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Supplemental Information

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Signaling to Regulate Arabidopsis Pollen

Tube Integrity

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(A) Phylogenetic analysis was conducted using Neighbor-joining method by MEGA6.Values on the tree are bootstrap values.

(**B-I**) Promoter activities of *LLG2* (**B-E**) and *LLG3* (**F-I**) in mature plants, inflorescences, mature pollen grains and young seedlings. Images are representative for more than 10 plants analyzed each except for (**B**) and (**F**), where only three plants were observed in each group.

(J-M) Localization of YFP-LLG3 protein in Arabidopsis pollen grain (J) and tube (K) using their endogenous promoters, and mCitrine-LLG2 and mCitrine-LLG3 in tobacco pollen tubes (L-M) using the *LAT52* promoter.

Scale bars: 1cm (B and F), 5 mm (C-D and G-H), 50 µm (E-J), 20 µm (K-M).

		LLG2-sgR1		
А	WT	GGAAGAATCAGAGAAACAATGGAGATTTCT-CCTTACTGTCTGCTTTCTCTTCTTCCTCCTCTCTCGGTTTCTCCCCTTTCATGTAATTCT		
	lla2-1	GGAAGAATCAGAGAAACAATGGAGATTTCT-CCTTACT		
	11a2-2			
	11022			
	ligz-3	GGAAGAATCAGAGAAACAATGGAGATTTTTTCCTTACAGGCGGAGCAACACACATTGCCGGATAATTTGGTCCTTTGCATCTGCTTGTTATG-ATTGT		
	WT	CTCCTCAATTTCTTGATGATTTGTTTTCTTTTCTTACTATGTTCATGTTCATGTTAAAAAAGAGA-GACCATTGTTAAAAAGTTAATGAATTTGAATGTG		
	llg2-1			
	11g2-2	CTCCTCAATTTCTTGATGATTGTTTTCTTTTCTTACTATGTTCATGTTCATGTTAAAAAGGA-GACCATTGTTAAAAAGTTAATGAATTTGAATGTG		
	11a2-3	GTAGTTCTTGTTAGCAAAATCTTCCTTGCAGGCTGTTCCAATACCAACAAGAAAAACAGATCCATACTTAAAGATTAATGTGTCTACATATA		
	ngr o			
	VA/T	02 C2 - MC2 MC2 3 CM 2 C C C C C C C C C C C C C C C C C		
	100 1	CAGA-TGATGATGTGATGGTCACGCAGCACCAGCAGCGCGCTCTTCTTCAGACCAGGACAAGTAAGATCATCCTTCCT		
	ligz-1			
	llg2-2	CAGA-TGATGAATTTGATGGTCACGCAGCAACAAGCAGAGCTCTTCTTCAGACAAGGACAAGTAAAGATCATCCTTCCT		
	llg2-3	} TATTCTAAACGATATTAGAATCATCAATTAGGAAGGATGATCTTTACTTGTCCTGGAGAAGAAGAGCTCTGCTTGCT		
	WT	TTAGAATATATATGTAGACACATTAATCTTTAAGTATGGATCTTCTTTGTTTG		
	11a2-1			
	11a2-2	та са 2 та та та та се са са са та 2 тотта 2 ста тоса тотто стато та та стаста з 1 са 2 со се со са 2 с		
	1192-2			
	ligz-3	TCATC-TGCACATTCAAATTCATTAACTTTTTTAACAATGGTCT-CTCTTTTTTATAATGAAACATAGTAAGAAAAGAA		
		LLG2-sgR2		
	WT	TACACAAATCATAACAAGCAGATGCAAAGGACCAAATTATCCGGCAAATGTGTGTTGCTCCGCCT-TCAAGGACTTTGCTTGCCCCTTTTGCAGAAGT		
	llg2-1	TCAAGGACTTTGCTTGCCCCTTTTGCAGAAGT		
	11a2-2	TACACAATCATAACAAGCAGATGCAAAAGGACCAAATTATCCGGCAAATGTGTGTTGCTCCGCCTATCAAGGACTTTGCCAGGACCTTTGCCAGAGAAGT		
	11023			
	ligz-3			
		LLG3-sgR1		
в	WT	TCTATGTGCAGTTGATGAATTTGAGTCACACCCATC-CACAAGCCGAGCTCTTGTTCAGGCAAAGGCAAGTAAGTAA		
	11/03-1			
	11/2 2 2			
	ligs-2	TCTATGTGCAGTTGATGATGTCACACCCCATCACACAGCCGAGCTCTTCTTCAGGCAAGGCAAGTAAGT		
	llg3-3	TCTATGTGCAGTTGATGAATTTGAGTCACACCCATGCCGAGCTCTTCTTCAGGCAAAGGCAAGTAAGTAATATAAACTCCCAAAATTTACACCA		
		TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC		
	WT	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACAATTTTAACAGC		
	WT	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACAATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACGAGCTTCATTGATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC		
	WT g3-1	TTGATTGTANTCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATGATTATTTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATGATTATTTAGCCTTAATAAGCAAAATATTCCATGATCATTACGATGATTATGACAATTTAACAGC		
	WT g3-1 g3-2	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACAATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACAATTTAACAGC		
	WT g3-1 g3-2 g3-3	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACAATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACAATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACAATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACAATTTTAACAGC		
	WT g3-1 g3-2 g3-3	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC		
	WT Ilg3-1 Ilg3-2 Ilg3-3 WT	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACAATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAAACGAGTAAATGCCAAAATATTCCCGGCCAAAGTATGTCTCGGCCTTCAATGAGAAT		
	WT g3-1 g3-2 g3-3 WT g3-1	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGGCCTTCAATGAGA ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC		
	WT <i>llg3-1</i> <i>llg3-2</i> <i>llg3-3</i> WT <i>llg3-1</i> <i>llg3-2</i>	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACAATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCGAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTGTCGGCCTTCAAGGAC		
	WT <i>llg3-1</i> <i>llg3-2</i> <i>llg3-3</i> WT <i>llg3-1</i> <i>llg3-2</i> <i>llg3-3</i>	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCCAAAGTAGTTGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCGAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTGTCGGCCTTCAAGGAC		
	WT lg3-1 lg3-2 lg3-3 WT lg3-1 lg3-2 lg3-3	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATGACAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTGGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTGGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTGGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTGGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTGGGCCTTCAAGGAC ATGCAAAGAAGATTTGCGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTGGGCCTTCAAGGAC		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCGAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCGAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCGAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCGAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCGAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTCGGCCTTCAAGGAC LLG3-sgR2 TTTGCTTGCCGCCATT_CGCGG		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-3 WT IIg3-1	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAACAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC ATGCAAAGAAGATTTTGCGGCGAAAGAATTACAACAATCATAACGAGATAATGCAAAGAACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGATAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTGCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTGCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTGCGGCCTTCAAGGAC LLG3-sgg2 TTGGCTGGCCCATTGCTGGCTTTCTTCTTCCCATTTTCCCCCTCTGGGTTTCTCCCCTTCAAGGAATTTCCCCGAATTTTTGCTGCCCCAATTTCTTGATGATTTTCTTGATGATTTTTCTTGAAGATTT		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-3 WT IIg3-1 IIg3-2	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC LLG3-sgR2 TTTGCTTGCCCCAT		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-2 IIg3-3	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACAACAATCATAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTCCGGCGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTCCGCGCAAAGAATTACACAATCCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC LLG3-sgR2 TTTGCTTGCCCCATTGCTGCTTTCTTCTTCTTCCTCCTCTCTGGTTTCCTCCTCTCATGTAATTCCTCCCCCAATTCTTGATGATCTTCTTGATGAGATT TTTGCTTGCCCCATT		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCGAAAGAATTACAACAATCATAACGAGATAATGCAAAGGACCAAATTACCCTGGCCAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTGCGGCCTTCAAGGAC LLG3-SgR2 TTTGCTTGCCCCATT - CGCGG TTTGCTTGCCCCATTGCCTGCTTTCTTCTTCTCCCATTTTCCCCCTTCATGGTATCTCCCCCTCCAATTTCCTCCCAATTTCTTGATGATTT TTTGCTTGCCCCATT		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-3 WT IIg3-3 WT	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC LLG3-SgR2 TTTGCTTGCCCCATT-CGCGG TTTGCTTGCCCCAT		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-3 WT IIg3-3 WT IIg3-1	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTAATGACATTTTAACAGC TTGATTGTAATCATGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGCCAATTCCTCCTCTCTCTCCCCTCTCGGTTTCTCCCGCCAATGTTGTTGTGCGCCAATGTTGTTCGGCCTTCAAGGAC LLG3-sgR2 TTTGCTTGCCCATTCGCGG		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-1 IIg3-1	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAGCGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTGTCGTCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTCGTCCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTCGTCCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCCTTCAAGGAC LLG3-SgR2 TTTGCTTGCCCCCAT - CGCGG TTTGCCTGCCCCAT - CGCGG CTTTTCTTTCTTCTTCCTCTTCTTCTTCCTCCTCTCTCTC		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-3 WT IIg3-1 IIg3-2 WT IIg3-2	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTTGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATGATGATGATGATGCTTAAGCAAAATATCCCATGATCATTACGTTAATGACATTTAACACG ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCCGCGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCGAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC LLG3-sgR2 TTTGCTTGCCCCATT-CCCGGG- TTTGCTTGCCCCATT-CCGCGG- CGCTGCCCATT-CCCGGG- TTTGCTTGCCCCATT-CCGCGG- GTTTTCCTTTGCTCGCCGG- GTTTTCCTTCCTCCTCATGTTCATGTCATCATAAAGAGAGACCAATGTAGTTGTGTGGCGCAGATGATGATGTCTCGCCTCCAATGTGTCGCCCATCGCGG- GTTTTCCTTTCCTACTATGTTCATGATGATAAAAGAGAGAACCAATGTTATAAGAATTTGAATGTGGCAGATGAATGA		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-2 IIg3-3	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTAATGACATTTTAACAGC TTGATTGTAATCATGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC LLG3-sgR2 TTTGCTTGCCCCATT		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-2 IIg3-3 WT	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAACTTCATTGATGATTATTAGCTTAATAGCAAAATATTCCATGATCATTACGTTAATGGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCCTTCAAGGAC LLG3-sgR2 TTTGCTTGCCCCATT-CGCGG TTTGCCTGCCCAT-CGCGG GTTTTCTTTTCTTCCTGCTGATGTCATGTTCATTGTTCTCCCCTTCCTGGTTTCTCCCCTTCAAGTATTTGATGGACGAGACCAATTGTAATGAATTTGAAGGACGAAGTATTGATGGCCAAGTGATGATGATGTGATGATGATGATGTCATGGTCACGGC		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-2 IIg3-3 WT IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-3 WT IIg3-3 WT IIg3-3 WT IIg3-2 IIg3-3 WT IIg3-4 IIg3-2 IIg3-4 IIg3-2 IIg3-4 IIg3-2 IIg3-4 II	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTTGGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATCCATGATCATTACGTTAATGACATTTAACAGC ATGCAAAGAAGATTTGCCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCCGCGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCCGCGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCCGCGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTCGGCCTTCAAGGAC LLG3-sgR2 TTTGCTTGCCCCATT-CCCGGG- TTTGCTTGCCCCATT-CCGCGG- CGCTGCCCATT-CGCGG- CTTGCCTGCCCCATT-CGCGG- CGTTTCCTTTCCTTCCTCCTCTTCTCCCCCTTCTGGTTTCTCCCCTTTCATGTAATTCTCTCCTCAAATTACACAATTACACAATTACACAAGAAGAACTATCTCTCCCCTTTCATGTATGAATTCTCTCCTCAAATTACACAAAGAAGAACCAATTCCTCCCCTTTCATGTATGT		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-3 WT IIg3-3 WT IIg3-3 WT IIg3-3 WT IIg3-3	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAACCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTGTTGGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCCAAAGAATTACACAATCATAACGAGTAAATGCCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTGTTGGGCCTTCAAGGAC LLG3-sgR2 TTTGCTTGCCCCAT- CGCGG GTTTTCTTTGCTGCCCAT- CGCGG GTTTTCTTTGCTGCCCAT- CGCGG GTTTTCTTTTCTTACTATGTTCATGTTCATGTCATTGTTAAAAAGAGAAGACCATTGTTAAAAAGATAATGAAATTTGATGGCCAAGGAAGAATTTGATGGTCACGGC GCAGCAACAAGCAGGACCATTGTTATAAAAAGAGAACAATCATCCTTCCT		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-2 IIg3-3 WT IIg3-2 IIg3-3 WT IIg3-2 IIg3-3 WT IIg3-2 IIg3-3 WT IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-2 IIg3-3 WT IIg3-3 WT IIg3-2 IIg3-3 WT IIg3-3 IIg3-3 WT IIg3-3 IIg3-3 WT IIg3-3 IIg3-3 WT IIg3-3 IIg3-3 WT IIg3-3 IIg3-3 WT IIg3-3 IIg3-3 WT IIg3-3 IIg3-3 WT IIg3-3 IIg3-3 WT IIg3-3 WT IIg3-3 IIg3-3 WT IIg3-3 WT IIg3-3 IIg3-3 WT IIg3-3 WT IIg3-3 WT	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTTGGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGAGAATTTAAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGAGATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAGCAAAATATCCATGATCATTACGTTAATGAGATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATGATGATGATGATGACCAAAGTAACCCGGCCAAAGTAATGCTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTGTCGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCGAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTGTTGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCGAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTGTTGTCGGCCCTTCAAGGAC LLG3-sgR2 TTTGCTTGCCCCCAT CGCGG TTTGCCTGCCCCAT CGCGG GTTTTCTTTCTTACTATGTCATGTTCATGTCATTCTCTCCCATTTTCTCCCCTTCCATGTTATGTAGTGGCAAGATTTGTCTGCGGCGAAGTAATGCAAAGAGACCAATTTGATGGCCAATCATGTGTCGGCCAATGTGTCATGTCATGATGTCATGTCATGATGATGTCATGATGTCATGGCCAACTATTGTTGGCCCAATCATGGCCGAAGGACGAATTAGCAAAGGAGACCAATGTTAAAAGGTTAATGGAATTTGATGGCGAAGAATTGCAAGGACGAATTTGGCCGAT CGCGG GTTTTCTTTTTCTTACTATGTTCATGTTCATGTTCATTGTTCAGGACCAATGTTAAAGAATATGGAATGGAAGGACGAAGTTAATGGAATTTGGAAGGACGAAGTTAATGGAATGGCAAGATGAAGGAGACCAATGTTAAAGAATTGGAAGGAA		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-2	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATGATGATAATTAGCATAATGACAAAATATCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTAGAAACAAGCTTCATGATGATGATGATGATGATGCAAAGGACCAAATTACCCGGCCAAAGTAAGT		
	WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-1 IIg3-2 IIg3-3 WT IIg3-2 IIg3-3 WT IIg3-2 IIg3-2 IIg3-3 WT	TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC TTGATTGTAATCATGTGTTTTAGAAACAAGCTTCATTGATGATTATTAGCTTAATAAGCAAAATATTCCATGATCATTACGTTAATGACATTTAACAGC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTATGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTGTTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTGGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTGGTCGGCCTTCAAGGAC ATGCAAAGAAGATTTTGCGGCAAAGAATTACACAATCATAACGAGTAAATGCAAAGGACCAAATTACCCGGCCAAAGTAGTTGTTGGTCGGCCTTCAAGGAC LLG3-SgR2 TTTGCTTGCCCCCAT- CGCGG GTTTTCTTTTCTTACTATGTTCATGTTCATTGTTCTTCTCTCTTTTTCTTCTTGATGATGTTGTCGCCAATTTGTTGAAGATTATGTAGATGTAATGTAGATTTGATGGACGAAGAATTTGATGGTCAGGG GTTTTCTTTTTCTTACTATGTTCATGTTCATGTTCATTATAAAAAGAGAAGAACCATTGTTAAAAAGGTTAATGAATTTGATGGCAAAGAATTATGTGAGAGCAAAGGAAGAATTTGATGATGATCATTGTTGAGAGACCAATTTGATGGATTATTGAAGGAAG		
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Figure S2. Sequences alignment of WT and *llg2/llg3* mutants. Related to Figure 1.

PCR products containing the CRISPR/Cas9 targets in *LLG2* (**A**) and *LLG3* (**B**) were amplified and sequenced to detect mutations. Sequences framed in black are sgRNAs within gene loci. The sequence alignment for each group was performed by MEGA6.





(**B-D**) Complementary assay of *llg2 llg3* double mutant with exogenous LLG2. Silique length (**B**) and seed set in the silique (**C**) of wild-type plants and *LLG2p::SP-GFP-LLG2* transgenic lines in the background of the *llg2 llg3* double mutant. Data are mean +/- SD of 5 siliques in each group. (**D**) Siliques of wild-type plants and transgenic lines. (**E-F**) Fertility defects of *llg2 llg3* double mutants are male-specific. Silique length (**E**) and seed number per silique (**F**) of crossed plants shown in Figure 2A. Data are mean +/- SD of 9 siliques in each group. *** P< 0.001 (Student's test).

Scale bars: 5.0 cm (A), 5.0 mm (D).



Figure S4. *LLG2/3* mutants show reduced seed yield, but normal pollen grains. Related to Figure 2.

(A) Schematic diagram of the *LLG2/3* RNAi construct. LAT52p was used as a pollenspecific promoter; 3'T indicates the transcription termination site; DNA sequence spanning amino acid residues 24-144 was used.

(B) Semi-quantitative RT-qPCR of *LLG2/3* RNAi mutants.

(C) Average seed yield per silique form independent T1 *LLG2/3* RNAi (Ri) lines. More than sixty T1 lines were generated. Seed yields are from lines that produced noticeably shorter siliques compared to wild type plants after self-pollination. **, significantly different (p<0.01) from Ri lines.

(**D**-E) Pollen tube growth phenotype of *LLG2/3* RNAi line Ri-38. T3 plants was used. (**D**) Pollen tube growth was reduced in self-pollinated Ri-38 pistil and also in a Ri-38 pollen to wild type pistil cross-pollination. (E) In reciprocal crosses, seed yields were reduced when Ri38 was used as pollen donor. **, significantly different (p<0.01) from wild type self-pollination and crosses where Ri38 was the female donor.

(**F-G**) Reproductive phenotype of *LLG2/3* RNAi line Ri-53 and Ri-27. Ri-lines (T3 plants) were used as pollen donor to hand-pollinate WT pistils. (**F**) Silique lengths. (**G**) Pollen tube growth was reduced when Ri-53 was used as pollen donor on wild type pistil relative to using wild type as pollen donor. **, significantly different (p<0.01). Arrows in (**D**) and (**F**) locations of the longest pollen tubes.

(**H**) Alexander staining of *llg2 llg3* pollen grains. More than 500 pollen grains were observed in each group.

(**I**) Scanning electron microscope (SEM) of pollen grains of *llg2 llg3* double mutant. More than 100 pollen grains were observed in each group.

Scale bars, 100 µm (H), 20 µm (I).





(A) Pollen germination rate of WT, *llg2 llg3* and *bups1 bups2* with/without RALF4 treatment. Pollen grains were spread on pollen germination medium containing 2 μM RALF4 peptide. Quantitative analysis was conducted 7 hours after germination.
(B) Localization of ANX1-GFP and BUPS2-GFP using the *LAT52* promoter. Plot by

Image J at the bottom indicates the GFP signal along the red line. Scale bars, 10 μm.(C) Peptide sequence of RALF4 and RALF4 variants in Figure 5A and Figure S5.

(**D-E**) Pull-down assays with LLG3-His and Flag-tagged BUPS1/ANX1 ectodomains with and without the addition of WT or C-terminal (**D**) and N-terminal (**E**) mutated RALF4 variants (each 100 nM) as indicated. The ectoBUPS1/ANX1-Flag proteins purified from transgenic tobacco leaves and His-tagged LLG2/3 generated in *E. coli* were subjected to binding assays with Ni Sepharose. Western blots were probed with α -Flag and α -His antibodies, respectively.

Similar results were obtained in three independent experiments.

(**F-G**) Pollen tube burst effect of RALF4/19 on *ralf4 ralf19* and RALF4 variants on WT pollen tubes. (**F**) Pollen tube burst of *ralf4 ralf19* tubes depending on RALF4/19 peptide concentration. (**G**) Pollen germination of WT tubes in medium containing each 2 μ M of the RALF4 variants. Pollen tube bursting phenotypes (%) and pollen germination among the overall pollen on the medium were analyzed 7 hours after incubation. Data are mean +/- SD. More than 1500 pollen grains/tubes were analyzed in each group. ** P< 0.01; *** P< 0.001 (Student's test).

Purpose	Primer name	Sequence (5'-3')
	LLG2-Pro-F	CACCTTGGTGGAGGATGAAGATGC
	LLG2-Pro-R	CATTGTTTCTCTGATTCTTCCTCT
Promoter cloning	LLG3-Pro-F	CACCAAGGAGTGGTTGATTAAACA
	LLG3-Pro-R	CATGTTTTTGTTTCCTCCTCTATT
	LLG2-RT-F	ATGGAGATTTCTCCTTACTGTCTG
RT-PCR analysis	LLG2-RT-R	TCAAGACGATAAGAACAAAAG
OF LLG2/3 KNA1	LLG3-RT-F	ATGAAGATTACTCATCATTGTTTG
lines	LLG3-RT-R	TTAGAAGAGGTGAAACAAGATGGA
	LLG2-SR-F	ACTGACACGGCGTCGTTTAGGCTAT
	LLG2-SR-R	GGTAGAAAGAACCGCGAGAGATGCAGT
CRISPR/Cas9	LLG2-CX	GGACTGGGTGACATCAGTGCAGTCA
mutant	LLG3-SR-F	TATGATCCGCTATATCCGCAGCA
genotyping	LLG3-SR-R	AGGTCGACTGGTAGAGTTATCGACACC
	LLG3-CX	AAACGGTGATTAGCAAAACGTGTG
	LLG2-mat-F	CACCATGTATGATGAATTTGATGGTCACGC
	LLG2-mat-R.SC	TCAAGAAGTTGCGGATGCGGACT
Protein	LLG3-mat-F	CACCATGCATCACATCTCTCTTGATGA
expression in E.	LLG3-mat-R.SC	TTATGATGTAGGGGTGACGTCGG
COll	LLG1-mat-F	CCCAAGCTTGGGATGAGTTTCATTTCAGATGGGGTC
	LLG1-mat-R.SC	CGGACTAGTCCGTCACGAGGTAGTTGCTGCGTTTA
	LLG2-C-F	CGGGGTACCCCGTGAAAGGGAGAAACCAGAGAG
Complementary	LLG2-C-R	GGCTGCTGCTGCTGCTGCTGCTGCTGTAATTCTCTCCTCAATT
assays	GFP-C-F	GATCTGGACGGGGTACCCCGATGGTGAGCAAGGGCGAGGA
	GFP-C-R	GCAGCAGCCCGCTCGAGCGGCTTGTACAGCTCGTCCATGC
	LLG2-F	CACCATGGAGATTTCTCCTTACTGTCTGCTTTCT
	LLG2-R	TCAAGACGATAAGAACAAAAGACACAGAACG
	LLG3-F	CACCATGGAGATTTCTCCTTACTGTCTGCTTTCT
Protein	LLG3-R	TTAGAAGAGGTGAAACAAGATGGAAACG
localization in	ANX1-F	CACCATGAGCGGGAAAACTCGGAT
tobacco PT	ANX1-R	TCGTCCTTTGGGATTTACAATCTG
	BUPS2-F	CACCATGGAGATAAGAAAGAAACCAAACATACC
	BUPS2-R	TCTTCCGTTAAGGCTAGCAAACTG
	LLG3-V-F	GGCTGCTGCTGCTGCTGCTGCTGCTCATCACATCTCTCTTGATG
		AATTTG
Protein	LLG3-V-R	CGGGGTACCCCGAGAGAAAGCGAATCCAGACAAAAGG
Arabidonsis	YFP-tag-F	GCTTTCTCTCGGGGTACCCCGATGGTGAGCAAGGGCGAGGAG
ALADIOOPSIS	YFP-tag-R	CAGCAGCAGCAGCAGCAGCCCGCTCGAGCGGCTTGTACAGCT CGTCCATGC

Table S1. Primers used in the work. Related to STAR Methods.