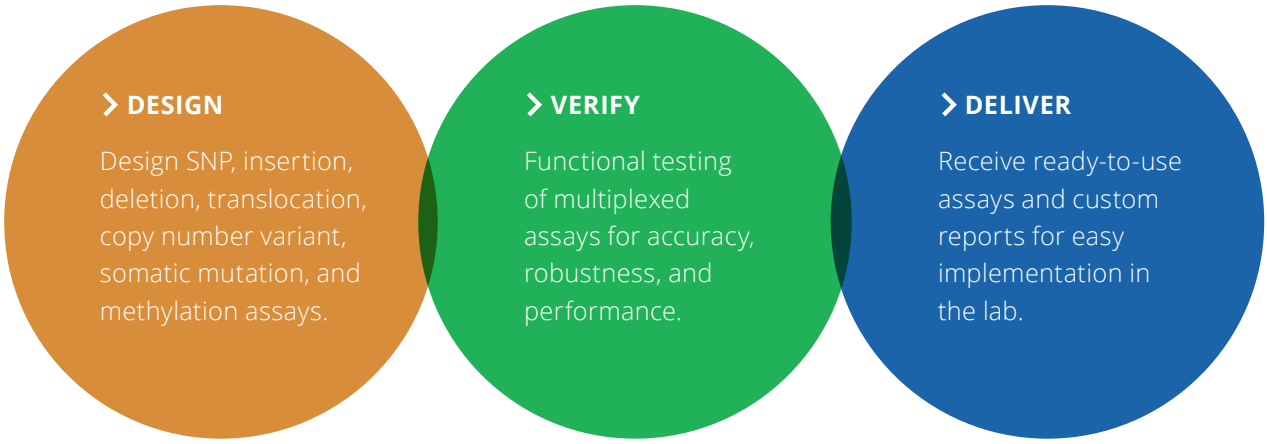
ASSAYS BY AGENA

Tailored Assay Solutions

Tools and Services for Rapid Test Deployment

Agena BIOSCIENCE

Assays By Agena Services



Agena Bioscience provides two different options for users interested in creating custom genotyping, somatic mutation, or epigenetic assays. You can independently design and develop content using our online Assay Design software, or partner with our scientists for assay development and verification services. Both options use the same chemistries, simple workflow, and application software for analysis.

Options for Assay Development:

Assay Design Tools

Design and develop your assays with user-friendly online tools.

- **EASY** – Simplified assay design with online tools.
- **QUICK** – Design large multiplexed assays in less than an hour.
- **PROVEN** – Over 3,000 peer-reviewed publications using Agena's assay design tools

Custom Assay Services

Partner with Agena scientists to design and verify assays.

- **EXPERT** – Assays designed and developed by Assays by Agena scientists.
- **ASSAY VERIFICATION** – Assays are functionally verified in the laboratory.
- **COLLABORATIVE** – Our scientists empower your success through training and support.

PARTNER WITH OUR EXPERT APPLICATION SCIENTISTS

Reduce your assay development time with Assays by Agena services. Our highly skilled scientists iteratively design and verify assays in the laboratory for superior performance. Software services to simplify data analysis with custom reports are also available.

Versatile Platform

The MassARRAY® System is a flexible platform that allows you to perform a variety of DNA analyses with different chemistries tailored to your biomarkers of interest. With general purpose reagents and standard, non-labeled oligonucleotides, generating custom assays is simple, fast, and cost-effective.

Variety of biomarkers that can be tested on the MassARRAY® System

	iPLEX® Pro	iPLEX® HS	UltraSEEK™	MassCLEAVE™
Ideal For	Genotyping germline variants	Detecting somatic and low-frequency variants	Detecting very low-frequency and rare variants	Quantifying methylation changes
Biomarkers	• SNPs • Insertions • Deletions • Translocations • Copy Number Variants	• SNPs • Insertions • Deletions	• SNPs • Insertions • Deletions	• CpG Methylation
Limit of Detection	5% - 10%	≥ 1%	≥ 0.1%	≥ 5%
Quantitative Range	5% - 100%	1% - 20%	0.1% - 10%	5% - 100%
Markers per Reaction	≤ 40	≤ 15	≤ 10	150 bp – 550 bp CpG-rich region
Sample Types	• Blood • Buccal cells • Hair follicles • Ear punches • WGA DNA • FTA cards	• Formalin-fixed, paraffin embedded tissue (FFPE) • Fine needle aspirates (FNA) • Cytology blocks • Core needle biopsy • Seed mixtures	• Plasma • Circulating cell-free DNA (ccfDNA) • Circulating tumor DNA (ctDNA) • Circulating tumor cells (CTCs)	• Blood • FFPE
Application Areas	• Pharmacogenetics • Inherited disease • Biomarker validation • Livestock testing • Crop strain validation	• Somatic mutations • Low-frequency variants • NGS discovery validation • GMO screening	• Oncogenic resistance and progression monitoring	• Epigenetic studies • Environmental factors studies • Biomarker validation • Disease prognostic markers

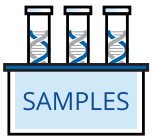
Rapid Results

All chemistries utilize a simple workflow with convenient, universal reaction conditions and general use reagents, generating results in as quickly as a day.

SAMPLE-TO-RESULTS WORKFLOW

1

Design custom assays and order primers from any oligo vendor or use Assays by Agena services for pre-verified assays



2

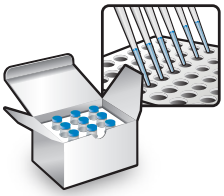
Sample collection

3

DNA isolation

Flexible Throughput

The MassARRAY System is a truly open platform providing flexibility in both sample and assay numbers. Use the power of multiplexing to assay tens to hundreds of genotyping and somatic mutation targets efficiently, with minimal input DNA. The open access format of the SpectroCHIP® Arrays allows you to test any combination of assays and samples, eliminating the need to batch samples. The SpectroCHIP Arrays are available in 96 and 384 configurations, and anywhere from one to ten SpectroCHIP Arrays can be processed on an instrument in a single day, accommodating varying sample throughputs.



4

Sample processing with general use reagents and assay-specific primers

5

Transfer of analytes to the SpectroCHIP Array and data acquisition with the MassARRAY Analyzer

6

Data analysis with easy to use application software and reports

Examples showing flexibility in sample and assay numbers

Panel	# and Type of Variants	# of Reactions per Sample	# of Samples per 96 SpectroCHIP Array	# of Samples per 384 SpectroCHIP Array
Exome QC	21 exonic SNPs, 3 gender assays & 25 QC assays	1	96	384
CFTR	74 germline variants	3	32	128
iPLEX HS Colon	86 somatic variants	8	12	48
UltraSEEK Lung	67 rare somatic variants	12	8	32
MGMT Methylation	CpG's across 100 bp region	1	96	384

Note: Two SpectroCHIP Arrays can be processed by the MassARRAY System in a single run.

Oncology

Develop disease-specific assays with targeted mutations to profile hot-spot mutations across oncogenes, tumor suppressors, and resistance markers.

Key oncogenes and tumor suppressors targeted by Assays by Agena assays

- ABL1
- AKT1/2/3
- APC
- BRAF
- CDK4
- CDKN2A
- CSF1R
- CTNNB1
- CXCR4
- DDR2
- DNMT3a
- EGFR
- EPHA3/5/6/10
- ERBB2/4
- FBX4
- FBXW7
- FGFR1/2/3/4
- FLT3
- FOXL2
- GNA11
- GNAQ
- HRAS
- IDH1/2
- JAK2
- KIT
- KRAS
- MAP2K1/2
- MEK
- MET
- MLH1
- MPL
- MYC
- NEK10
- NOTCH1
- NPM1
- NRAS
- NTRK1/2/3
- PDGFRA
- PIK3CA
- PPP2R1
- PTCH1
- PTEN
- PTK2B
- PTN11
- PTPN11
- PTPRD
- RB1
- RET
- ROR2
- SF3B1
- SOS1
- SRSF2
- STK11
- TP53
- U2AF1
- VHL

SOLID TUMOR SAMPLES

- Design assays with Agena scientists using iPLEX® HS chemistry to detect variants as low as 1% minor allele frequency (MAF) from FFPE tissue, core needle biopsies, FNA, and cytology smears.
- Reduce sequencing costs with custom panels to pre-screen samples for known mutations.
- Salvage samples with less than 20% tumor content.

LIQUID BIOPSY SAMPLES

- Design assays with UltraSEEK™ chemistry and detect over 50 variants using DNA from a single blood draw, at as low as 0.1% MAF.
- Implement non-invasive testing to monitor disease progression and identify resistance conferring markers from ctDNA, CTC, and ccfDNA.
- Develop personalized assays in as quickly as a week to target an individual's mutation profile.

TRANSLOCATIONS

Screen for *ALK, RET,* or *ROS1* translocations in non-small cell lung cancer using pre-designed assays that identify differential expression across fusion partners. Create custom assays for other gene translocations such as *MET, NOTCH1,* etc., and incorporate internal controls to assess RNA quality and genomic DNA contamination.

CUSTOM ONCOLOGY ASSAYS

Pre-designed panels for oncology studies

Catalog No.	Panel	Area of Focus	# of Genes	# of Targets	Limit of Detection	Sample Type
17942	UltraSEEK Colon	Colon Cancer	5	107	≥ 0.1%	Plasma
17943	UltraSEEK Lung	Lung Cancer	5	>60	≥ 0.1%	Plasma
06021	UltraSEEK Melanoma	Melanoma	13	65	≥ 0.1%	Plasma
06079	UltraSEEK EGFR	Lung Cancer	1	6	≥ 0.1%	Plasma
17936	OncoFOCUS	Colon, Lung & Melanoma Cancers	5	>230	5% - 10%	Tissue
17940	iPLEX HS Colon	Colon Cancer	5	86	≥ 1%	Tissue
17941	iPLEX HS Lung	Lung Cancer	5	>60	≥ 1%	Tissue
06037	iPLEX HS Melanoma	Melanoma	11	97	≥ 1%	Tissue
06067	AML Somatic Mutation	AML	14	58	5% - 10%	Blood
06061	iPLEX HS JAK2 V617F	Myeloproliferative Cancer	1	1	≥ 1%	Blood
17918	GyneCarta	Ovarian & Uterine Cancers	13	160	5% - 10%	Tissue
06032	IDH Plus	Gliomas & Glioblastoma	5	23	5% - 10%	Tissue
17916	EML4-ALK Variants	Translocations in Lung Cancer	2	11	5% - 10%	Tissue
17919	RET Variants	Translocations in Lung Cancer	1	7	5% - 10%	Tissue
17920	ROS1 Variants	Translocations in Lung Cancer	1	15	5% - 10%	Tissue
06026	MLH1 Methylation	Lynch Syndrome	1	400 bp	5%	Tissue
06031	MGMT Methylation	Glioma & Glioblastoma	1	100 bp	5%	Tissue

METHYLATION PROFILING

Quantitatively assess methylation changes in CpG rich-regions ranging from 150bp – 550bp in length using MassCLEAVE™ chemistry. Easily validate findings from genome-wide methylation screening studies and cost-effectively test hundreds to thousands of samples.

Key epigenetics related genes targeted by Assays by Agena assays

- AKT1
- APC
- BRAF
- BRCA1
- CDH1/13
- CDKN2A
- C/EBP-A
- DAPK1
- DUSP1
- EGFR
- FHIT
- GSTP1
- HOXA1
- IGF2
- KRAS
- MAPK1
- MGMT
- MLH1
- MSH
- NEUROG1
- NFKB1
- PDLIM4
- PTEN
- RARα/β
- RASSF1
- RUNX3
- SOCS1
- TIMP3
- TP53/73
- VHL

Pharmacogenetics

Target the most important haplotypes related to drug absorption, distribution, metabolism, excretion, and toxicity (ADME-T) with robust assays. Investigate copy number variants and hybrid alleles along with SNPs, insertions, and deletions in the same workflow, increasing lab efficiency. Use PGx report modules to generate haplotypes and star alleles from genotypes. Enhance drug development and clinical trial research with assays to:

- Identify individuals susceptible to adverse drug reactions.
- Distinguish between poor, intermediate, extensive, and ultra-extensive metabolizers.
- Target variants prevalent in specific ethnicities or populations for improved drug efficacy.

Key pharmacogenetics-related genes targeted by Assays By Agena assays

- ABCB1
- ABCC2
- ABCG2
- APOE
- COMT
- CYP1A1
- CYP1A2
- CYP2A6
- CYP2B6
- CYP2C19
- CYP2C8
- CYP2C9
- CYP2D6
- CYP2E1
- CYP3A4
- CYP3A5
- DPYD
- DRD2
- FII
- FV
- GLP1R
- GSTM1
- GSTP1
- GSTT1
- GSTT2b
- MTHFR
- NAT1
- NAT2
- OPRM1
- PNPLA5
- SLC15A2
- SLC22A1
- SLC22A2
- SLC22A6
- SLCO1B1
- SLCO1B3
- SLCO2B1
- SULT1A1
- SULT4A1
- TPMT
- UGT1A1
- UGT2B15
- UGT2B17
- UGT2B7
- VKORC1

CUSTOM PHARMACOGENETICS ASSAYS

Pre-designed panels for pharmacogenetics studies

Catalog No.	Panel	Area of Focus	# of Genes	# of Targets	Biomarkers
17931	PGx 74	Drug Metabolism	20	74	SNPs, indels, CNVs
17923	CYP2D6	Drug Metabolism	1	35	SNPs and CNVs across CYP2D6
17924	CYP2C19	Drug Metabolism	1	31	SNPs across CYP2C19
17925	CYP2C9/ VKORC1	Cardiovascular Drugs	4	51	SNPs and indels across CYP2C9, CYP4F2, VKORC1, and GGCX
06028	SLC6A4	Psychotropic Drugs	1	Variable insertions	5-HTTLPR (SLC6A4)
17927	UGT1A1	Adverse drug reactions	1	4	TA repeats across UGT1A1
06027	HLA Sensitivity	HLA-A and HLA-B subtypes associated with drug response	2	6	SNPs across HLA-A and HLA-B

Carrier Screening and Inherited Disease

Use pre-designed assays to screen for β-thalassemia, hemochromatosis and other genetic disorders.

CYSTIC FIBROSIS SCREENING

Develop custom assays targeting anywhere from the 23 ACMG/ACOG recommended mutations to over 150 *CFTR* variants to provide enhanced coverage for various ethnic groups.

ASHKENAZI JEWISH GENETIC DISEASES

Use pre-designed assays to screen for over 35 rare disorders that occur more frequently in people of Eastern European (Ashkenazi) Jewish heritage.

HEARING IMPAIRMENT

Employ robust assays to identify mutations in *GJB2, GJB3, SLC26A4, MTRNR1,* and other genes to study congenital profound hearing loss in newborns.

CELIAC DISEASE

Study susceptibility to celiac disease, an autoimmune disorder that affects ability to digest gluten-containing food such as wheat and barley. Genotype human leukocyte antigen *(HLA)* sequence haplotypes HLA-DQA1*05, HLA-DQB1*02, and HLA-DQB1*03:02 to supplement serology tests.

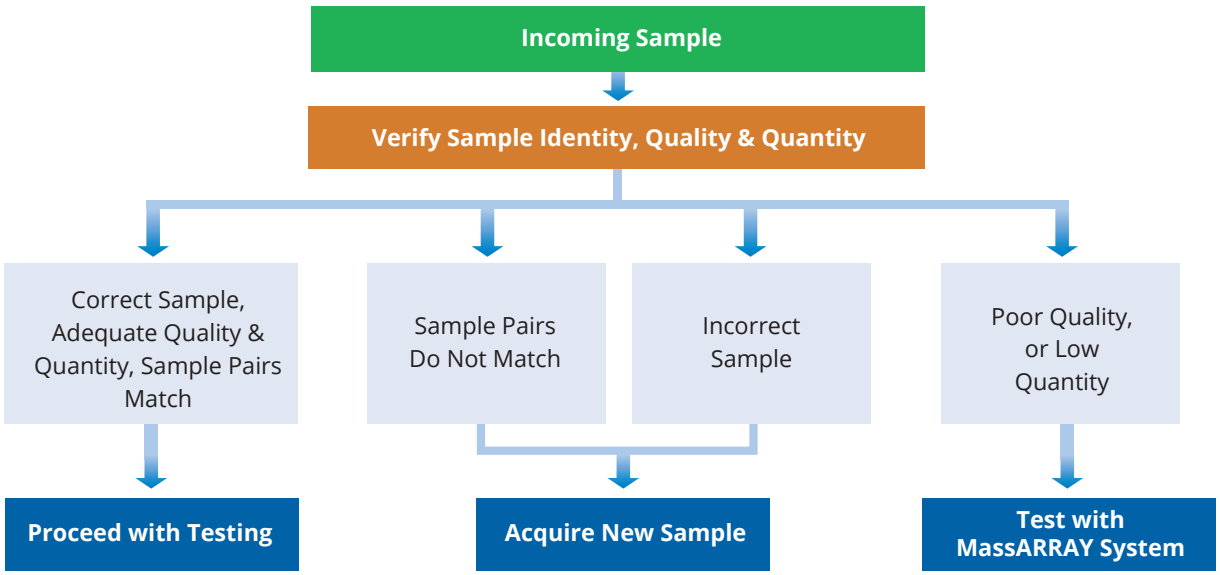
Pre-designed panels for carrier screening and inherited disease studies

Catalog No.	Panel	Area of Focus	# of Genes	# of Targets
06017	Ashkenazi Jewish Diseases	Screening for 35 rare inherited diseases	39	123 SNPs
06033	Celiac Exclusion	Susceptibility to celiac disease	1	3 Haplotypes
17935	CFTR	Cystic Fibrosis Carrier Screening	1	74 SNPs and indels
06005	HLA-B Subtypes	Loci implicated in Behcet's Disease and HLA-B*27	1	2 Haplotypes
06045	β-Thalassemia	HBB and HBG1 variants associated with beta thalassemia	2	20 variants including indels
06085	Hearing Impairment	Congenital hearing loss	4	28 variants including indels

Sample Identification and Qualification

Develop custom solutions to track samples through your laboratory's workflow using a SNP-based barcode. Prevent costly sample failures due to insufficient quality and quantity by assessing DNA degradation and the number of available amplifiable copies, simultaneously. Utilize pre-designed assays to assess DNA quality across a broad dynamic range of 100 – 100,000 (0.3 ng – 300 ng) amplifiable template copies and 100bp – 500bp size. Apply powerful algorithms to match sample pairs such as tumor and normal tissue, as well as multiple samples acquired from the same individual at different times.

Applications for Sample ID and QC



CHIMERISM

Detect genetic mixtures, sample contamination, distinguish between maternal and fetal DNA, or monitor transplant success using SNPs instead of labor intensive short tandem repeat (STR) analysis. Utilize a pre-verified assay consisting of 92 SNPs, selected for high MAF across six major HapMap populations and not in linkage disequilibrium, which enables efficient identification of sample mixtures as low as 2%.

Pre-designed panels for sample identification and qualification studies

Catalog No.	Panel	Area of Focus	# of Targets	Biomarkers
06001	Exome QC	Sample identification, DNA degradation and quality	21 SNPs and 25 quantitative assays	Exonic SNPs, gender, and DNA quantitative assays
06006	Chimeric ID	Identification of genetic mixtures	92	SNPs

Blood Group Genotyping

Develop DNA-based extended antigen typing of erythrocytes, neutrophils, and platelets. Utilize Agena's expertise in typing over 100 antigens in 16 blood group systems, including 23 platelet and neutrophil antigens (HPA/HNA). Resolve complex *RH* genotypes and identify *RHD* zygosity and *RHD-RHCE* hybrid alleles.

Pre-designed panels for blood group genotyping studies

Catalog No.	Blood Group	Predicted Phenotypes Assayed
06072	Kell	K/k, K_{mod}, Kp^a/Kp^b, Js^a/Jsb, KEL11/KEL17, K_{null} or K0
	Kidd	Jk^a/Jk^b, Jk(a–b–) or Jk_0
	Duffy	Fy^a/Fy^b, Fy(a–b–) or Fy_0 (GATA), $Fy(b+^w)$ or Fyx+
06073	MNS	M/N, S/s, Mt^a, Vw, Hut, IVS5 or P2
06074	RHD	RHD weak type, RHD categories, partial RHD, deletions
	RHD-RHCE	Identify over 30 RHDCE hybrid alleles
06075	HNA	HNA-1a/b/ab/ac/bc /c, HNA-3a/b, HNA-4a/bw, HNA-5a/bw
	HPA	HPA-1a/b, HPA-2a/b, HPA-3a/b, HPA-4a/b, HPA-5a/b, HPA-6a/bw, HPA-15a/b
17934	Donor Quick Screen	Quickly screen donors for rare antigens across Rhesus, KKD, MNS, Lutheran, Dombrock, Landsteiner-Wiener, Diego, Colton, Scianna, and Cartwright blood group systems

Infectious Disease

Employ multiplexed assays to rapidly identify *Staphylococcus aureus, Pseudomonas aeruginosa, M. tuberculosis* Complex (MTBC), or gram negative bacteria, and screen for resistance to antibiotics.

HPV TYPING

Enhance research in head and neck, gynecological, and dermatological cancers by identifying 19 different HPV subtypes. Utilize minimal input DNA to screen samples with limited availability and perform confirmatory testing.

Pre-designed panel for HPV genotyping studies

Catalog No.	Risk	HPV Subtypes & IARC Classification
06010	High Risk	16 (1), 18 (1), 31 (1), 33 (1), 35 (1), 39 (1), 45 (1), 51 (1), 52 (1), 56 (1), 58 (1), 59 (1)
	Low Risk	6 (3), 11 (3), 53 (2B), 66 (2B), 67 (2B), 68 (2A), 73 (2B)

Note: Panel not available for sale in the USA

Agricultural Genetics

Create custom assays for any species, including complex polyploids, to validate sequencing discoveries and test large numbers of samples cost-effectively, with a low cost per genotype. The MassARRAY is a high-throughput system enabling you to generate >150,000 genotypes per day with the help of a single technician.

Sampling of plants and animals genotyped with the MassARRAY System

- Alpaca
- Arabidopsis
- Barley
- Canola
- Cattle
- Corn
- Cotton
- Deer
- Elk
- Goat
- Hardwood Tree
- Horse
- Maize
- Oak Tree
- Palm Oil Tree
- Pig
- Pine Tree
- Prawn
- Salmon
- Sheep
- Soybean
- Sugarcane
- Tomato
- Watermelon
- Wheat

BOVINE PARENTAGE AND TRAIT SELECTION

Pre-designed panels for bovine parentage and trait selection studies

Catalog No.	Risk	Targets
17930	Bos taurus	>115 markers including international society for animal genetics (ISAG) recommended core markers
06046	Bos indicus	100 ISAG recommended core markers

PLANT GENOTYPING

Create custom panels to perform crop strain validation, marker assisted breeding, bulk segregant analysis (BSA), genetic mapping, quantitative trait locus (QTL) analysis, and distinguish genetically modified organisms (GMO) on a variety of plant species such as corn, barley, wheat, and soybean.

Interested In Developing Your Own Custom Assay?

Contact your local Agena Bioscience sales representative to learn more about Assays by Agena services and to request a quote for content tailored to your needs.

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