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Supplemental Information

Long Non-coding RNA LINC00339 Stimulates Glioma

Vasculogenic Mimicry Formation by Regulating

the miR-539-5p/TWIST1/MMPs Axis

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Fig.1

B

NBTs	LGGTs	HGGTs	n=3, NBTs group; n=10, each glioma tissue gro				
0.88	2.23	4.99					
1.13	3.04	4.11					
0.91	1.88	6.08					
	3.39	7.21					
	2.66	4.72					
	1.25	4.33					
	2.81	5.61					
	2.55	3.92					
	3.72	6.52					
	0.94	4.08					

C

NHA	U87	U251	n=6, each	
0.64	2.21	2.19		
1.33	3.28	3.13		
1.48	1.73	1.65		
0.93	2.88	2.74		
1.89	4.06	3.81		
0.79	1.11	0.99		

D

	NBTs	LGGTs	HGGTs
VM+	0	2	4
VM-	3	8	6

Fig.2A

	U87			U251			
Control	shNC	shLINC00339	Control	shNC	shLINC00339		n=5, each
1.11	1.08	0.24	1.14	1.05	0.35		
1.26	1.18	0.15	1.30	1.21	0.26		
0.88	0.83	0.43	0.93	0.83	0.49		
1.25	1.20	0.35	1.38	1.23	0.42		
0.85	0.87	0.11	0.91	0.86	0.29		

B

U87			U251				
Control	shNC	shLINC00339	Control	shNC	shLINC00339	n=5, each	
100.00	90.21	45.00	100.00	100.00	50.33		
70.86	79.68	19.24	80.22	77.34	39.45		
140.53	128.50	65.72	135.44	132.06	68.39		
112.39	105.74	53.24	72.13	81.14	20.18		
82.41	75.41	30.33	112.52	109.33	58.70		

C

U87			U251				
Control	shNC	shLINC00339	Control	shNC	shLINC00339	n=5, each	
15.00	13.00	4.00	12.00	10.00	2.00		
18.00	17.00	2.00	10.00	12.00	3.00		
22.00	20.00	5.00	8.00	5.00	0.00		
26.00	25.00	7.00	18.00	19.00	6.00		
10.00	11.00	1.00	15.00	14.00	5.00		

D

U87 migration			U87 invasion				
Control	shNC	shLINC00339	Control	shNC	shLINC00339		
120.00	115.00	58.00	62.00	65.00	15.00		
80.00	70.00	35.00	80.00	85.00	25.00		
150.00	152.00	76.00	100.00	110.00	50.00		
100.00	95.00	50.00	25.00	30.00	5.00		
90.00	80.00	42.00	46.00	44.00	10.00		
U251 migration			U251 invasion				
Control	shNC	shLINC00339	Control	shNC	shLINC00339	n=5, each	
110.00	110.00	40.00	50.00	48.00	20.00		
65.00	70.00	10.00	40.00	35.00	10.00		
125.00	135.00	50.00	80.00	78.00	30.00		
145.00	150.00	75.00	95.00	92.00	50.00		
90.00	95.00	30.00	70.00	67.00	30.00		

E

U87				U251			
Control	shNC	shLINC00339		Control	shNC	shLINC00339	
0.93	0.90	0.10		1.30	1.42	0.94	
1.35	1.20	0.25		0.70	0.83	0.55	
1.16	1.14	0.16	MMP2	0.85	1.15	0.77	MMP2
0.62	0.58	0.11		0.93	1.22	0.61	
0.76	0.77	0.03		1.10	0.77	0.69	
U87				U251			
Control	shNC	shLINC00339		Control	shNC	shLINC00339	
0.76	0.80	0.50		1.06	1.10	0.58	
0.65	0.68	0.26		0.86	0.80	0.40	
0.50	0.53	0.19	MMP14	0.68	0.59	0.33	MMP14
0.88	0.91	0.34		0.93	0.96	0.48	
0.70	0.77	0.40		0.78	0.77	0.40	

n=5, each

Fig.3

A

NBTs	LGGTs	HGGTs	n=3, NBTs group; n=10, each glioma tissue group
1.13	0.75	0.15	
0.74	0.35	0.25	
1.33	0.59	0.45	
	0.67	0.11	
	0.40	0.29	
	0.54	0.05	
	0.45	0.30	
	0.75	0.05	
	0.40	0.04	
	0.20	0.55	

B

NHA	U87	U251
1.22	0.77	0.74
0.81	0.41	0.43
1.04	0.55	0.60
1.59	0.35	0.33
0.55	0.15	0.24

n=5, each

C

U87					U251				
Control	pre-NC	pre-miR-	anti-NC	anti-miR-539-5p	Control	pre-NC	pre-miR-	anti-NC	anti-miR-539-5p
0.93	1.12	9.80	0.95	0.10	1.15	0.93	8.94	1.10	0.27
1.35	1.33	7.50	1.30	0.45	1.30	1.20	6.90	1.34	0.65
1.16	1.20	8.67	1.22	0.16	1.29	1.03	7.78	1.19	0.36
0.62	0.89	7.92	1.00	0.20	0.89	0.88	7.46	0.89	0.20
0.76	1.00	8.00	1.16	0.55	0.92	0.94	8.00	1.14	0.55

n=5, each

D

U87					U251				
Control	pre-NC	pre-miR-	anti-NC	anti-miR-539-5p	Control	pre-NC	pre-miR-	anti-NC	anti-miR-539-5p
100.00	99.42	49.01	95.00	170.31	100.00	89.45	62.34	92.41	170.92
88.34	79.71	35.41	75.59	155.42	85.31	82.34	40.34	80.72	155.53
131.21	134.20	59.41	110.41	140.00	125.49	125.59	65.91	120.33	140.00
115.41	117.20	60.39	125.72	185.61	112.42	99.31	50.33	105.30	190.40
75.30	72.49	39.41	70.31	125.31	70.62	59.88	38.26	75.51	130.72

n=5, each

E

U87					U251				
Control	pre-NC	pre-miR-	anti-NC	anti-miR-539-5p	Control	pre-NC	pre-miR-	anti-NC	anti-miR-539-5p
10.00	12.00	7.00	18.00	27.00	9.00	8.00	2.00	9.00	20.00
15.00	18.00	3.00	14.00	23.00	14.00	11.00	5.00	12.00	25.00
19.00	21.00	5.00	21.00	30.00	5.00	5.00	0.00	5.00	12.00
22.00	25.00	12.00	25.00	33.00	15.00	13.00	5.00	14.00	16.00
12.00	10.00	0.00	10.00	20.00	8.00	6.00	1.00	6.00	15.00

n=5, each

F

U87 migration					U87 invasion				
Control	pre-NC	pre-miR	anti-NC	anti-miR-539-5p	Control	pre-NC	pre-miR	anti-NC	anti-miR-539-5p
110.00	115.00	55.00	115.00	140.00	70.00	75.00	25.00	73.00	85.00
70.00	75.00	40.00	85.00	120.00	92.00	100.00	35.00	95.00	130.00
125.00	125.00	75.00	125.00	179.00	50.00	52.00	10.00	52.00	125.00
135.00	138.00	80.00	135.00	160.00	85.00	88.00	25.00	88.00	100.00
85.00	88.00	50.00	95.00	135.00	66.00	69.00	30.00	70.00	100.00
U251 migration					U251 invasion				
Control	pre-NC	pre-miR	anti-NC	anti-miR-539-5p	Control	pre-NC	pre-miR	anti-NC	anti-miR-539-5p n=5, each
110.00	110.00	50.00	100.00	155.00	60.00	67.00	30.00	60.00	110.00
85.00	85.00	40.00	80.00	140.00	45.00	53.00	10.00	50.00	80.00
120.00	120.00	60.00	113.00	185.00	85.00	87.00	45.00	85.00	115.00
130.00	129.00	75.00	125.00	170.00	90.00	93.00	40.00	90.00	120.00
70.00	72.00	30.00	70.00	125.00	70.00	72.00	20.00	70.00	100.00

G

U87					U251					
Control	pre-NC	pre-miR	anti-NC	anti-miR-539-5p	Control	pre-NC	pre-miR	anti-NC	anti-miR-539-5p	
0.93	1.32	0.46	1.59	2.43	1.20	1.00	0.50	1.00	1.79	
0.62	0.89	0.38	1.43	2.20	1.35	1.25	0.71	1.37	2.30	
0.76	0.75	0.29	1.32	2.10	MMP2	1.00	1.10	0.60	1.20	2.18
1.35	1.26	0.74	0.87	1.89	0.80	0.70	0.38	1.10	1.99	
1.17	1.14	0.62	1.10	1.96	1.10	1.39	0.40	0.68	1.50	
U87					U251					
Control	pre-NC	pre-miR	anti-NC	anti-miR-539-5p	Control	pre-NC	pre-miR	anti-NC	anti-miR-539-5p n=5, each	
1.28	1.20	0.64	1.30	2.50	0.75	0.80	0.38	0.70	1.69	
1.00	0.97	0.40	1.01	1.94	0.50	1.00	0.50	1.00	1.42	
0.65	0.80	0.59	0.86	1.62	MMP14	1.00	0.58	0.20	0.46	1.22
0.86	0.73	0.43	0.77	1.55	0.61	0.69	0.30	0.60	1.30	
0.59	0.60	0.21	0.90	1.38	0.60	0.50	0.19	0.61	1.36	

Fig.4

A

U87			U251		
Control	shNC	shLINC00339	Control	shNC	shLINC00339
0.98	0.89	2.66	1.00	2.08	1.54
1.43	0.83	2.00	0.69	0.88	1.76
0.66	1.24	2.42	1.19	1.33	2.03

n=3, each

B

Control	LINC00	LINC00	LINC00	LINC00339-Mut+pre-miR
0.90	0.91	0.38	0.87	0.83
1.00	1.12	0.59	0.99	0.90
1.15	1.20	0.45	1.10	1.00

n=3, each

Fig.5

A

U87					U251				
Control	shNC+p	shLINC0	shNC+a	shLINC00339+a	Control	shNC+pre	shLINC0	shNC+a	shLINC00339+a
100.00	90.32	37.20	94.61	98.61	100.00	93.50	55.25	98.62	110.34
79.34	70.00	30.31	75.00	75.12	79.42	66.00	39.42	67.32	72.35
107.39	106.00	42.41	110.42	112.69	140.72	132.83	44.78	110.38	94.45
129.91	129.45	51.00	129.10	130.36	110.50	108.02	57.92	120.49	87.69
91.45	65.50	20.34	66.51	70.83	83.71	77.72	27.48	83.41	119.06

n=5, each

B

U87					U251				
Control	shNC+p	shLINC0	shNC+a	shLINC00339+a	Control	shNC+pre	shLINC0	shNC+a	shLINC00339+a
14.00	12.00	2.00	17.00	15.00	13.00	14.00	3.00	11.00	10.00
17.00	17.00	3.00	22.00	18.00	10.00	9.00	2.00	7.00	7.00
22.00	20.00	4.00	26.00	22.00	8.00	11.00	4.00	9.00	9.00
26.00	25.00	5.00	20.00	25.00	9.00	8.00	1.00	10.00	11.00
13.00	13.00	0.00	13.00	13.00	8.00	9.00	0.00	7.00	7.00

n=5, each

C

U87 migration					U87 invasion						
Control	shNC+p	shLINC00339	shNC+a	shLINC00339+a	Control	shNC+pre	shLINC00339	shNC+a	shLINC00339+a	anti-miR-539-5p	
110.00	105.00	45.00	106.00	107.00	65.00	65.00	25.00	88.00	90.00		
85.00	90.00	25.00	88.00	90.00	50.00	52.00	10.00	65.00	67.00		
130.00	125.00	10.00	127.00	128.00	80.00	82.00	5.00	55.00	54.00		
145.00	135.00		133.00	135.00	95.00	94.00	28.00	92.00	87.00		
80.00	85.00		85.00	80.00	55.00	57.00	17.00	60.00	62.00		
U251 migration					U251 invasion						
Control	shNC+p	shLINC00339	shNC+a	shLINC00339+a	anti-miR-539-5p	Control	shNC+pre	shLINC00339	shNC+a	shLINC00339+a	anti-miR-539-5p
110.00	111.00	50.00	100.00	110.00		60	62	14	63	61	
90.00	90.00	30.00	85.00	90.00		48	48	10	48	48	
125.00	130.00	20.00	125.00	130.00		76	80	20	78	80	
140.00	137.00	62.00	135.00	138.00		55	55	5	52	53	
65.00	66.00	20.00	65.00	66.00		90	95	30	88	97	

n=5, each

D

U87					U251						
Control	shNC+p	shLINC00339	shNC+a	shLINC00339+a	Control	shNC+pre	shLINC00339	shNC+a	shLINC00339+a	anti-miR-539-5p	
1.00	1.13	0.35	1.44	1.40	1.00	1.05	0.37	1.20	1.19		
1.10	1.05	0.59	1.13	1.23	1.15	1.20	0.56	1.05	1.00		
1.27	1.29	0.53	1.26	1.14	MMP2	0.89	0.85	0.25	0.80	0.84	MMP2
1.00	0.93	0.22	0.88	0.83		0.78	1.36	0.20	1.38	1.40	
1.35	1.40	0.40	1.25	1.25		1.34	0.77	0.22	0.75	0.74	
U87					U251						
Control	shNC+p	shLINC00339	shNC+a	shLINC00339+a	Control	shNC+pre	shLINC00339	shNC+a	shLINC00339+a	anti-miR-539-5p	
0.85	0.90	0.25	0.90	0.83		0.8	0.77	0.26	0.83	0.85	
1.05	1.12	0.10	1.20	1.00		1	0.65	0.44	0.95	0.99	
0.78	0.80	0.32	0.82	0.70	MMP14	0.69	0.7	0.15	0.69	0.7	MMP14
0.89	1.00	0.40	0.90	0.90		0.73	0.94	0.3	0.9	0.9	
0.66	0.86	0.11	0.85	0.80		0.77	0.8	0.35	0.8	0.85	

n=5, each

Fig.6

A

U87					U251					
Control	pre-NC	pre-miR	anti-NC	anti-miR-539-5p	Control	pre-NC	pre-miR	anti-NC	anti-miR-539-5p	n=3, each
1.44	1.72	0.11	1.27	2.30	1.02	1.00	0.45	0.80	2.07	
0.79	0.94	0.30	0.76	1.78	0.82	0.84	0.52	1.22	1.80	
1.27	1.30	0.48	1.20	2.22	1.13	1.13	0.33	0.99	2.41	

B

Control	TWIST	TWIST	TWIST	TWIST1-Mut+p	n=3, each
1.26	0.94	0.53	1.03	0.95	
1.00	1.19	0.40	1.23	1.23	
1.11	0.97	0.65	0.90	0.87	

Fig.7

A

U87					U251					
Control	pre-NC+	pre-miR	pre-miR	pre-miR-539-5p+TWIST1	Control	pre-NC+	pre-miR	pre-miR	pre-miR-539-5p+TWIST1	-n=5, each
100.00	115.00	51.48	169.32	128.43	100.00	90.80	42.48	155.47	105.50	
86.45	78.32	42.36	145.06	10.37	88.88	70.37	35.30	137.48	85.29	
126.40	128.89	65.00	186.42	135.04	135.62	116.64	70.39	180.84	135.62	
117.73	90.00	37.52	155.30	120.82	120.30	115.09	50.63	169.74	127.47	
80.35	83.67	28.44	120.49	85.39	65.19	60.48	30.37	125.03	70.29	

B

U87					U251					
Control	pre-NC+	pre-miR	pre-miR	pre-miR-539-5p+TWIST1	Control	pre-NC+	pre-miR	pre-miR	pre-miR-539-5p+TWIST1	-n=5, each
15.00	17.00	1.00	25.00	22.00	10.00	11.00	2.00	18.00	14.00	
17.00	21.00	3.00	29.00	26.00	7.00	9.00	0.00	12.00	10.00	
25.00	27.00	8.00	35.00	32.00	13.00	15.00	4.00	20.00	16.00	
15.00	22.00	5.00	28.00	25.00	12.00	13.00	3.00	18.00	18.00	
23.00	15.00	2.00	30.00	29.00	9.00	9.00	1.00	15.00	10.00	

C

U87 migration					U87 invasion							
Control	pre-NC+	pre-miR	pre-miR	pre-miR-539-5p+	Control	pre-NC+	pre-miR	pre-miR	pre-miR-539-5p+	TWIST1-ORF-3'UTR		
110.00	112.00	40.00	160.00	125.00	67.00	70.00	37.00	112.00	77.00			
90.00	93.00	30.00	130.00	99.00	80.00	85.00	48.00	125.00	90.00			
130.00	132.00	40.00	179.00	140.00	46.00	50.00	25.00	100.00	58.00			
145.00	149.00	60.00	200.00	150.00	56.00	60.00	32.00	105.00	69.00			
80.00	84.00	20.00	110.00	90.00	40.00	45.00	19.00	75.00	50.00			
U251 migration					U251 invasion							
Control	pre-NC+	pre-miR	pre-miR	pre-miR-539-5p+	Control	pre-NC+	pre-miR	pre-miR	pre-miR-539-5p+	TWIST1-ORF-3'UTR		
110.00	113.00	45.00	139.00	118.00	80.00	72.00	25.00	100.00	95.00			
90.00	87.00	33.00	115.00	98.00	60.00	61.00	18.00	90.00	75.00			
125.00	125.00	45.00	162.00	132.00	100.00	105.00	48.00	130.00	115.00			
140.00	143.00	55.00	180.00	145.00	90.00	88.00	35.00	120.00	100.00			
85.00	82.00	20.00	124.00	88.00	50.00	55.00	15.00	100.00	82.00			

D

U87					U251							
Control	pre-NC+	pre-miR	pre-miR	pre-miR-539-5p+	Control	pre-NC+	pre-miR	pre-miR	pre-miR-539-5p+	TWIST1-ORF-3'UTR		
1.39	1.40	0.30	2.10	1.60	1.00	1.15	0.48	1.60	1.42			
0.80	0.85	0.54	2.45	1.77	1.00	1.00	0.56	1.87	1.30			
1.50	1.52	0.25	2.00	1.49	MMP2	1.38	1.10	0.37	1.75	1.00	MMP2	
1.00	0.90	0.18	1.97	1.28	0.97	1.36	0.25	1.70	1.55			
0.94	1.15	0.20	1.89	1.35	1.00	0.99	0.30	1.55	1.20			
U87					U251							
	Control	pre-NC+	pre-miR	pre-miR	pre-miR-539-5p+	TWIST1-ORF-3'UTR	Control	pre-NC+	pre-miR	pre-miR	pre-miR-539-5p+	TWIST1-ORF-3'UTR
	0.85	0.90	0.25	1.80	1.40		0.60	0.64	0.15	1.25	0.85	
	0.99	1.00	0.33	2.00	0.85		0.40	0.45	0.30	1.42	1.00	
	0.72	0.75	0.54	1.69	1.50	MMP14	0.70	0.70	0.22	1.30	1.13	MMP14
	0.80	1.23	0.20	1.80	0.91		0.55	0.60	0.10	1.00	0.78	
	1.15	0.80	0.18	1.90	1.20		0.70	0.69	0.10	1.55	0.84	

Fig.8

A

U87	PCR1			PCR2			PCR3		
	input	IgG	TWIST1	input	IgG	TWIST1	input	IgG	TWIST1
	1.07		0.93	1.11		0.81	0.91		
	0.86		0.88	0.83		1.05	1.08		
	1.15		1.22	0.94		1.10	1.03		

U251	PCR1			PCR2			PCR3		
	input	IgG	TWIST1	input	IgG	TWIST1	input	IgG	TWIST1
	0.98		1.12	1.02		1.08	1.18		
	1.21		0.83	1.25		1.07	0.82		
	0.85		0.97	0.79		1.03	0.87		

n=3 each

B

U87	PCR1			PCR2			PCR3		
	input	IgG	TWIST1	input	IgG	TWIST1	input	IgG	TWIST1
	1.13		0.87	0.74		1.02	1.16		
	0.94		1.02	0.99		1.18	1.09		
	0.93		1.12	1.03		0.82	1.02		

U251	PCR1			PCR2			PCR3		
	input	IgG	TWIST1	input	IgG	TWIST1	input	IgG	TWIST1
	1.02		0.85	1.32		0.92	1.08		
	0.95		0.69	0.71		1.18	1.02		
	1.05		1.40	0.86		1.21	1.14		

n=3 each

Fig.9

A	Days	Control			shNC+pre-NC			shLINC00339			pre-miR-539-5p			shLINC00339+pre-miR-539-5p		
U87	5	110	40	8	90	40	8	70	40	8	70	40	8	50	40	8
	10	180	40	8	190	40	8	130	40	8	125	40	8	60	40	8
	15	300	40	8	280	40	8	200	40	8	180	40	8	70	40	8
	20	430	35	8	400	35	8	250	35	8	225	35	8	120	35	8
	25	530	35	8	500	35	8	365	35	8	330	35	8	170	35	8
	30	580	35	8	590	35	8	430	35	8	400	35	8	205	35	8

35	610	40	8	640	40	8	500	40	8	480	40	8	265	40	8
40	700	40	8	710	40	8	550	40	8	510	40	8	310	40	8
45	790	40	8	760	40	8	610	40	8	600	40	8	365	40	8

U251	Days	Control			shNC+pre-NC			shLINC00339			pre-miR-539-5p			shLINC00339+pre-miR-539-5p		
	5	100	40	8	90	40	8	70	40	8	70	40	8	40	40	8
10	170	40	8	190	40	8	125	40	8	120	40	8	50	40	8	
15	290	40	8	280	40	8	169	40	8	160	40	8	60	40	8	
20	400	35	8	380	35	8	175	35	8	180	35	8	70	35	8	
25	460	35	8	450	35	8	250	35	8	269	35	8	98	35	3	
30	570	35	8	580	35	8	320	35	8	330	35	8	115	35	8	
35	600	40	8	640	40	8	400	40	8	400	40	8	175	40	8	
40	680	40	8	710	40	8	469	40	8	450	40	8	210	40	8	
45	770	40	8	750	40	8	500	40	8	510	40	8	260	40	8	

B

Days	U87				Days	U251				
	Control	shNC+pr	shLINC0	pre-miR-5		shLINC00339+pre-miR-539-5p	Control	shNC+pr	shLINC0	pre-miR-5
1					1					
2					2					
3					3					
4					4					
5					5					
6					6					
7					7					
8					8					
9					9					
10					10					
11	1				11	1				
12		1			12		2			

13	1				
14		2			
15		1			
16	1				
17		1			
18	2				
19					
20		1	1		
21	1			1	
22					
23		1	2		
24	1			1	
25	1				
26		1	1		
27			1	1	
28					1
29			1	1	
30					
31					1
32			1	1	
33					
34			1		
35				1	1
36					2
37				2	
38				2	
39					1
40					
41					1
42					
43					
44					1

13			1		
14	1				
15			1		
16	2				
17					
18			1		
19	1				
20					
21			1	2	
22	1				
23	1				1
24			1	1	
25				1	
26					1
27			1	1	
28	1				1
29					
30				1	
31					1
32				1	
33					
34					
35					1
36					2
37					2
38				1	
39					1
40					
41					1
42					
43					
44					1

45

45

46

1

47

C

U87					U251							
Control	shNC+pr	shLINC0	pre-miR-	shLINC00339+pre-miR-539-	Control	shNC+pre	shLINC0	pre-miR-	shLINC00339+pre-miR-539-5p			
4	3	1	1	0	4	5	1	1	1			
5	4	0	2	1	2	3	1	2	1			
2	3	2	2	0	6	6	2	3	0			