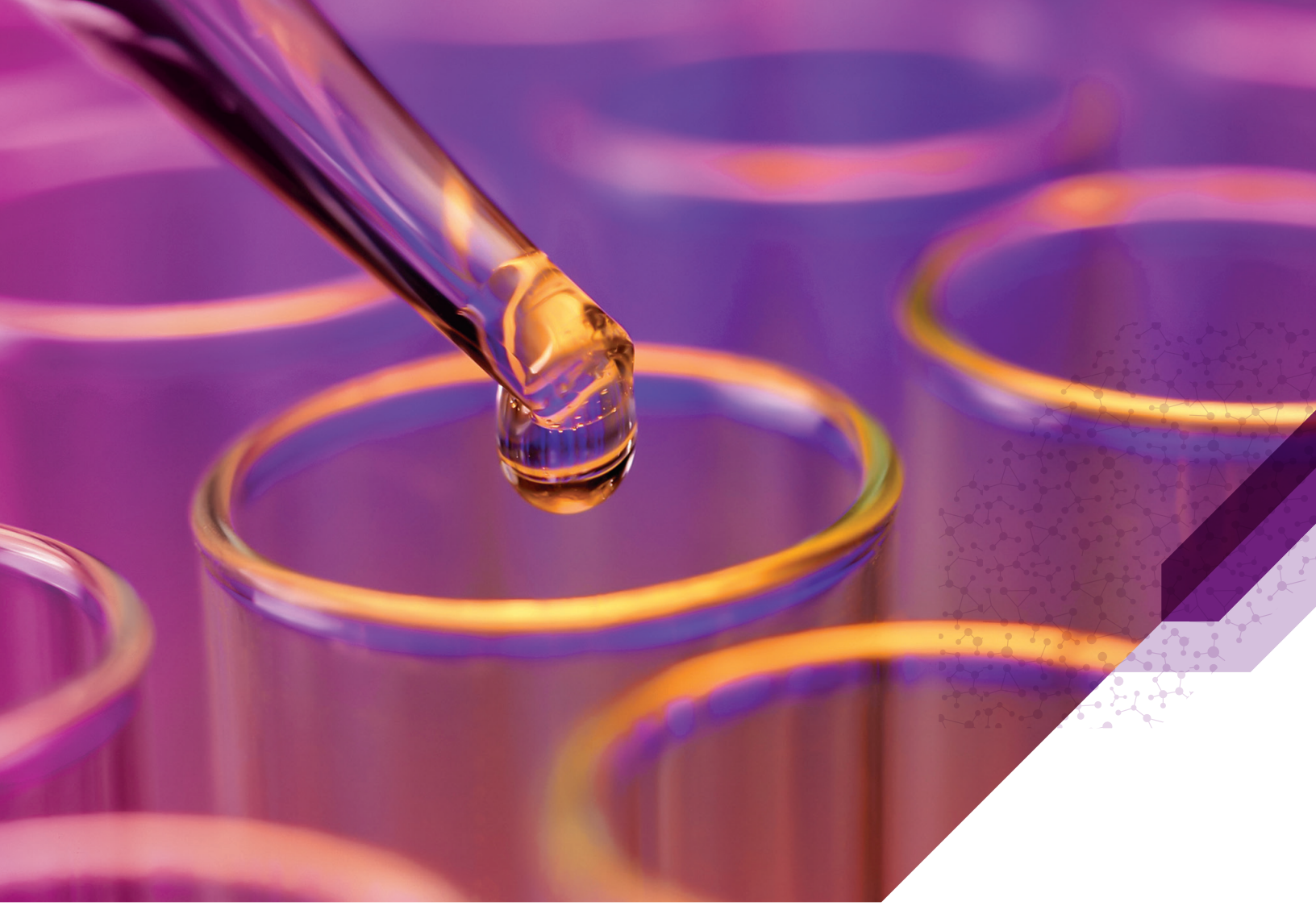
Q² Solutions
a Quintiles Quest Joint Venture

Actionable Insights for
Better Health™

Global Flow Cytometry Services

Q² Solutions' unique global flow cytometry services implemented with customizable solutions are designed to meet your clinical trial needs.

Flow cytometry is an essential technological component of biological research that aids in the development of therapeutic strategies for the enhanced treatment of diseases. With an exponential growth in the area of personalized medicine and in particular immuno-oncology, Q² Solutions shapes the market landscape with the largest global footprint for flow cytometry services, innovative technology that provides high quality data with minimal variability, and continuous improvement efficiency initiatives to meet customers' individual needs.



Providing flow cytometry innovation

Tailored solutions

Q² Solutions' global laboratories, including two satellite translational science assay development laboratories, are equipped with industry leading development expertise and value-added offerings that bring your drugs to market faster.

Our extensive flow cytometry technologies include access to both the BD FACSCanto II 8 Color instrument in our central laboratories worldwide and the BD FACSCanto 10 Color instrument in the U.S., UK/EU, Singapore, and Beijing, China. Utilizing these additional colors allows us to define populations that cannot be enumerated from a single 8-color tube, thereby reducing the total assay tube number and producing a more complete data set more efficiently for our customer.

In conjunction with our flow cytometry services, we have experience in **anatomic and molecular pathology, immunoassay and genomics-based assay development and testing** that provides a customized, end-to-end solution specifically suited for the unique combination of therapeutic indication and targeted mechanism-of-action that also drives modern oncology drug development.

Q² Solutions' experienced assay development scientists, scientific advisors, immunologists, geneticists, pathologists and bioinformaticists in our global laboratories each play a key role in collaboration and provide early and continued engagement with sponsors. From technology selection through assay design, validation and deployment, our integrated scientific teams collaborate to optimize the method, maintain sample integrity and generate the best data set in support of clinical trials.

Spotlight on Oncology

With oncology accounting for approximately one-third of all R&D investments today, we implement an integrated scientific approach that drives successful immuno-oncology clinical studies. This approach utilizes multiple technologies and methods such as cell surface and intracellular immuno-phenotyping and monitoring as well as Target Receptor Occupancy. These approaches aid in research to better understand a patient's immune profile in response to tumor treatment.

As part of our cancer immunotherapy monitoring, we also have extensive cell culture capabilities that allow us to isolate, stimulate and culture cells before the flow assay is completed, thereby improving the consistency and reproducibility of results for our customer.

Capitalize on Q^2 Solutions' unique assay design, validation and production capabilities that can be tailored to meet your needs. Our flow cytometry service includes numerous assays that are available in cancer immunotherapy monitoring, including:

- **Antigen Specific T Cells**
  – Dimers, Tetramers, Pentamers
- **Apoptosis Assays**
- **B Cell Bcl-2 Family Assay**
- **Basophil Activation**
- **Bispecific Antibody Assays**
- **CAR T Cell Assays**
- **Cell Culture/Predictive Bioassays**
- **Chimeric-Ag Receptor (CAR) T Cells**
- **Cytotoxic T Cells**
  – Functional Assays
- **Dendritic Cell Assays**
  – pDC, m1DC, m2DC
- **HLA-B27**
- **Leukemia/Lymphoma Assays**
  – EuroFlow
- **Magnetic Bead Separation**
  – RNA, DNA
- **Minimal Residual Disease Assay**
  – CLL, ML, MM, AML, ALL, NHL
- **Monocyte Subsets**
- **Myeloid/Fibrocyte Derived Suppressor Cell Assays**
- **NK & Innate Lymphoid Assays**
- **Phosphorylated Protein Assays**
  – pSMAD, pCCR5, Whole Blood & PBMC
- **Platelet Assays**
- **Receptor Occupancy Assays**
- **Stem Cells Enumeration**
- **T Cell Homing/Activation**
  – ICOS, CD38, HLA-DR, CD28, CD25, CD69, CD71, CD1 34
- **T Cell Checkpoint/Exhaustion Assays**
  – CTLA-4, PD-1, PD-L1, TIM3
- **T Helper (Th) Assays**
- **T Naïve/Memory/Effector/Effector Memory T Cell Proliferation**
- **T Regulatory Cell Assays**
  – Surface, FoxP3, activated
- **T/B/NK Cells**
- **TIL Assays (Tumor Infiltrating T Cells)**

See the case study on the next page for results highlighting a custom flow cytometry solution.

Case study

Laboratory expertise helps identify optimal immunotherapy dose

Q² Solutions flow panels identify dose dependent PD effect of checkpoint inhibitor combination therapy

Situation

- Multicenter, non-randomized, open-label Phase Ib study at 5 cancer centers in the U.S.
- Immunotherapy-naive patients aged 18 or older with confirmed locally advanced or metastatic NSCLC
- Primary endpoint of dose escalation study was safety for check-point inhibitor combination therapy of durvalumab (blocks PD-L1 binding to PD-1 and CD80) and tremelimumab (anti-CTLA-4)
- Sponsor-driven flow cytometry panels to determine optimum dose selection to minimize toxic effects of combination durvalumab and tremelimumab regime

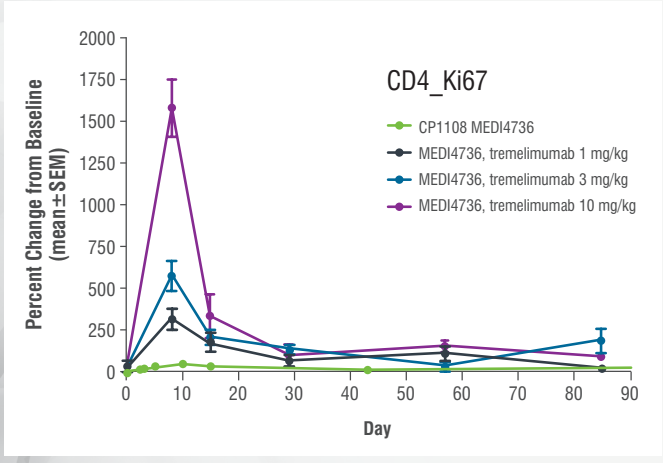
Solution

- Q² Solutions monitored circulating quantities of T cells (using CD4 and CD8 cell surface markers) expressing the activation marker HLA-DR or the intracellular proliferation marker Ki67 with validated flow cytometry-based assays
- Combined data from A129 & A115 Flow Panels running in the U.S. (Atlanta), Europe and Asia (Singapore)

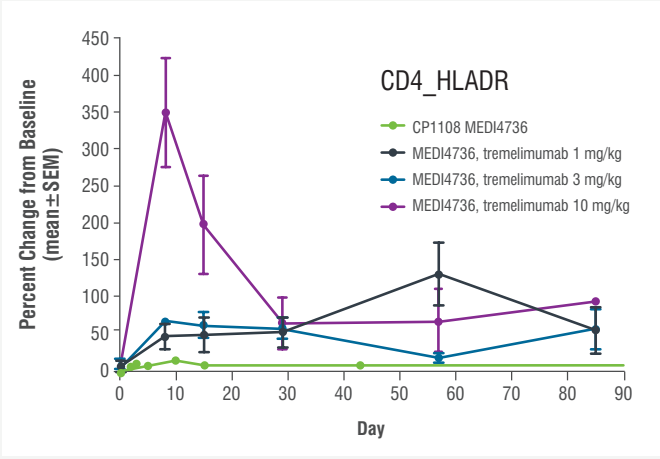
Result

- PD-L 1 negative patients are less responsive to treatment with single drugs that block the PD-1 checkpoint pathway
- PD-L 1/PD-1 and CTLA-4 pathways are non-redundant, suggesting that targeting both pathways could have synergistic effects in patient treatment
- Based on Phase Ib results, the optimum dose of durvalumab and tremelimumab regime was selected for Phase III trials: durvalumab 20mg/kg every 4 weeks plus tremelimumab 1 mg/kg showed manageable tolerability with anti-tumor activity irrespective of PD-L1 status

A129 proliferating T cell panel



A115 activation & memory T cell panel



Source: Safety and antitumour activity of durvalumab plus Tremelimumab in non-small cell lung cancer: a multicentre, phase 1b study. Scott Antonia, Sarah B Goldberg, Ani Balmanoukian, Jamie E Chaft, Rachel E Sanborn, Ashok Gupta, Rajesh Narwal, Keith Steele, Yu Gu, Joyson J Karakunnel, Naiyer A Rizvi. *Lancet Oncology*, Vol 17, March 2016:299-308

Q² Solutions helped develop many biomarkers used today including

BCR-Abl, ALK, BRAF, C-KIT, EGFR, KRAS, HER2, MET, PD-L1

Delivery excellence

Q² Solutions is a quality-driven organization that takes the necessary steps to ensure your clinical trial success along the drug development continuum. A new intensive flow cytometry training program is in place to support assays new to our facilities that include bench training on sample processing; data acquisition and troubleshooting; data interpretation and analysis; and ongoing internal proficiency testing schemes.

From panel design to review of the validation report, data, technology transfer and more, we encourage sponsor engagement throughout the process.

Global Assay Development, Validation and Deployment Workflow

- Consultation/Collaboration
- Custom Panel Design
- Validation Plan
- eSOP & Gating Guide
- System Documents Build
- Validation Report
- Technical Transfer
- Instrument Qualification
- Operator Qualification
- Training Dedicated Analysts
- Senior Data Analyst Oversight

8 & 10 Color BD FACSCanto Instruments

33 new flow cytometry assays validated in 2015

Typically **8-12** weeks per validation

>100,000 flow samples will be analyzed globally in 2016, **>50% in U.S.**

Q² Solutions' flow cytometry services are led by a dedicated team with deep scientific experience and expertise in flow cytometry to help guide your clinical project from drug discovery to development. This flow cytometry team also oversees global standardization and harmonization to ensure minimal technical variability and high quality results across the globe for every study. Our flow cytometry, scientific advisor has >36 years' experience and is adept in all aspects of clinical and research flow cytometry, including complex panel and assay design, cell sorting, and new workflow development, analytical and automated techniques.

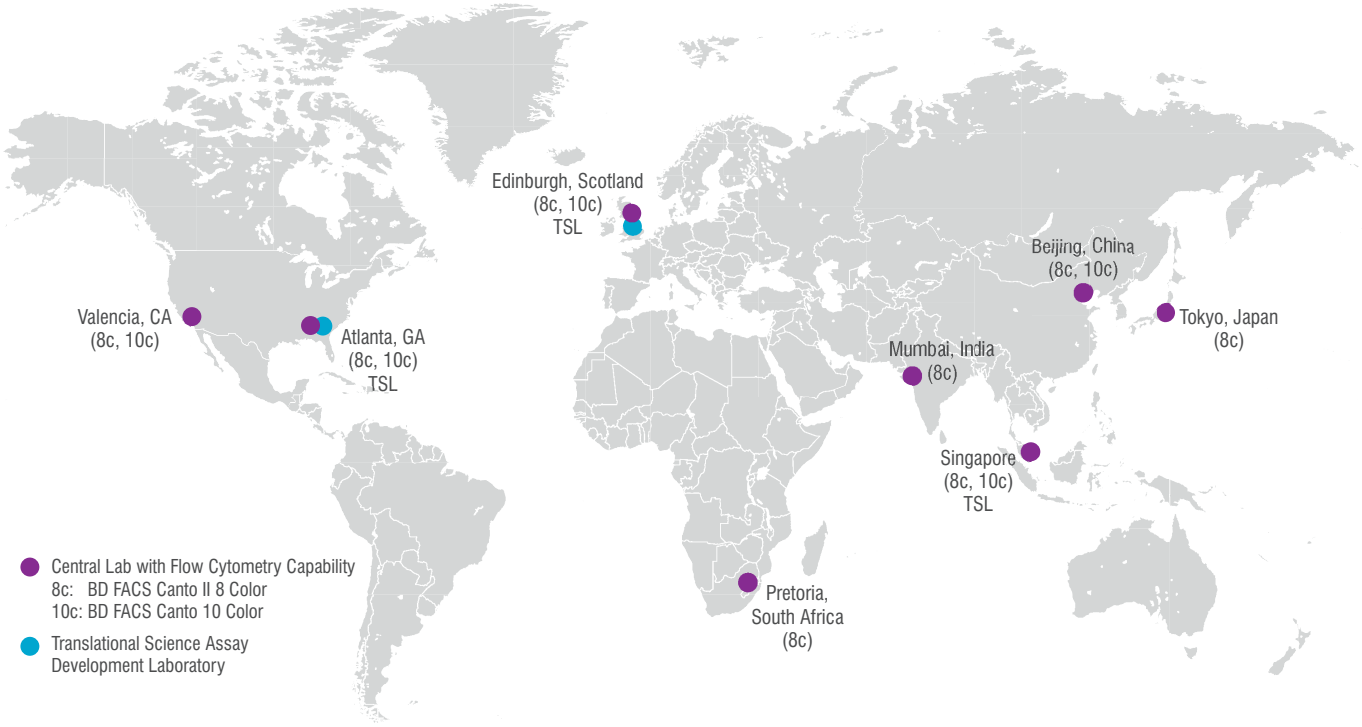
Shaping outcomes

With only a **2-5% instrument-to-instrument variation**, Q² Solutions employs a unique quantitative standardization system in conjunction with automated offsets of daily variation in instruments to provide a proficient and cost-effective production environment for your study. From panel design to final data analysis, Q² Solutions ensures constant contact and collaboration to optimize your clinical trial outcomes.

Q² Solutions' unique customizable flow cytometry services exemplify our dedication to transform science and data into actionable medical insights.

Q² Solutions Flow Cytometry Network

Flow cytometry Centers of Excellence co-located with translational science assay labs provide industry leading expertise



Q² Solutions helped develop **93%** of the **Top 30 best-selling oncology products** of 2016

LARGEST global flow cytometry footprint

Contact us

Toll free: 1 855.277.9929
Direct: +1 919.998.7000
International: +44 (0) 1506 814000
Website: www.Q2LabSolutions.com

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