

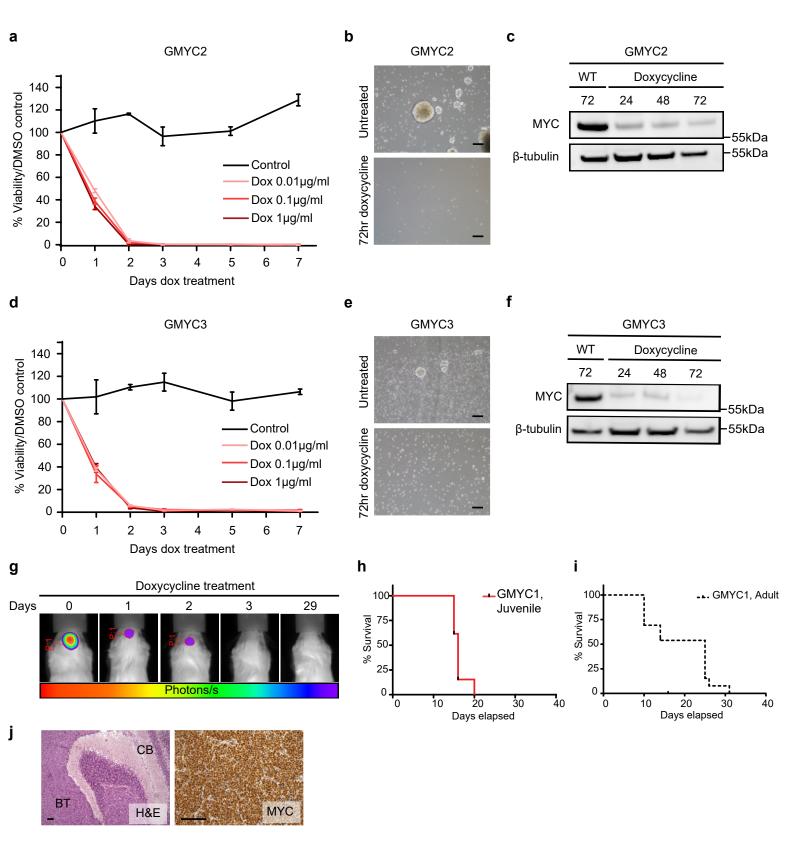
## Supplementary Fig. 1. Cross-species comparison to pediatric tumor data sets demonstrates that GMYC and GTML resemble human MB.

**a.** t-SNE plot comparing GMYC and GTML tumor samples (colored triangles) to various human glial and mixed brain tumors (colored circles) and MB (squares; human tumor data from CBTTC database).

**b.** t-SNE plot comparing GMYC and GTML tumor samples (colored triangles) to various human nonglial brain tumors (colored circles) and MB (squares; human tumor data from CBTTC database).

**c.** t-SNE plot comparing GMYC and GTML tumor samples (colored triangles) to various embryonal brain tumors (colored circles), including MB (squares of different subtypes; human tumor data from GSE73038). All t-SNE plots were produced from the metagene expression values obtained after cross-species mapping of transcriptional profiles from mouse tumors onto human tumors.

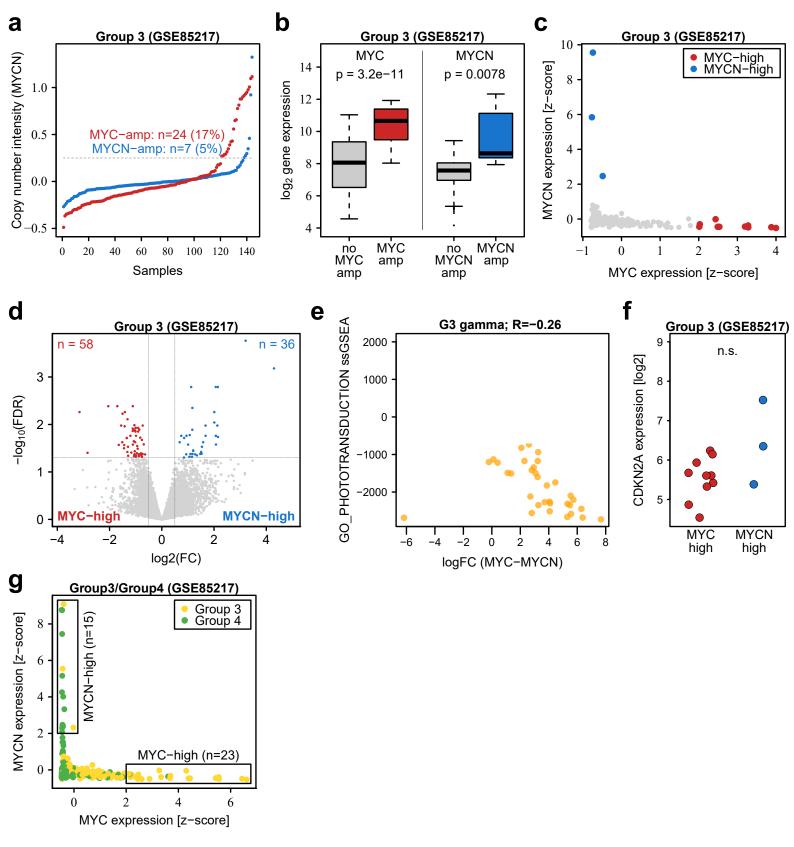
**d.** ssGSEA enrichment analysis of GMYC and GTML tumors against human MB subtypes (GSE85217). GTML tumours appear to best resemble G3 $\alpha$  and G4-like MB and GMYC tumors appear to best resemble G3 $\gamma$ -like MB.



## Supplementary Fig. 2. MYC suppression leads to complete ablation of tumor cells and survival of mice. GMYC tumors likely arise during embryonal development and can be maintained in vitro.

- a. GMYC2 cells can be dox treated in vitro and are rapidly ablated following exposure. Mean ± SD.
- **b.** Micrograph of GMYC2 cells growing *in vitro*, both untreated and treated for 72 hours with dox. Scale bars represent 100µM.
- c. Protein analysis of dox treated GMYC2 cells in vitro over 72 hours.
- d. GMYC3 cells can be dox treated in vitro and are rapidly ablated following exposure. Mean ± SD.
- e. Micrograph of GMYC3 cells growing in vitro, both untreated and treated for 72 hours with dox. Scale bars represent 100µM.
- f. Protein analysis of dox treated GMYC3 cells in vitro.
- **g.** A GMYC/TreCRE-LC1 mouse followed during dox treatment over approx. a month. Day 0 indicates when the tumor was phenotypically visible on the mouse. Dox-mediated *MYC* suppression rapidly leads to complete clearance of Luc-positive tumor cells.
- h. Survival plot of juvenile immunocompetent FVBN mice who received cerebellar injections of 200,000 GMYC1 cells.
- i. Survival plot of adult FVBN mice who received cerebellar injections of 100,000 GMYC1 cells.
- j. H&E and MYC immunostaining of allografted tumors show cerebellar disruption and high levels of MYC protein. Scale bars represent 100µM.

All experimental data from immunostainings and treatments (**a-g**, **j**) was verified from at least two independent biological replicates.



#### Supplementary Fig. 3. Identification and comparison of MYC-high/amplified and MYCN-high/amplified Group 3 MBs.

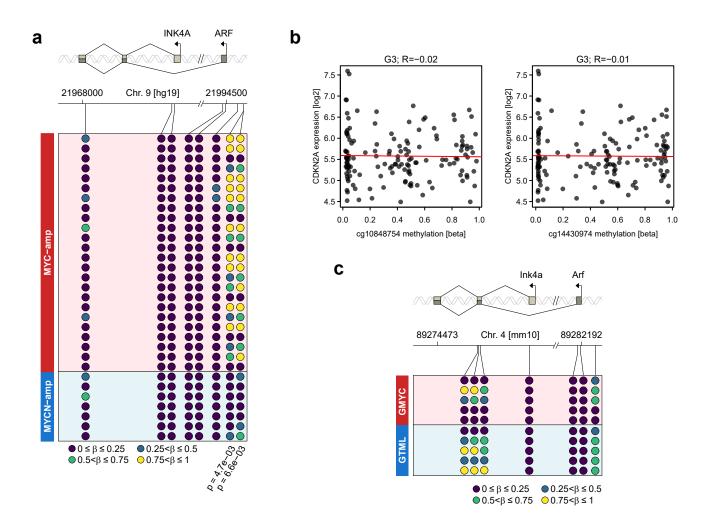
a. Illustration of the estimation of putative copy number events of MYC (red) and MYCN (blue) in Group 3 MBs based on methylation-derived copy number intensity values. Dashed line indicates the cut off (>0.25) for selecting samples with putative amplification. Numbers above the dashed line represent the identified number of amplified cases for MYC (red) and MYCN (blue).
 b. Boxplots comparing the gene expression of MYCN or MYC between samples with putative amplifications in that gene and samples without the amplification. P-values were computed using one-sided Welch's t-test.

**c.** Scatter plot comparing the z-score of gene expression values (in normal scale) between *MYC* and *MYCN* within Group 3 MBs. MYC-high and MYCN-high samples were selected as those cases with  $z \ge 2$  for the respective gene.

**d.** Volcano plot depicting the differential expression results between the MYC-high (n=10) and MYCN-high (n=3) Group 3 MBs. *MYC* and *MYCN* were removed from the expression data prior to the differential analysis. The horizontal dashed line indicates the FDR=0.05 threshold, while the vertical dashed lines indicate a logFC of -0.5 or 0.5, respectively.

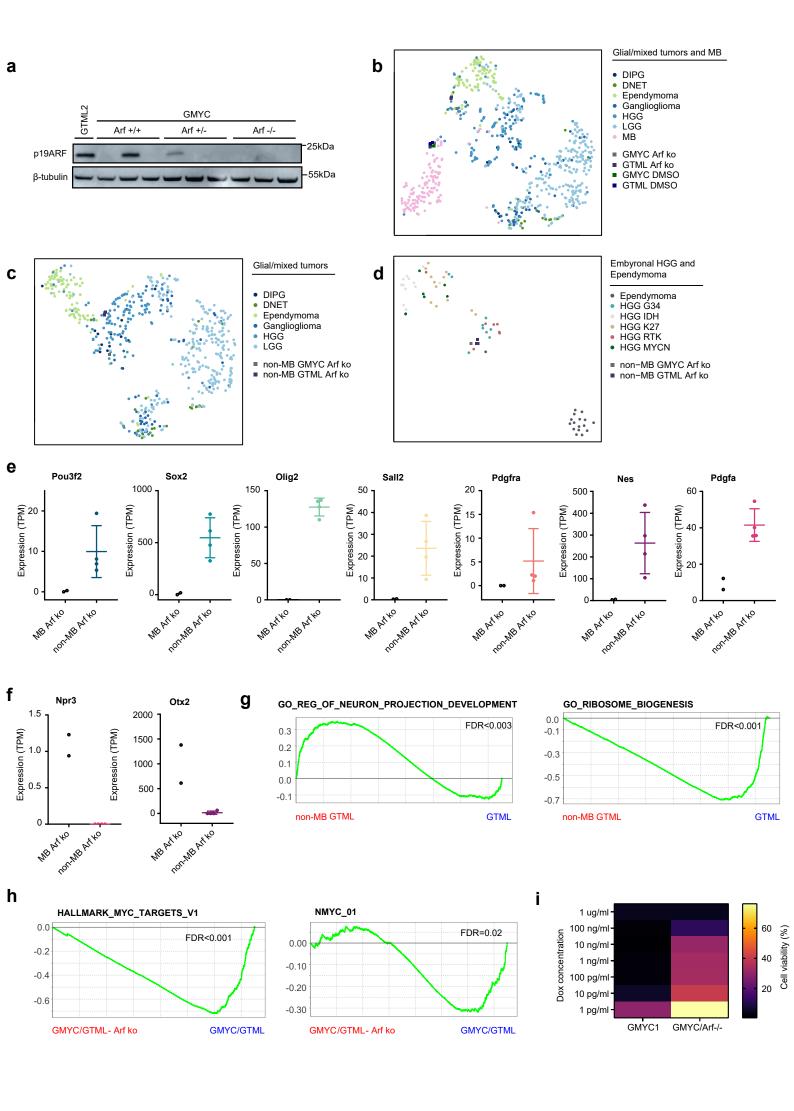
e. Scatter plot comparing the ssGSEA enrichment score for a phototransduction gene set (identified in Fig. 4B) with the corresponding *MYC* expression levels in human Group 3-gamma patients. The R-value reflects the Pearson correlation coefficient.
 f. Strip chart comparing the gene expression of *CDKN2A* between MYC-high (n=10) and MYCN-high (n=3) Group 3 MBs. The p-value (n.s.: p>0.05) was computed using a two-sided Welch's t-test.

**g.** Scatter plot comparing the z-score of gene expression values (in normal scale) between *MYC* and *MYCN* within Group 3 and Group 4 MBs. MYC-high and MYCN-high samples were selected as those cases with z>=2 for the respective gene.



**Supplementary Fig. 4. Methylation analysis of CDKN2A locus in human Gr. 3 MB and in mouse brain tumors. a.** Comparison of *CDKN2A* methylation between human Group 3 samples with putative MYC amplification and Group 3 samples with putative MYCN amplification. The position of CpG probes is shown relative to the exons utilized by *ARF* and/or *INK4A*.

b. Comparison of expression levels of CDKN2A of hyper- and hypo-methylated samples from human Group 3 MB.
c. Comparison of *Cdkn2a* methylation in tumor DNA between GMYC and GTML models using MM285 Infinium Mouse Methylation BeadChip. The position of CpG probes is shown relative to the exons utilized by *Arf* and/or *Ink4a*.



**Supplementary Fig. 5. ARF depleted GMYC/GTML animals promote an increased glioma-like tumor development. a.** Protein analysis of p19ARF in the GTML2 cell line and fresh tumor biopsies taken from GMYC mice that were wildtype for *Cdkn2a/p19Arf* or had partial or complete knockout of the *Arf* gene.

**b-d.** tSNE plots for the *Arf* ko GMYC and GTML tumours (colored squares) that appear to be either MB-like resembling human MB (pink) or non-MB-like and then more closely similar to human HGG-G34 or HGG-RTKs when performing cross-species RNA seq analysis. The same human data sets from Supplementary Fig. 1 were used here.

**e.** Transcriptional profiling expression patterns for markers defining glioma propagation transcription factors (Pou3f2, Sall2, Sox2, Olig2) and upregulation of Pdgfra, Nes and Pdgfa commonly involved in HGG-RTKs. MB Arf ko (n = 2). Non-MB Arf ko (n = 4). Scatter dot plot presented as mean values +/- SD for non-MB Arf ko.

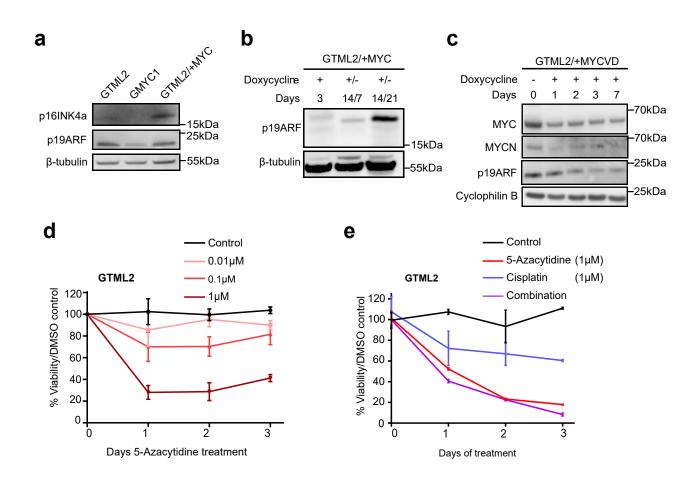
**f.** Transcriptional profiling expression patterns for Group 3 MB-specific markers (Npr3 and Otx2) lost in HGGs. MB Arf ko (n = 2). Non-MB Arf ko (n = 4). Scatter dot plot presented as mean values +/- SD for non-MB Arf ko.

**g.** Significant gene set enrichment in regulation of neuron projection development (GO\_REGULATION\_OF\_NEURON PROJECTION\_DEVELOPMENT) in non-MB GTML tumors as compared to MB GTML tumors in were ribosome biogenesis (GO\_RIBOSOME\_BIOGENESIS) instead was significantly enriched.

**h.** Significant gene set enrichment of MYC hallmark gene sets (HALLMARK\_MYC\_TARGETS\_V1) and MYCN target gene sets (NMYC\_01.v7.5.1 from GSE107405) in Arf wild type as compared to Arf knock out GTML and GMYC tumor lines.

i. Heat map showing cell viability of GMYC1 and GMYC Arf ko cells based on Alamar Blue assay after 72 h dox treatment at various concentrations as indicated. A significant difference (p<0.05) in response was found between the lines when using a two-tailed Student's t-test.

All experimental data from immunostainings (a) or treatments (i) was verified from at least two independent biological replicates.

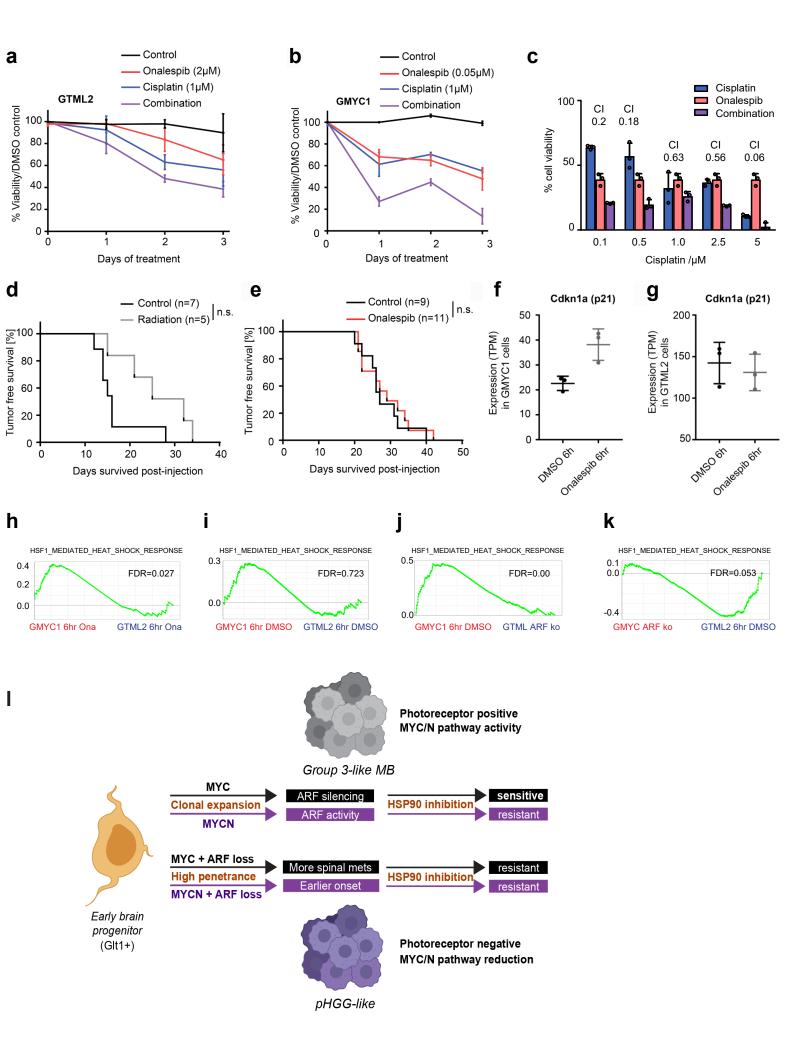


# Supplementary Fig. 6. MYC is suppressing ARF levels and MYCN-driven GTML2 cells treated with 5-Azacytidine show a decrease in cell survival.

a. Protein analysis of p16INK4a and p19ARF in untreated GTML2, GMYC1, and GTML2/+MYC cell lines.
 b. Protein analysis of GTML2/+MYC cell line during dox treatment. 14/7 and 14/21 indicate days of dox treatment and days released from treatment. MYC promotes temporary de novo methylation of the ARF gene, indicated with less protein. Removal from dox, and hence restoration of the original MYCN driver, leads to restoration of the ARF gene and its product.

**c.** GTML2/+MYCVD cells treated with dox in vitro over a period of 7 days show stable levels of MYC, a decrease of MYCN levels during dox treatment, and reduction of total ARF protein.

**d.** GTML2 cells were treated in vitro with 5-Azacytidine over 3 days. The highest concentration  $(1\mu mol/L)$  caused a reduction in cell viability and proliferation. n = 3 for each treatment variable. Mean ± SD. **e.** GTML2 cells were then treated in vitro with 5-Azacytidine (demethylation), cisplatin (alkylation), or combination treatment over 3 days. Independent treatments saw a reduction in cell viability and proliferation. n = 3 for each treatment data from immunostainings (**a-c**) and treatments (**d-e**) was verified from at least 2 biological replicates.



## Supplementary Fig. 7. MYC-driven MB-like tumors are more sensitive to HSP90 inhibition as compared to MYCN-driven MB-like tumors.

**a.** GTML2 cells treated with Onalespib, cisplatin or combination treatment over 3 days. Independent treatments reduced cell viability. Combinatorial treatment was non-significant nor synergistic n = 3 for each treatment variable. Mean  $\pm$  SD. **b.** GMYC1 cells treated with Onalespib, cisplatin, or combination treatment over 3 days. Independent treatments reduced cell viability. n = 3 for each treatment variable. Mean  $\pm$  SD.

**c.** Synergism scores and combinatorial index (CI) from GMYC1 cells treated with Onalespib ( $0.1\mu$ M) and varying conc. of cisplatin over 3 days. The combinatorial treatment had a synergistic effect on these cells. n = 3 for each treatment variable. Mean ± SD.

**d.** GMYC/TetGFP/Luc cells injected into the cerebellum of immunocompetent mice, which underwent a daily regimen of 2 Gy irradiation for 5 days or received I.P. injections of vehicle (2-hydroxypropyl-β-cyclodextrin). Irradiation increased overall survival but was not significant (p=0.0536). Log-rank Mantel-Cox statistical test.

**e.** GMYC/ARFKO cells injected into the cerebellum of immunocompetent mice, which underwent daily I.P. injections of 20 mg/kg of Onalespib or vehicle (2-hydroxypropy-β-cyclodextrin) for 4 days. Onalespib treatment did not significantly increase survival (p=0.7857). Log-rank Mantel-Cox statistical test.

**f-g.** RNA expression data of GMYC1 and GTML2 cells treated with high-dose Onalespib over 6 hours. *p21* expression increased in GMYC1 cells as compared to GTML2 cells, indicative of HSP90 inhibitory treatment and subsequent effects on MDM2 pathway. DMSO 6hr n = 3. Onalespib 6hr n = 3. Scatter dot plot presented as mean values +/- SD. **h-k.** GSEA analysis of GMYC1 and GTML2 cells (treated with Onalespib, DMSO or with Arf ko) with enrichment of the REACTOME\_REGULATION\_OF\_HSF1\_MEDIATED\_HEAT\_SHOCK\_RESPONSE gene set. Enrichments were considered significant if FDR < 0.05.

I. Overview of the distinct tumor development from Glt1-positive brain cells in this model system. While MYC and MYCN both generate photoreceptor-positive brain tumors, MYC generates MB-like tumors that are sensitive to HSP90 inhibition. MYC-driven tumors show significantly lower ARF expression compared to MYCN-driven tumors. MYC or MYCN in combination with ARF depletion promotes formation of photoreceptor-negative pediatric HGG (pHGG)-like tumors that show less prominent MYC pathway dependency and less sensitivity to HSP90 inhibitors. Figure was partly created with BioRender.com.

All experimental data from treatments (a-c) was verified in at least two independent biological replicates.

### Supplementary Table 1. Trp53 mutations found after sequencing of 24 GMYC and 12 GTML tumor biopsies.

Sequencing results for evaluation of mutational status of *Trp53* in GMYC and GTML tumors.

							Annotation		Gene			Transcript					CDS.pos			Variant	
Sample	Model	#CHROM	POS	REF	ALT	Annotation	Impact	Multplicity	Name	Gene_ID	Feature_ID	BioType	Rank	HGVS.c	HGVS.p	/length	/length	/length	depth	depth 1	freq
Sample-5_S5	GMYC	chr11	69589629	G	С	missense_variant	MODERATE	1	Trp53	ENSMUSG0000059552	ENSMUST00000108658.9	protein_coding	8/11	c.830G>C	p.Arg277Thr	987/1771	830/1173	277/390	167	49	29,34%
Sample-9_S9	GMYC	chr11	69588362	A		splice_acceptor_variant & intron_variant	нідн	1	Trp53	ENSMUSG0000059552	ENSMUST00000108658.9	protein_coding	4/10	c.367-2A>T					107	90	84,11%
Sample-19 S3	GMYC	chr11	69588505	G	А	missense variant	MODERATE	1	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein coding	5/11	c.508G>A	p.Val170Met	665/1771	508/1173	170/390	177	87	49,15%
Sample-21 S5	GMYC	chr11	69588461	G	С	missense variant	MODERATE	3	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein coding	5/11	c.464G>C	p.Arg155Pro	621/1771	464/1173	155/390	163	107	65,64%
Sample-24 S8	GMYC	chr11	69589607	с	т	missense variant	MODERATE	1	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein coding	8/11	c.808C>T	p.Arg270Cys	965/1771	808/1173	270/390	184	152	82,61%
Sample-25 S9	GMYC	chr11	69588393	с	G	missense variant	MODERATE	3			ENSMUST00000108658.9		-	c.396C>G	p.Cys132Trp		-		-	40	35,09%
Sample-26_S10	GMYC	chr11	69589608	G	т	missense variant	MODERATE	1	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein coding	8/11	c.809G>T	p.Arg270Leu	-			-	92	46,70%
Sample-27_S11			69589608			missense variant	MODERATE	1	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein coding	8/11	c.809G>A	p.Arg270His		-		-	89	60,14%
Sample-27 S11		chr11	69589635	G	A	missense variant	MODERATE	1	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein coding	8/11	c.836G>A	p.Arg279His				164	54	32,93%
Sample-28 S12	GMYC	chr11	69588382	A	G	missense variant	MODERATE	1	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein coding	5/11	c.385A>G	p.Lys129Glu	542/1771	385/1173	129/390	106	94	88,68%
Sample-31_S15	GMYC	chr11	69589210	С	т	missense variant	MODERATE	1	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein coding	7/11	c.733C>T	p.Arg245Cys	890/1771	733/1173	245/390	129	109	84,50%
Sample-37 S21	GTML	chr11	69588461	G	С	missense variant	MODERATE	3	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein coding	5/11	c.464G>C	p.Arg155Pro	621/1771	464/1173	155/390	188	96	51,06%
Sample-40 S24	GTML	chr11	69588512	G	A	missense variant	MODERATE	2	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein coding	5/11	c.515G>A	p.Arg172His	672/1771	515/1173	172/390	168	138	82,14%
Sample-40_S24	GTML	chr11	69588393	С	G	missense_variant	MODERATE	3	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein_coding	5/11	c.396C>G	p.Cys132Trp	553/1771	396/1173	132/390	144	17	11,81%
Sample-42 S26	GTML	chr11	69588461	G	С	missense variant	MODERATE	3	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein coding	5/11	c.464G>C	p.Arg155Pro	621/1771	464/1173	155/390	210	86	40,95%
Sample-44_S28	GTML	chr11	69588463	G	С	missense_variant	MODERATE	1	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein_coding	5/11	c.466G>C	p.Ala156Pro	623/1771	466/1173	156/390	159	88	55,35%
Sample-44_S28	GTML	chr11	69588393	С	G	 missense_variant	MODERATE	3	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein_coding	5/11	c.396C>G	p.Cys132Trp	553/1771	396/1173	132/390	106	33	31,13%
Sample-47_S31		chr11	69588512	G	А	missense_variant	MODERATE	2	Trp53	ENSMUSG00000059552	ENSMUST00000108658.9	protein_coding	5/11	c.515G>A	p.Arg172His	672/1771	515/1173	172/390	121	32	26,45%

Supplementary Table 2. Gene set enrichment analysis in GMYC1 and GTML2 cells after HSP90 inhibit							
Significantly enriched in GMYC1 cells after 6h Onalespib treatment $^{\star}$	NES	FDR q-val**	SIZE				
REACTOME_COMPLEMENT_CASCADE	2,2338	0,0000	20				
KRIGE_AMINO_ACID_DEPRIVATION	2,1623	0,0023	22				
CONCANNON_APOPTOSIS_BY_EPOXOMICIN_UP	2,1341	0,0023	207				
ZHAN_MULTIPLE_MYELOMA_CD1_UP	2,1258	0,0018	39				
SU_KIDNEY	2,1201	0,0014	15				
HELLER_SILENCED_BY_METHYLATION_DN	2,1147	0,0016	85				
NIELSEN_SYNOVIAL_SARCOMA_DN	2,0916	0,0027	17				
KUROZUMI_RESPONSE_TO_ONCOCYTIC_VIRUS	2,0901	0,0025	40				
DELPUECH_FOXO3_TARGETS_DN	2,0864	0,0027	32				
VANASSE_BCL2_TARGETS_UP	2,0830	0,0027	30				
DAUER_STAT3_TARGETS_DN	2,0487	0,0047	37				
GO_POSITIVE_REGULATION_OF_INTERLEUKIN_8_PRODUCTION	2,0406	0,0048	41				
KEGG_COMPLEMENT_AND_COAGULATION_CASCADES	2,0287	0,0057	56				
GO_REGULATION_OF_INTERLEUKIN_8_PRODUCTION	2,0181	0,0065	55				
WANG_NEOPLASTIC_TRANSFORMATION_BY_CCND1_MYC	2,0121	0,0067	20				
GAUSSMANN_MLL_AF4_FUSION_TARGETS_F_DN	2,0083	0,0069	30				
WENG_POR_TARGETS_LIVER_DN	1,9849	0,0097	19				
GO_MONOCYTE_CHEMOTAXIS	1,9845	0,0094	24				
GO_NEUTRAL_AMINO_ACID_TRANSPORT	1,9823	0,0099	33				
GO_CELLULAR_RESPONSE_TO_HEAT	1,9763	0,0102	30				
YORDY_RECIPROCAL_REGULATION_BY_ETS1_AND_SP100_DN	1,9532	0,0120	63				
GO_L_AMINO_ACID_TRANSPORT	1,9451	0,0138	56				
GO_NEURONAL_ACTION_POTENTIAL	1,9374	0,0149	27				
GO_CALCIUM_ION_IMPORT	1,9275	0,0164	60				
GO_MULTICELLULAR_ORGANISMAL_SIGNALING	1,9260	0,0165	119				
REACTOME_CHEMOKINE_RECEPTORS_BIND_CHEMOKINES	1,9027	0,0228	33				
MIKKELSEN_IPS_ICP_WITH_H3K4ME3_AND_H327ME3	1,9024	0,0222	106				
SHIN_B_CELL_LYMPHOMA_CLUSTER_5	1,8859	0,0275	16				
MENSSEN_MYC_TARGETS	1,8820	0,0282	45				
MIKKELSEN_MEF_LCP_WITH_H3K27ME3	1,8755	0,0299	58				
NIKOLSKY_BREAST_CANCER_1Q21_AMPLICON	1,8625	0,0352	35				
REACTOME_ACTIVATION_OF_GENES_BY_ATF4	1,8594	0,0360	22				
CUI_TCF21_TARGETS_DN	1,8592	0,0352	25				
KEGG_AUTOIMMUNE_THYROID_DISEASE	1,8568	0,0353	25				
HANN_RESISTANCE_TO_BCL2_INHIBITOR_DN	1,8546	0,0353	44				
ODONNELL_TARGETS_OF_MYC_AND_TFRC_UP	1,8514	0,0364	63				
REACTOME_AMINO_ACID_TRANSPORT_ACROSS_THE_PLASMA_MEMBRANE	1,8506	0,0359	29				
GAUSSMANN_MLL_AF4_FUSION_TARGETS_D_UP	1,8478	0,0362	34				
KEGG_INTESTINAL_IMMUNE_NETWORK_FOR_IGA_PRODUCTION	1,8404	0,0394	30				
VECCHI_GASTRIC_CANCER_EARLY_DN	1,8397	0,0388	287				
GO_ACTION_POTENTIAL	1,8331	0,0412	89				
GO_CHAPERONE_MEDIATED_PROTEIN_FOLDING	1,8238	0,0459	44				
GAJATE_RESPONSE_TO_TRABECTEDIN_UP	1,8187	0,0473	54				
GO_REGULATION_OF_CELLULAR_RESPONSE_TO_HEAT	1,8158	0,0484	69				
GO_MEMBRANE_DEPOLARIZATION_DURING_ACTION_POTENTIAL	1,8149	0,0480	38				
HUMMERICH_MALIGNANT_SKIN_TUMOR_DN	1,8147	0,0470	15				
GO_CALCIUM_ION_IMPORT_INTO_CYTOSOL	1,8134	0,0469	40				
LEI_HOXC8_TARGETS_DN	1,8070	0,0499	15				

Significantly enriched in GTML2 cells after 6h Onalespib treatment							
ZHAN_MULTIPLE_MYELOMA_CD1_VS_CD2_UP	2,2033	0,0000	55				
REACTOME_OLFACTORY_SIGNALING_PATHWAY	2,0985	0,0018	176				
TIEN_INTESTINE_PROBIOTICS_24HR_DN	2,0950	0,0012	188				
KEGG_ANTIGEN_PROCESSING_AND_PRESENTATION	2,0723	0,0018	44				
KRIGE_AMINO_ACID_DEPRIVATION	2,0167	0,0055	22				
NIELSEN_SCHWANNOMA_UP	1,9763	0,0110	16				
GO_RESPONSE_TO_TOPOLOGICALLY_INCORRECT_PROTEIN	1,9567	0,0151	142				
ZHAN_MULTIPLE_MYELOMA_CD1_UP	1,9479	0,0156	39				
GO_ENDOPLASMIC_RETICULUM_TO_CYTOSOL_TRANSPORT	1,9162	0,0236	20				
GROSS_HYPOXIA_VIA_ELK3_ONLY_UP	1,9076	0,0253	28				
WU_ALZHEIMER_DISEASE_DN	1,9014	0,0258	16				
PACHER_TARGETS_OF_IGF1_AND_IGF2_UP	1,8786	0,0343	33				
GO_PROTEIN_REFOLDING	1,8762	0,0332	18				
GO_RESPONSE_TO_PH	1,8742	0,0322	36				
HALLMARK_UNFOLDED_PROTEIN_RESPONSE	1,8650	0,0355	100				
SHIN_B_CELL_LYMPHOMA_CLUSTER_5	1,8637	0,0341	16				
REACTOME_AMINO_ACID_TRANSPORT_ACROSS_THE_PLASMA_MEMBRANE 1,8529 0,0391 29							

\*Significantly enriched publically available gene sets in GMYC1 or GTML2 cells after 6 hours of Onalespib treatment from AmpliSeq RNA sequencing analysis. \*\*Cut off FDR q-val<0,05.