

Contents

1	Noise arising from protein production is minimized for noise-prone genes	1
1.1	Introduction	1
1.2	Results	5
2	microRNA control of protein expression noise	11
2.1	Introduction	11
2.2	Mathematical model of microRNA noise effects	14
2.3	Experimental validation of microRNA noise effects	23
2.3.1	Experimental validation of noise effects for miR-20a in mouse embryonic stem cells	23
2.3.2	Generality of intrinsic noise reduction for microRNAs and other post-transcriptional repressors	31
2.3.3	Additional extrinsic noise from individual and mixed microRNA pools	34
2.4	microRNA noise effects in endogenous target situations	37
2.5	microRNAs predominantly increase production ratios	45
2.6	Noise-sensitive genes are enriched for microRNA regulation	49
3	Conclusions and Outlook	61
3.1	Protein expression noise in mammalian cells	61
3.2	microRNA control of protein expression noise in mammalian cells	62
4	Materials & Methods	67
4.1	Bioinformatics	67
4.2	Experiments	72
4.3	Measuring fluorescent protein variability on a flow cytometry	78
4.4	GO Term microRNA regulation	85
	References	103