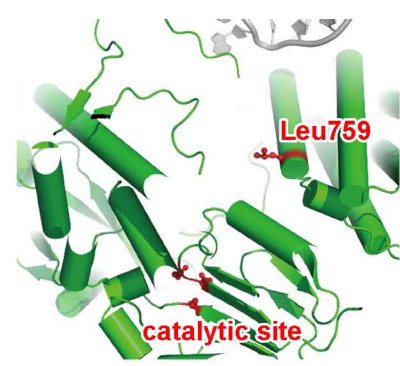
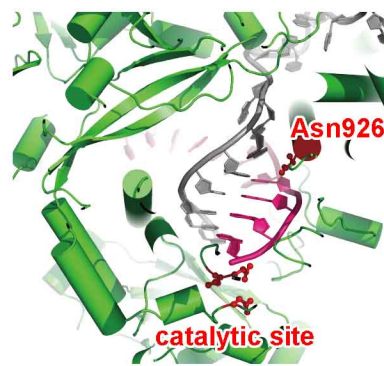
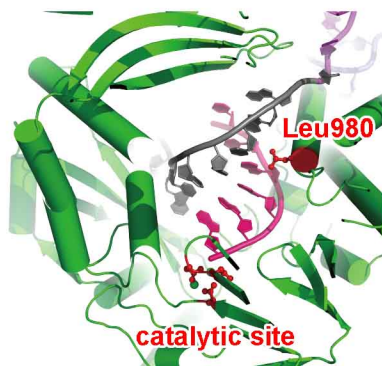


a

		960	970	980	990	1000		
Deuterostomia	Vertebrates	<i>H. sapiens</i>	TSIRASLTFN.RGFK.AGRN.	MRRKLLFGVLR	KCHSLF	LDLQVNSLQT	VCTNIYKIFLLQA	
		<i>M. auratus</i>	TSIKASLTFQ.RTFK.AGRN.	MRQKLLAVLR	KCHSLF	LDLQVNSLQT	VCIINVYKIFLLQA	
		<i>M. musculus</i>	TSIKTSLTFQ.SVFK.AGKT.	MRRKLLSVLR	KCHGLF	LDLQVNSLQT	VCIINVYKIFLLQA	
		<i>R. norvegicus</i>	TSIKMSLTFQ.GVSR.AGKT.	MRYKLLSVLR	KCHGLF	LDLQVNSLQT	VCIINVYKIFLLQA	
		<i>C. familiaris</i>	TSIRASLTFQ.QGAK.PGRN.	MRRKLLAVLR	KCCALF	LDLQVNGIHT	VYMNVIYKIFLLQA	
		<i>B. taurus</i>	TSIRASLTFQ.QGFK.PGRN.	MRRKLLAVLR	KCHGLF	LDLQVNSLQT	VYMNVIYKIFLLQA	
		<i>C. japonica</i>	TSIRSLSLTFN.SSRI.AGKN.	MKCKLTAVALK	KCHPLL	LDLQVNSLQT	VLIINVYKIFLLQA	
		<i>G. gallus</i>	TSIRSLSLTFN.SSRI.AGKN.	MKCKLTAVALK	KCHPLL	LDLQVNSLQT	VLIINVYKIFLLQA	
		<i>X. laevis</i>	TSIRSMTLTFC.HSSA.AGKY.	MKCKLIRVLR	KCHSLF	LDLQVNSLRT	VCIINVYKIFLLQA	
		<i>O. latipes</i>	LSLRYSLTLG.SAHS.AGQQ.	MRRKLLMSILR	KCHPLF	LDLQVNSLRT	VYMNVIYKIFLLQA	
		<i>O. melastigma</i>	LSLRYSLTLG.SAHS.AGQQ.	MRRKLLMSILR	KCHPLF	LDLQVNSLRT	VYMNVIYKIFLLQA	
		<i>E. coioides</i>	LSLRYSLTLG.SAHS.AGQQ.	MRRKLLMSILR	KCHPLF	LDLQVNSLRT	VYMNVIYKIFLLQA	
		<i>T. rubripes</i>	LSLRYSLTLG.SAHS.AGQQ.	MRRKLLMSILR	KCHPLF	LDLQVNSLRT	VYMNVIYKIFLLQA	
		<i>D. rerio</i>	LSLRYSLTLG.SAHS.AGQQ.	MRRKLLMSILR	KCHPLF	LDLQVNSLRT	VYMNVIYKIFLLQA	
		Chordata	<i>P. marinus</i>	VQVSWTMSLFC.FASQ.PGHT.	MRTKLLMHVLR	KCQPIL	LDLQVNSLRT	VYMNVIYKIFLLQA
			<i>S. kowalevskii</i>	IDMADTFTMD.LTKQ.PGKS.	LINIKMKQTVSL	KCHPIF	MDGQVNSLRT	VYMNVIYKIFLLQA
		Echinodermata	<i>A. rubens</i>	VSISSHMTIVN.FTDK.DVLPK.	VKTQVLRQLLR	KCNKFF	LDPEINFP	PEIKRNCYEFFLLSA
<i>P. miniata</i>	VSISSHMTIVN.FTDK.DVLPK.		VKTQVLRQLLR	KCNKFF	LDPEINFP	PEIKRNCYEFFLLSA		
<i>A. planci</i>	VSISSHMTIVN.FTDK.DVLPK.		VKTQVLRQLLR	KCNKFF	LDPEINFP	PEIKRNCYEFFLLSA		
Protostomia	Mollusca	<i>P. diffusa</i>	LGISDTSISFD.GCHK.PGET.	IKKMLMSLTF	RSHQIFFD	PLNINS	EERILLNAFCITFFFLA	
		<i>P. canaliculata</i>	LGISDTSISFD.GCHK.PGET.	IKKMLMSLTF	RSHQIFFD	PLNINS	EERILLNAFCITFFFLA	
		<i>C. gigas</i>	IRMRHTLTVS.VSMN.PGRT.	MKRKLLMSLRF	KCHAIFFD	TELSNS	TEVCSVNCRLLLLTA	
		<i>C. virginica</i>	IRMRHTLTVS.VSMN.PGRT.	MKRKLLMSLRF	KCHAIFFD	TELSNS	TEVCSVNCRLLLLTA	
		<i>M. yessoensis</i>	ICVADTMSFD.LSRD.PLMT.	LKHKLLNALKP	KSHVIYMD	TELSNT	TEIVVTNIFKIFVFLNA	
	Annelida	<i>H. robusta</i>	LSVKYTMAS.FSNH.PGSA.	IEKLLFSVRS	KCNISYFD	TTYSNS	VNTIFLNVYKIFLLLA	
Basal metazoa	Placozoa	<i>T. adhaerens</i>	IRISECMTIN.ISNN.AGQT.	MRAKMLQVVRM	LCQIITLD	PEMNSKLT	IGINIFDKLQQLIM	
		<i>A. queenslandica</i>	..IRDCLTIS.NSSIVPAHS.	LSIQQLIQALS	KCVPHL	LDLQVNSLRT	VYMNVIYKIFLLQA	
	Porifera	<i>A. tenebrosa</i>	KH.RN.TVLRN.LHYH.PGRS.	LLEKLLXYSLLN	KSHPLL	LDLQVNSLRT	VYMNVIYKIFLLQA	
		<i>M. millepora</i>	IQLRD.TLSVS.LDAH.PGKA.	LRRKLLCSVRF	KCHPLL	LDLQVNSLRT	VYMNVIYKIFLLQA	
	Cnidaria	<i>E. diaphana</i>	VNPRKIFPKT.RQCN.NSQV.	LSSKLLSFSARN	KCHPLL	LDLQVNSLRT	VYMNVIYKIFLLQA	
		<i>P. damicornis</i>	SLLRD.TLTVS.LDAH.PGEA.	LSSKLLSFSARN	KCHPLL	LDLQVNSLRT	VYMNVIYKIFLLQA	
		<i>S. pistillata</i>	SLLRD.TLTVS.LDAH.PGEA.	LSSKLLSFSARN	KCHPLL	LDLQVNSLRT	VYMNVIYKIFLLQA	
		<i>O. faveolata</i>	LLLRD.TLTVS.LDAH.PGEA.	LRRKLLSFSARN	KCHPLL	LDLQVNSLRT	VYMNVIYKIFLLQA	
		<i>N. vectensis</i>	GVEDSI.QGP.MASH.TGHG.	ISTKLLKFSLR	KCVPLL	LDLQVNSLRT	VYMNVIYKIFLLQA	
		Plants	<i>A. thaliana</i>	GHISSTFSVA.WQNK.PVRN.	LROKLLCYFLVF	KCHPIFFD	SNINS	GEIVRLNIYQIFLLA
			<i>M. esculenta</i>	KHLRS.TLTVS.WQNK.PGHR.	LKTKLLCDFMRP	KCHPIFFD	SNINS	GSVVRNIYQIFLLA
	<i>N. tabacum</i>		FPLSS.TLTVG.WLNK.PGRD.	LKVKLLCYFLVF	KCHPIFFD	SNINS	AAVVRNIYQIFLLA	
	<i>B. vulgaris</i>		DHLSS.TLTVS.WQNK.PGRD.	LKAKLLRAYMRP	KCHPIFFD	SNINS	SPVVRNIYQIFLLA	
<i>A. trichopoda</i>	THISS.TVTVW.RQAK.PGSH.	LKGGKLDYMRP	KCHALFYD	SNINS	PATVRLNAYQIFLLA			
Ciliates	<i>E. aediculatus</i>	G.ILC.TLNLNMQTKK.ASMW.	LKKKLLKSFLLM	NITHYFRK	TITTE	DFANKTLNKLFISSGGY		
	<i>E. crassus</i>	G.ILC.TLNLNMQTKK.ASMW.	LKKKLLKSFLLM	NITHYFRK	TITTE	DFANKTLNKLFISSGGY		
	<i>O. trifallax</i>	G.ILC.TLNLNMQTKK.ASMW.	LKKKLLKSFLLM	NITHYFRK	TITTE	DFANKTLNKLFISSGGY		
	<i>P. caudatum</i>	TKFQYQINVNLPKV.KTYY.	IKSKLLKSLILN	QKFFFN	SKLNDKPTM	IKVLFVHSGLV		
	<i>P. tetraurelia</i>	SKFNSQINVNLPKRI.NSYF.	FKAKLLKSLMLN	QKFFFN	NPKINDQPTL	IKIAKTFIHAGLI		
	<i>T. thermophila</i>	QBINQ.TINVAISIKN.LKSQ.	LKNKLLRSLFLN	QLIDYF	NPNINS	SFEGLCRQLYHHSKATVM		
Fungi	<i>A. clavatus</i>	ATLASLSTVE.SARA.PGRS.	LHRKMLSAFKL	QMHPMYLD	TOHNS	LSAVLSNLYASFVTA		
	<i>A. fumigatus</i>	GTISSSLTVE.FTRA.PGRS.	LHRKMLSAFKL	QMHPMYLD	TOHNS	LSAVLSNLYASFVTA		
	<i>C. albicans</i>	SGSISLVTN.FRTF...KT.	LVKYLKTFYQL	NLEGLD	DCSPGV	LENVNLNMYQSLRLVL		
	<i>N. fischeri</i>	ATISSSLTVE.STRA.PGRS.	LHRKMLSAFKL	QMHPMYLD	TOHNS	LSAVLSNLYASFVTA		
	<i>K. lactis</i>	...NVLGTV.LGSS...KQ.	LYNKLLWIFEM	RLSYNM	LDLQVNSLRT	VYMNVIYKIFLLQA		
	<i>A. nidulans</i>	VALSDSLSID.STRT.PGRS.	FYRKVLASIKQ	SMHPMYLD	STHNS	LPAVLLNVYKSFVTA		
	<i>E. cuniculi</i>	ADPYLPFSIA.HSSTKPGA.	LRSRMKLLQNR	RMSRIY	IDPN.NK.	KAYENIYDTFFLFYQ		
	<i>S. bayanus</i>	SNMTNMFNVR.SNSSK...I.	IFRRLTSLFNT	RVSYKT	INYNLNS	TATVLMQIYIVKKNIS		
	<i>S. cerevisiae</i>	SSMTNMFNIR.SKSSK...G.	IFRSLIALFNT	RISYKT	IDTNLNS	TNTVLMQIDHVVKNIS		
	<i>S. kudriavzevii</i>	SSMTNMFNIR.SNSSK...K.	IFRRLTSLFNT	RISYKT	ADSNLNS	ITTVLMQIYIVKKNIS		
	<i>S. mikatae</i>	SSMTNMFNIR.SNSSK...K.	IFRSLIALFNT	RISYKT	IDPNLNS	ITTVLMQIYIVKKNIS		
	<i>S. paradoxus</i>	SSMTNMFNIR.SNSSK...R.	IFRSLIALFNT	RISYKT	VDSNLNS	TTTVLMQIYIVKKNIS		
<i>A. gossypii</i>	KETYNKIQSY.LSSA...NK.	LYKLLRWLFE	RMAYEIT	QPTYNS	WEAVIVTHEVQATINLA			
<i>S. pombe</i>	.ALFNSTLVE.LTKH.MGKS.	FFYKILRSLSLA	SFAQVF	IDITNS	KFNSCCNIYRLLGYSMC			

b

Supplementary information, Fig. S11 Conservation of zipper-head mechanism in eukaryotes. **a** Multiple sequence alignment of the thumb-helix-flanking sequence of TERT proteins from various eukaryotes. Positions equivalent to human TERT^{Leu980} are highlighted with respective colors. **b** Structural comparison analysis of the active sites in human, *Tetrahymena thermophila* and *Candida albicans* TERT proteins. The three essential aspartate residues in the catalytic centers and the zipper head residues (Leu980 in human TERT, Asn926 in *T. thermophila* TERT and Leu766 in *C. albicans* TERT) are denoted.