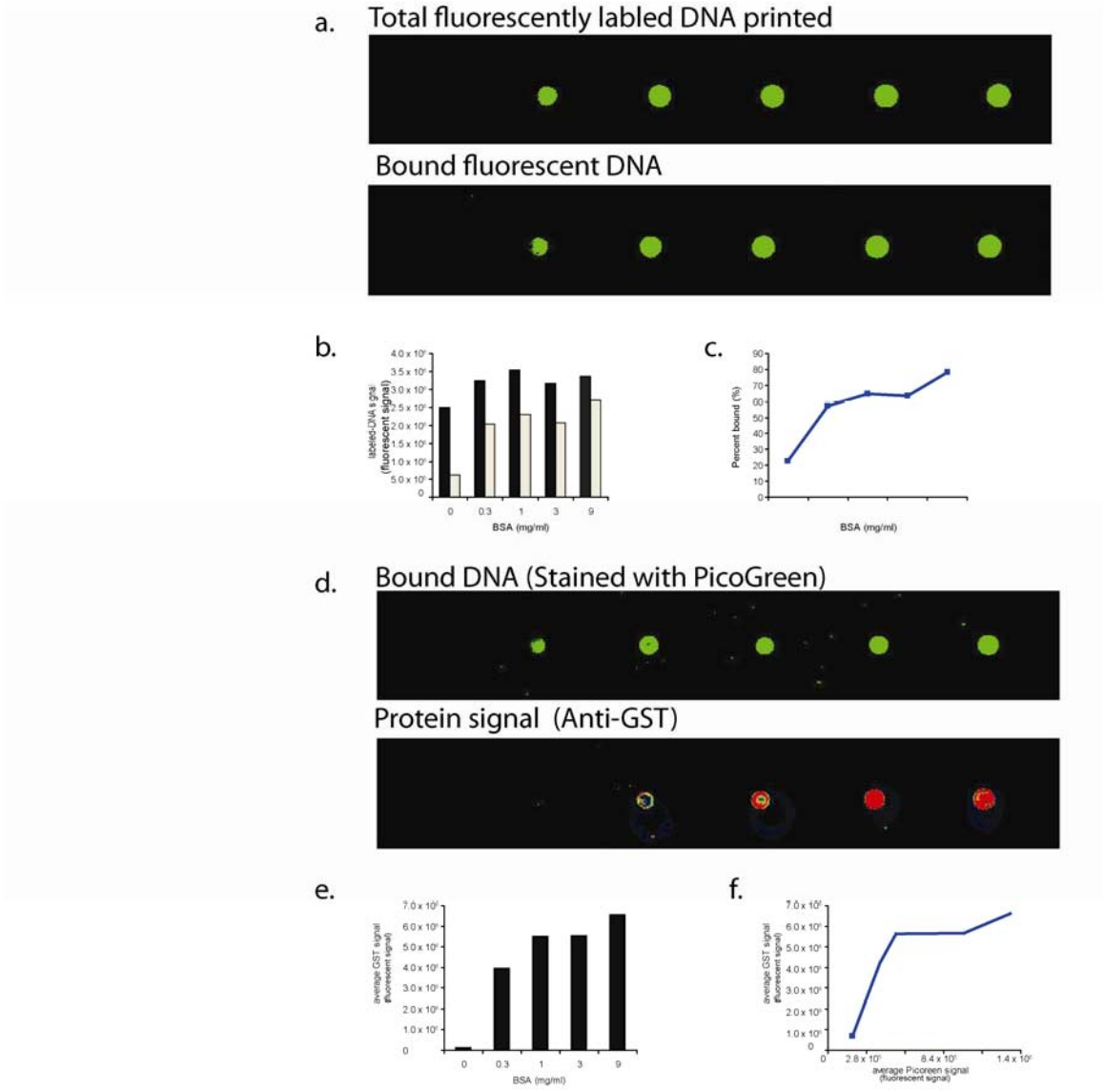
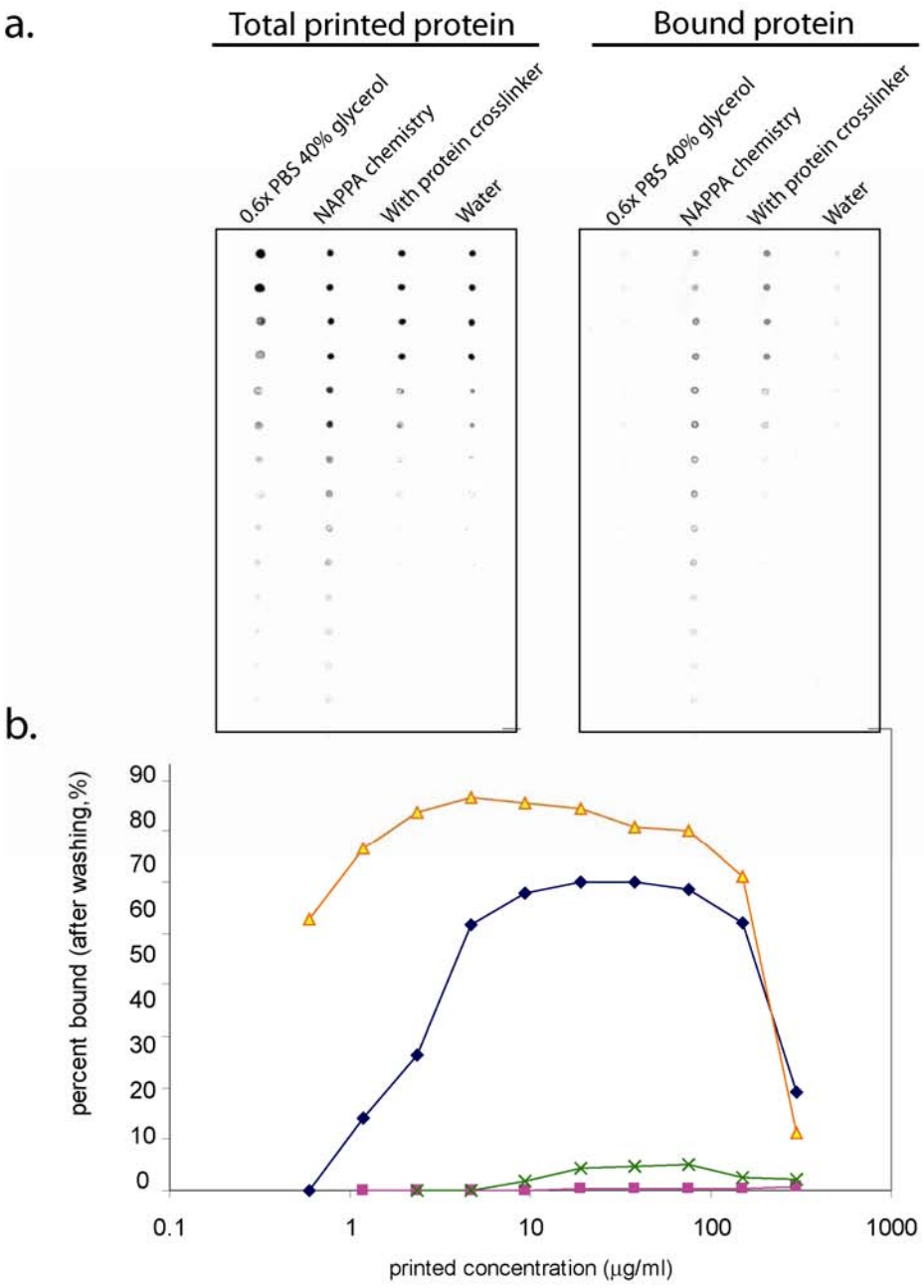
Supplementary figure 1 Optimization of DNA Binding



Supplementary figure 1. Optimization of DNA Binding. (**a**) To estimate the amount of DNA captured onto the array surface, 30 µg of plasmid DNA was incubated with 20 µL of PicoGreen dye. The DNA was precipitated and washed with 80% ethanol to remove unincorporated PicoGreen dye. DNA was dissolved to a final concentration of 1.5 µg/µL and supplemented with the capture antibody (final 50 µg/mL), protein crosslinker (final 2 mM) and varying concentrations of BSA (0-9 mg/mL). The sample was printed onto amine coated glass slides,

and the printed samples were imaged. The slides were washed with 1xPBS for 1 hr at RT and the slides were imaged again to measure the bound fraction. (**b**) Total fluorescent DNA is indicated by black bar and bound DNA is indcated by the grey bar. (**c**) Amount of protein signal obtained with respect to the amount of DNA printed**.** (**d**) Sample containing unlabelled DNA (final 1.5 µg/µL), capture antibody (final 50 µg/mL), protein crosslinker (final 2 mM) and varying concentrations of BSA (09 mg/mL) were printed on to the amino coated array surface. The arrays were stained with PicoGreen dye to measure the DNA bound. To detect protein signal, the arrays were activated with the cell free lysate and stained with anti-GST antibody. The colors ranging from black, blue, green, yellow, to red represent low to high signal, respectively. (**e**) Amount of protein signal attained with increasing amounts of BSA. (**f**) Amount of protein signal obtained with respect to the amount of DNA bound**.**

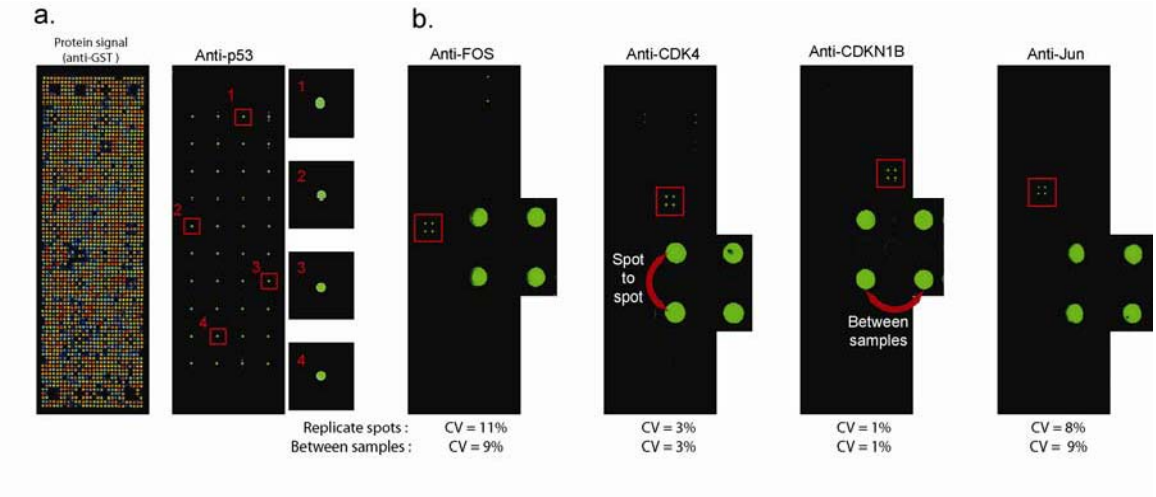
Supplementary figure 2 Purified protein spotting



Supplementary Figure 2. Purified protein spotting. (**a**) Purified Cy5 labeled anti-mouse antibody was printed at various concentrations (0-300 µg/mL) in four different buffers: 0.6x PBS with 40% glycerol; NAPPA chemistry (BSA (3 mg/mL), crosslinker (2 mM)); crosslinker only (2

mM); and water. The arrays were imaged to determine total signal from the printed protein and then washed in 1x PBS for 1 hour and re-imaged to determine signal from the bound protein. (**b**) The binding efficiency of the protein under various spotting conditions was determined by dividing the bound signal by the total signal.

Supplementary figure 3 Signal variation



Supplementary Figure 3. Signal variation**.** (**a**) To assess the zone variation due to array processing, a single sample preparation of the *p53* gene was aliquoted into multiple wells and printed throughout the high density array (left panel) in a 4 x 10 pattern. The *p53* protein signal from all 40 *p53* features was detected using an anti-*p53* antibody (CV for 40 spots = 7%). Crosstalk of the p53 signal into the neighboring spots was evaluated by comparing the signal intensity of the spots surrounding the *p53* against a group of spots that were at least 4 spots or 2572 microns away from the nearest *p53* signal. The average signal neighboring *p53* was 1.9% of the *p53* signal (compared with 0.7% for control features). (**b**) To assess the variation in sample preparation prior to printing, we independently processed duplicate samples for 48 genes. The samples were printed and their protein signal was measured using protein specific antibodies when available. Between sample CV was calculated based on the 4 spots (duplicates of the two independently processed samples).

Supplementary Methods

Expression plasmids were transformed into *E.coli* DH5alpha and grown overnight at 37°C in 1.5 mL terrific broth and ampicillin (100 μg/mL). Cultures were pelleted by centrifugation at 5000 rcf for 15 mins. DNA was purified using the NucleoPrepII anion exchange resin (Macherey Nagel). Bacterial pellets were resuspended by vortex in 200 μL Buffer 1 (50 mM tris, 10 mM EDTA, 100 μg/mL RNAse A). Cells were lysed by adding 200 μL Buffer 2 (200 mM NaOH, 1% SDS), mixing by block inversion and incubating for 5mins. The preparation was neutralized by adding 200 μL Buffer 3 (2.8 M KOAc, pH to 5.3 with glacial acetic acid) and mixing by block inversion. The resulting lysate from the alkaline lysis preparation was cleared by centrifugation at 5000 rcf for 15 mins. The supernatant was loaded directly onto 80 mg of equilibrated (Buffer N2: 100 mM tris, 900 mM KCl, 15% EtOH, 0.15% Triton X-100, pH to 6.3 with phosphoric acid) NucleoPrep II anion exchange resin using a Biomek FX (Beckman Coulter) automated laboratory workstation. The column was washed with 2 mL of wash Buffer N3 (100 mM tris, 1.15 M KCl, 15% EtOH, pH to 6.3 with phosphoric acid) over vacuum, dried by centrifugation and eluted with 300 μL Elution Buffer N5 (100 mM tris, 1 M KCl, 15% EtOH, pH to 8.5 with phosphoric acid). Automated addition of all solutions was accomplished using a WellMate (Matrix) rapid bulk liquid-dispensing instrument.

Purified DNA was precipitated by addition of 0.6 volumes isopropanol, followed by centrifugation at 5000 rcf for 30 mins. The DNA pellet was washed with 200 μL of 80% ethanol, centrifuged at 5000 rcf for 15 mins and dried. The dried DNA pellet was dissloved in 23 μL printing solution containing 50 ng/μL of capture antibody (Amersham), 3.6 mg/mL bovine serum albumin (Sigma) and 2 mM BS3 (Bis[sulfosuccinimidyl] suberate) (Pierce). The

printing solution was transferred to a 384-well printing plate (Genetix) and arrayed onto aminosilane coated glass slides. The printing was performed using a Genetix QArray2 with 300 μm solid tungsten pins and the slides were stored dry at room temperature.

The slides were blocked in Superblock (Pierce) for 1 hour at room temperature, rinsed with double deionized water, and dried using house air. An incubation chamber (Grace Bio.) was applied to the array surface and ~130 μL of the cell-free transcription and translation mix (T7-TNT system, Promega) prepared according to manufacturers instructions were added to the slides. The slides were incubated in a chilling oven (Torrey Pines) at 30°C for 1.5 hours and 0.5 hours at 15°C. For protein interactions, the cell free lysate was supplemented with 100-300 ng of query DNA (pANT7_HA,[27]) and incubated in the chilling incubator at 30°C for 1.5 hours and 2 hours at 15°C. Following activation with cell free lysate, the slides were blocked with Blocking Buffer (5% milk in phosphate buffered saline supplemented with 0.2% Tween 20) for 1 hour. For detecting protein expression universally on the array, the slides were incubated with 2 mL of primary monoclonal antibody (10 μg/mL, mouse anti-GST antibody, Cell Signaling Technologies) and a HRP linked secondary antibody (10 μg/mL anti-mouse IgG, Amersham) diluted in Blocking Buffer. For detection of specific proteins, the slides were incubated with 2 mL of primary monoclonal antibody (Santa Cruz mouse anti-p53 (D01), Santa Cruz rabbit anti-c-Jun (N), Cell Signaling rabbit anti-c-Fos, Sigma mouse antiCDK4, Sigma mouse anti-p27-KIP1) diluted 1:200 in Blocking Buffer followed by a HRP linked secondary antibody (Jackson goat anti-mouse IgG, Santa Cruz goat anti-rabbit IgG) diluted 1:500 or 1:200 respectively in Blocking Buffer. The incubation with the detection antibodies was carried out using a hybridization chamber (Corning) mixing for 16 hours with the primary antibody at 4°C and 1

hour at room temperature for the secondary. The slides were rinsed with the Blocking Buffer between the two incubations with the antibodies and finally rinsed with PBS prior to applying the developing solution. The arrays were developed by adding 600 μL of the tyramide signal amplification reagent (Perkin Elmer) for 10 mins using a cover slip (Lifterslips, Erie). The slides were rinsed with de-ionized water, dried using house air and scanned with a ProScanArray HT scanner (PerkinElmer). The array images were quantified using the MicroVigene software, version 2.9.9.2 (VigeneTech).

Human kinase list was assembled by mining gene functional and structural annotations in public databases[13,28]. Human Transcription Factors (TF) were assembled by mining the literature about well-studied TF[29] and the literature of genome-scale TF search by sequence similarity[30]. This list was also supplemented by the TFs identified by mining Gene Ontology and other databases such as Swissprot and Genatlas. TM was predicted using TMHMM[31, 32] and Sosui[33].

Supplementary Protocols

1. DNA Minipreps

Material/Equipment	**Amount for one 96-well block**
TB culture medium (KPI+Ampicillin)	1.5 mL
96-pin device (Boekel 140500)	1
Solution 1	200 uL/well
Solution 2	200 uL/well
Solution 3	200 uL/well
Isopropanol	600 uL/well
Solution N2	200 uL/well
Solution N3	2000 uL/well
Solution N5	300 uL/well
800 uL glass fiber MBPP 25 micron filter plate (Whatman 13503-040)	1
Deep-well block	2
Gas permeable plate seal	1
Aluminum plate seal	2
ATR Multitron shaker (37oC)	1
Centrifuge, Eppendorf 5810	1
Eppendorf Thermomixer	1
Omni plate (Nunc 242811)	
LB	
Agar	
Sorvall RC12 centrifuge	
Sorvall Legend RT centrifuge	
350 uL 96-well plate (Greiner 651201) for alkaline lysis DNA prep	
800 uL 96-well block (Abgene AB-0859) for Nucleobond prep	
Nucleobond resin (Machery-Nagel custom order)	

1) Antibiotic concentrations – Ampicillin (100ug/ml), Chloramphenicol (34 ug/ml), Kanamycin (50ug/ml).

2) Create an overnight culture using either LB/Agar or LB liquid cultures.

LB/Agar culture

a. Spot 3ul from the glycerol stock onto a pre-warmed agar plate. Incubate overnight at 37°C.

b. Sterilize the 96-pin device using 80% ethanol and a flame. Let it cool. Inoculate the blocks (1.5mL of TB) and culture at 37°C with vigorous shaking for 24-26 hours.

3)**Pellet cultures.** Spin blocks for 15 min at 4000rpm /5300 rcf on the Sorvall RC12 centrifuge. After spinning, decant the media from each block into a large bucket or beaker. Blot the decanted blocks, upside-down, on paper-towels spread on the bench-top to remove excess media. Seal each block using an aluminum plate seal and store the blocks at –20°C until needed for DNA purification. The decanted media should be bleached at a final concentration of 5% bleach for 20-30 mins in the fume hood before being discarded.

4) Prepare solutions 1, 2, and 3 according to the following recipes (also available at the end):

Soln 1: TE Resuspension Buffer
50 mM Tris pH 8.0 10 mM EDTA (8.0)
0.1 mg/mL RNAse (2ml of Sigma RNAse/1L of solution 1)
Store at 4°C

Soln 2: NaOH/SDS Lysis Buffer
0.2 M NaOH
1% SDS

Soln 3: KOAC Neutralization Buffer
2.8 M KOAc
Glacial Acetic Acid: added until pH is 5.1
Store at 4°C

5)**Add 200 uL of soln 1** and resuspend by vortexing vigorously. Make sure that no wells contain clumps of bacteria as they will result in low plasmid yield. If unable to disperse by vortexing, then pipette using a P1000.

6)**Add 200 uL of soln 2**, seal the plate with an aluminum seal and gently mix the plate by inverting 4 or 5 times. Carefully time this step from the beginning of soln 2 addition so as not to exceed 5 minutes. Do not shake the plate vigorously as this will result in the undesired shearing of bacterial genomic DNA.

7)**Add 200uL of soln 3**, seal the plate with an aluminum seal and mix the plate by inverting 4 or 5 times. The seal will be loose due to the lysis/neutralization buffers so use caution when inverting.

8)**Spin the block for 20 minutes at 4000rpm/5300 rcf** on the Sorvall RC12 centrifuge to pellet the lysate.

For Nucleobond anion exchange DNA preparation

9) Prepare solutions N2, N3, and N5 according to the following recipes (also available at end of protocol):

Soln N2: Equilibration Buffer

100 mM Tris 15% EtOH 900 mM KCl 0.15% Triton X-100 Phosphoric Acid: added until pH is 6.3

*To prepare **anion exchange slurry**, add 200ml of N2 buffer to every 100ml of beads.*

Soln N3: Wash Buffer

100 mM Tris 15% EtOH
1.15 M KCl
Phosphoric Acid: added until pH is 6.3

Soln N5: Elution Buffer

100 mM Tris 15% EtOH 1 M KCl Phosphoric Acid: added until pH is 8.5

10) **Prepare anion exchange resin plate**. Transfer 400ul of the slurry into each well 25 um Whatman MBPP filter plate. When done, centrifuge at 500 rpm for 5 minutes using the table-top centrifuges.

11) **Transfer lysate supernatant to the resin plate**

12) **Spin the stacked plates for 10 mins at 300 rpm**.

13) **Wash column step**. Place stack plate onto the WellMate and add **500 uL of wash buffer N3** to each well. Alternatively, a 1 mL multi-channel pipette may be used to add the wash buffer. Transfer the resin plate to vacuum manifold to remove wash buffer**. Repeat wash steps 4x**. On the last wash make sure all wells are properly emptied. **Spin the stack plate at 500rpm/750 rcf for 3 mins** using any centrifuge to remove residual wash buffer.

14) **Elution**. Place resin plate onto a clean 800 uL collection plate. Place the stacked plates onto the WellMate and add **300 uL of elution buffer N5** to each well. Alternatively, a 1 mL multi-channel pipette may be used to add the elution buffer. Let **sit at RT for ~30 minutes** then **spin the stacked plates for 10 mins at 300 rpm, then 2 mins at 1000 rpm**.

15) Quantitate DNA using UV or fluorescence.

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2. Aminosilane slide coating

Material/Equipment	**Amount (for 30 slides)**
Glass slides (VWR 48300-047)	30
Acetone 99.9%	300 mL
Aminosilane (Pierce 80370)	6 mL
Metal 30-slide rack (Wheaton 900234) with no handles	1
Glass box (Wheaton 900201)	1
Lock & Lock 1.5 cup boxes (ZHPL810)	1
Rocking shaker	

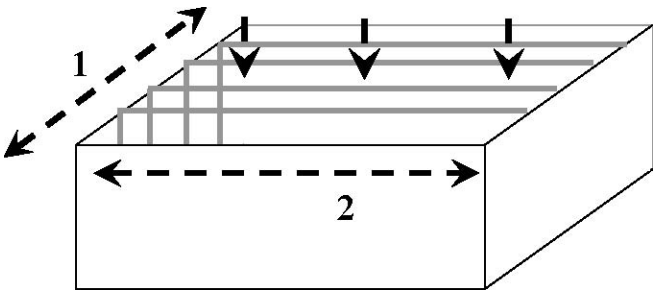
1) Put 30 slides in each metal rack (remember to fill one extra rack).

2) Prepare 300 mL of 2% aminosilane coating solution in glass troughs and cover with saran wrap (6 mL aminosilane in 300 mL acetone – use plastic pipette for silane). *This solution can be used 3-4 times.*

3) Treat glass slides in aminosilane coating solution for 15 minutes. Rinse off with acetone in another trough, and then dip in a third trough containing distilled water.

4) Dry with filtered compressed air in chemical hood. *Drying pattern as depicted below:*

3 3 3



1 Longitudinal, along slides
2 Along the width of the slides
3 Down the edges of the slides

5) Store at room temperature in rack in Lock & Lock box. Use within one week.

3. Array printing

Material/Equipment	**Amount/well**
Plasmid DNA (from NAPPA DNA prep protocol)	
Sodium acetate (3M, pH 5.5)	
Isopropanol	
Ethanol	
384 well plate for arraying, Genetix x7020	
Polyclonal anti-GST antibody (GE Healthcare/Amersham 27457701)	
Polyclonal anti-FLAG antibody (Sigma F7425)	
BS_3 Linker (Pierce 21580)	
Purified GST protein (Sigma G5663)/Flag protein ()	
Whole mouse IgG antibody (Pierce 31204)	
Centrifuge, Eppendorf 5810	
QArray2	
Silica packets (VWR 100489-246)	
Genetix Bioassay dish dividers (x6026 divider only; x6027 with dish)	
Corning deep bioassay dish (431111)	
WellMate	
Eppendorf Thermomixer	

1) Take out the DNA plates to be printed from the -20°C freezer and allow them to come to room temperature.

2) Precipitate the DNA by **adding 200 uL of isopropanol to each well**. Cover the plate with an aluminum seal and mix by inverting a few times.

3) **Centrifuge at 4000rpm for 30 minutes**. Discard the supernatant.

4) **Add 400-500 uL of 75% ethanol to each well** using WellMate.

5) Centrifuge at 4000rpm for 15 mins at 20°C. Discard the supernatant.

6) Dry the plate, uncovered for 10-15 mins. You should not see any alcohol at bottom of well. Seal and centrifuge at 1000 rpm for 2 minutes to bring any pellets down.

Array sample preparation:

7) **Prepare master mix**. For one 96-well plate prepare approximately 3 mL of master mix. Master mix contains polyclonal antibody (final: 1:100 dilution or 50 ug/mL), BSA (final: 3.6 mg/mL) and BS^3 linker (final: 1.25 mg/mL or 2 mM).

For GST arrays:

Number of 96 well plates	1	4	8	24
Volume needed	3ml	10ml	20ml	50ml
BSA (66mg/ml)	166.5	555	1110	2775
BS3 linker	75	250	500	1250
anti-GST (5mg/ml)	30	100	200	500
AC mQ H2O	2728.5	9095	18190	45475
Total	3000	10000	20000	50000

8) Transfer 20ul to each well of the dry DNA pellet. Spin down and shake at 200 rpm for 30-60 minutes.

9) **Transfer all 20uL to 384 array plate**.

10) Spin the plate down briefly (1500 rpm for 1 minute – to get rid of bubbles).

11) **Array** *(see below)* using the appropriate array setup and humidity control approximately 60%.

Arrayer Setup

12) If the 384 well plates for printing were frozen, take them out and allow to come to room temperature.

13) **Put blank slides on arrayer, start vacuum and check for no leaks.** If all is good, start humidifier.

14) Spin down your 384 well plates at ~1500rpm for 1 minute. Remove foil and place on arrayer deck so that the A1 position is closest to you – bottom right. Check the parameters of the program, and then start it.

15) **When arraying is done, place slide labels on the bottom** (non-arrayed) side of each slide. Maintain the slides order on the deck in numerical order.

16) **Place the printed slides back in the metal rack**, then place in lock-and-lock boxes along with 1-2 silica packs.

4. Detection of the DNA on NAPPA slides

Material/Equipment	**Amount (for 4 slides)**
PicoGreen (Invitrogen P11495)	
PicoGreen stock solution	33 uL
SuperBlock	50 mL
PBS (pH 7.4)	150 mL
Coverslips, 24 x 60 mm	4
Lifterslips, 24 x 65 mm	4
Rocking shaker	
Scanner, PerkinElmer ProScanArray	

1) Block the slides with SuperBlock on a rocking shaker for 30-60 minutes.

2) If necessary, prepare PicoGreen stock solution: To the 100 uL/vial that comes, add 200 uL TE buffer, then do a 1:600 dilution in SuperBlock (i.e. for 4 slides, add 33 uL PicoGreen stock solution to 20 mL SuperBlock).

3) For a single slide, small array: apply 150 uL PicoGreen mix, and apply coverslip. Let sit for 5 minutes at room temperature. For 4 slides, add 20 mL in a box and shake on rocking shaker for 5 minutes.

4) Wash with 1xPBS (pH 7.4) 3 times, ~ 5 min each. Quickly rinse with Milli-Q water.

5) Dry with filtered compressed air.

6) Scan

5. Expression of the NAPPA slides

Material/Equipment	**Amount (for 3 slides)**
HybriWell gaskets (Grace HBW2160-1LA)	3
Cell free expression system i.e. rabbit reticulocyte lysate (Promega L4610)	1 tube
RNaseOUT (Invitrogen 10777-019)	8 uL
DEPC water (Ambion 9906)	160 uL
SuperBlock (Pierce 37535)	~30 mL
Blocking solution: 5% Milk in PBS with 0.2% Tween20	~120 mL
PBS	
Programmable chilling incubator, with leveling shelves	
Rocking shaker	
Genetix Bioassay dish dividers (x6026 divider only; x6027 with dish)	
Corning deep bioassay dish (431111)	

1) Block slides in 30-50ml Superblock for 30-60 minutes.

2) Pre-heat the incubator to be used for IVT at 30°C.

3)**Rinse with Milli-Q water**. Dry with filtered compressed air.

4)**Apply HybriWell gasket** to each slide (align at the top of the slides). Use the wooden stick to rub the areas where the adhesive is to make sure it is stuck to the slide all around.
Do not press down too hard, otherwise it will be difficult for the retic to go in.

5)**Prepare IVT**. Each slide will require **130 uL of IVT lysate mix**. Each tube after component addition will contain 400 uL of lysate mix. Since the lysate tubes cannot be re-frozen, always try to express slides in batches of some multiple of three.

e.g. 1 tube = 3 slides = 400 uL -16 uL TNT buffer -8 uL T7 polymerase -4 uL of –Met -4 uL of –Leu or –Cys -168 uL of DEPC water -200 uL of reticulocyte lysate

6)**Add IVT mix from the non-label or non-specimen end**. Place the tip against the bottom of the entry port (nearest to the spots) and dispense the IVT quickly into the hybriwell. Gently massage the HybriWell to get the IVT mix to spread down along the slides first then down the center of the slide. When done, wipe the portals dry with gloved hand (not tissue) and apply seal to each portal. Push any bubbles to the edges of the hybriwell.

7)**Place the slides on a bioassay dish** with divider on top of the leveling shelf inside the incubator. Incubate for 1.5 hr at 30°C for protein expression (30 is key; 28 or 32 give reduced yield), followed by 30 min at 15°C for the query protein to bind to the immobilized protein.

8) Remove the HybriWell and rinse twice with PBS.

9)**Immerse each slide in milk immediately**; wash with milk 3 times, 5 minutes each, in a pipette box. Use about 30 mL milk per wash.

10) **Block with milk** on rocking shaker at room temperature for an additional 30-45 minutes.

6. Detection of expression on NAPPA

Material/Equipment	**Amount (for 1 slide)**
Primary AB, mouse anti-GST (Cell Signal #2624)	150 uL of stock solution
Primary AB, mouse anti-HA (12CA5, ordered from DFCI)	150 uL of stock solution
Primary AB, mouse anti-Flag (Sigma #)	
Secondary AB, HRP-conjugated anti-mouse (Amersham NA931)	150 uL of stock solution
Secondary AB, HRP-conjugated anti-mouse (Jackson Lab Cat #515-035-062)	
TSA reagent (PerkinElmer SAT704B001EA)	150 uL of stock solution
Milk (5% Milk in PBS with 0.2% Tween20)	90 mL for 4 slides at once
PBS (pH 7.4)	90 mL for 4 slides at once
Coverslips, 24 x 60 mm (VWR 48393-106)	3
Lifterslips, 24 x 65 mm (Erie 25X65I-2-5251-001-LS)	3
Pipette boxes	1
Scanner, PerkinElmer ProScanArray	

If needed, prepare antibody solutions in 5% milk/PBST:

Antigen (antibody against)	Dilution factor
GST	300
HA	1000
Mouse IgG (secondary)	500

1)**Apply primary AB** (mouse anti-GST, mouse anti-HA or mouse anti-Flag): ***Work quickly but do one slide at a time.*** Take a slide out of the milk block and tap against a paper towel to get rid of excess milk. Add 600 uL of the primary antibody and **incubate for 1 hr at RT; wash 3x 5 minutes with milk on a rocking shaker**.

2)**Apply secondary AB**: ***Work quickly but do one slide at a time.*** Take a slide out of the milk block and tap against a paper towel to get rid of excess milk. Add 600 uL of the secondary antibody and **incubate for 1 hr at RT; wash 3x 5 minutes with PBS on a rocking shaker**.

3)**Dilute the appropriate amount of 50x TSA into the diluent.** The dried TSA tube should be resuspended in 150ul DMSO and vortexed vigorously. This is now the 50x TSA. For each slide, you will need 500ul of 1x TSA (so 10ul of 50x TSA and 500ul of diluent).

4)After the last PBS wash, rinse the slides quickly with water and apply 500ul of 1x TSA. Use the lifterslip to spread the TSA across the slide. **Incubate for 10 minutes at room temperature**. Rinse in Milli-Q water; dry with filtered compressed air

5) Scan.

Supplementary Table 1 List of genes printed in figure 2

GeneID	Gene Syml	Reference GI
3884	KRT33B	14602964
3661	IRF3	14424769
7266	DNAJC7	15080123
10458	BAIAP2	15559319
5027	P2RX7	15080308
2264	FGFR4	15080147
5350	PLN	13528956
6158	RPL28	14603451
10775	POP4	13325237
5223	PGAM1	15079725
335	APOA1	13529241
79444	BIRC7	15680240
10807	SDCCAG3	15680299
81488	GRINL1A	16306672
1973	EIF4A1	16307019
10606	PAICS	17939424
10146	G3BP1	13937793
79663	HSPBAP1	15080263
59348	ZNF350	14602837
6890	TAP1	15559425
6613	SUMO2	14250086
56993	TOMM22	14424694
400	ARL1	13937800
9077	DIRAS3	13529193
1511	CTSG	15680216
5082	PDCL	16878028
56941	C3orf37	14603027
11116	FGFR1OP	15080275
59307	SIGIRR	13097794
3597	IL13RA1	14602931
5199	CFP	16041750
5547	PRCP	16306647
27067	STAU2	14249966
10318	TNIP1	15559296
9961	MVP	15990477
54205	CYCS	13529022
8996	NOL3	15215393
598	BCL2L1	17939633
25796	PGLS	15559292
29079	MED4	13528773
4191	MDH2	12804928
23770	FKBP8	14602949
51566	ARMCX3	13528785
64172	OSGEPL1	15080281
55081	IFT57	15080266
92745	SLC38A5	17512591
18	ABAT	15990486
10574	CCT7	17939553

22954	TRIM32	13111962
5098	PCDHGC3	17939497
51728	POLR3K	15080354
6392	SDHD	13528941
200420	LOC20042	15680270
56616	DIABLO	15080296
3113	HLA-DPA1	14602922
2274	FHL2	17939426
112942	CCDC104	14603077
11135	CDC42EP1	14424673
23197	UBXD8	15559283
4885	NPTX2	14602846
948	CD36	14250019
2923	PDIA3	15680172
51477	ISYNA1	17511981
57147	SCYL3	15779206
3630	INS	13528923
4818	NKG7	16041756
51226	COPZ2	16198486
2952	GSTT1	13937910
3001	GZMA	16041722
356	FASLG	17028380
5134	PDCD2	14249982
5984	RFC4	16924322
1797	DOM3Z	14424641
2224	FDPS	14603060
3662	IRF4	16041743
51067	YARS2	15990481
23532	PRAME	15559410
138151	BTBD14A	15990514
10131	TRAP1	17511975
29894	CPSF1	16878040
6230	RPS25	13436421
23479	ISCU	15080287
8766	RAB11A	15426486
962	CD48	16740596
3816	KLK1	13529058
25936	NSL1	13937915
50855	PARD6A	15990483
548596	CKMT1A	12804946
7448	VTN	13477168
1718	DHCR24	13325123
2678	GGT1	19684049
11000	SLC27A3	12804360
7356	SCGB1A1	13325339
7319	UBE2A	14603454
140767	NRSN1	33871592
3068	HDGF	17512034
57048	PLSCR3	15079875
51657	STYXL1	33869206
653145	ANXA8	13325125

10120	ACTR1B	19718809
10449	ACAA2	12804930
9806	SPOCK2	33873301
84527	ZNF559	13623632
3329	HSPD1	12804340
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4796	NFKBIL2	14250635
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5376	PMP22	17512120
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1128	CHRM1	14043504
53371	NUP54	15214834
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5266	PI3	15012094
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2348	FOLR1	12804178
11266	DUSP12	13623373
56944	OLFML3	14602834
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3032	HADHB	17068369
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9136	RRP9	12654556
23636	NUP62	13177792
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4729	NDUFV2	12804450
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57215	THAP11	15082546
3420	IDH3B	12805012
4782	NFIC	15082409
56172	ANKH	15778895
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587	BCAT2	12804896
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9099	USP2	12804194
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3399	ID3	13111878
51645	PPIL1	12804374
7980	TFPI2	13529109
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4060	LUM	13937864
50814	NSDHL	12652968
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79058	ASPSCR1	17511731
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2252	FGF7	15147344
4312	MMP1	15530200
6623	SNCG	15559464
8031	NCOA4	16306752
226	ALDOA	16877048
4102	MAGEA3	16877053
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7163	TPD52	17390256
3486	IGFBP3	17511987
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5468	PPARG	20336230
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6275	S100A4	179916
894	CCND2	179999
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1017	CDK2	180177
4072	TACSTD1	181132
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207	AKT1	190827
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578	BAK1	595923
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8290	HIST3H3	871259
638	BIK	929654
573	BAG1	1143475
11031	RAB31	1388194
4070	TACSTD2	1524102
11200	CHEK2	3982839
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347	APOD	4502162
8823	FGF16	4503690
2574	GAGE2	4503878
2576	GAGE4	4503882
3606	IL18	4504652
5155	PDGFB	4505680
7031	TFF1	4507450
2697	GJA1	4755136
388	RHOB	4757763
9077	DIRAS3	4757771
2255	FGF10	4758359
389	RHOC	4885066
3265	HRAS	4885424
3939	LDHA	5031856
5915	RARB	5616236
10000	AKT3	5804885
813	CALU	6005991
5245	PHB	6031190
2353	FOS	6552332
5947	RBP1	8400726
1027	CDKN1B	9652559
8519	IFITM1	12654158
2810	SFN	12803037
4700	NDUFA6	12803858

8900	CCNA1
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9133	CCNB2
7157	TP53
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595	CCND1
5111	PCNA
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332	BIRC5
4102	MAGEA3
4105	MAGEA6
25803	SPDEF
4609	MYC
3945	LDHB
6278	S100A7
2896	GRN

Supplementary Table 2 List of genes printed in figure 3

GeneID	Gene Syml	Reference GI
123887	ZG16	20810120
6000	RGS7	18314629
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169966	FAM46D	23271016
901	CCNG2	21619119
11069	RAPGEF4	18645150
57409	MIF4GD	21707111
169693	C9orf71	20988238
8303	SNN	22209020
3156	HMGCR	21707181
84101	USP44	21265142
2182	ACSL4	23273826
881	CCIN	17512603
55867	SLC22A11	21706713
2676	GFRA3	23274188
84572	GNPTG	15779034
5128	PCTK2	21542570
84692	CCDC54	21314970
27232	GNMT	21619157
2123	EVI2A	23272679
57092	PCNP	18314419
4184	SMCP	15779037
205564	SENP5	21265144
84078	KBTBD7	18314477
6583	SLC22A4	20271468
1102	RCBTB2	20810514
54474	KRT20	21594988
9182	PAMCI	21594848
9046	DOK2	21618482
57863	CADM3	21708057
10140	TOB1	21618646
283238	MGC34821	21706723
496	ATP4B	20809654
132112	RTP1	21961544
84708	LNX1	21961542
627	BDNF	20987591
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11022	TDRKH	21595811
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51449	PCYOX1	21708071
5624	PROC	21707770
83659	TEKT1	15779055
51704	GPRC5B	21759766
29882	ANAPC2	21595797
2669	GEM	18314424

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54360	CYTL1	21594982
7097	TLR2	21708104
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3026	HABP2	21618648
66002	CYP4F12	23243429
168391	GALNTL5	18314428
90459	THEX1	23271400
9583	ENTPD4	21759776
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8477	GPR65	23243459
10669	CGREF1	21961321
378108	TRIM74	21707221
349565	NMNAT3	21706743
200185	KRTCAP2	20987524
8100	IFT88	21315054
5992	RFX4	21040408
81616	ACSBG2	18314433
28955	DEXI	22902431
66036	MTMR9	18314566
4675	NAP1L3	23270931
11318	ADMR	21961319
2209	FCGR1A	21619685
2827	GPR3	21618432
6834	SURF1	20271429
6781	STC1	20810067
25791	NGEF	21595071
10512	SEMA3C	21265134
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7984	ARHGEF5	15778952
10404	PGCP	18088383
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79412	KREMEN2	13097629
771	CA12	18645128
51534	VTA1	13937779
2705	GJB1	12803916
5013	OTX1	14043259
397	ARHGDIB	14327951
6522	SLC4A2	14495651
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57062	DDX24	14250755
11132	CAPN10	13279049
81533	ITFG1	18848294
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79102	RNF26	14043098
654817	NCF1C	12803938
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2117	ETV3	18605788
751867	SNHG3-RC	13938340
55968	NSFL1C	12803908
8613	PPAP2B	14327943
10481	HOXB13	13937957
4801	NFYB	13529070
79706	PRKRIP1	15679979
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84962	JUB	14043184
1327	COX4I1	14250513
26986	PABPC1	16358989
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311	ANXA11	14043152
6663	SOX10	12803952
8463	TEAD2	14043136
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57325	CSRP2BP	14043102
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84725	PLEKHA8	12803978
83540	NUF2	14250143
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51132	RNF12	15426503
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7416	VDAC1	14250131
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4312	MMP1	15530200
3490	IGFBP7	861520
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598	BCL2L1	17939633
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894	CCND2	179999
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9636	ISG15	4826773
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1026	CDKN1A	11386202
3565	IL4	4504668
3578	IL9	10834979
7472	WNT2	4507926
5266	PI3	4505786
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5578	PRKCA	4506066
1514	CTSL1	4503154
7124	TNF	10835154
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2258	FGF13	4758365
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983	CDC2	4502708
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6678	SPARC	4507170
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312	ANXA13	4757753
2668	GDNF	4503974
638	BIK	7262371
5443	POMC	4505948
3440	IFNA2	11067750
835	CASP2	537293
7532	YWHAG	34193665
951	CD37	4502662
4817	NIT1	5031946
1266	CNN3	4502922
9402	GRAP2	19344011
8544	PIR	33876802
9939	RBM8A	15812217
6770	STAR	14714802
22924	MAPRE3	15079433
8624	DSCR2	4505022
1353	COX11	4758033
7008	TEF	34486096
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22808	MRAS	4105177
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5872	RAB13	4506362
5721	PSME2	4506236
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54741	LEPROT	33990029
308	ANXA5	33876205
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6181	RPLP2	38383132
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6449	SGTA	12804260
9255	SCYE1	33878437
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3202	HOXA5	9506790
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11158	RABL2B	18999458
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7135	TNNI1	339964
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3397	ID1	4504568
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3162	HMOX1	4504436
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3958	LGALS3	1196441
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2354	FOSB	5803016
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6917	TCEA1	5803190
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3174	HNF4G	33096751
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4879	NPPB	19343959
8504	PEX3	15930133
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977	CD151	33870216
4987	OPRL1	23468340
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5264	PHYH	20809598
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9141	PDCD5	4759223
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9607	CARTPT	4757909
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1396	CRIP1	4503046
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3489	IGFBP6	11321592
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1337	COX6A1	10047079
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6376	CX3CL1	4506856
1454	CSNK1E	4503092
5763	PTMS	4506278
51741	WWOX	7706522
1019	CDK4	4502734
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1337	COX6A1	10047079
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7481	WNT11	4759319
8682	PEA15	4505704
318	NUDT2	4502124
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53822	FXYD7	11612658
2752	GLUL	4504026
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653	BMP5	10835090
1207	CLNS1A	4502890
27243	CHMP2A	7656921
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