Brandon Seaton, HTL (ASCP)

Brandon Seaton is the clinical IHC supervisor at PhenoPath. He supervises the clinical IHC and Histology departments. These departments perform all clinical immunohistochemistry, histology, immunofluorescence, and chromogenic in-situ hybridization. As supervisor, Brandon plays an administrative role in ensuring the department has appropriate staffing, supplies, and training to perform IHC at the highest level of quality. He is also involved in both test and instrument validation, and fills in on the IHC bench when needed.

Before joining PhenoPath, Brandon worked as a histology trainer/histotechnologist at LabCorp in Seattle where he was responsible for all IHC and special stains in a fast paced, high volume laboratory. He also worked as a clinical histotechnologist at Seattle Cancer Care Alliance where he performed all tasks in the histology and IHC workflow in a lab uniquely designed to serve bone marrow transplant patients.

Brandon obtained a Biotechnology Laboratory Specialist certificate from Shoreline Community College. He has a bachelor's degree in Zoology from University of Washington. Brandon is ASCP certified as a histotechnologist (HTL).
PD-L1 Testing Update (see attached poster)

PhenoPath is on the forefront of biomarker testing, offering all FDA-approved PD-L1 clones, and having tested and analyzed over 3,000 specimens since the launch of PD-L1 testing in June of 2015. Please see the biomarker poster on the following page with up-to-date FDA-approval status to assist oncologists and pathologists navigate the various PD-L1 options, all of which PhenoPath offers. Refer to www.phenopath.com for the most up-to-date version upon additional FDA approvals.

PhenoPath is providing PD-L1 testing for both patient management in the clinical setting as well as for R&D and clinical trials, crossing over various tumor types (lung, breast, H&N, GU, GI, melanoma, etc.) and platforms (Dako and Ventana), in addition to comparison studies among the various PD-L1 clones. PhenoPath is currently supporting over 80 R&D and clinical trials, many of which include PD-L1 testing of various clones.

New Publications from PhenoPath Pathologists/Scientists

Investigation of PD-L1 Biomarker Testing Methods for PD-1 Axis Inhibition in Non-squamous Non-small Cell Lung Cancer

Inhibitors of the programmed cell death 1 (PD-1) signaling axis have recently demonstrated efficacy and are rapidly being incorporated into the treatment of non-small cell lung cancers (NSCLCs). Despite clear benefits to certain patients, the association of these responses with a predictive biomarker remains uncertain. Several different biomarkers have been proposed, with differing results and conclusions. This study compares multiple methods of biomarker testing for treatment of NSCLCs with PD-1 axis inhibitors. Tissue microarrays of matched primary and metastatic NSCLCs were used to compare four different PD-1 ligand (PD-L1) IHC techniques, as well as RNA in situ hybridization (ISH). Eighty cases were included in the IHC study. Multiple IHC methodologies showed a high rate of agreement (Kappa = 0.67). When calibrated to RNA expression, agreement improved significantly (Kappa = 0.90, p=0.0049), PD-L1 status of primary and metastatic tumors was discordant in 17 (22%) cases. This study suggests that different IHC methodologies for PD-L1 assessment provide slightly different results.

Comparative Sensitivities and Specificities of Antibodies to Breast Markers GCDFP-15, Mammaglobin A, and Different Clones of Antibodies to GATA-3: A Study of 338 Tumors Using Whole Sections

GATA-3 is a transcription factor that has recently been identified by immunohistochemistry to be highly expressed in urothelial and breast carcinomas (CAs). We sought to determine the potential utility of GATA-3 in identifying metastatic breast CA, and to compare its utility with the standard breast markers, GCDFP-15, and mammaglobin A. We identified an archival series of 338 formalin-fixed paraffin-embedded whole-tissue sections of various CAs. Using standard immunohistochemical (IHC) techniques we used mouse monoclonal antibodies to GATA-3 (clones L50-823, HG3-31), GCDFP-15 (23A3), and mammaglobin A (31A5). Both clones of GATA-3 showed positivity in 96% of non-triple-negative breast carcinomas (TNBCs), L50-823 and HG3-31, demonstrating expression in 87% and 63% of TNBCs, respectively; GCDFP-15 and mammaglobin A were expressed in 69% and 61% of non-TNBCs, respectively, and 10% and 17%, of TNBCs, respectively. The L50-823 clone manifested a lower specificity in identifying breast CAs (84%) than did the HG3-31 clone (97%). Both monoclonal antibodies to GATA-3 are very sensitive reagents for the identification of breast CA, surpassing antibodies to GCDFP-15 and mammaglobin A, and offer a significant improvement in identifying TNBCs. However, the L50-823 clone showed a lower level of specificity, which may qualify its utility in the setting of CAs of unknown primary.
# Biomarker Testing for Checkpoint Inhibitors

<table>
<thead>
<tr>
<th></th>
<th><strong>KEYTRUDA</strong>&lt;sup&gt;®&lt;/sup&gt; (pembrolizumab) anti-PD-1</th>
<th><strong>OPDIVO</strong>&lt;sup&gt;®&lt;/sup&gt; (nivolumab) anti-PD-1</th>
<th><strong>TECENTRIQ</strong>&lt;sup&gt;®&lt;/sup&gt; (atezolizumab) anti-PD-L1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PD-L1</strong></td>
<td><strong>22C3</strong>&lt;sup&gt;Δ&lt;/sup&gt; (tumor cells)</td>
<td><strong>28-8</strong>&lt;sup&gt;†&lt;/sup&gt; (tumor cells)</td>
<td><strong>SP142</strong>&lt;sup&gt;†&lt;/sup&gt; (immune cells / tumor cells)</td>
</tr>
<tr>
<td><strong>Head &amp; Neck Squamous Cell CA</strong></td>
<td>FDA approved; no testing required</td>
<td>FDA approved; no testing required</td>
<td>FDA approved; no testing required</td>
</tr>
<tr>
<td><strong>Hodgkin Lymphoma</strong></td>
<td>FDA approved; no testing required</td>
<td>FDA approved; no testing required</td>
<td>FDA approved; no testing required</td>
</tr>
<tr>
<td><strong>Melanoma</strong></td>
<td>FDA approved; no testing required</td>
<td>FDA approved with <strong>28-8</strong>&lt;sup&gt;†&lt;/sup&gt; ≥1% TPS</td>
<td>FDA approved with <strong>28-8</strong>&lt;sup&gt;†&lt;/sup&gt; ≥1% TPS</td>
</tr>
<tr>
<td><strong>NSCLC 1st line</strong></td>
<td>FDA approved with <strong>22C3</strong>&lt;sup&gt;Δ&lt;/sup&gt; ≥50% TPS</td>
<td>FDA approved with <strong>28-8</strong>&lt;sup&gt;†&lt;/sup&gt; ≥1% TPS</td>
<td>FDA approved with <strong>SP142</strong>&lt;sup&gt;†&lt;/sup&gt; ≥50% TC / ≥10% IC</td>
</tr>
<tr>
<td><strong>NSCLC 2nd line</strong></td>
<td>FDA approved with <strong>22C3</strong>&lt;sup&gt;Δ&lt;/sup&gt; ≥1% TPS</td>
<td>FDA approved with <strong>28-8</strong>&lt;sup&gt;†&lt;/sup&gt; ≥1% TPS</td>
<td>FDA approved with <strong>SP142</strong>&lt;sup&gt;†&lt;/sup&gt; ≥5% IC</td>
</tr>
<tr>
<td><strong>Renal Cell CA</strong></td>
<td>FDA approved; no testing required</td>
<td>FDA approved; no testing required</td>
<td>FDA approved with <strong>SP142</strong>&lt;sup&gt;†&lt;/sup&gt; ≥5% IC</td>
</tr>
<tr>
<td><strong>Urothelial CA</strong> (bladder)**</td>
<td>FDA approved; no testing required</td>
<td>FDA approved; no testing required</td>
<td>FDA approved with <strong>SP142</strong>&lt;sup&gt;†&lt;/sup&gt; ≥5% IC</td>
</tr>
</tbody>
</table>

**Δ** = FDA approved companion diagnostic (required); † = FDA approved complementary diagnostic (optional)

TPS = Tumor proportion score; TC = tumor cells; IC = immune cells

**PD-L1 testing available NOW at PhenoPath**

<table>
<thead>
<tr>
<th>Clone</th>
<th>Dako Link 48</th>
<th>Dako Link 48</th>
<th>Ventana Ultra</th>
<th>Generic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>22C3</strong></td>
<td><strong>28-8</strong></td>
<td><strong>SP142</strong></td>
<td><strong>E1L3N</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Specimen requirements:** FFPE block or 4 to 5 unstained slides cut at 4µm

**To submit a specimen:** Request supplies or use any requisition form at www.phenopath.com; indicate PD-L1 clone desired; ship FedEx standard overnight in secure shipping container (provided by PhenoPath upon request)

**Turnaround time:** 24-48 hours from receipt of specimen

**References:** keytruda.com, opdivo.com, tecentriq.com, dakocom, ventana.com, fda.gov, drugs.com

**Disclaimer:** The content of this poster should not be relied upon as the sole source of information to guide specimen testing or patient treatment.

www.phenopath.com • 888-927-4366
PhenoPath at the USCAP, Mar 4-10, 2017, San Antonio, TX (Booth #411)

Monday, March 6, 2017, 1:00PM-4:30PM, Exhibit Hall 1 / Poster Session II #288 "Robotic and Semi-Automated Microtomy Can Decrease Variability in HER2 Staining Intensity" (Abstract #2026), Studies performed in conjunction with Premier Lab, Longmont, CO; Array Science, Sausalito, CA; Sakura Finetek, Torrance, CA; Horizon Discovery, Cambridge, UK; Boulder Statistics, Boulder, CO; PhenoPath, Seattle, WA

Tuesday, March 7, 2017, 9:30AM-12:00PM, Exhibit Hall 1 / Poster Session III #135 "Concordance Study of 4 Anti-PD-L1 Antibodies in Primary and Metastatic Bladder Cancer" (Abstract #966), Studies performed in conjunction with Univ of Washington, Seattle, WA; Univ of Chicago, IL; PhenoPath, Seattle, WA

Tuesday, March 7, 2017, 1:00PM-4:30PM, Exhibit Hall 1 / Poster Session IV #120 "Comparison of 4 PD-L1 Antibodies in 560 Kidney, Bladder and Prostate Cancers" (Abstract #1062), Studies performed in conjunction with Univ of Washington, Seattle, WA; PhenoPath, Seattle, WA; Northwestern Univ, Chicago, IL

Wednesday, March 8, 2017, 9:30AM-12:00PM, Exhibit Hall 1 / Poster Session V #143 "Role of SATB2 in Distinguishing the Site of Origin in Glandular Lesions of the Bladder/Urethra: An Immunohistochemical Study" (Abstract #913), Studies performed in conjunction with Vanderbilt, Nashville, TN; PhenoPath, Seattle, WA; John Hopkins, Baltimore, MD

Wednesday, March 8, 2017, 12:00PM-1:00PM, RC Conf Room 1-4 / "Hot Topics in Pathology 03-Immunohistochemistry in Evaluating Tumors of Undetermined Origin", Moderated by Jason L. Hornick, MD, PhD, Brigham and Women's Hospital, Boston, MA in conjunction with Andrew M. Bellizzi, MD, Univ of Iowa Carver College of Medicine, Iowa City, IA; Allen M. Gown, MD, PhenoPath, Seattle, WA

PhenoPath at the NCCN, Mar 23-25, 2017, Orlando, FL

Visit us at the following poster session:

Thursday, March 23, 2017 & Friday, March 24, 2017 / General Poster Sessions “PD-L1 Testing in Non-Small Cell Lung Cancer”, Allen M. Gown, MD and Regan Fulton, MD, PhD, PhenoPath, Seattle, WA

www.phenopath.com