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Supplementary Materials for

ATAC-seq identifies thousands of extrachromosomal circular DNA in cancer and cell lines

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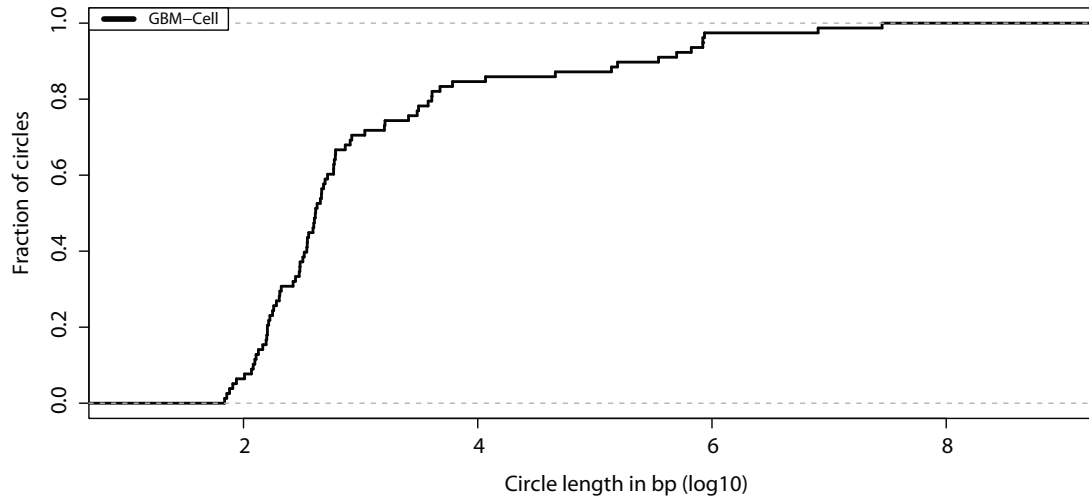
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Supplementary Materials

The number of ATAC-seq libraries analyzed in this study for various tumor type as follow: ACC **8**; BLCA **10**; BRCA **70**; CESC **3**; CHOL **1**; COAD **38**; ESCA **17**; GBM **8**; HNSC **9**; KIRC **15**; KIRP **29**; LGG **10**; LIHC **15**; LUAD **21**; LUSC **12**; MESO **5**; PCPG **9**; PRAD **21**; SKCM **9**; STAD **19**; TGCT **8**; THCA **12**; UCEC **10**.

A

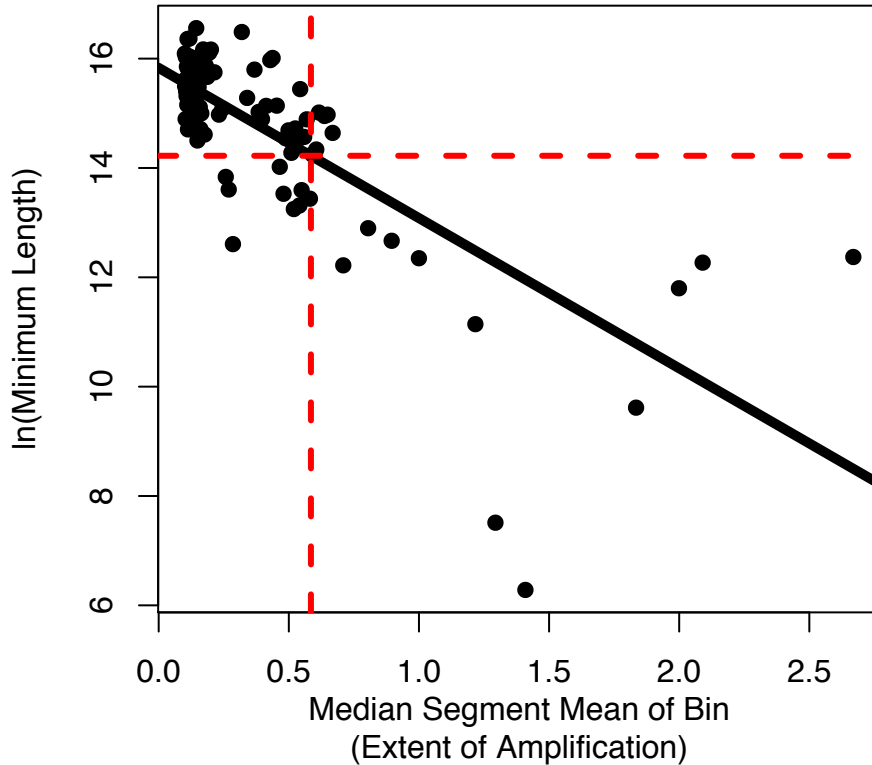


B



eccDNA distribution on various chromosomes

Supplementary Figure 1: eccDNA in GBM cell lines. (A) Length distribution of identified eccDNA in GBM cell lines. **(B)** Karyotype plot showing chromosomal distribution of eccDNA identified in GBM cell lines.



Supplementary Figure 2: Copy number analysis limitation with TCGA array

data. In general, genotyping arrays will fail to identify amplifications caused by the circular DNAs detected in our analysis. The minimum detectable segment length (y-axis) is partially dependent on the extent of amplification (x-axis). Assuming that one copy of a circular DNA is present in every cell of a patient's tumor, the segment mean would be 0.585 and the minimum detectable length would therefore be approximately 1.5 MB. Given that the average length of the circular DNAs detected in this analysis was 2KB, the circular DNAs detected in this analysis would not show up as amplifications when genotyping array data is analyzed.

Supplementary Table 1: Summary of eccDNA sequencing and mapping to the human genome in C4-2 & OVCAR8 cell lines.

	C4-2	OVCAR8
Total PE150 reads	374,931,197	346,833,854
Mapped in pairs	372,561,742	345,127,010
Mapped-Reads	373,585,003	343,541,464
Un-Mapped-Reads	1346194	1,706,844
#eccDNA	1,335	611

Supplementary Table 2A: Common eccDNA between WGS & ATACseq libraries in TCGA-DU-5870-02A

	JT-ATAC	JT-WGS	Length
chr12:8208854-8238302	1	13	29448
chr13:42373132-42373518	1	12	386
chr14:56200142-56200312	2	4	170
chr14:99811139-99811333	2	1	194
chr15:52523965-52524853	1	16	888
chr1:60822423-60822666	1	7	243
chr16:69820782-69825118	3	15	4336
chr17:80024303-80024653	1	11	350
chr18:79200703-79200779	1	2	76
chr19:17722272-17722449	1	3	177
chr2:110101070-110104430	1	14	3360
chr22:49226585-49228448	2	11	1863
chr3:42898790-46004380	1	1	3105590
chr4:150242941-150244988	7	15	2047
chr4:156660547-156660686	1	1	139
chr6:167516501-167516632	1	1	131
chr6:54059859-54063911	2	19	4052
chr7:24028695-24028902	1	3	207
chr7:47669120-47669934	1	10	814
chr7:65038315-65873352	3	3	835037
chr9:14692642-14692781	1	1	139

Supplementary Table 2B: Common eccDNA between WGS & ATACseq libraries in TCGA-DU-5870-02A

	JT-ATAC	JT-WGS	Length
chr10:95447028-95448268	1	7	1240
chr11:28824878-36215494	1	16	7390616
chr11:29133708-29430833	1	4	297125
chr11:31877072-36188811	3	13	4311739
chr11:36202059-36238115	2	28	36056
chr11:36214300-36237662	1	9	23362
chr11:36412110-36417948	2	13	5838
chr11:36412110-36417951	2	13	5841
chr1:14109813-14112070	1	1	2257
chr13:113232110-113232386	1	1	276
chr13:35957905-35958285	1	3	380
chr13:42373132-42373518	1	15	386
chr13:76789088-76789267	1	1	179
chr14:100526783-100526942	1	1	159
chr1:56530360-56530674	1	2	314
chr15:91440230-91446387	1	13	6157
chr17:41632757-41633279	1	1	522
chr17:80024303-80024653	1	1	350
chr20:2236337-2236458	2	19	121
chr2:11554-91086	1	10	79532
chr2:16052063-16452027	1	9	399964
chr2:16177696-17516120	6	157	1338424
chr2:16225124-16226720	8	195	1596
chr2:16567034-17412029	1	1	844995
chr2:16632426-17084537	1	13	452111
chr2:16741536-17706105	2	56	964569
chr2:17279980-17334701	7	15	54721
chr2:17296668-17297551	3	14	883
chr2:17584356-17877776	2	18	293420
chr22:27805472-27805771	3	2	299
chr2:63459820-63461139	1	6	1319
chr3:5565190-5565271	1	1	81
chr3:95749272-95752156	1	9	2884
chr4:52081945-52082092	1	1	147
chr5:168031041-168034576	3	5	3535
chr6:118690555-118692765	1	6	2210
chr6:118940825-118941155	1	19	330
chr6:54059859-54063911	1	9	4052

chr7:116674913-121917354	10	44	5242441
chr7:482867-483641	1	11	774
chr7:76498793-76998017	2	1	499224
chr8:145036620-145051835	1	15	15215
chrX:105007860-105008004	1	1	144
chrY:10945178-11295108	2	11	349930