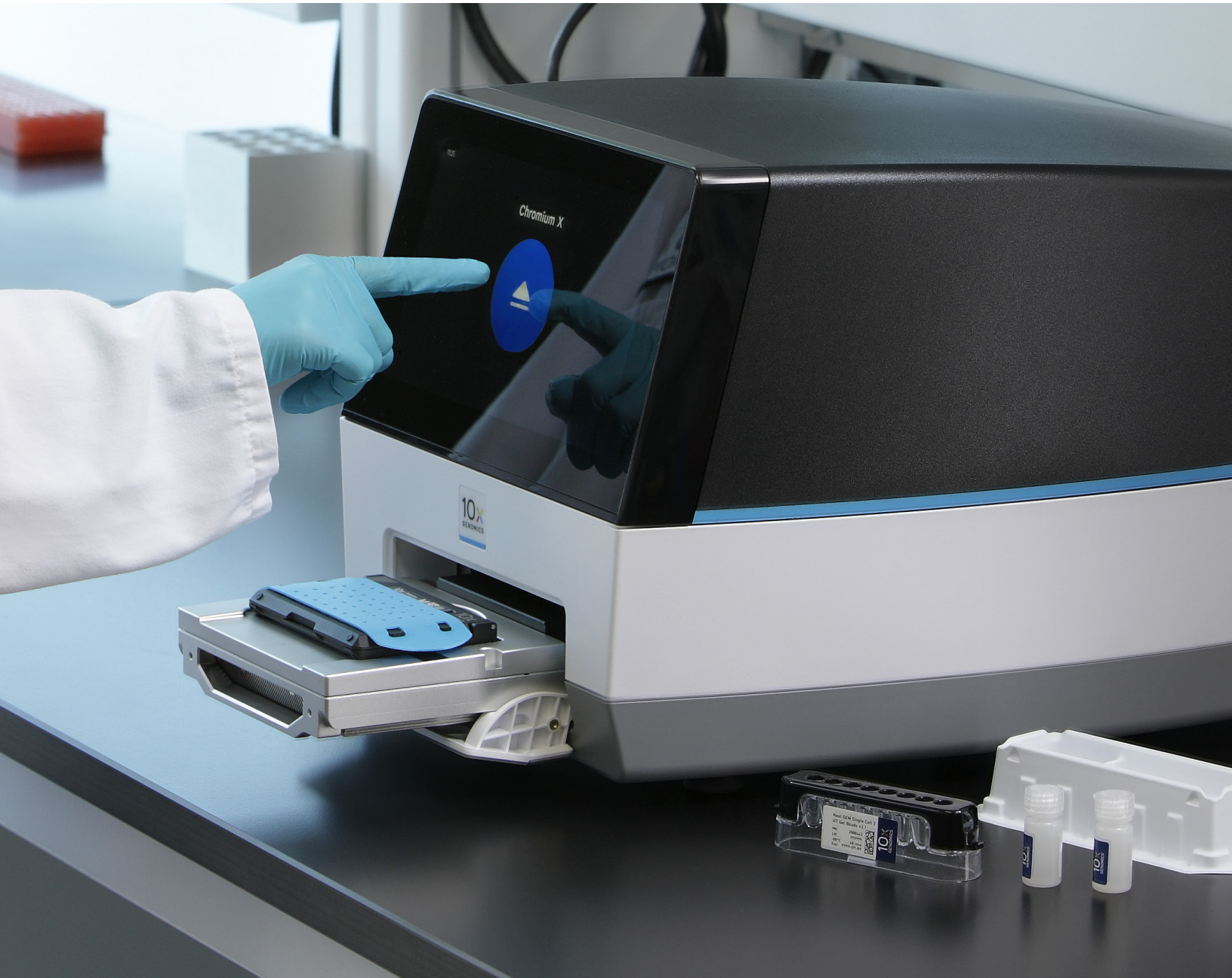
10x GENOMICS

Inside Chromium Next GEM Technology



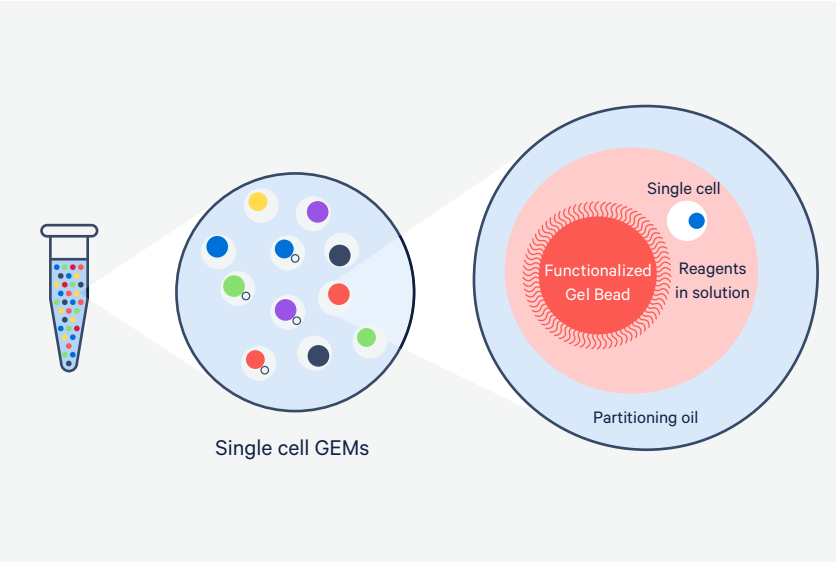
Resolving biology with scalable, single cell multiomic solutions

The Chromium platform, powered by Next GEM technology, enables integrated analysis of single cells at massive scale. Our suite of Chromium Single Cell products can capture molecular readouts of cell activity in multiple dimensions, including gene expression, chromatin accessibility, cell surface proteins, immune clonotype, antigen specificity, and CRISPR edits. The key to this technology is the ability to generate tens of thousands of single cell partitions, each containing an identifying barcode for downstream analysis. The Chromium family of instruments uses advanced microfluidics to perform single cell partitioning and barcoding in a matter of minutes.

The core of Next GEM Technology

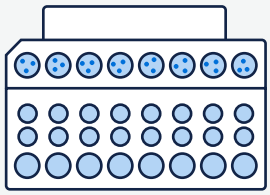
At the core of Next GEM Technology are Gel Beads, each one coated with a unique oligonucleotide barcode sequence and assay-specific functionalized sequences to capture molecules of interest.

Using advanced microfluidics, Chromium instruments encapsulate Gel Beads in GEMs, or a "Gel Bead-in-emulsion," along with a single cell or nucleus and reagents to create a micro-reaction.

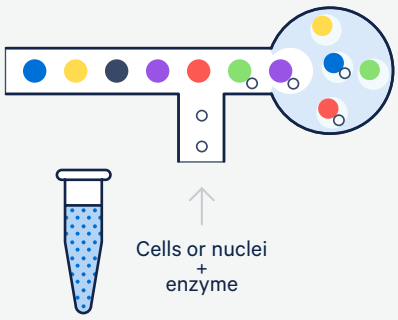


How it works: From cells and nuclei to sequencing-ready libraries

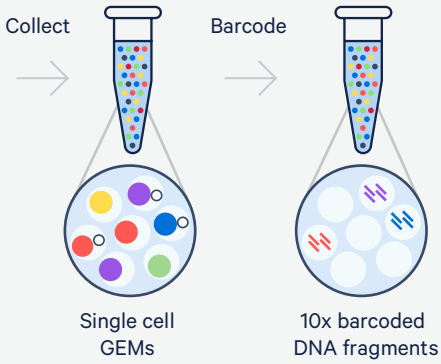
1. Gel Beads, cells or nuclei, enzymes, and partitioning oil are loaded onto a Next GEM chip.



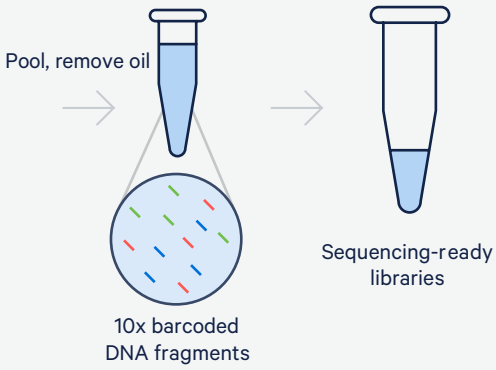
2. Within the Chromium instrument, barcoded Gel Beads are mixed with the cells or nuclei, enzymes, and partitioning oil to form tens of thousands of GEMs.



3. Each GEM acts as an individual reaction droplet in which the Gel Beads are dissolved and molecules of interest from each cell are captured and barcoded.



4. After barcoding, all fragments from the same cell or nucleus share a common 10x Barcode. Barcoded fragments for hundreds to tens of thousands of cells are pooled for downstream reactions to create short-read sequencer–compatible libraries.

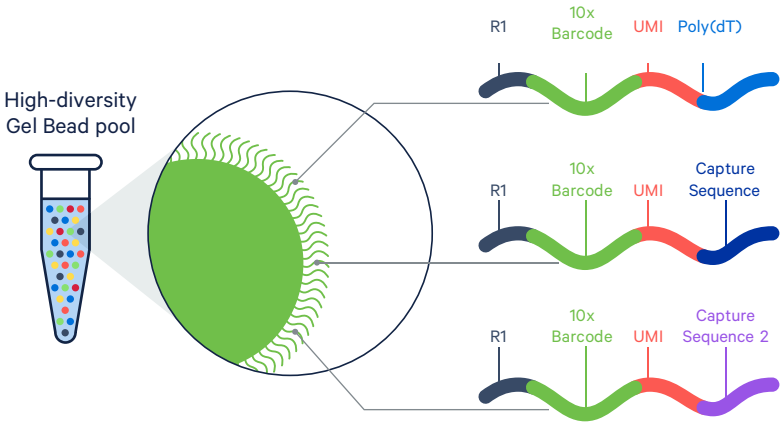


Chromium assays

Chromium Single Cell Gene Expression

Chromium Single Cell Gene Expression provides single cell transcriptome 3' gene expression and multiomic capabilities to explore cellular heterogeneity, discover novel targets, and identify biomarkers with combined detection of surface protein expression or CRISPR edits in each cell. While Next GEM technology enables single cell analysis, Feature Barcode sequences expand the breadth of analytes that can be captured at single cell resolution.

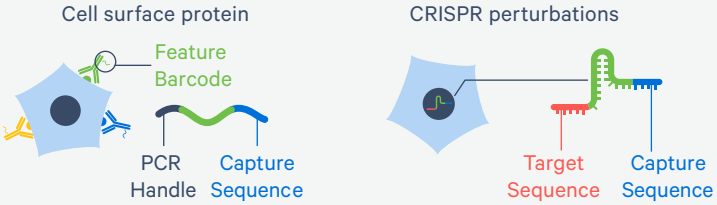
Assay input: Whole cells or nuclei



Functionalized sequences on the Gel Bead enable capture of 3' mRNA alone or in combination with Feature Barcode–labeled antibodies for cell surface protein analysis, or Feature Barcode–labeled CRISPR guides to link edits with cell phenotypes. Feature Barcode sequences are complementary to the Capture Sequences on Gel Beads.

Enabling single cell multiomics: What is Feature Barcode technology?

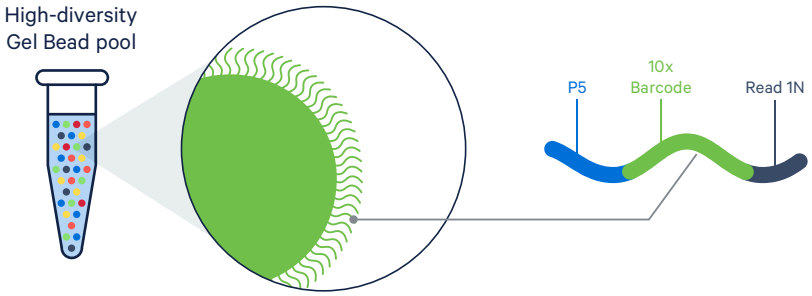
Feature Barcode oligonucleotides have barcode sequences that are used to label antibodies or CRISPR guides for simultaneous measurement of gene expression and additional cellular features in the same single cell.



Chromium Single Cell ATAC

Chromium Single Cell ATAC (Assay for Transposase Accessible Chromatin) allows you to analyze chromatin accessibility at the single cell level, providing insights into cell types and states and a deeper understanding of gene regulatory mechanisms.

Assay input: Nuclei

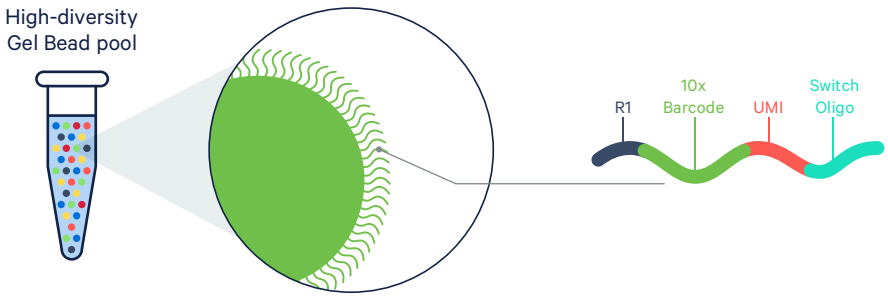


Functionalized sequences on the Gel Bead enable the capture of accessible chromatin fragments (from transposed DNA).

Chromium Single Cell Immune Profiling

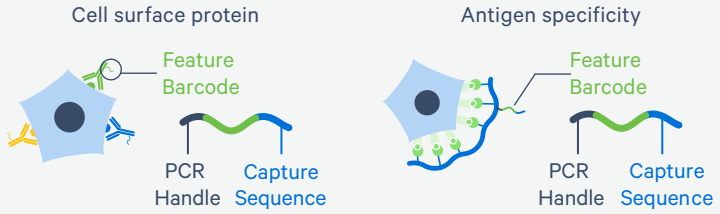
Chromium Single Cell Immune Profiling provides a multiomic solution to tackle your immunology questions. Analyze full-length, paired B-cell or T-cell receptors (BCR/TCR), surface protein expression, antigen specificity, and 5' gene expression, all from a single cell.

Assay input: Whole cells or nuclei



Functionalized sequences on the Gel Bead enable capture of 5' mRNA alone or in combination with Feature Barcode–labeled antibodies for cell surface protein analysis, or Feature Barcode–labeled peptide–MHC multimers to measure antigen specificity. Paired full-length BCR/TCR genes can also be captured and sequenced.

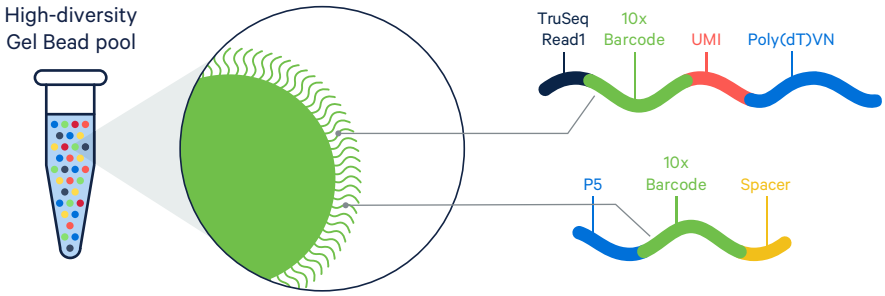
Feature Barcode technology for immune profiling



Chromium Single Cell Multiome ATAC + Gene Expression

Simultaneously profile gene expression and open chromatin from the same cell with Chromium Single Cell Multiome ATAC + Gene Expression. Multiply your power of discovery to characterize cell types and states, and uncover gene regulatory programs.

Assay input: Nuclei



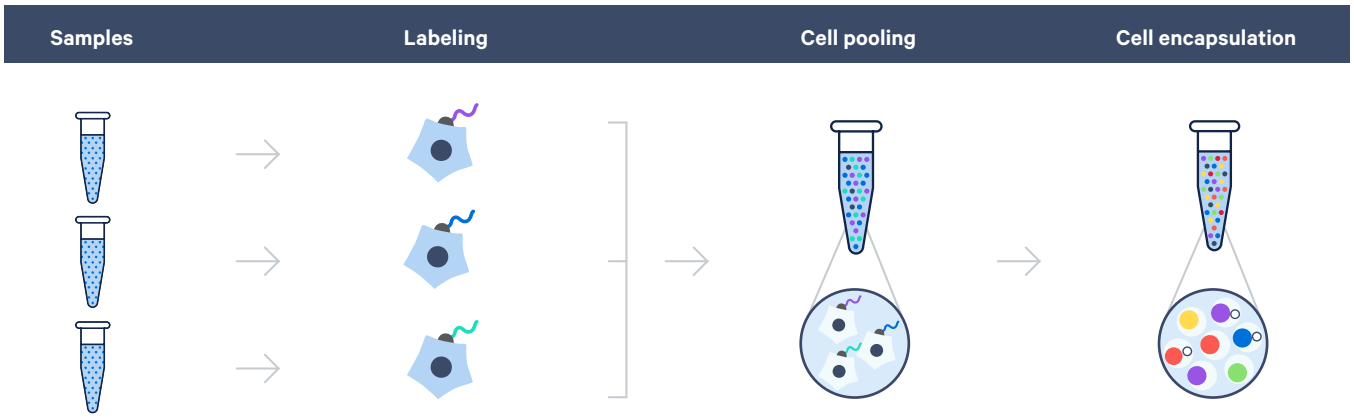
Functionalized sequences on the Gel Bead enable the dual capture of accessible chromatin fragments (from transposed DNA) and 3' mRNA.

Extend your capabilities

Sample multiplexing with 3’ CellPlex

Scale your single cell studies with an end-to-end sample multiplexing solution, utilizing species-agnostic tags. Enabled by Feature Barcode technology, 3’ CellPlex lets you combine up to 12 samples and recover up to 45,000 singlets* in a single channel, or 730,000 singlets per chip.

Compatible assays: Chromium Single Cell Gene Expression



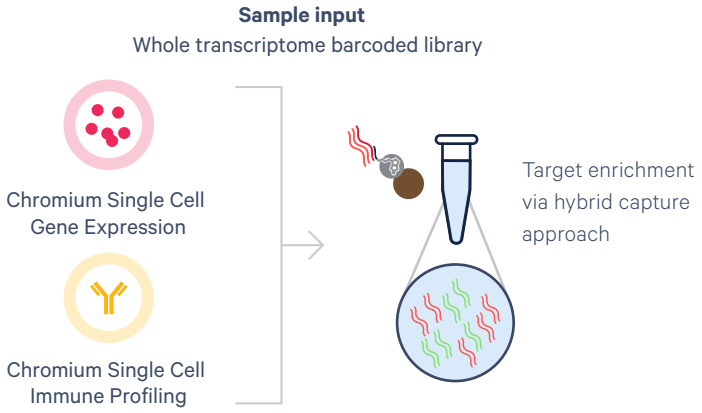
Starting with single cell or nuclei suspensions, each sample is stained with a unique lipid tag, then pooled and loaded onto a Chromium Next GEM chip. During the Single Cell Gene Expression workflow, mRNA, 3' CellPlex sample tags, and, if desired, protein or CRISPR guide RNAs are barcoded to identify individual GEMs. After sequencing, the samples are then bioinformatically demultiplexed with Cell Ranger software.

*Singlets are single cells or nuclei after multiplet removal.

Targeted Gene Expression

Profile a defined set of transcripts to reduce sequencing costs while increasing sample number or sequencing depth with customizable, comprehensive gene panels.

Compatible assays: Chromium Single Cell Gene Expression, Chromium Single Cell Immune Profiling

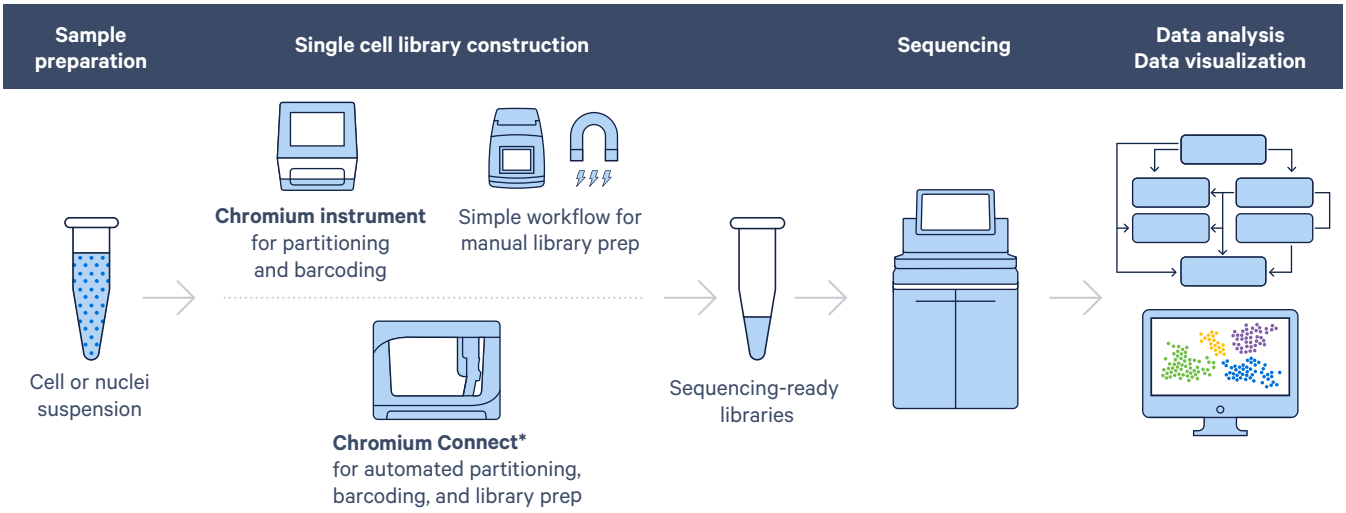


Starting with a final, barcoded library, up to eight input libraries can be pooled before target enrichment using hybrid capture. Enriched libraries can be sequenced at up to 90% lower cost than that of a corresponding whole transcriptome library.

Targeted Gene Expression panels	
Add up to 200 genes to pre-designed panels with the Custom Panel Designer	
Human Pan-Cancer Panel:	1,253 genes
Human Immunology Panel:	1,056 genes
Human Gene Signature Panel:	1,142 genes
Human Neuroscience Panel:	1,186 genes
Custom Human or Mouse Panels:	10–1,500 user-defined genes

Chromium Single Cell workflow

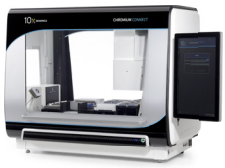
The Chromium platform is a transformative technology that fits easily into your existing lab infrastructure. This end-to-end single cell sequencing solution includes sample preparation support and turnkey data analysis and visualization tools.



*Compatible with Chromium Single Cell Gene Expression and Immune Profiling.

Chromium instrument family

Chromium instruments use advanced microfluidics to perform single cell partitioning and barcoding in a matter of minutes, enabling a seamless workflow from single cell or nuclei suspensions to sequencer-ready libraries.

	Chromium X Series	Chromium Controller	Chromium Connect
			
Instrument dimensions	11.25” x 19” x 10.75”	7.9" x 10.3" x 6.4"	42" x 28" x 35"
Instrument weight	41.4 lb (18.8 kg)	12.5 lb (5.6 kg)	350 lb (158.8 kg)
Supported workflow	Manual	Manual	Automated
Supported single cell assays	All assays and throughputs (low, standard, and high)	All assays; standard and low throughputs only	Gene Expression Immune Profiling

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