# The Cancer Genome Atlas (TCGA)

is a collaboration between the National Cancer Institute (NCI) and the National Human Genome Research Institute (NHGRI)

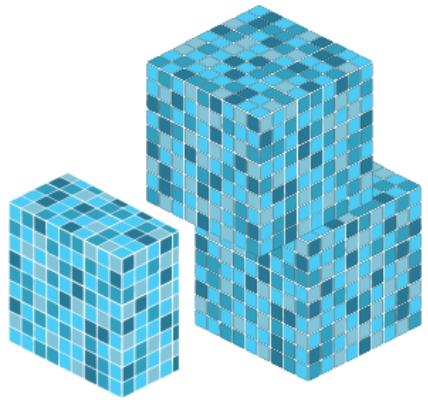

http://cancergenome.nih.gov/

TCGA produced over

**2.5**

PETABYTES

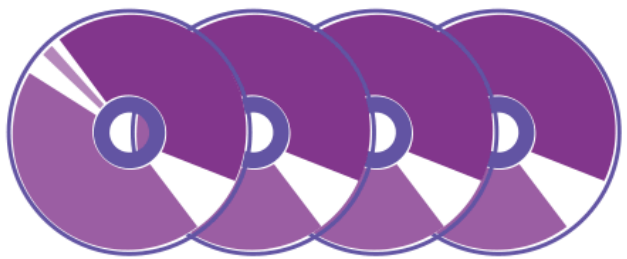
of data



To put this into perspective, **1 petabyte** of data is equal to

**212,000**

DVDs



TCGA data describes

**33**

DIFFERENT TUMOR TYPES

...including

**10**

RARE CANCERS

...based on paired tumor and normal tissue sets collected from

**11,000**

PATIENTS

...using

**7**

DIFFERENT DATA TYPES

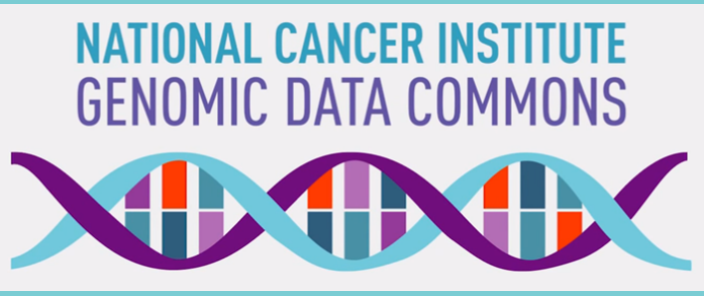
www.cancer.gov/ccg

# Major TCGA Resources : Tumor samples and Data

*Tumor Samples: large collection from 11K patients*

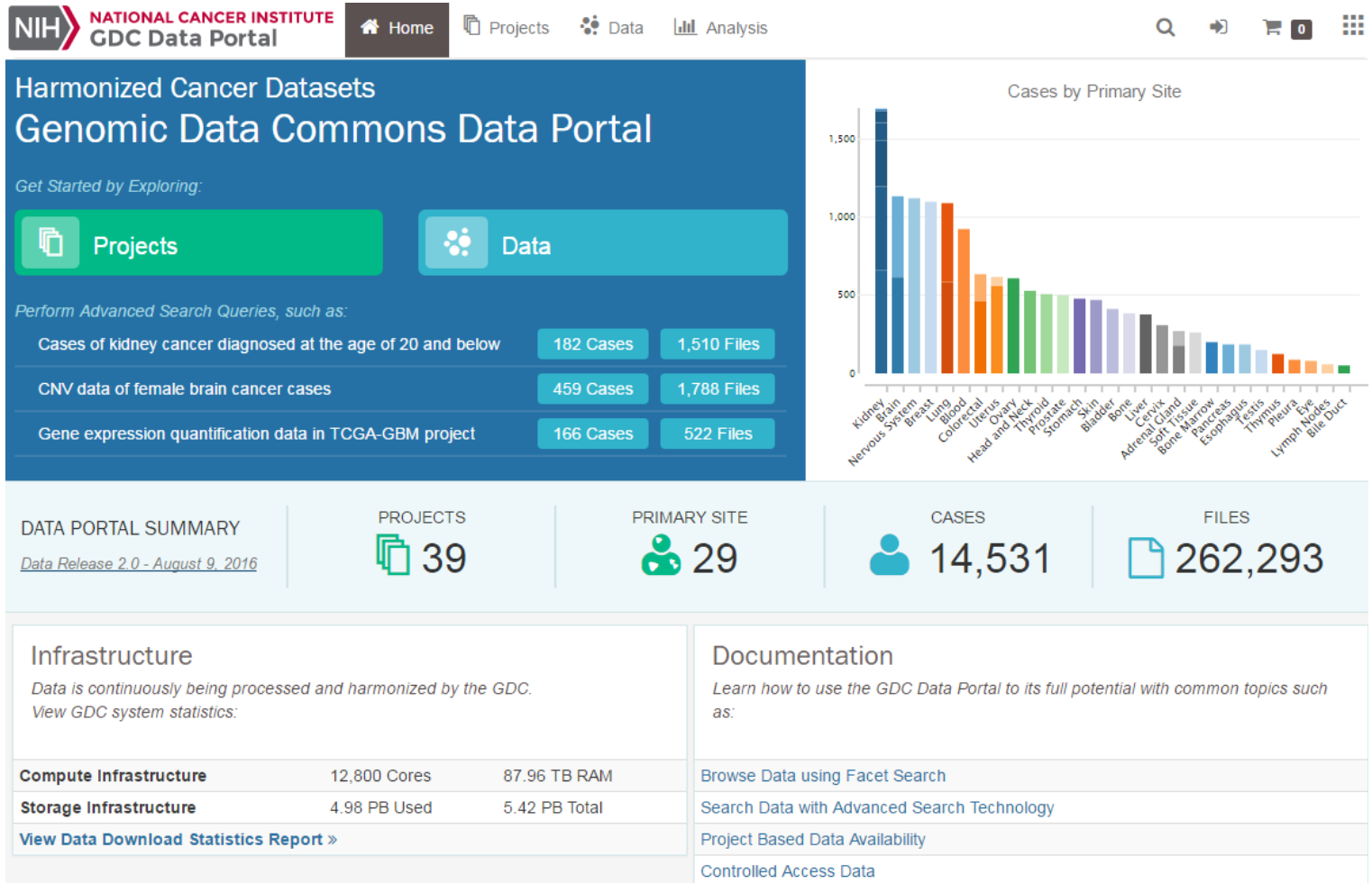
- Example: September 2016
- Next-Generation Pathology: TCGA Microscope Slides Helped Train an Automated Lung Cancer Diagnostic Tool
- Using over 2,000 pathology slides of lung cancer from The Cancer Genome Atlas (TCGA), researchers from Stanford University trained a machine-learning pipeline to create the first computational model that analyzes image features to better predict patient outcomes.

# TCGA Resources: Genomic Data Commons (GDC)



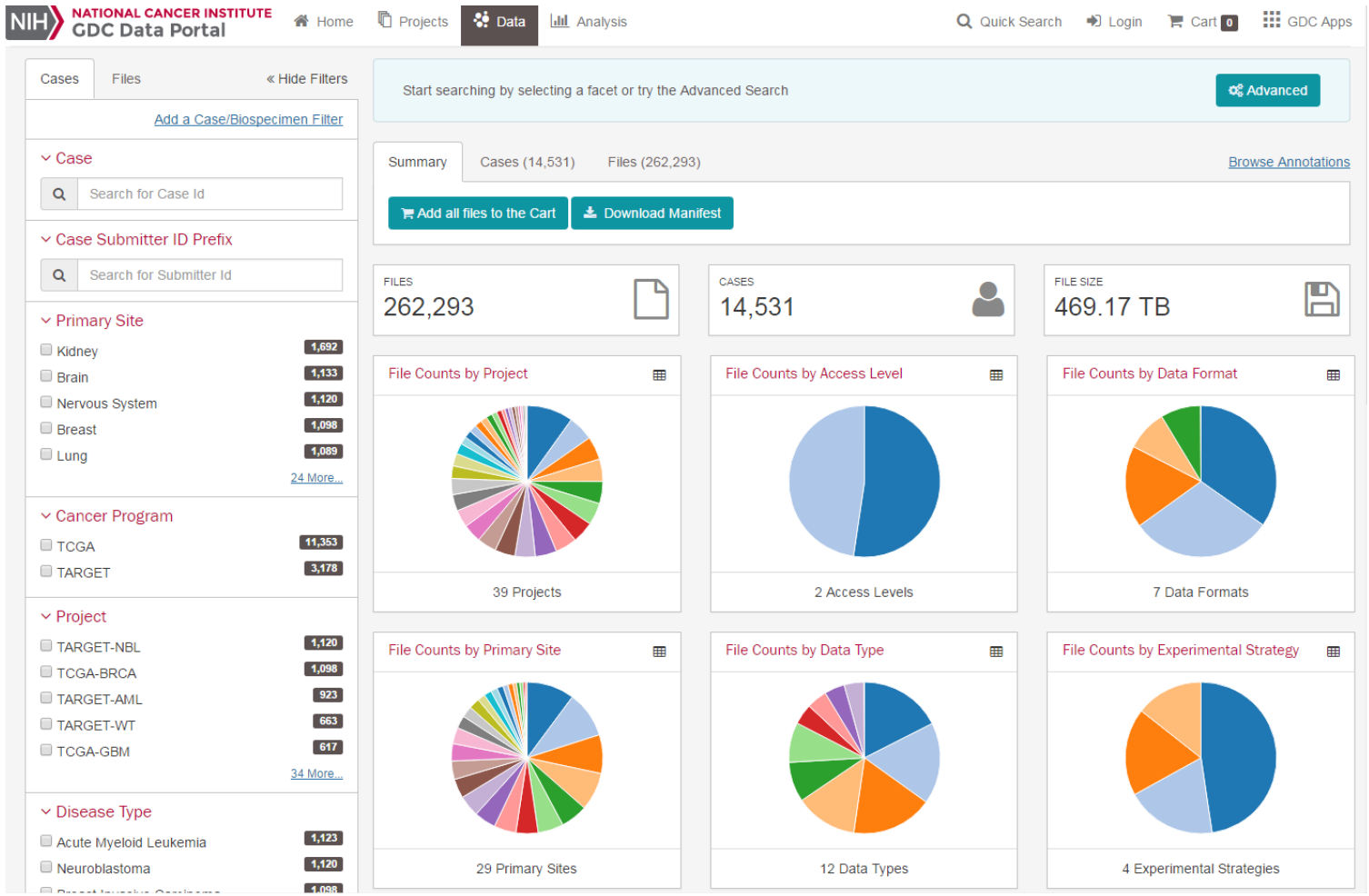

- Newly launched Genomic Data Commons to facilitate data and clinical information sharing (June 6, 2016)
- The Genomic Data Commons (GDC), a unified data system that promotes sharing of genomic and clinical data between researchers, launched on June 6, 2016 with a visit from Vice President Joe Biden to the operations center at the University of Chicago.
- An initiative of the National Cancer Institute (NCI), the GDC will be a core component of the National Cancer Moonshot and the President's Precision Medicine Initiative (PMI)
- The GDC will centralize, standardize and make accessible data from large-scale NCI programs such as The Cancer Genome Atlas (TCGA) and its pediatric equivalent, Therapeutically Applicable Research to Generate Effective Treatments (TARGET). NCI is part of the National Institutes of Health.

# GDC – A Data Sharing Platform to Promote Precision Oncology




https://gdc-portal.nci.nih.gov

# GDC – A Data Sharing Platform to Promote Precision Oncology

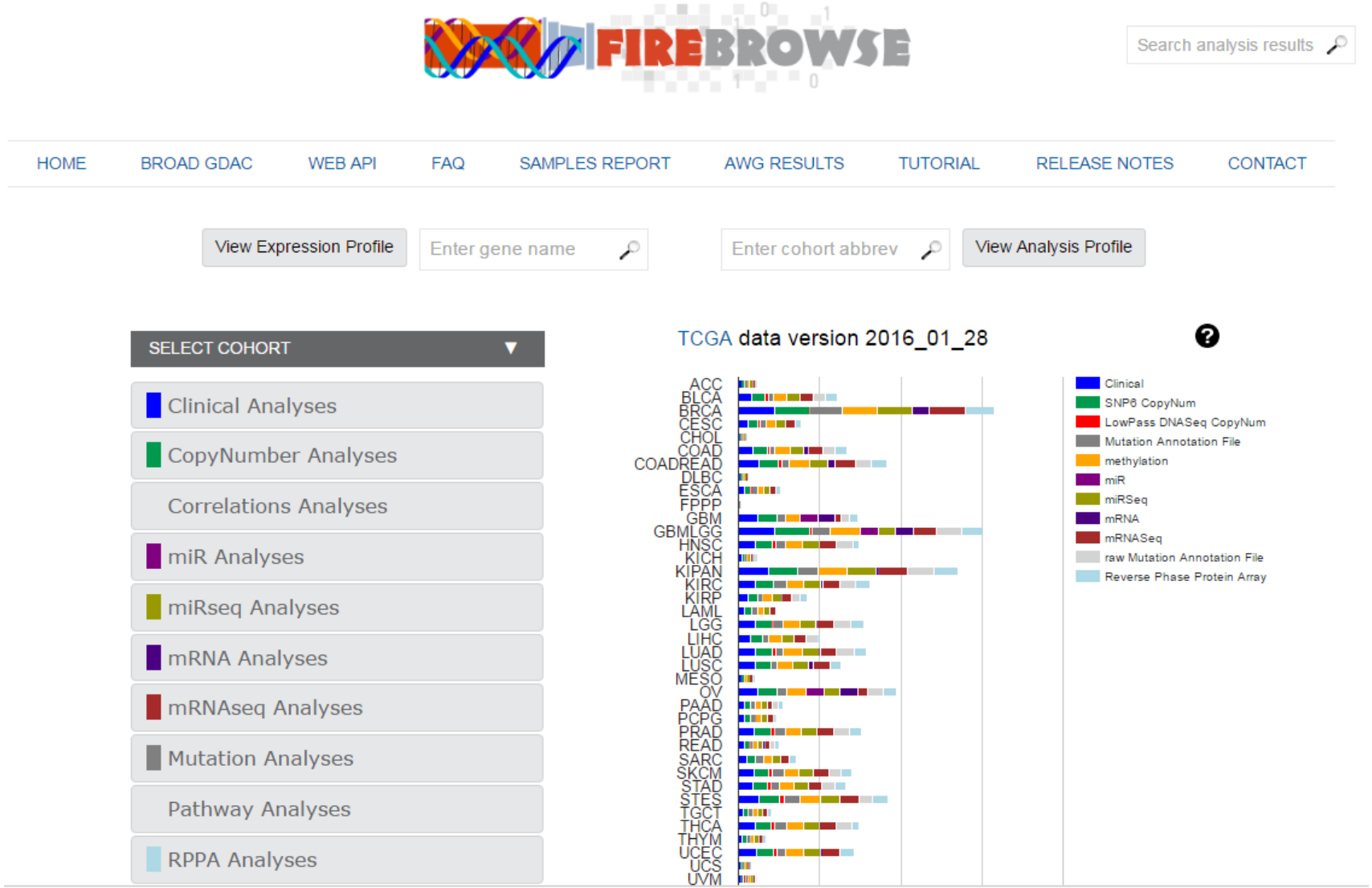



https://gdc-portal.nci.nih.gov

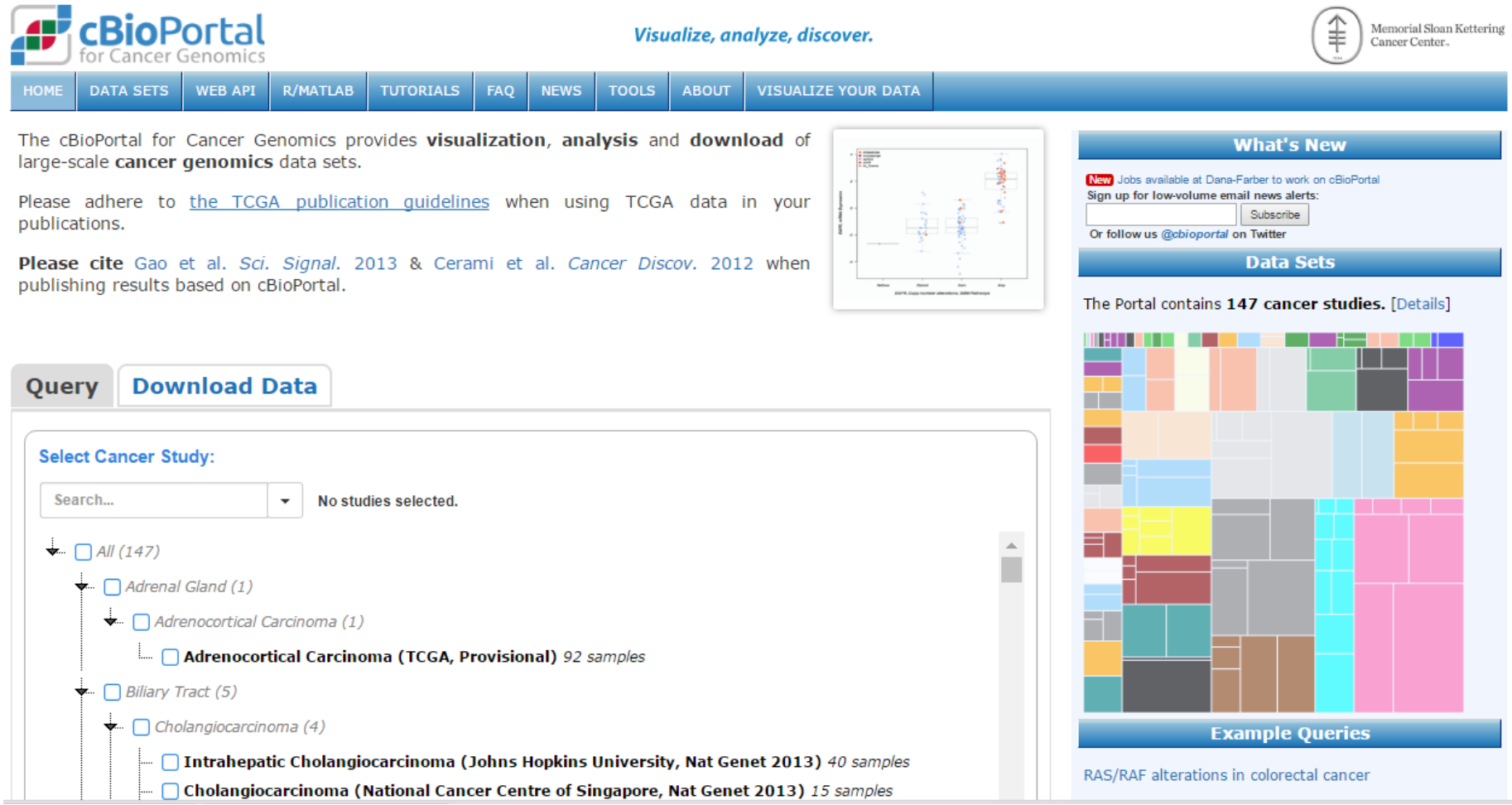
# TCGA Eco System: Other Important Resources

- Genomic Data Commons – U. Of Chicago
  -Data sharing platform
- Broad GDAC Firehose and FireBrowse - Broad Institute (MIT&Harvard)
  - TCGA Data Portal http://gdac.broadinstitute.org/
- cBio Portal for Cancer Genomics (Memorial Sloan-Kettering Cancer Center) www.cbioportal.org
- UCSC Cancer Genomics Browser (University Of California at Santa Cruz) https://genome-cancer.ucsc.edu/
- Cancer Cloud Pilots: Seven Bridges Cancer Genomic Cloud
  - Access to TCGA data collection and Data Analysis pipelines http://www.cancergenomicscloud.org/

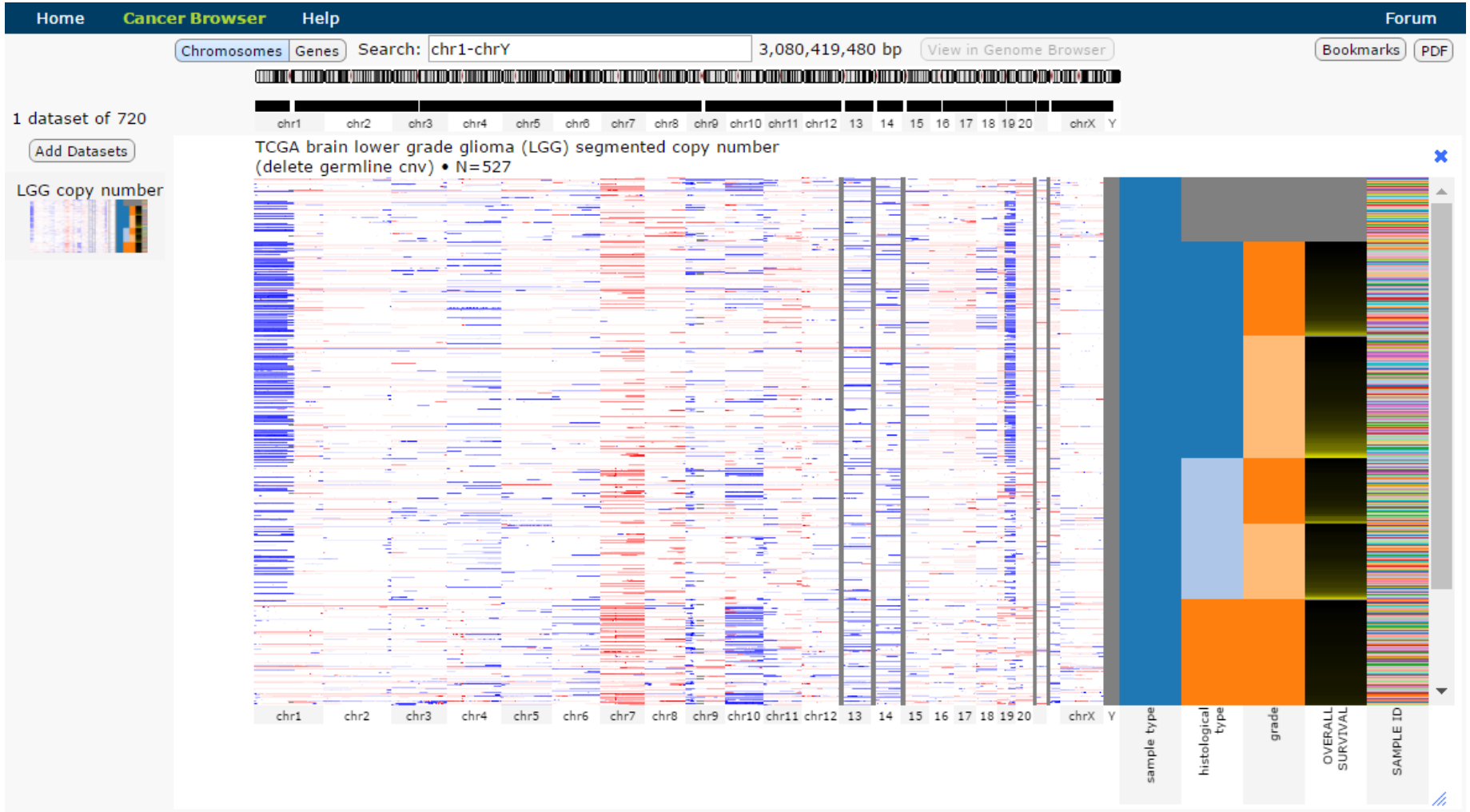
# FireHose and FireBrowse - Broad Institute



# cBio Portal for Cancer Genomics (Memorial Sloan-Kettering Cancer Center)



# UCSC Cancer Genomics Browser (University Of California at Santa Cruz)



# Summary: Cancers Selected for Study by TCGA

### Breast

- Breast Ductal Carcinoma
- Breast Lobular Carcinoma

### Central Nervous System

- Glioblastoma Multiforme
- Lower Grade Glioma

### Endocrine

- Adrenocortical Carcinoma
- Papillary Thyroid Carcinoma
- Paraganglioma
- Pheochromocytoma

### Gastrointestinal

- Cholangiocarcinoma
- Colorectal Adenocarcinoma
- Esophageal Cancer
- Liver Hepatocellular Carcinoma
- Pancreatic Ductal Adenocarcinoma
- Stomach Cancer

### Gynecologic

- Cervical Cancer
- Ovarian Serous Cystadenocarcinoma
- Uterine Carcinosarcoma
- Uterine Corpus Endometrial Carcinoma

### Head and Neck

- Head and Neck Squamous Cell Carcinoma
- Uveal Melanoma

### Hematologic

- Acute Myeloid Leukemia
- Diffuse Large B-Cell Lymphoma
- Thymoma

### Skin

- Cutaneous Melanoma

### Soft Tissue

- Sarcoma

### Thoracic

- Lung Adenocarcinoma
- Lung Squamous Cell Carcinoma
- Mesothelioma

### Urologic

- Chromophobe Renal Cell Carcinoma
- Clear Cell Kidney Carcinoma
- Papillary Kidney Carcinoma
- Prostate Adenocarcinoma
- Testicular Germ Cell Cancer
- Urothelial Bladder Carcinoma

http://cancergenome.nih.gov/pdfs/TCGA_Program_Brochure_2014

# TCGA Results and Findings

| | | |
|---|---|---|
| **MOLECULAR BASIS OF CANCER** | Improved our understanding of the genomic underpinnings of cancer | For example, a TCGA study found the basal-like subtype of breast cancer to be similar to the serous subtype of ovarian cancer on a molecular level, suggesting that despite arising from different tissues in the body, these subtypes may share a common path of development and respond to similar therapeutic strategies. |
| **TUMOR SUBTYPES** | Revolutionized how cancer is classified | TCGA revolutionized how cancer is classified by identifying tumor subtypes with distinct sets of genomic alterations.* |
| **THERAPEUTIC TARGETS** | Identified genomic characteristics of tumors that can be targeted with currently available therapies or used to help with drug development | TCGA's identification of targetable genomic alterations in lung squamous cell carcinoma led to NCI's Lung-MAP Trial, which will treat patients based on the specific genomic changes in their tumor. |

www.cancer.gov/ccg

# Summary: Accomplishments of TCGA

- TCGA was initiated as a pilot project in 2006 by the National Cancer Institute and the National Human Genome Research Institute, both parts of the National Institutes of Health. Its goal was to comprehensively map and characterize the genomic changes in brain and ovarian cancers, as well as to prove that a national network of researchers could effectively collaborate to generate large-scale genomic data and make discoveries.
- The achievements of the pilot project led the National Institutes of Health to commit additional resources to TCGA for the characterization of more than *30 additional tumor types*, including nine rare cancers.
- This success of the expansion has inspired the creation of international programs like the International Cancer Genome Consortium, in which TCGA participates.

http://cancergenome.nih.gov/pdfs/TCGA_Program_Brochure_2014