Comprehensive Solution for Oncology NGS: QIAseq Targeted DNA, RNA and Multimodal DNA/RNA

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QIAGEN

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OUTLINE

QIAseq Solutions for Clinical and Life Science Applications

1. Overview

- Cancer Incidence in Vietnam
- Molecular Genetic Testing
- Sequencer Platforms and QIAseq Compatibility

2. QIAseq NGS Portfolio

- Basic NGS End-to-end Workflow
- QIAseq NGS Portfolio
- Cancer Analysis Guideline
- Comprehensive Genomic Profiling (CGP) Panel (New)
- QIAseq Long Read Solution (New)

Cancer incidence in Vietnam

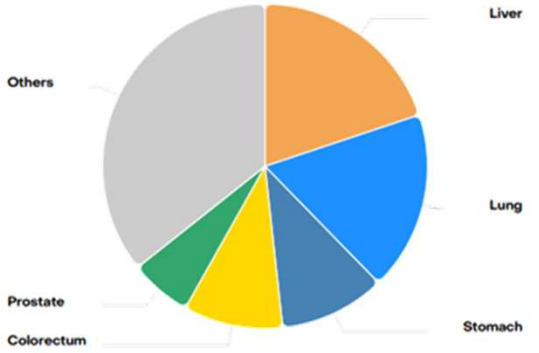
WHO 2022

https://gco.iarc.who.int/media/globocan/factsheets/populations/704-viet-nam-fact-sheet.pdf?utm_source=chatgpt.com

Top 5 most frequent cancers in Vietnam

WHO 2022

Males

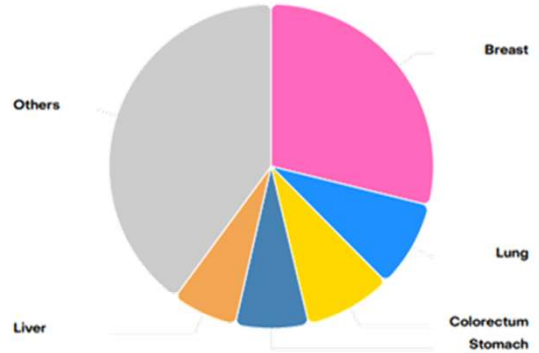


Total: 95 358

Rank	Cancer site	Number of cases	Percent
1st	Liver	18 952	19.9%
2nd	Lung	17 007	17.8%
3rd	Stomach	10 062	10.6%
4th	Colorectum	9 433	9.9%
5th	Prostate	5 875	6.2%
-	Others	34 029	35.7%

Number of new cases in 2022, males, all ages

Females

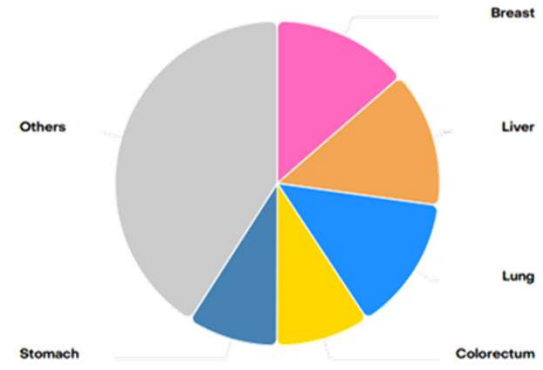


Total: 85 122

Rank	Cancer site	Number of cases	Percent
1st	Breast	24 563	28.9%
2nd	Lung	7 419	8.7%
3rd	Colorectum	7 402	8.7%
4th	Stomach	6 215	7.3%
5th	Liver	5 550	6.5%
-	Others	33 973	39.9%

Number of new cases in 2022, females, all ages

Both sexes



Total: 180 480

Rank	Cancer site	Number of cases	Percent
1st	Breast	24 563	13.6%
2nd	Liver	24 502	13.6%
3rd	Lung	24 426	13.5%
4th	Colorectum	16 835	9.3%
5th	Stomach	16 277	9.0%
-	Others	73 877	40.9%

Number of new cases in 2022, both sexes, all ages

https://gco.iarc.who.int/media/globocan/factsheets/populations/704-viet-nam-fact-sheet.pdf?utm_source=chatgpt.com

Risk Key Factors

Infectious Agents

Chronic infections including hepatitis B virus (HBV) and human papillomavirus (HPV) contribute significantly to liver and cervical cancers respectively.

Vaccination programs: Efforts to increase HBV vaccination coverage aim to reduce liver cancer incidence

Tobacco Use

High smoking rates, especially among Vietnamese men, increase risk of lung, throat, and other cancers.

Tobacco control: Policies to reduce smoking rates include advertising bans, health warnings, and increased taxation

Alcohol Consumption

Excessive alcohol intake increases risk of liver, colorectal, and other digestive system cancers.

Environmental Factors

Air pollution and ecosystem degradation have been linked to higher incidences of lung cancer.

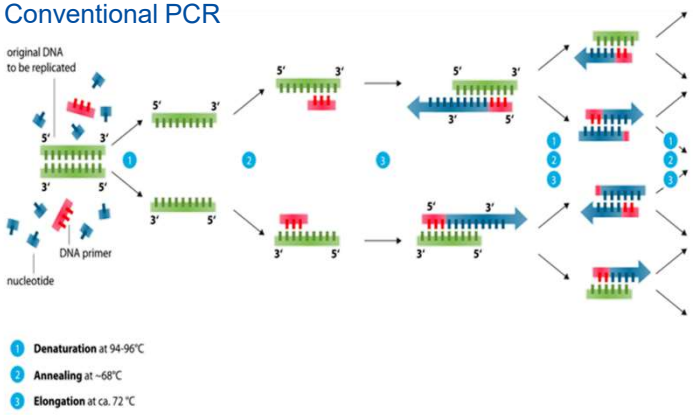
International collaboration: Partnerships with organizations like the WHO support the development of national cancer control strategies via genetic testing.

If we know what drives a tumor at the genetic level, how might that change the way we *diagnose*, *treat*, or even *prevent cancer*?

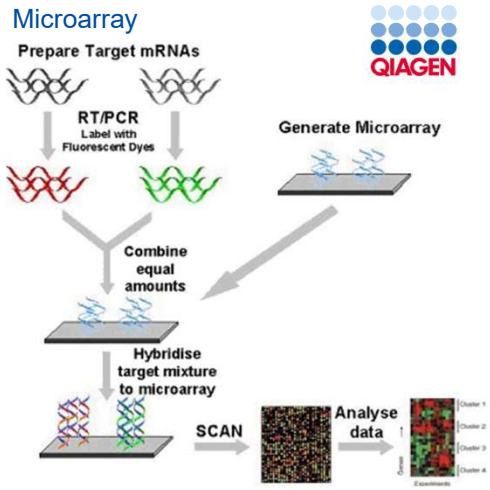
Overview on molecular genetic testing

Method	Pros	Cons
Conventional PCR	Easy, cost effective, high sensitivity	Contamination, laborious, time-consume for optimize
Microarray (DNA chips)	Well-establish protocol, cost effective, flexibility	Reliant on pre-defined sequences, sample input (>300ng RNA), Sample group per run
Sanger sequencing	Long read length (500-700bp), easy to analysis, small data storage required	Low throughput, scalable to a few genes, unable to detect CNV & chromosome aberration, expensive sample per base
Next Generation Sequencing	Available for Short read and long read length (50-2Mb fragments), High throughput, cheap sample per base, high depth of sequencing	Expensive technology, high TAT, huge output data

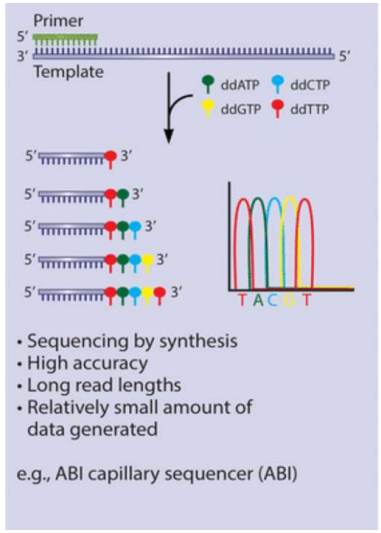
Conventional PCR



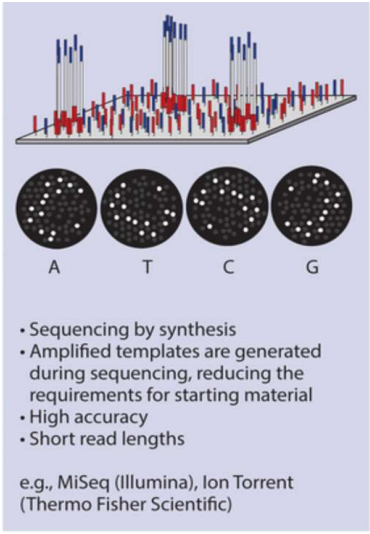
Microarray



Sanger sequencing



NGS sequencing



Sequencing Generations

First Generation

- Sanger Sequencing, Maxam and Gilbert, Sanger chain termination
- Infer nucleotide identity using dNTPs, then visualize with electrophoresis
- 500-1000bp fragment

Second Generation

- 454, Solexa, Ion Torrent, Illumina
- High throughput from the parallelization of sequencing reactions
- 50-500bp fragments

Third Generation

- PacBios, Oxford Nanopore
- Sequence native DNA in real time with single molecule resolution
- Approx. kb-Mb fragments

https://www.pacb.com/blog/the-evolution-of-dna-sequencing-tools/

https://pubmed.ncbi.nlm.nih.gov/31947757/

https://doi.org/10.3390/life12010030

Current Sequencer Platforms

Long-read sequencer

PacBio Revio

PacBio Vega

Oxford Nanopore

Short-read sequencer

MGI

Illumina

Thermo Ion Torrent

GeneMind

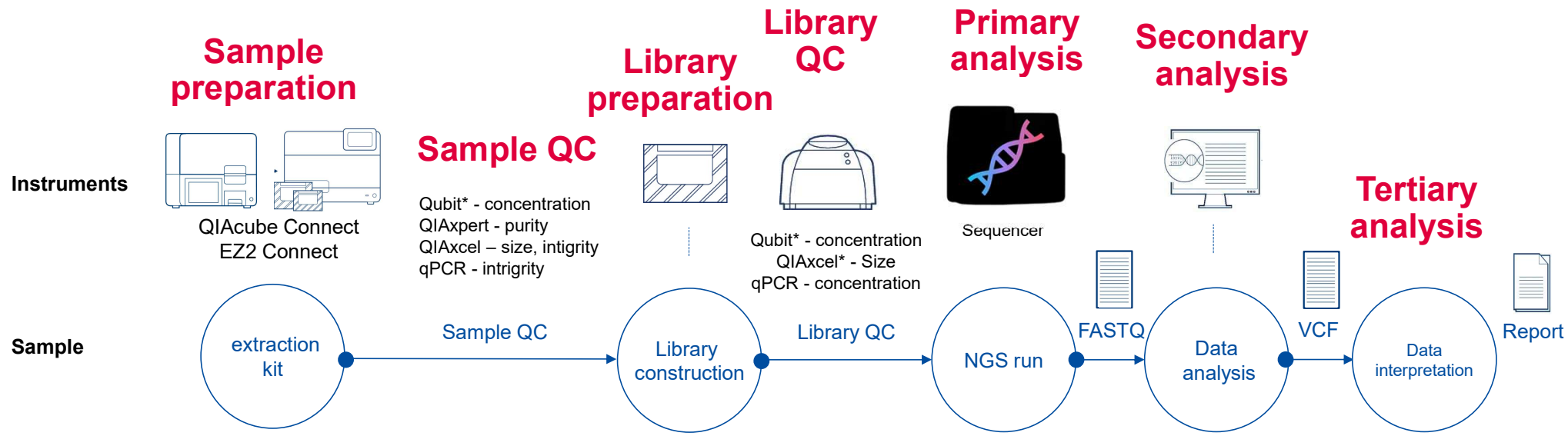
PacBio Onso

Element Bioscience AVITI

Singular Genomics G4

Ultima Genomics UG 100

From Tumor to Target: The Journey of Genomic Insight



QIAGEN provides a complete solution from sample to insight — except the sequencer. That's why we developed uNGS: UNIVERSAL library prep kits compatible with various platforms.

QIAseq Compatibility and Validation (06/2025)

QIAseq portfolio	PacBio (Onso)	ONT / PacBio (Revio)	MGI	ILMN	Ion S5	Element	GeneMind	Singular	Ultima
QIAseq FX DNA library kit									
QIAseq Ultralow input kit									
QIAseq FX single cell DNA library kit									
QIAseq UPX single cell DNA library kit									
QIAseq xHYB Human exome & Human Clinical Exome									
QIAseq targeted DNA panel									
QIAseq targeted DNA Pro panel									
QIAseq targeted cfDNA DNA ultra panel									
QIAseq multimodal DNA/RNA library kit									
QIAseq multimodal panel HT									
QIAseq FastSelect RNA library kit									
QIAseq UPXome RNA library kit									
QIAseq UPX 3' targeted RNA panel									
QIAseq targeted RNA panel TCR kit									
QIAseq FusionXP RNA library kit									
QIAseq FX single cell RNA library kit									
QIAseq miRNA library kit									
QIAseq 16S/ITS panel									
QIAseq xHYB microbial panel									
QIAseq methyl DNA library kit									
QIAseq targeted methyl panel									
QIAseq ultralow input kit									
QIAseq xHYB Long Read Panel									
QIAseq xHYB CGP Panel									

- Not compatible
- Compatible
- Compatible + validated

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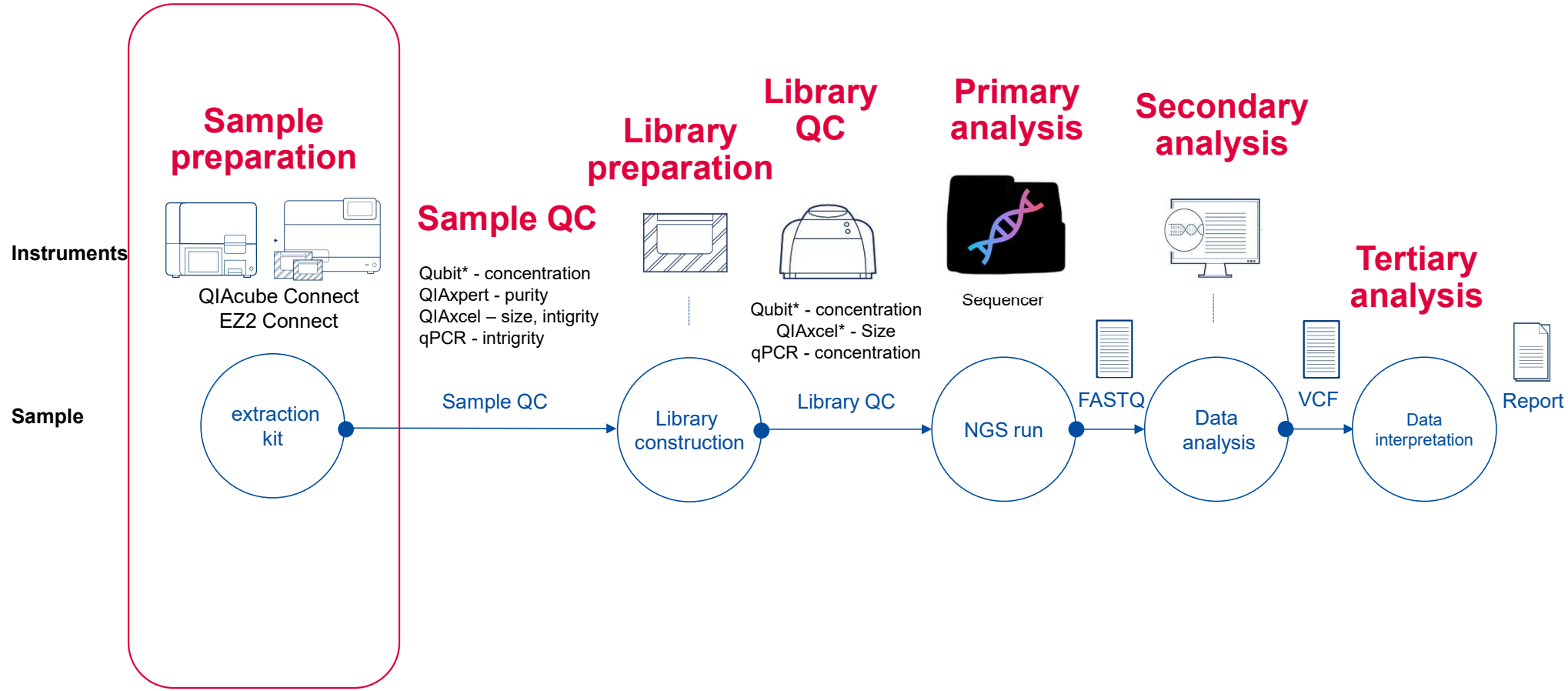


Versatile Extraction Kits Tailored to Your Sample Needs

DNA-seq extraction kits

- Standard DNA — QIAamp® DNA Mini Kit
- FFPE — QIAamp DNA FFPE Advanced Kit
- cfDNA — QIAamp Circulating Nucleic Acid Kit

cfDNA-seq extraction kits

- cfDNA — QIAamp Circulating Nucleic Acid Kit (5 ml of serum or plasma)
  QIAseq MinElute ccfDNA Mini kit – (4 ml of serum or plasma)
  QIAamp MinElute ccfDNA Midi kit – (10 ml of serum or plasma)

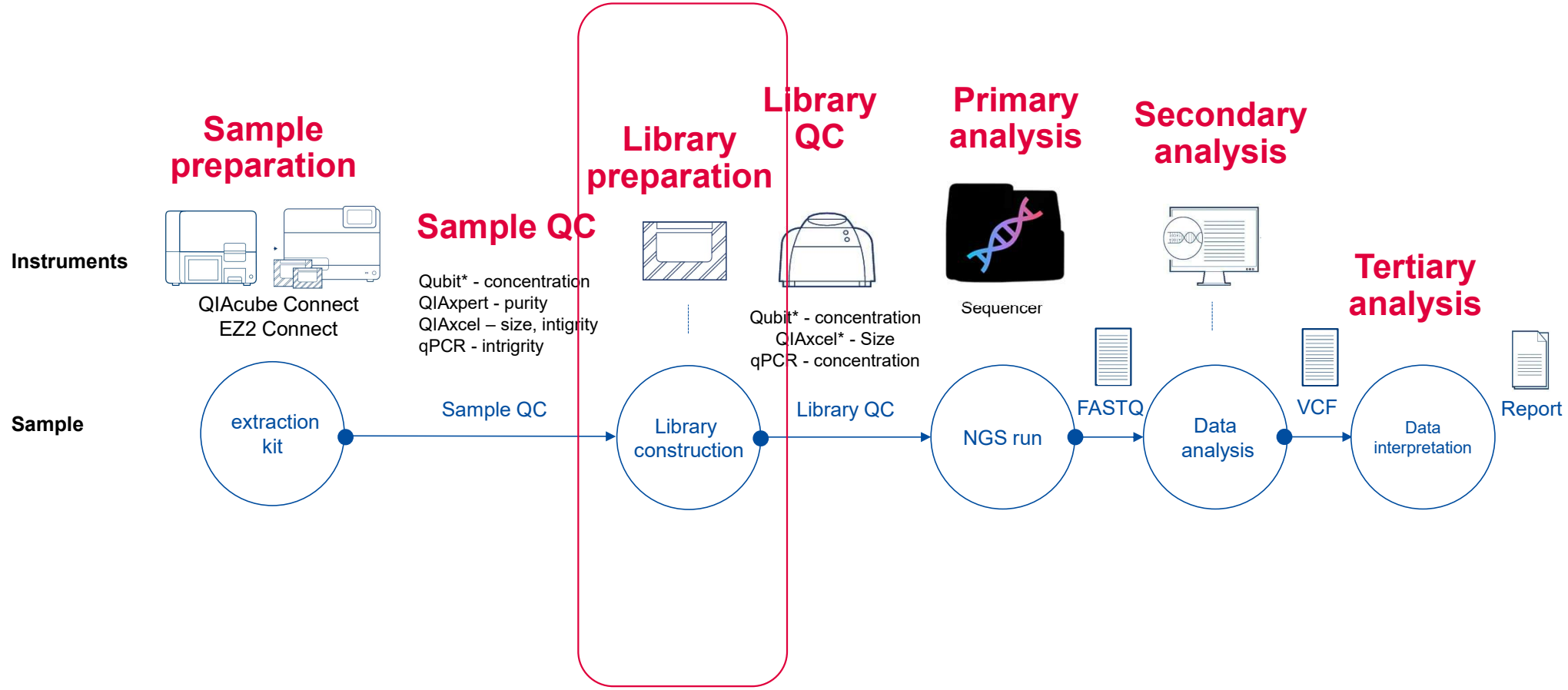
RNA-seq extraction kits

- Standard DNA — QIAGEN's RNeasy® Mini Kit / RNeasy Micro Kit
- FFPE — RNeasy FFPE Kit / AllPrep DNA/RNA FFPE Kit
- Extracellular vesicle — ExoRNeasy Midi Kit / ExoRNeasy Maxi Kit

Multimodal DNA/RNA extraction kits - The kit yields DNA and RNA in separate tubes

- Cells and tissue — AllPrep DNA/RNA Mini Kit
- FFPE samples — AllPrep DNA/RNA FFPE Kit
- Plasma and serum — QIAamp Circulating Nucleic Acid Kit / RNeasy MinElute Cleanup Kit

From Tumor to Target: The Journey of Genomic Insight



Cancer Analysis Guideline

Low Risk

Individuals with a family history of cancer

Intermediate Risk

Healthy individuals with elevated cancer risk indicators

High Risk

Individuals diagnosed with cancer

Cancer Analysis Guideline

Low Risk

Individuals with a family history of cancer

↓

Germline testing to identify inherited pathogenic variants predisposing to cancer

↓

Risk reduction strategies: lifestyle modifications and environmental awareness

Suggested kit: QIAseq Comprehensive Hereditary Cancer Research Panel (V4)

Intermediate Risk

Healthy individuals with elevated cancer risk indicators

High Risk

Individuals diagnosed with cancer

QIAseq Hereditary Cancer Research Panel (V4)

Gene List

ACVR1, ADGRB3, AIP, ALK, ALPK2, APC, AR, ATM, ATR, ATRX, AURKA, AXIN2, B2M, BAP1, BCL11B, BCOR, BLM, BMPR1A, **BRAF**, **BRCA1, BRCA2**, BRIP1, CACNA1D, CARD11, CASR, CBL, CCND1, CDC73, CDH1, CDK4, CDKN1B, CDKN1C, CDKN2A, CDKN2B, CDKN2B-AS1, CEBPA, CFTR, CHD2, CHD7, CHEK2, CHIC2, CIC, CLTCL1, CPA1, CREBBP, CTCF, CTNNA1, CTNNB1, CTRC, CYLD, DCLRE1C, DDB2, DDX3X, DDX41, DDX60, DEPDC5, DICER1, DIS3L2, DNAH14, DNAJC21, DNM2, DNMT3A, DYNC1H1, ECT2L, EED, EGFR, EHBP1, ELAC2, EP300, EPCAM, EPHB2, ERBB2, ERBB3, ERCC2, ERCC3, ERCC4, ERCC5, ERG, ETV6, EZH2, FANCA, FANCB, FANCC, FANCD2, FANCE, FANCF, FANCG, FANCI, FANCL, FANCM, FAP, FBXW7, FCRL2, FGFR1, FGFR4, FH, FLCN, FLT1, FLT3, FOXO1, G6PD, GABRG1, GALNT12, GATA1, GATA2, GATA3, GNB1, GPAM, GREM1, H1-5, H2AC7, H2BC6, H2BC7, H3-3A, H3C4, H4C4, HAVCR2, HDAC9, HIPK2, HNRNPA1, HNRNPR, HOXB13, HRAS, IDH1, IDH2, IFIT3, IKZF1, IKZF2, IKZF3, IL7R, IRS2, IRX2, JAK1, JAK2, JAK3, KAT6A, KCNQ1, KDM4C, KDM6A, KIF1B, KIF7, KIT, KLHDC8B, KMT2B, KMT2D, **KRAS**, LEF1, LMO2, LPP, LRRK1, LRRK2, LZTR1, MAP2K1, MAP2K2, MAPK1, MAST4, MAX, MC1R, MDM2, MDM4, MEN1, MET, MITF, MLH1, MLH3, MLLT10, MN1, MPL, MSH2, MSH3, MSH6, MSMB, MTOR, MUTYH, MYB, MYC, MYCN, NBN, NCAPD3, NF1, NF2, NLRP5, NOTCH1, **NRAS**, NRP1, NSD1, NSD2, NTHL1, OLIG2, OTOF, OTX2, PAG1, PALB2, PALLD, PARP2, PAX3, PAX5, PAX6, PAX7, PCDHGB3, PDGFB, PDGFRA, PFKP, PHF6, PHOX2B, PIK3CA, PKHD1, PLA2G2A, PMS1, PMS2, POLD1, POLE, POLH, POT1, POU6F2, PRF1, PRKAG2, PRKAR1A, PRLR, PRSS1, PRSS2, PTCH1, PTCH2, PTEN, PTPN11, RAB11FIP1, RABL3, RAD51C, RAD51D, RAF1, RARA, RB1, RECQL4, RELN, REST, RET, RNASEL, RNF43, RPS20, RUNX1, SDHA, SDHAF2, SDHB, SDHC, SDHD, SEMA4A, SETBP1, SETD2, SF3B1, SH2B3, SH3GL1, SLX4, SMAD4, SMAD7, SMARCA4, SMARCB1, SMARCE1, SMO, SOS1, SPINK1, STK11, STYK1, SUFU, SUZ12, TAL1, TERC, TERT, TGFBR2, TLR2, TMEM127, TMPRSS2, TP53, TPO, TSC1, TSC2, TTN, TYR, VHL, WDFY3, WDFY4, WRN, WT1, XPA, XPC, XRCC2, XRCC3, ZMYM3

Associate cancers

- **317 genes, 12 cancers, 124 subtypes**
- https://geneglobe.qiagen.com/us/product-groups/qiaseq-targeted-dna-pro-panels/PHS-3200Z

Sample multiplexing guideline for QIAseq Targeted DNA Pro (V4) panels (LOD = 0.5%VAF)

Cat. No.	Product name	Variant types and targeted regions	Total number of primers	Sample per run for somatic variant detection (5%VAF, 7200x)		Sample per run for germline variant detection MiSeq V3 600cycles (500x)	
				MiSeq V3 600cycles	NextSeq High Output		
PHS-3000Z	Comprehensive Cancer Research Panel	Somatic mutation, Full coding	12,264	N/A	9	-	
PHS-001Z	Breast Cancer Research Panel		2534	3	44	-	
PHS-002Z	Colorectal Cancer Research Panel		3430	2	32	-	
PHS-003Z	Myeloid Neoplasms Research Panel		6848	1	16	-	
PHS-004Z	Brain Cancer Research Panel		2742	3	41	-	
PHS-005Z	Lung Cancer Research Panel		2571	3	43	-	
PHS-3100Z	Comprehensive Cancer Focus Panel	Somatic mutation, Hot spot	2990	2	37	-	
PHS-101Z	Breast Cancer Focus Panel		633	11	176	-	
PHS-102Z	Colorectal Cancer Focus Panel		1000	7	111	-	
PHS-103Z	Myeloid Neoplasms Focus Panel		1680	4	66	-	
PHS-104Z	Brain Cancer Focus Panel		649	11	171	-	
PHS-105Z	Lung Cancer Focus Panel		759	9	146	-	
PHS-3200Z	Comprehensive Hereditary Cancer Research Panel		15370	-	-	7	Screening purpose
PHS-201Z	Hereditary Breast and Ovarian Cancer Panel	Germline mutation, Full coding	2508	-	-	40	
PHS-202Z	Hereditary Colorectal Cancer Panel		2226	-	-	45	
PHS-203Z	Hematologic Malignancy Panel		1276	-	-	78	
PHS-204Z	Hereditary Prostate Cancer Panel		1135	-	-	88	
PHS-205Z	Hereditary Pancreatic Cancer Panel		1595	-	-	63	

Calculation based on 2 x 150bp paired-end reads

Guidance After Receiving a Negative Genetic Test Result

(No Gene Mutation Detected)

- This means you did not inherit the mutated BRCA1 or BRCA2 genes from family members. However, your risk of developing cancer (somatic cancer) is still the same as the general population.
- You do not need to undergo any special screening programs.
- You should continue to receive regular cancer screenings as recommended.
  - This approach, however, shifts from primarily addressing inherited risk to focusing on the individual's age, sex, personal and family history, and lifestyle factors to guide adherence to standard screening guidelines and potentially more tailored recommendations.

Hospital Checkup Program Suggestions Based on Comprehensive Negative Germline Testing:

Cancer Type	Sex	Age Group	Screening Method(s)	Frequency
Breast Cancer	Women	40-49	Mammogram (individual decision with provider)	Annually (if chosen)
Breast Cancer	Women	50-74	Mammogram	Biennially or annually
Breast Cancer	Women	75+	Mammogram (as long as in good health and expected to live 5-10+ years)	Discuss with provider
Cervical Cancer	Women	21-29	Pap test	Every 3 years
Cervical Cancer	Women	30-65	Pap test every 3 years OR high-risk HPV test every 5 years OR co-testing (Pap + HPV) every 5 years	As indicated above
Cervical Cancer	Women	65+	Not needed if a history of normal results	As per prior history and provider recommendation
Colorectal Cancer	Men & Women	45+	Stool-based tests: FOBT/FIT (annually) OR sDNA (1-3 years) OR Visual exams: Colonoscopy (10 years) OR CT colonography (5 years) OR Flexible sigmoidoscopy (5 years)	Varies by test; discuss options with provider
Prostate Cancer	Men	50+ (45+ for higher risk)	PSA blood test and Digital Rectal Exam (DRE) (discussion with provider recommended to weigh risks and benefits)	Varies based on individual risk and PSA levels; discuss with provider
Lung Cancer	Men & Women	50-80 (high risk)	Annual low-dose CT scan (for current or former smokers meeting specific criteria: 20+ pack-year history, quit within 15 years)	Annually
Ovarian Cancer	Women	Average Risk	No routine screening recommended	Be aware of symptoms; discuss concerns with provider
Endometrial Cancer	Women	Average Risk	No routine screening recommended	Report abnormal bleeding; discuss concerns with provider

https://www.cancer.org/
https://www.uspreventiveservicestaskforce.org/
https://www.cancer.gov/
https://www.acog.org/
https://gastro.org/

Cancer Analysis Guideline

Low Risk

Individuals with a family history of cancer

↓

Germline testing to identify inherited pathogenic variants predisposing to cancer

↓

Risk reduction strategies: lifestyle modifications and environmental awareness

Suggested kit: QIAseq Comprehensive Hereditary Cancer Research Panel (V4)

Intermediate Risk

Healthy individuals with elevated cancer risk indicators

↓

Comprehensive Somatic tumor profiling to identify actionable mutations for diagnosis and treatment guidance

↓

Precision medicine

Suggested kit: QIAseq Human Actionable Solid Tumor (V3)

High Risk

Individuals diagnosed with cancer

Cancer Risk/Detection Indicators*

Cancer Type	Key Blood-Based/Clinical Indicators	Details & Additional Indicators
Breast	CA 15-3, CA 27.29, CEA (non-specific), ESR	Useful in **monitoring**, not early detection. **Elevated ESR/CRP** may reflect inflammation in advanced disease.
Lung	CEA, CYFRA 21-1 (non-small cell), NSE (small cell), ProGRP	**ProGRP** specific for small-cell type. LDH elevated in advanced disease.
Colorectal	CEA, SEPT9 methylation (plasma test), Fecal immunochemical test (FIT)	CEA used post-surgery. **FIT or FOBT** is first-line for screening. CRP may rise in advanced stages.
Gliomas (Brain)	GFAP (Glial Fibrillary Acidic Protein), Neuron-Specific Enolase (NSE), IL-6, IL-8	**No validated early detection blood test**. These markers are **under investigation** or used prognostically.
Leukemia	CBC (↑WBC, anemia, thrombocytopenia), Peripheral blasts, LDH, uric acid	**WBC abnormalities**, **LDH**, and ↑**uric acid** reflect high cell turnover. Can be picked up in routine blood tests.
Ovarian	CA-125, HE4, ROMA Index (CA-125 + HE4 + menopausal status)	**HE4 more specific** than CA-125. CA-125 can also be raised in benign conditions.
GIST	None standard in blood; LDH, ferritin (non-specific) may elevate	Primarily diagnosed via imaging and biopsy. **Anemia or GI bleeding** may be first sign.
Melanoma	LDH, S100 protein (advanced disease)	LDH correlates with metastatic burden. **S100** sometimes used to monitor progression.
Endometrial	CA-125 (advanced cases), CBC (anemia), abnormal uterine bleeding	**Anemia** from chronic blood loss can be seen. No reliable marker for early detection.
Gastric	CEA, CA 19-9, PG I/II ratio, H. pylori serology	**Pepsinogen I/II** ratio used to detect **atrophic gastritis**, a precancerous condition. H. pylori IgG positive in infection.
Bladder	NMP22, BTA, UroVysion FISH (mainly urine), CBC (hematuria-induced anemia)	**Blood in urine (hematuria)** is often the first sign; no solid blood-based markers exist.
Thyroid	Thyroglobulin (TG), Calcitonin (medullary cancer), TSH, Anti-TPO antibodies	**Calcitonin elevated** in medullary type. **TG** used post-thyroidectomy for recurrence.
Kidney (RCC)	ESR, CRP, LDH, anemia, elevated calcium	**Hypercalcemia**, **anemia**, and **elevated ESR** often seen. Tumor can cause systemic effects.
Pancreatic	CA 19-9, CEA, Lipase, Bilirubin (obstructive), CRP	CA 19-9 limited in early detection. **Elevated bilirubin** common in head-of-pancreas tumors.
Myeloma	SPEP/UPEP, Free light chains, β2-microglobulin, Calcium, Creatinine, CBC (anemia)	**Hypercalcemia**, **renal dysfunction**, and **anemia** are hallmark findings.
Head & Neck	EBV DNA (nasopharyngeal), HPV serology (oropharyngeal), LDH, inflammatory markers	EBV DNA used for screening in **NPC (Asia)**. HPV16 IgG/IgA used in **screening studies**.
AML	CBC (anemia, thrombocytopenia), peripheral blasts, LDH, D-dimer, uric acid	**Rapid onset of pancytopenia**, **LDH**↑, and **coagulopathy** may be detected early on.

QIAseq Actionable Solid Tumor (AIT) Panel, Custom (V3)

Gene List and associate cancers

No.	ENSG Number	Genes	Role	Associated Cancers
1	ENSG00000157764	BRAF	Oncogene (activates MAPK/ERK signaling)	Melanoma, thyroid, colorectal, lung, gliomas
2	ENSG00000134853	PDGFRA	Oncogene (growth factor receptor, promotes proliferation)	Gastrointestinal stromal tumors (GIST), gliomas
3	ENSG00000146648	EGFR	Oncogene (growth factor receptor, drives cell survival)	Lung, glioblastoma, colorectal
4	ENSG00000133703	KRAS	Oncogene (GTPase, activates MAPK and PI3K pathways)	Lung, colorectal, pancreatic
5	ENSG00000213281	NRAS	Oncogene (GTPase, MAPK/ERK pathway activator)	Melanoma, leukemia, thyroid
6	ENSG00000157404	KIT	Oncogene (growth factor receptor, drives cell division)	Gastrointestinal stromal tumors (GIST), melanoma, leukemia
7	ENSG00000142208	AKT1	Oncogene (PI3K-AKT signaling, promotes survival)	Breast, lung, ovarian, prostate
8	ENSG00000171094	ALK	Oncogene (tyrosine kinase, promotes proliferation)	Lung (NSCLC), neuroblastoma, lymphoma
9	ENSG00000168036	CTNNB1	Oncogene (Wnt signaling, β-catenin activation)	Colorectal, liver (HCC), ovarian, endometrial
10	ENSG00000065361	ERBB3	Oncogene (growth factor receptor, HER family)	Breast, lung, gastric
11	ENSG00000091831	ESR1	Oncogene (estrogen receptor, hormone-driven growth)	Breast, endometrial
12	ENSG00000088256	GNA11	Oncogene (G-protein, MAPK activation)	Uveal melanoma
13	ENSG00000156052	GNAQ	Oncogene (G-protein, MAPK activation)	Uveal melanoma, blue nevus
14	ENSG00000105976	MET	Oncogene (tyrosine kinase, promotes proliferation)	Lung, kidney (RCC), gastric
15	ENSG00000169397	RAF1	Oncogene (MAPK pathway activator)	Lung, melanoma, leukemia
16	ENSG00000141736	ERBB2	Oncogene (growth factor receptor, HER family)	Breast, gastric, lung
17	ENSG00000121879	PIK3CA	Oncogene (PI3K-AKT pathway, cell survival)	Breast, colorectal, ovarian, endometrial
18	ENSG00000156065	DDR2	Oncogene (receptor tyrosine kinase, collagen binding)	Lung adenocarcinoma, squamous cell carcinoma, gastric cancer
19	ENSG00000134406	FBXW7	Tumor suppressor (ubiquitin ligase component)	Colorectal, breast, gastric, ovarian, glioblastoma, leukemia
20	ENSG00000153178	FGFR1	Oncogene (fibroblast growth factor receptor)	Bladder, breast, lung, prostate, hematological malignancies
21	ENSG00000108270	FGFR2	Oncogene (fibroblast growth factor receptor)	Gastric, breast, endometrial, cholangiocarcinoma
22	ENSG00000129677	FGFR3	Oncogene (fibroblast growth factor receptor)	Bladder, multiple myeloma, head and neck cancer
23	ENSG00000125574	FLT3	Oncogene (receptor tyrosine kinase)	Acute myeloid leukemia (AML)
24	ENSG00000203430	HRAS	Oncogene (GTPase, RAS family)	Bladder, kidney, thyroid cancers, Costello syndrome
25	ENSG00000132142	MAP2K1	Oncogene (MAPK/ERK signaling pathway)	Melanoma, lung, colorectal, thyroid cancers, cardiofaciocutaneous syndrome
26	ENSG00000160237	MAP2K2	Oncogene (MAPK/ERK signaling pathway)	Melanoma, leukemia, Noonan syndrome
27	ENSG00000148400	NOTCH1	Oncogene/Tumor suppressor (Notch signaling pathway)	T-cell acute lymphoblastic leukemia (T-ALL), chronic lymphocytic leukemia (CLL), head and neck squamous cell carcinoma (HNSCC), breast cancer (context-dependent), gastric cancer (context-dependent)
28	ENSG00000103537	SMAD4	Tumor suppressor (TGF-beta signaling pathway)	Colorectal, pancreatic, gastric cancers, juvenile polyposis syndrome
29	ENSG00000198888	STK11	Tumor suppressor (serine/threonine kinase)	Lung, colorectal, pancreatic, Peutz-Jeghers syndrome
30	ENSG00000187867	ERBB4	Oncogene (receptor tyrosine kinase, HER family)	Breast, lung, melanoma

To add or remove genes from the original panel is doable

Sample multiplexing guideline for QIAseq Targeted DNA legacy (V3) panels (LOD = 1.0%VAF)

Panels	Variant (Cat.) number	Number of genes	Number of primers	Sample per run for somatic variant detection (5%VAF, 7200x)		Sample per run for germline variant detection (500x)
				MiSeq V3 600cycles	NextSeq High Output	MiSeq V3 600cycles
Human Breast Cancer Panel	DHS-001Z	93	4831	1	23	21
Human Colorectal Cancer Panel	DHS-002Z	71	2929	2	38	34
Human Myeloid Neoplasms Panel	DHS-003Z	141	5887	1	19	17
Human Lung Cancer Panel	DHS-005Z	72	4149	2	27	24
Human Actionable Solid Tumor Custom Panel	CDHS-39382Z-909	30	909	8	122	110
Human BRCA1 and BRCA2 Panel	DHS-102Z	2	223	31	498	448
Human BRCA1 and BRCA2 Plus Panel	DHS-103Z	6	348	20	319	287
Human Pharmacogenomics Panel	DHS-104Z	31	146	48	761	685
Human Mitochondria Panel	DHS-105Z	37	222	31	501	450
Human HRR Panel **Including BRCA1 BRCA2**	DHS-110Z	15	2,303	3	48	43
Human Inherited Disease Panel	DHS-3011Z	298	11,579	N/A	10	9
Human Cancer Predisposition Panel	DHS-3013Z	-	5,587	1	20	18
Human Comprehensive Cancer Panel	DHS-3501Z	275	11,311	N/A	10	9
Tumor Mutational Burden Panel	DHS-6600Z	486	19,121	N/A	6	5
Human MSI Panel	DHS-7700Z	-	92	75	1208	1087
Human TMB and MSI Panel	DHS-8800Z	-	19,213	N/A	6	5

Screening and Treatment purposes

Calculation based on 2 x 150bp paired-end reads

Cancer Analysis Guideline

Low Risk

Individuals with a family history of cancer

↓

Germline testing to identify inherited pathogenic variants predisposing to cancer

↓

Risk reduction strategies: lifestyle modifications and environmental awareness

Suggested kit: QIAseq Comprehensive Hereditary Cancer Research Panel (V4)

Intermediate Risk

Healthy individuals with elevated cancer risk indicators

↓

Comprehensive Somatic tumor profiling to identify actionable mutations for diagnosis and treatment guidance

↓

Precision medicine

Suggested kit: QIAseq Human Actionable Solid Tumor (V3)

QIAseq comprehensive cancer focus panel (V4)

High Risk

Individuals diagnosed with cancer

↓

Specific Somatic mutation analysis to guide specific therapy selection

↓

Precision medicine

Suggested kit: QIAseq Human HRR Panel (V3)

Lung Cancer Focus Panel (V4)

Brain Cancer Focus Panel (V4)

Colorectal Cancer Focus Panel (V4)

Breast Cancer Focus Panel (V4)

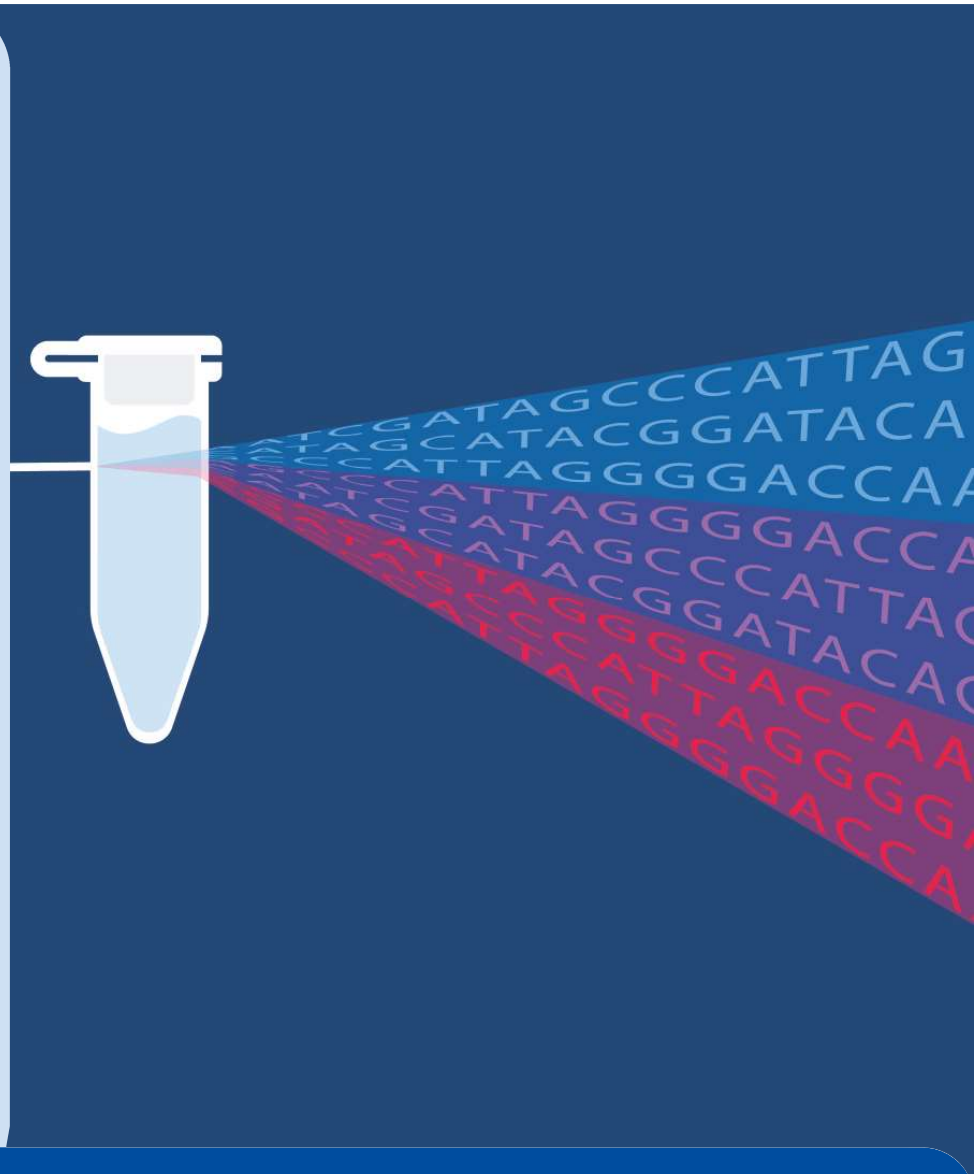
Sample multiplexing guideline for QIAseq Targeted DNA Pro (V4) panels (LOD = 0.5%VAF)

Cat. No.	Product name	Variant types and targeted regions	Total number of primers	Sample per run for somatic variant detection (5%VAF, 7200x)		Sample per run for germline variant detection MiSeq V3 600cycles (500x)
				MiSeq V3 600cycles	NextSeq High Output	
PHS-3000Z	Comprehensive Cancer Research Panel	Somatic mutation, Full coding	12,264	N/A	9	-
PHS-001Z	Breast Cancer Research Panel		2534	3	44	-
PHS-002Z	Colorectal Cancer Research Panel		3430	2	32	-
PHS-003Z	Myeloid Neoplasms Research Panel		6848	1	16	-
PHS-004Z	Brain Cancer Research Panel		2742	3	41	-
PHS-005Z	Lung Cancer Research Panel		2571	3	43	-
PHS-3100Z	Comprehensive Cancer Focus Panel		2990	2	37	-
PHS-101Z	Breast Cancer Focus Panel	Somatic mutation, Hot spot	633	11	176	-
PHS-102Z	Colorectal Cancer Focus Panel		1000	7	111	-
PHS-103Z	Myeloid Neoplasms Focus Panel		1680	4	66	-
PHS-104Z	Brain Cancer Focus Panel		649	11	171	-
PHS-105Z	Lung Cancer Focus Panel		759	9	146	-
PHS-3200Z	Comprehensive Hereditary Cancer Research Panel	Germline mutation, Full coding	15370	-	-	7
PHS-201Z	Hereditary Breast and Ovarian Cancer Panel		2508	-	-	40
PHS-202Z	Hereditary Colorectal Cancer Panel		2226	-	-	45
PHS-203Z	Hematologic Malignancy Panel		1276	-	-	78
PHS-204Z	Hereditary Prostate Cancer Panel		1135	-	-	88
PHS-205Z	Hereditary Pancreatic Cancer Panel		1595	-	-	63

Treatment purposes

Calculation based on 2 x 150bp paired-end reads

Think Bigger!
Detect More!

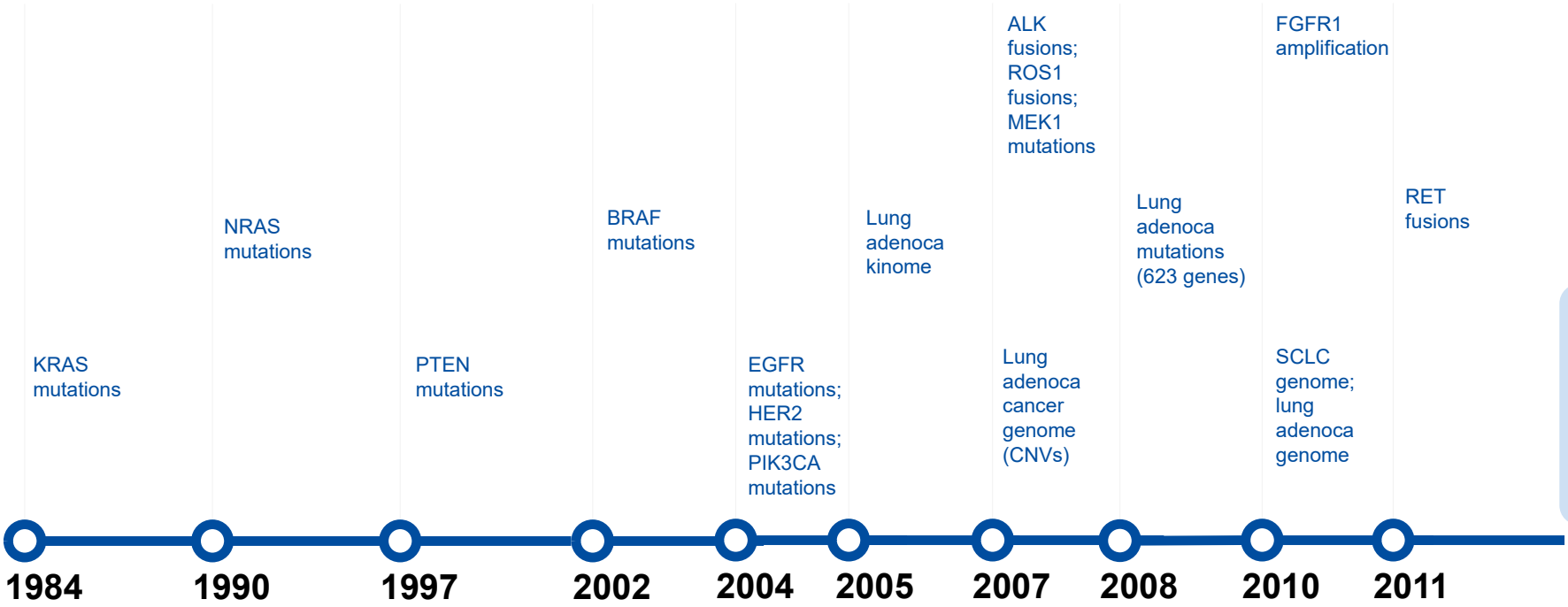


QIAseq Multimodal DNA/RNA library kit
Comprehensive Genomic Profiling (CGP) Panel

https://www.qiagen.com/th/products/discovery-and-translational-research/next-generation-sequencing/dna-sequencing/qiaseq-xhyb-cgp-panels?catno=335122

Why Comprehensive Genomic Profiling (CGP)?

Timeline for the discovery of significant molecular alterations in lung cancer



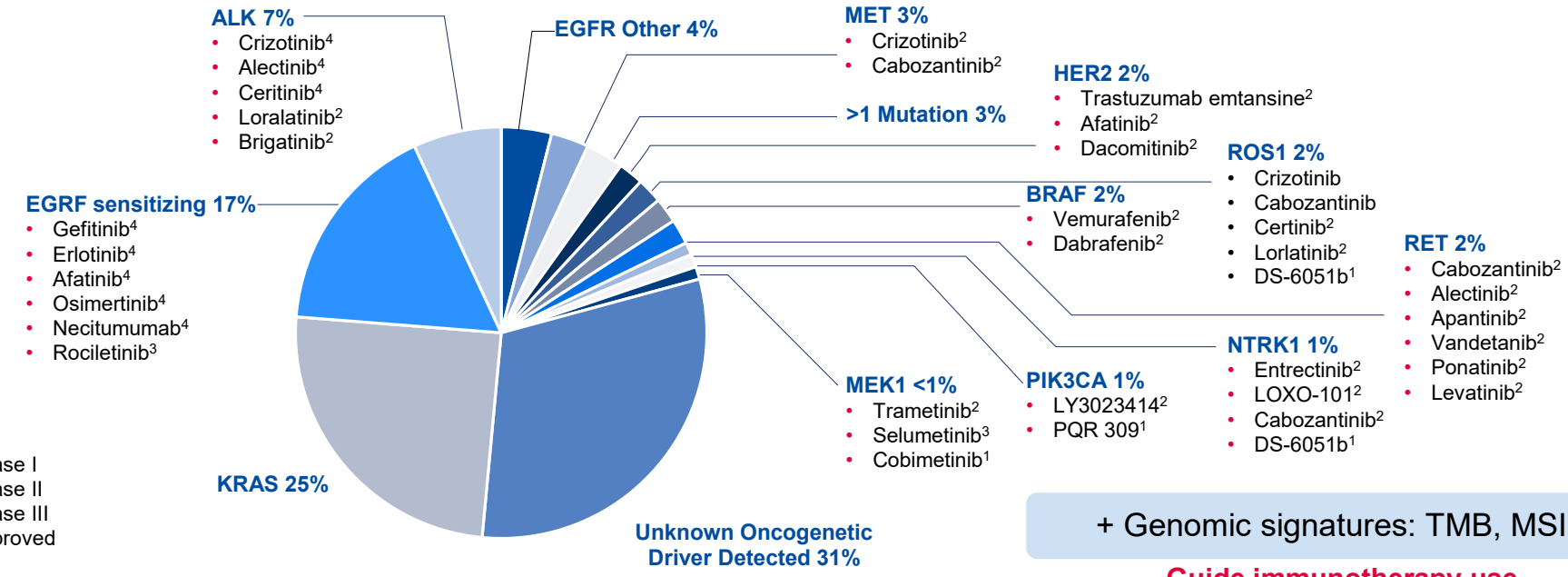
Cancer biomarker profiles are becoming more complex.

Single-gene tests have become inefficient.

Figure adapted from: Levy MA, Lovly CM, Pao W. Translating genomic information into clinical medicine: lung cancer as a paradigm. *Genome Res.* 2012;22(11):2101–2108.

Growing number of questions for a small amount of tissue

Biomarkers associated with FDA-approved drugs for NSCLC (non-small cell lung cancer)



+ Genomic signatures: TMB, MSI

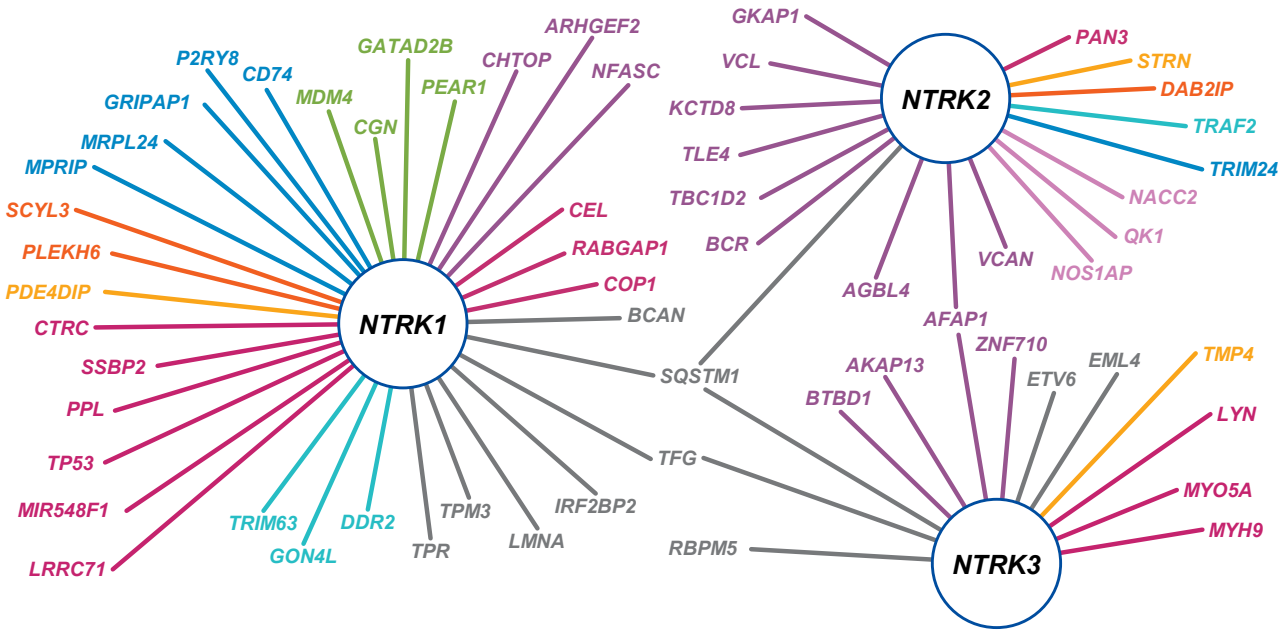
Guide immunotherapy use

Can one single assay test for all relevant biomarkers at the same time?

Tsao AS, Scagliotti GV, Bunn PA Jr et al. Scientific advances in lung cancer. 2015. *J Thorac Oncol.* 2016;11:613-638.

Growing number of gene fusions in cancer

Gene fusions are complex – multiple actionable biomarkers have numerous known and novel fusion partners



An example:

- *NTRK1, NTRK2, NTRK3*
- Have 61 known fusion partners across multiple tumor types
- Might have several currently unknown partners –new partners are being detected and characterized
- *NTRK* fusions can be targeted with TRK inhibitor drugs

- Glioma, glioblastoma
- Lung cancer
- Colon, colorectal cancer
- Other tumor types
- Melanoma
- Breast cancer
- Astrocytoma
- Sarcoma
- Found in multiple tumor types

Figure adapted from: Kummar S. TRK inhibition: A new tumor-agnostic treatment strategy. *Target Oncol.* 2018;13(5):545–556

Comprehensive Genome Profiling (CGP) Content Functionalities

- **DNA Biomarker**: Full coding regions of **724 oncogenes and tumor suppressor genes** for short **SNVs/Indels** detection and **TMB** analysis
- SNP backbone for **genome-wide CNV/LOH analysis**
- Microsatellite instability (**MSI**) markers
- DNA **translocations**
- **RNA Biomarkers**: All RNA transcripts of **234 genes** for **known and novel fusion** detection

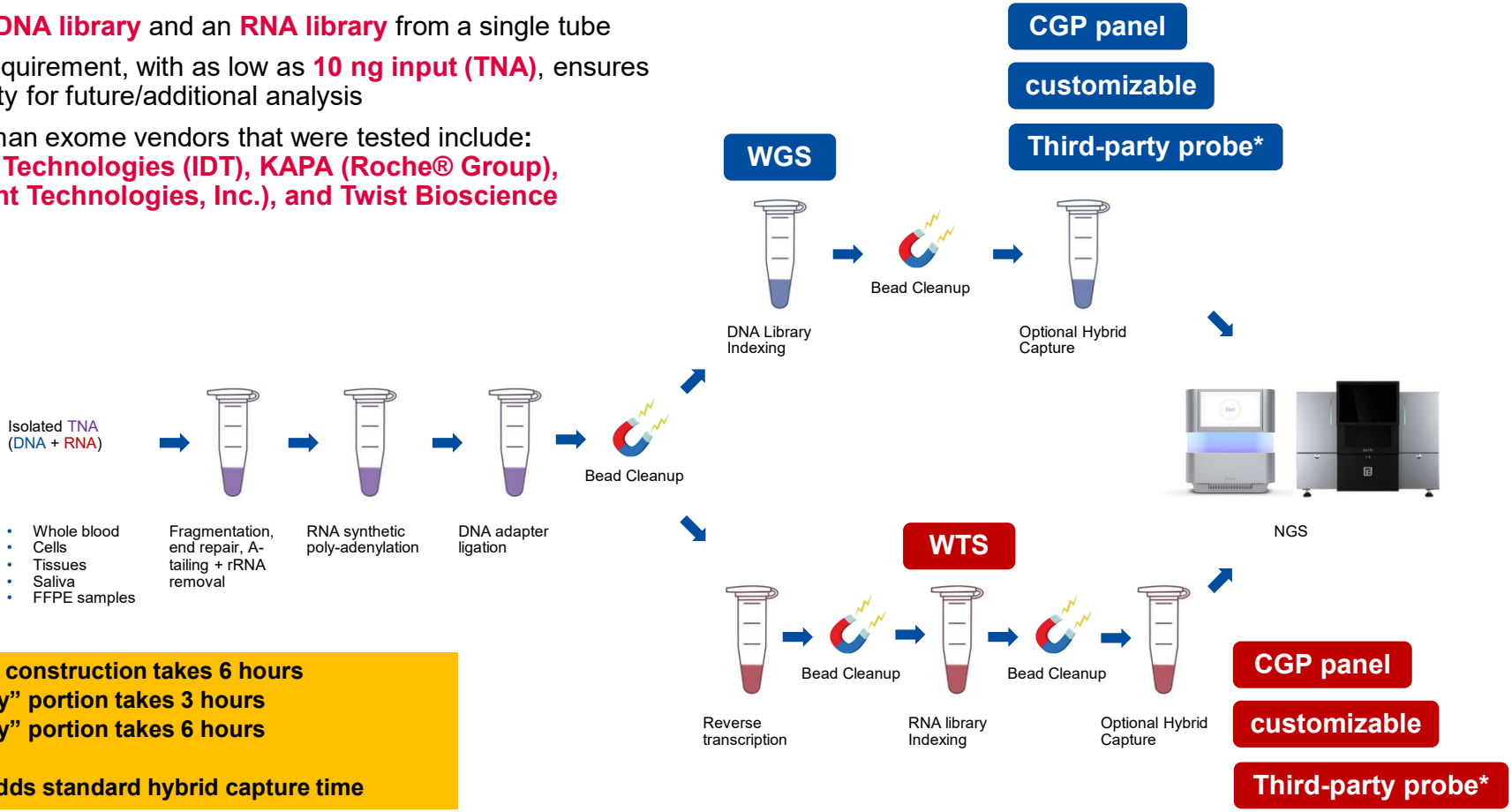
Cancer Types:

- Brain
- Breast
- Colorectal
- Lung
- Leukemia
- Lymphoma
- Myeloid Neoplasms
- Pancreatic
- Ovarian
- Prostate
- Bladder
- Gastric
- Liver
- Melanoma

Introducing the new QIAseq Multimodal DNA/RNA Library Kit

What does it do?

- Generation of a **DNA library** and an **RNA library** from a single tube
- Single sample requirement, with as low as **10 ng input (TNA)**, ensures sample availability for future/additional analysis
- * Third-party human exome vendors that were tested include: **Integrated DNA Technologies (IDT), KAPA (Roche® Group), Agilent® (Agilent Technologies, Inc.), and Twist Bioscience**



WGS/WTS library construction takes 6 hours

- **"DNA only" portion takes 3 hours**
- **"RNA only" portion takes 6 hours**

Hybrid Capture adds standard hybrid capture time

Want to try this solution for the first time?

Get in touch with our team today and request a quote to trial the QIAseq xHYB CGP DNA/RNA Panels (24).

QIAseq xHYB CGP DNA/RNA Panels offer the option to order either the DNA workflow reagents or the RNA workflow reagents separately.

QIAseq xHYB CGP DNA/RNA Panels (24)

Cat no. / ID. 335122

QIAseq xHYB probe panels for DNA and RNA target enrichments for comprehensive ge profiling, fixed panel for 24 samples. Must additionally purchase 2 x QIAseq xHYB Hum Reagent Kit (24) for library enrichment.

Copy order details

1. Panel / Kit

- QIAseq xHYB CGP DNA Panel
- QIAseq xHYB CGP RNA Panel
- QIAseq xHYB CGP DNA/RNA Panel
- QIAseq xHYB DNA Fusion & MSI+ Panel
- QIAseq xHYB Human Reagent Kit

2. For number of samples

- 24
- 96

https://www.qiagen.com/th/products/discovery-and-translational-research/next-generation-sequencing/dna-sequencing/qiaseq-xhyb-cgp-panels?catno=335122

QIAseq (Multimodal) xHYB CGP Panels: Competitive analysis

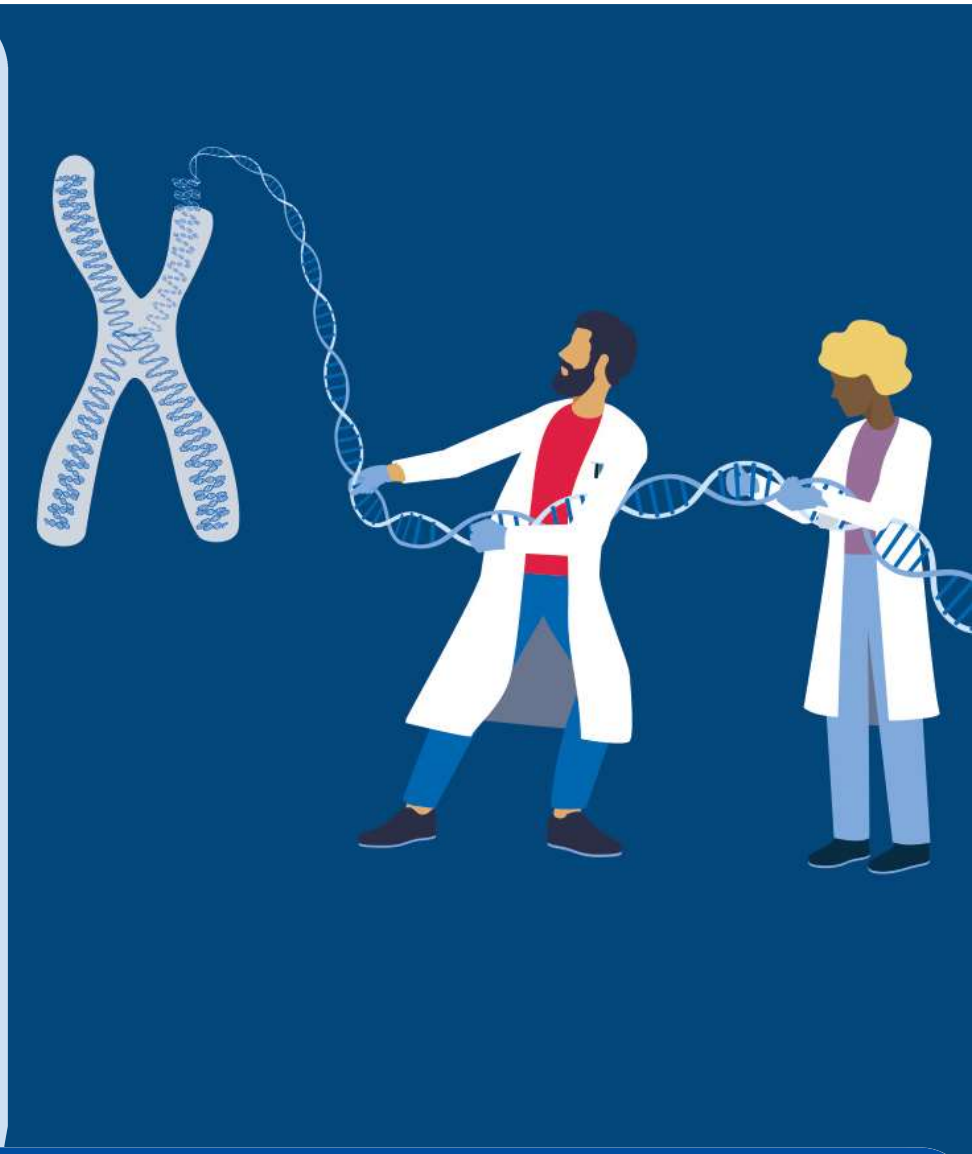
Feature	QIAseq xHYB CGP Panels	Company A	Company B	Company C	Company D
Comprehensive Insights	724 DNA genes 274 RNA genes	523 DNA genes 55 RNA genes	517 DNA genes 49 RNA genes	679 DNA genes 80 RNA genes	335 DNA genes
Custom Option	Yes	No	No	Yes (up to 750 genes)	No
Turnaround time for Library prep	1 – 2 days	2-3 days	1 day	1.5 days	2 days
Non-invasive flexibility	FFPE and cfDNA	FFPE and cfDNA	FFPE	FFPE	FFPE
Minimum input requirement for challenging samples	40 ng	40 ng	20 ng	50 ng	50 ng
Limit of detection for SNVs/Indels	5%* for FFPE 0.5% for cfDNA	5% for FFPE 0.5% for cfDNA	5%	5%	5%
Sequencing reads per samples	75 M for DNA 50 M for RNA 350 M for cfDNA**	80 M for DNA 16 M for RNA 800 M for cfDNA	35 M for DNA 3 M RNA	40 M for DNA 10 M for RNA	60 M
Price per sample for DNA/RNA library prep workflow	$$	$$$$$$	$$$$$	$$$	$$$$$

* Variants down to 1% can be detected with reduced specificity

** Development in-progress

*** Based on 96-samples kit

Beyond Boundaries:
Long Read Ready!



QIAseq xHYB Long Read Panels

Hereditary Cancer Panel

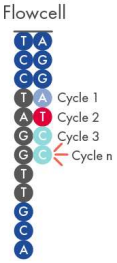
HLA Typing Panel

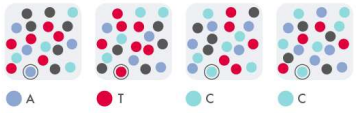
https://geneglobe.qiagen.com/th/product-groups/qiaseq-xhyb-long-read-panels

Long-read sequencing: Benefits relative to short read

NGS

Illumina

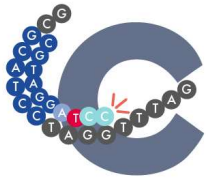


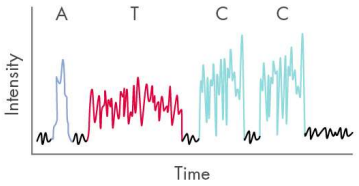


- Read length <500 bp

Third-generation sequencing

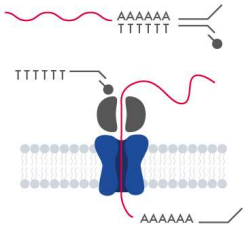
Pacific Biosciences





- Read length: Up to 20 kb
- Minimal GC bias
- Extremely accurate
- Compatible with PacBio SMRTbell® adapter ligation (Purchase separately)

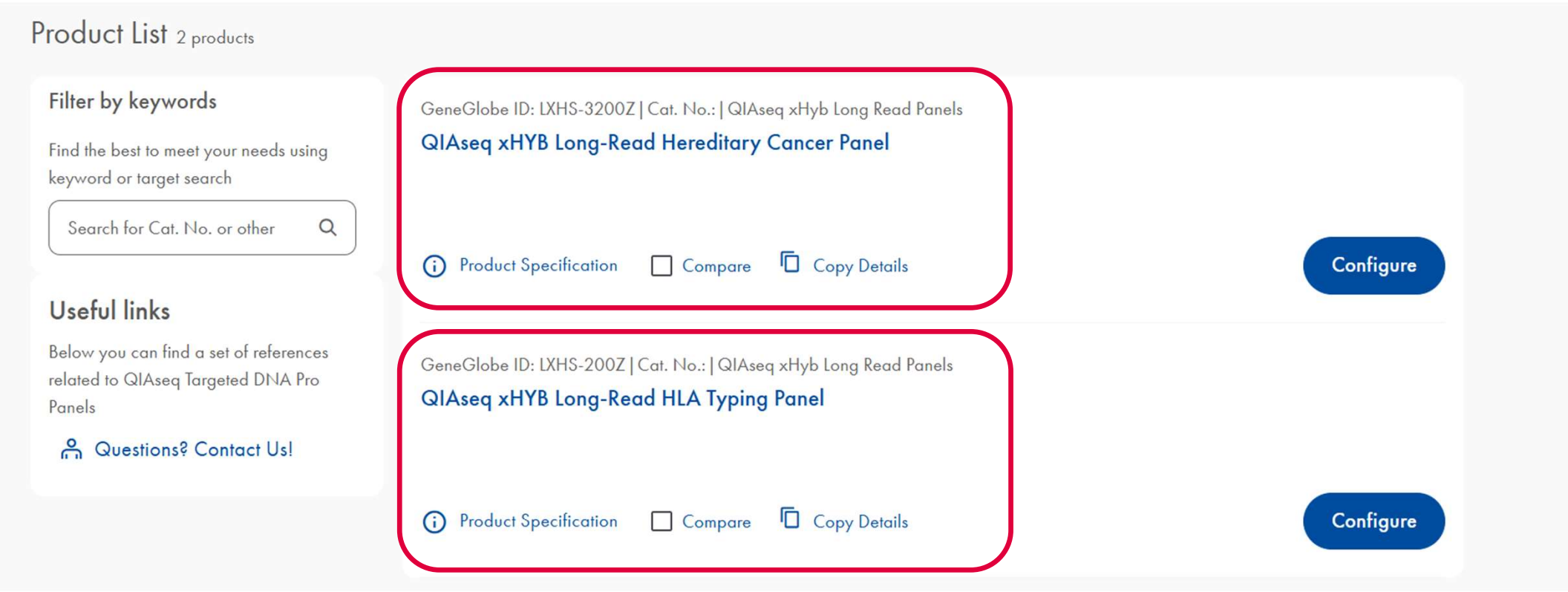
Oxford Nanopore



- Read length: Up to 2 Mb
- Real-time sequencing data
- Adaptive sampling enrichment
- Compatible with ONT LA adapter (Need to modify by End Repair/dA-Tailing)

https://bip.weizmann.ac.il/course/course2021-22/ThirdGenSeq_GilStelzer_7dec2021.pdf. Accessed: May 14, 2025.

Available QIAseq xHYB Long Read Panels



https://geneglobe.qiagen.com/th/product-groups/qiaseq-xhyb-long-read-panels

QIAseq xHYB CGP Long Read Panels target key genomic regions

The QIAseq xHYB Long Read Hereditary Cancer Panel covers 95 genes with known large structural variants implicated in cancer progression

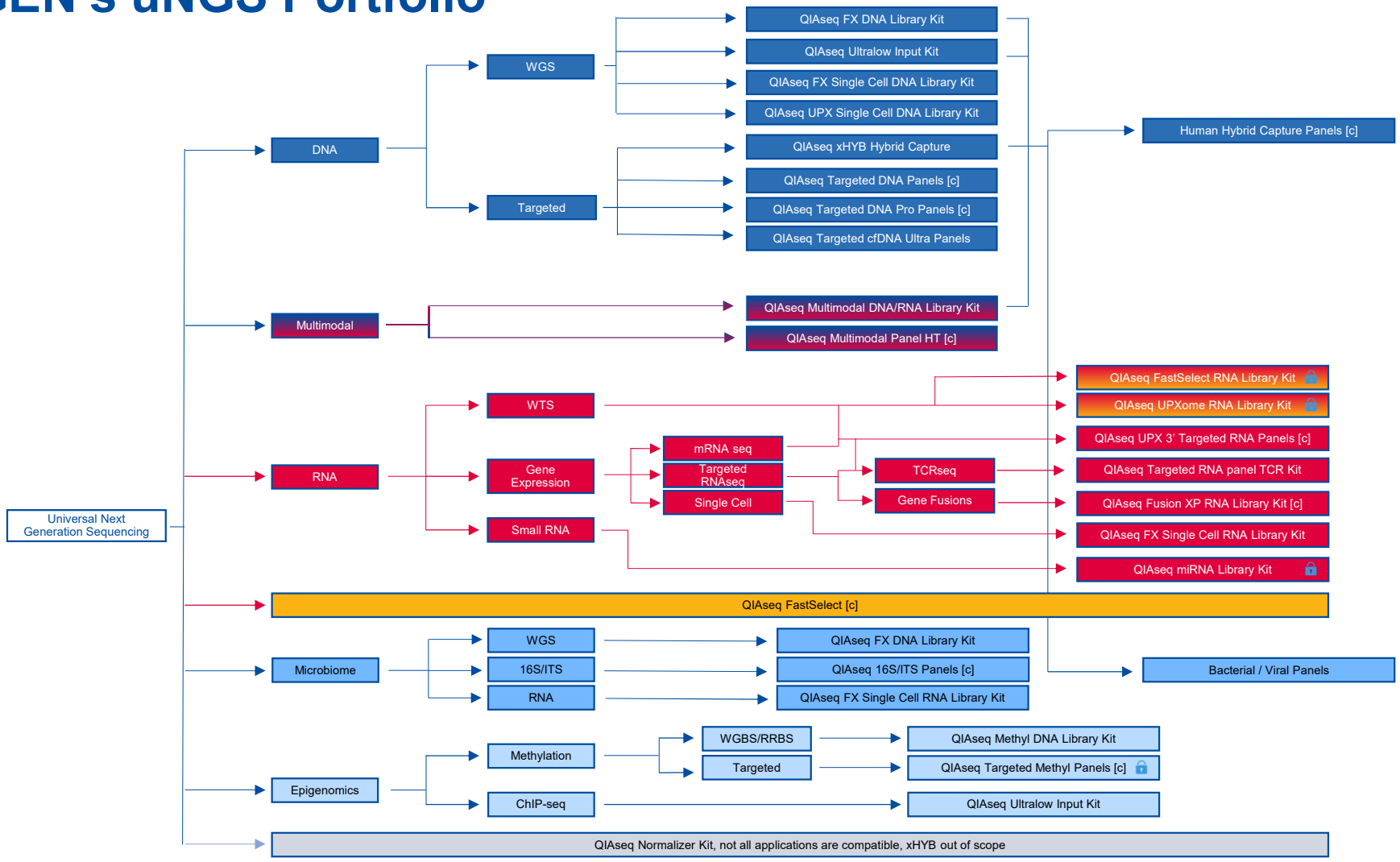
- Entire genes are targeted including exons, introns and UTRs for complete unbiased characterization of variants
- 95 genes targeted, with direct evidence for cancer-driving large structural variations
- Probe design is optimized for long-read sequencing to minimize off-target performance while covering challenging low-complexity regions with high-uniformity
- Customizable panel design means that you can tailor QIAseq xHYB long-read chemistry to your specific research focus

Genes covered by the QIAseq xHYB Long Read Hereditary Cancer Panel					
ACTRT1	*BRCA2*	*FANCC*	*MLH1*	*PMS2*	*SLX4*
AK3	*BRIP1*	*FANCM*	*MRE11*	*POLD1*	*SMAD4*
ANKRD24	*CDH1*	*FIBIN*	*MSH2*	*POLE*	*SMARCA4*
APC	*CDH18*	*FOCAD*	*MSH6*	*PPM1D*	*SSC5D*
APC2	*CDKN2A*	*GPC6*	*MUTYH*	*PTEN*	*STK11*
APOBEC3B	*CHEK2*	*GREM1*	*NBN*	*PTPRJ*	*TEK*
AR	*CNTN1*	*GSTT1*	*NELL1*	*RAD50*	*TMTC3*
ATM	*CNTNAP2*	*HRAS*	*NF1*	*RAD51C*	*TP53*
ATP2A2	*COL7A1*	*IGFBP5*	*NKX2-3*	*RAD51D*	*TSC2*
ATR	*CPA1*	*KANSL1*	*OR4C11*	*RAD54L*	*TTF2*
BAP1	*DCC*	*LAMA1*	*ORM1*	*RERGL*	*TYRO3*
BARD1	*DOCK8*	*LINC00583*	*PABPC1*	*RNF5*	*UGT2B17*
BCL3	*DYNLRB2*	*LTBP3*	*PALB2*	*RSPO2*	*ULK2*
BCR	*EGFR*	*MFHAS1*	*PCSK1*	*SEMA3D*	*WRN*
BLM	*EPCAM*	*MIR491*	*PLXDC2*	*SLC25A13*	*ZFHX3*
BRCA1	*FANCA*	*MIR646*	*PMS1*	*SLIT2*	

QIAseq xHYB Long Read Panels – Hereditary cancer panel

Company	QIAGEN		
Kit name	QIAseq xHYB Long Read Panels	Company A	Company B
Special features	Flexible Fragmentation Streamlined Workflow	Synthetic long read	Optimized Universal Adapter System
Target Insert size	3-10 kb	500-700 bp	≤ 8 kb
Assay time	1.5 days	2 days	2-3 days
Hands-on Time	~ 7 hrs	~ 6 hrs	~ 7 hrs
Input Quantity	10 -200 ng	50 ng	200 ng
Method	Hybrid capture	Hybrid capture	Hybrid capture
Multiplexing	Up to 96 on PacBio Up to 24 on ONT	Up to 64 on NovaSeq	Up to 400
Variant Class	Short tandem repeats (STRs), Single nucleotide polymorphisms (SNPs), Germline variants, Structural variants, Insertions-deletions (indels), Copy number variants (CNVs)	Short tandem repeats (STRs), Single nucleotide polymorphisms (SNPs), Germline variants, Structural variants, Insertions-deletions (indels), Copy number variants (CNVs)	Short tandem repeats (STRs), Single nucleotide polymorphisms (SNPs), Germline variants, Structural variants, Insertions-deletions (indels), Copy number variants (CNVs)

QIAGEN's uNGS Portfolio



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Thank you for your attention. Questions?