabip4 ⁴³ ; Rabaptin5β ²² ; GARP complex (Vps51, Vps52, Vps53) ⁴³ ; Rabenosyn5 ³⁴	Early/recycling endocytosis	Autophagy ^{55, 57}
Rab5A ³¹ /B ³¹ /C ^{14, 26, 72}	TBC1D3 ^{37, 38, 118} ; RUTBC3 ¹¹⁸ (A-C) ^{37, 38} ; USP6NL ^{37, 118} (A) ³⁸	RIN1 ^{35, 55, 118} ; RIN2 ^{35, 55, 118} ; <u>RIN3</u> ^{35, 39, 55, 118} ; RINL ³⁵ ; ALS2 ^{35, 55, 118} ; ALS2CL ^{35, 55} ; Rabex5 ^{29, 34, 55, 118} ; Vsp9 ⁵⁵ ; GAPVD1 ^{35, 55}	HOPS complex ³⁴ ; Rabenosyn5 ^{22, 43} ; <u>EAA1</u> ^{29, 72} ; p150 ²² ; Vac1 ^{22, 55} ; PI3K ²² ; Vps34 ^{43, 55} ; Vps45 ²² ; CORVET ^{22, 55} ; Rabaptin5 ^{29, 34, 43} ; huntingtin ⁴³ ; Kif13A ⁴³ ; Ccz1 ⁴³ ; TBC1D15 ⁴³ ; APPL ²⁹	Early endocytosis	Autophagy ^{46, 55, 57, 64} ; Macropinocytosis ³⁸
Rab6 ^{26, 75}	TBC1D11 ^{37, 38, 118}	RIC1-RGP1 ^{29, 35}	Rabkinesin6 ²² ; GAPCenA ²² ; OCRL1 ⁴³ ; TMF1 ⁴³ ; EVI5 ⁴³ ; TRAPPI ⁴³ ; DENND5 ⁴³ (A) ³⁴ ; TBC1D5 ⁴³ ; Bicaudal-D ^{34, 43, 56}	Intra-Golgi trafficking	NI
Rab7 ^{15, 31, 72, 75, 84, 89, 90, 91}	TBC1D2 ^{37, 38, 85} ; TBC1D5 ³⁷ ; TBC1D15 ^{37, 38, 55, 118} ; RUTBC3 ¹¹⁸ ; EVI5L ³⁸	Mon1-Ccz1 ^{23, 24, 29, 35, 55} ; Vsp39 ²³ ; HOPS complex ³⁴	RILP ^{55, 23, 84, 90} ;ORP1L ^{23, 55} ; Rabring7 ^{22, 90} ; <u>Rac1</u> ^{90, 92} ; <u>PLEKHM1</u> ^{84, 91} ; HOPS complex ^{22, 23} (subunit Vps39, Vps41) ²⁹ ; FYCO1 ^{23, 46, 55} PLEKHF1 (Phafin1) ⁵⁵ ; VAMP8 ⁵⁵ ; Rubicon ⁴³	Late endocytosis	Autophagy ^{46, 55, 56} ; <u>Bone resorption</u> ^{23, 31, 32, 90, 91, 92}
Rab8B ³¹	TBC1D1 ³⁸ ; TBC1D17 ⁵⁵	RABIN8 ^{24, 35, 55, 118} ; RPGR ³⁵ ; GRAB ³⁵	Rab8IP ²² ; <u>TBK1</u> ^{46, 55} ; Sec15 ³⁵	Golgi to basolateral membrane trafficking	Xenophagy ^{46, 55, 57} ; Wnt/β-catenin signaling ⁴⁶
Rab9 ^{14, 26, 72} A ³¹	NI	DENND2A ^{31, 55} ; DENND2B ³⁵ ; DENND2C ³⁵ ; DENND2D ³⁵	HSP4 ³⁵ ; <u>p40</u> ²² (A) ²⁹ ; TIP47 ²² (A) ²⁹ ; RUTBC1 ^{29, 34} ; GM130 ⁴³ ; RUBTBC2 ^{29, 34}	Late endocytosis to <i>trans</i> Golgi	Xenophagy ^{46, 55} ; Cholesterol trafficking ³⁰
Rab10 ^{26, 31, 75}	TBC1D1 ³⁸ ; TBC1D4 ^{37, 38} ; RUTBC3 ¹¹⁸ ; EVI5L ^{38, 118} ; RAB3GAP* ¹¹⁸	DENND4A ³⁵ ; DENND4B/C ³⁵	EVI5 ³⁷ ; EVI5L ³⁷	Golgi to basolateral membrane trafficking	NI
Rab11 ^{15, 75} A ³¹ /B ^{14, 26, 72}	TBC1D11 ^{37, 38} ; TBC1D15 ³⁸ (A) ³⁷ ; EVI5 ^{37, 38, 55}	TRAPPC2 ⁵⁵ ; HTT complex ⁵⁵ ; REI1 ³⁵	TBC1D14 ^{46, 55, 63} ; Myosin Vb (A) ³⁴ ; Rabin8 ³⁵ ; Rabiphilin11 ²² ; Rab11BP ²² ; FIP2 ²² ; FIP3 ²² ; FIP4 ²² ; Sec15 ^{22, 35} ; RIP11 ²² ; PI4KIIIβ (A) ³⁴	Recycling endocytosis	Autophagy ^{46, 55, 57, 64}
Rab12 ³¹	NI	DENND3 ^{35, 42}	RILPL1 ^{35, 42}	Vesicles transport from peripheral to perinuclear region	Autophagy ⁶⁴
Rab13 ^{31, 32}	<u>TBC1D25</u> ^{38, 40}	DENND1C ³⁵ ; DENND2B ³⁵	MICAL-L2 ³⁵ ; Delta-PDE ²²	NI	Tight junctions assembly ³¹ ; Traffic of glucose transporters ³¹ ; Neuron regeneration ³¹
Rab14 ^{31, 75}	TBC1D1 ³⁸ ; TBC1D4 ^{37, 38}	DENND6A/B ³⁵ ; FAM116A ²⁹	NI	Transport between endocytosis and Golgi	NI
Rab18 ^{31, 75}	NI	RAB3GAP1-RAB3GAP2 ^{35, 43, 65}	Syntaxin-18 ⁴³ ; TBC1D5 ⁴³ ; LRRK2 ⁴³ ; Spartin ⁴³ ; NRZ complex ⁴³	ER to Golgi trafficking	Autophagy ⁶⁴ ; Virus infection ⁶⁵ ; Lipid droplets metabolism ^{43, 65}
Rab20 ³¹	NI	NI	NI	Recycling/apical endocytosis	Vacuolar H ⁺ ATPase trafficking ³⁰
Rab21 ³¹	TBC1D17 ^{37, 38}	MTMR13 ⁷⁰ ; Rabex5 ³⁵ ; RINL ³⁵ ; Varp ^{29, 70}	VAMP8 ⁷⁰	Early endocytosis	Autophagy ⁷⁰
Rab22A ³¹	TBC1D10B ^{37, 38} ; TBC1D18 ^{37, 38, 118} ; RAB3GAP* ¹¹⁸	Rabex5 ³⁵ ; RINL ³⁵	TBC1D2B ³⁷ ; Rabenosyn5 ³⁴ ; <u>EAA1</u> ³⁴	<i>Trans</i> Golgi network to endocytosis	Phagosome maturation (A) ³⁰
Rab23 ³¹	EVI5L ^{37, 38}	NI	NI	Transport between plasma membrane and endocytosis	Xenophagy ⁴⁶ ; Hedgehog signaling ^{30, 46}
Rab24 ³¹	NI	NI	NI	NI	Autophagy ^{46, 56, 57} ; Cell division ⁴⁶
Rab27A ^{31, 32, 46} /B ³²	TBC1D10A (A) ^{37, 38} ; TBC1D10B (A) ^{37, 38}	MADD ^{35, 46}	Melanophilin ¹⁰¹ (A) ³⁴ ; Mun13-4 (A) ³⁴ ; Rabphilin3 ²² ; Noc2 ²² ; Granuphilin ²² ; Slp2a ³⁴	NI	Secretory granules ³² ; Melanosome transport ³² ; <u>Bone resorption (A)</u> ³²
Rab30 ³¹	NI	NI	p115 ^{43, 57} ; Bicaudal-D ^{43, 57} ; GM130 ⁴³ ; Ik2 ⁴³ ; USP6NL ³⁷	NI	Xenophagy ⁵⁷
Rab31 ³¹	TBC1D10B ³⁸	GAPVD1 ³⁵ ; RIN1 ³⁵ ; RIN2 ³⁵ ; <u>RIN3</u> ^{35, 39} ; RINL ³⁵ ; ASL2 ³⁵ ; ALS2CL ³⁵	NI	<i>Trans</i> Golgi network to endocytosis	NI
Rab32 ³¹	RUTBC1 ^{29, 34, 55}	HPS1-HPS4 ^{29, 34, 35}	Varp ³⁵	NI	Autophagy ^{46, 55, 64} ; Mitochondrial dynamics ^{31, 46} ; Melanosome transport ^{31, 46}
Rab33A ³¹ /B ³¹	<u>TBC1D25</u> ^{38, 40, 69} ; RUTBC1 ³⁴	NI	Rab33B-BP ²² ; Rabaptin5 ³⁴ ; Atg16L ⁶⁸	Intra-Golgi trafficking	Autophagy (B) ^{46, 55, 57, 68, 69}
Rab34 ³¹	TBC1D18 ^{38, 118} ; <u>TBC1D25</u> ^{38, 40, 118}	NI	<u>RILP</u> ^{22, 90}	NI	Macropinocytosis ³⁰ ; Lysosomes distribution ³⁰
Rab35 ^{14, 26, 72}	TBC1D10A ^{37, 38, 58} ; TBC1D10B ^{37, 38} ; TBC1D20C ^{37, 38} ; TBC1D17 ³⁷ ; EVI5 ^{37, 38}	DENND1A ³⁵ ; DENND1B ^{24, 35} ; DENND1C ³⁵ ; FLNC ³⁵	NI	Recycling endocytosis	Sorting melanosomes ³² ; Phagosome maturation ³² ; T cell recycling ³⁸ ; Mitophagy ⁵⁸
Rab38 ^{31, 77}	NI	HPS1-HPS4 ^{29, 34, 35}	Varp ³⁵	NI	Melanosome transport ^{22, 32, 35} ; Secretory granules ²²
Rab44 ⁷⁸	NI	NI	NI	NI	NI

Underlined: Expressed or function in OCs; Superscript: Reference; (X): Specific to the isoform; *Atypical RabGAP without TBC domain; NI: Not identified