IHC Update: New and Adoption of Not So New Markers

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Objectives

Familiarize pathologists with and review antibodies recently introduced into clinical practice.

Adoption of selected established markers.

Illustrate optimal immunoreactivity patterns and pitfalls.
<table>
<thead>
<tr>
<th>Clones</th>
<th>Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDH1/ ATRX</td>
<td>SatB2/CADH-17</td>
</tr>
<tr>
<td>BAP1</td>
<td>INSM1</td>
</tr>
<tr>
<td>LEF1</td>
<td>NKX2.2</td>
</tr>
<tr>
<td>PhoxB2</td>
<td>TLE1</td>
</tr>
<tr>
<td>Adipophilin</td>
<td>PRAME</td>
</tr>
</tbody>
</table>

Clones indicated are most widely used and/or used in the Sonora-Quest IHC Lab.
IDH1 R132H

IDH1/2 mutated in the majority of diffuse astrocytomas, WHO grades 1-3, oligodendrogliomas and secondary GBM.

Also mutated in chondroid neoplasms.

R132H is the most common IDH mutation and the one the available mutation specific antibody recognizes; cytoplasmic immunoreactivity indicates mutation.

A negative result does not exclude the possibility of an alternate IDH mutation; sequencing may be required.
ATRX

Normally expressed in all nucleated cells.

Mutation usually leads to loss of protein expression.

ATRX is mutated in most diffuse astrocytomomas and in secondary GBM and retained in oligodendroglioma

Paired testing of all gliomas is now standard of practice.

ATRX clones: BSB-108 or D-5
<table>
<thead>
<tr>
<th>IDH1 R132H</th>
<th>Current Approach @Mayo</th>
<th>ATRX</th>
</tr>
</thead>
<tbody>
<tr>
<td>POS</td>
<td>IDH-mutant Astro ? Grade (II/III/ IV)</td>
<td>LOSS of expression (i.e. POS)</td>
</tr>
<tr>
<td>NEG</td>
<td>?? Another IDH mutation ⇒ IDH1/ IDH2 Seq. POS: IDH-mut Astro Neg: IDH-wt Astro</td>
<td>Retained expression (i.e. NEG)</td>
</tr>
</tbody>
</table>

- IDH-mutant glioma?
  - Oligo
  - 1p/19q Testing
    - Codel = Oligo
    - Not = Astro

- IF Not GBM OR age <54 yrs ⇒ IDH Seq
- IF GBM 54+ ⇒ STOP
  Likely IDH-wt (>99%)
Diffuse astrocytoma

Clone: BSB-108
ATRX loss

Clone MRQ-67
IDH1-RH132 mutant
Diffuse Glioma
Likely oligo
IDH1-RH132 mutant

1p, 19q FISH Testing indicated
ATRX intact
ATRX intact

Primary GMB

IDH1-RH132 Wild type
Use internal controls

ATRX intact

Primary GMB

IDH1-RH132 Wild type

NL
IDH1/ ATRX references


SatB2

Nuclear transcription factor expressed in lower GI mucosa.

Osteoblasts and subset of neuronal cells in the CNS; weak to moderate expression in lining cells of testicular tubules and epididymis.

Preferentially expressed in colorectal and appendiceal adenocarcinomas, much less so in upper GI tract and pancreatico-biliary adenocarcina, as compared to CDX2.
Coupled with CK20, identifies 97% of CRC/medullary ca.

Coupled with CDX2, at least 90% specific for CRC, when >50% of cell expression at moderate or strong intensity.

Loss of expression in IBD associated dysplasia and carcinoma.
SatB2
CRCa
SatB2
Weak pos
CRCa
Colorectal Medullary ca (2)
MLH1
Colorectal Medullary Ca

PMS2

MSH2

MSH6
Colorectal Medullary ca (3)
CDX2
Colorectal
Medullary ca

CK20
Colorectal
Medullary ca
SatB2
Colorectal Medullary Ca
SatB2
Pancreas
Ductal ca
SatB2
osteosarcoma
Ovarian
carcinosarcoma
SatB2: References

Magnusson K, et al. SATB2 in Combination With Cytokeratin 20 Identifies Over 95% of all Colorectal Carcinomas. Am J Surg Pathol 2011;35:937–948)


Cadherin-17

CDH17 (Li-cadherin) is a member of the cadherin superfamily, a transmembrane glycoprotein.

Mediates cell adhesion and is an intestinal peptide transporter.

Preferentially expressed in epithelium of GI tract and pancreatic ducts.

Among adenocarcinomas, expressed at high levels in lower GI, esophageal and NE neoplasms.
## Cadherin-17

**CDH17 Expression in 270 GI and Pancreatic Adenocarcinomas**

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Neg.</th>
<th>1+</th>
<th>2+</th>
<th>3+</th>
<th>4+</th>
<th>#+/Tot (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esophagus</td>
<td>10</td>
<td>3</td>
<td>15</td>
<td>2</td>
<td>0</td>
<td>20/30 (67)</td>
</tr>
<tr>
<td>Stomach</td>
<td>15</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>5/20 (25)</td>
</tr>
<tr>
<td>Colon</td>
<td>2</td>
<td>0</td>
<td>7</td>
<td>8</td>
<td>108</td>
<td>123/125 (98)</td>
</tr>
<tr>
<td>Pancreas</td>
<td>78</td>
<td>9</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>17/95 (18)</td>
</tr>
</tbody>
</table>

CDH17 Expression in colorectal medullary carcinomas

<table>
<thead>
<tr>
<th></th>
<th>Count</th>
<th>Percentage</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDH17</td>
<td>16/18</td>
<td>87%</td>
<td>&gt;3+</td>
</tr>
<tr>
<td>SatB2</td>
<td>16/18</td>
<td>87%</td>
<td>&gt;3+</td>
</tr>
<tr>
<td>CDX2</td>
<td>12/18</td>
<td>67%</td>
<td>&gt;3+</td>
</tr>
<tr>
<td>CK20</td>
<td>5/18</td>
<td>42%</td>
<td>&gt;3+</td>
</tr>
</tbody>
</table>

12/18 also expressed calretinin (akin to triple negative breast cancers)

medullary carcinoma (case 16). Hematoxylin-eosin stain (A); loss of expression of MLH1 (B); positive for cadherin-17 (C), SATB-2 (D), TFF3 (E), MUC4 (F)

Cadherin-17 membranous staining of adenocarcinoma of the colon (A), esophagus (B), pancreas (C), lung (D), endocervix (E), and endometrium (F).

Tumor suppressor, BRCA-associated protein 1 (BAP1), located at 3p21.

Functions to inhibit cell proliferation and promote apoptosis of DNA damaged cells.

Expressed in most normal cells
BAP1

Germline mutations in BAP1 have been associated with increased risk for malignant mesothelioma, melanoma, meningioma, RCC, lung adenoma, cutaneous SCC, BCC

BAP1 mutations have been demonstrated in non-hereditary mesotheliomas.

BAP1 IHC: prognostic value in uveal melanoma and renal cell carcinoma.

Loss of nuclear expression is abnormal; must have positive internal control cells for reliable evaluation.
BAP1 IHC

TMA study: 0/49 benign mesothelial proliferations lost BAP-1. 0/37 benign proliferations lost BAP-1 or were positive for homozygous p16 deletion (FISH)
7/26 (27%) mesotheliomas lost BAP-1 by IHC
14/24 (58%) mesotheliomas lost BAP-1 or showed p16 deletion

Fluid Study: 15 paired mesotheliomas: 10/15 (67%) lost BAP1 in tissue and fluid CB.
12/15 biopsies (80%) and 8/11 fluids (73%) showed p16 deletion.
Righi L, et al. (2016) studied 143 malignant pleural mesotheliomas.

67% lost nuclear expression; strong correlation with mutation.

Higher in epithelial vs sarcomatoid (22% lost in latter)

Biphasic tumors may show loss in epithelial component only.
BAP1
Nevus
Intact
Clone
BSB-109
Metastatic Melanoma
Intact/retained
BAP1
mesothelioma
retained
BAP1
Mesothelioma
Lost- biopsy
Note positive int.
Control cells
BAP1
Mesothelioma
Lost- biopsy
Sme case
BAP1
Mesothelioma
Lost - biopsy
BAP1
Mesothelioma
Lost - biopsy
BAP1
Spitz nevus
Lost (clue to Possible germline in pts with multiple Spitz nevi)
BAP1
Spitz nevus
Lost
BAP1: References


INSM1

Insulinoma-associated protein, first isolated from pancreatic insulin producing tumors.

A zinc finger transcription factor expressed in NE cells, regulating synthesis of synaptophysin and chromogranin- pineal, pituitary, lung, skin, GI tract, pancreatic islets, adrenal medulla, thyroid C-cells, but not parathyroid.

Rosenbaum et al. assayed normal and neoplastic tissues by IHC in 2015.

Found in nearly all NE neoplasms except parathyroid tumors.

<table>
<thead>
<tr>
<th>Neoplasm</th>
<th>Proportion No./Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroepithelial and NE neoplasms</td>
<td></td>
</tr>
<tr>
<td>Carcinoid (lung)</td>
<td>6/6</td>
</tr>
<tr>
<td>Esthesioneuroblastoma</td>
<td>1/1</td>
</tr>
<tr>
<td>GI-NEN (GI carcinoid)</td>
<td>40/4/42</td>
</tr>
<tr>
<td>Large cell NE carcinoma</td>
<td>2/2</td>
</tr>
<tr>
<td>Medullary thyroid carcinoma</td>
<td>2/3</td>
</tr>
<tr>
<td>Medulloblastoma</td>
<td>2/2</td>
</tr>
<tr>
<td>Merkel cell carcinoma</td>
<td>6/6</td>
</tr>
<tr>
<td>EMPSCC</td>
<td>1/1</td>
</tr>
<tr>
<td>NE carcinoma of breast</td>
<td>1/1</td>
</tr>
<tr>
<td>Neuroblastoma</td>
<td>3/4</td>
</tr>
<tr>
<td>Pan-NEN</td>
<td>19/21</td>
</tr>
<tr>
<td>Paraganglioma</td>
<td>9/9</td>
</tr>
<tr>
<td>Parathyroid adenoma</td>
<td>0/4</td>
</tr>
<tr>
<td>Parathyroid carcinoma</td>
<td>0/2</td>
</tr>
<tr>
<td>Pheochromocytoma</td>
<td>7/7</td>
</tr>
<tr>
<td>Pituitary adenoma</td>
<td>4/6</td>
</tr>
<tr>
<td>Pituitary carcinoma</td>
<td>3/3</td>
</tr>
<tr>
<td>PNET</td>
<td>1/2</td>
</tr>
<tr>
<td>Retinoblastoma</td>
<td>2/2</td>
</tr>
<tr>
<td>Small cell carcinoma (lung)</td>
<td>3/3</td>
</tr>
<tr>
<td>Teratoma, immature</td>
<td>2/2</td>
</tr>
<tr>
<td>Total</td>
<td>114/129</td>
</tr>
<tr>
<td>Non-NE neoplasms</td>
<td></td>
</tr>
<tr>
<td>Adrenal cortical neoplasms</td>
<td>0/3</td>
</tr>
<tr>
<td>Breast adenocarcinoma</td>
<td>1/4</td>
</tr>
<tr>
<td>Colonic adenocarcinoma</td>
<td>0/2</td>
</tr>
<tr>
<td>Lung adenocarcinoma</td>
<td>0/2</td>
</tr>
<tr>
<td>Melanoma</td>
<td>0/4</td>
</tr>
<tr>
<td>Pancreatic carcinoma</td>
<td>0/3</td>
</tr>
<tr>
<td>Prostate adenocarcinoma</td>
<td>0/2</td>
</tr>
<tr>
<td>Thyroid carcinoma</td>
<td>0/4</td>
</tr>
<tr>
<td>Total</td>
<td>1/24</td>
</tr>
<tr>
<td>Neoplasms with NE differentiation recognized on H&amp;E</td>
<td></td>
</tr>
<tr>
<td>Colonic adenocarcinoma</td>
<td>1/1</td>
</tr>
<tr>
<td>Endometrioid carcinoma</td>
<td>1/2</td>
</tr>
<tr>
<td>Prostate adenocarcinoma</td>
<td>2/2</td>
</tr>
<tr>
<td>Total</td>
<td>4/5</td>
</tr>
</tbody>
</table>
Table 2
Normal Adult Tissues Lacking Expression of INSM1 by Immunohistochemistry

<table>
<thead>
<tr>
<th>Tissue/Cell Type</th>
<th>No. of Slides Reviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adnexa of skin</td>
<td>7</td>
</tr>
<tr>
<td>Adrenal cortex</td>
<td>7</td>
</tr>
<tr>
<td>Bone</td>
<td>6</td>
</tr>
<tr>
<td>Breast ductal epithelium</td>
<td>6</td>
</tr>
<tr>
<td>Brunner’s glands</td>
<td>4</td>
</tr>
<tr>
<td>Cardiac muscle</td>
<td>1</td>
</tr>
<tr>
<td>Cartilage</td>
<td>5</td>
</tr>
<tr>
<td>Cerebellum</td>
<td>1</td>
</tr>
<tr>
<td>Cerebral cortex</td>
<td>2</td>
</tr>
<tr>
<td>Dermis</td>
<td>6</td>
</tr>
<tr>
<td>Endocardium</td>
<td>1</td>
</tr>
<tr>
<td>Endometrial glands</td>
<td>2</td>
</tr>
<tr>
<td>Endometrial stroma</td>
<td>2</td>
</tr>
<tr>
<td>Epithelium, unspecified</td>
<td>5</td>
</tr>
<tr>
<td>Exocrine pancreas</td>
<td>14</td>
</tr>
<tr>
<td>Glomeruli</td>
<td>2</td>
</tr>
<tr>
<td>Hair follicles</td>
<td>7</td>
</tr>
<tr>
<td>Liver</td>
<td>2</td>
</tr>
<tr>
<td>Lymphoid tissue</td>
<td>66</td>
</tr>
<tr>
<td>Olfactory epithelium</td>
<td>3</td>
</tr>
<tr>
<td>Optic nerve</td>
<td>2</td>
</tr>
<tr>
<td>Ovarian stroma</td>
<td>3</td>
</tr>
<tr>
<td>Pancreatic ductal epithelium</td>
<td>13</td>
</tr>
<tr>
<td>Parathyroid</td>
<td>3</td>
</tr>
<tr>
<td>Pleura</td>
<td>5</td>
</tr>
<tr>
<td>Pneumocytes</td>
<td>10</td>
</tr>
<tr>
<td>Prostate parenchyma</td>
<td>4</td>
</tr>
<tr>
<td>Renal tubular epithelum</td>
<td>2</td>
</tr>
<tr>
<td>Retina</td>
<td>2</td>
</tr>
<tr>
<td>Sclera</td>
<td>2</td>
</tr>
<tr>
<td>Seminiferous tubules</td>
<td>1</td>
</tr>
<tr>
<td>Serosa</td>
<td>2</td>
</tr>
<tr>
<td>Skeletal muscle</td>
<td>10</td>
</tr>
<tr>
<td>Squamous epithelium</td>
<td>9</td>
</tr>
<tr>
<td>Sustentacular cells</td>
<td>8</td>
</tr>
<tr>
<td>Thyroid</td>
<td>5</td>
</tr>
<tr>
<td>Urothelium</td>
<td>2</td>
</tr>
</tbody>
</table>

*Expression of INSM1 was evaluated on nonneoplastic tissue immunohistochemistry stain in the course of evaluating neo- slides. INSM1 could not be detected in any of the listed tissues, blood vessels, smooth muscle, fibroconnective tissue, nervous tissue, or cartilage. mammalian INSM1 expression. The right panel shows a magnified view of the parathyroid tissue, indicating the lack of INSM1 expression.*

Mukhopadhyay S, et al.
Modern Pathology; July, 2018
INSM1- Grade 1 NET
Small bowel
INSM1- Grade 1 NET duodenum

INSM1- Grade 2 NET pancreas
INSM1 - grade 2 NET lung; atypical carcinoid

INSM1 - LCNEC lung
INSM1 - small cell ca lung
INSM1- Merkel cell ca
LEF1: Lymphoid enhancer-binding factor 1

Expressed on T cells and pro-B cells but not mature B-cells
Aberrantly expressed in the neoplastic B-cells in majority of CLL/SLL (95-100%).

Nearly all cells should be positive; **nuclear labeling only**; must correlate with HE, results of other markers as % reactive T-cells vary

Not expressed in vast majority of other small lymphocytic neoplasms, mantle cell or marginal zone lymphoma, follicular lymphoma.

Expressed in subset of AML, ALL’s, a subset of DLBCL and many solid malignancies.

290 lymphoid tumors analyzed:

92/92 (100%) SLL/ CLL cases positive, including 2 CD5 negative tumors. Virtually all neoplastic cells were immunoreactive.

All 53 mantle cell, 31 LG follicular and 31 MZ (3 CD5 +) lymphomas were negative.

In 12 grade 3 follicular lymphomas: 5-15% of tumor cells positive.

DLBCL: 27/71 (38%) were LEF1 positive
CLL-LEF1
lymph node bx
RM clone
EP310
CLL-BM
LEF1 Positive
BM Bx

BM Clot

CLL-LEF1 Positive
CLL
Bone marrow
LEF1 positive
CLL-SLL
Core bx
LEF1 Pos
CLL-BM
LEF1 weak positive
Compare with CD3/CD5
CLL-myeloma
CLL
Concomitant myeloma
CD138
CLL-LEF1 +
Concomitant myeloma negative
Mantle cell lymphoma
LEF1 negative
Mantle cell lymphoma
LEF1 negative
Marginal zone lymph
LEF1 negative
Marginal zone lymph
LEF1 negative
Follicular lymph
LEF1 negative
Follicular Lymphoma
FNA
LEF negative
LEF1
DLBCL
CD5 +
positive

LEF1
DLBCL
negative
LEF1
DLBCL
Weak pos
LEF1
DLBCL
effusion
negative
LEF1 classical Hodgkin negative

LEF1 Classical Hodgkin positive
LEF1

Additional references:


2/23 mantle cell lymphomas expressed LEF1 (4-12% in literature)


25/25 CLL positive by flow; 34 other low grade lymphomas neg.
NKK2.2

- NKX2.2 is a nuclear protein with considerable usefulness in supporting a diagnosis of Ewing sarcoma with greater specificity than CD99. Coupled with Phox2b, synaptophysin, CD45, Pax-5, desmin and myogenin—a sensitive and specific small round blue cell panel.

- The vast majority of Ewing sarcoma cases express NKX2.2 (a nuclear transcription factor). NKX2.2 will label up to 30% of pulmonary small cell carcinomas, olfactory neuroblastomas, mesenchymal chondroblastomas and very rarely conventional neuroblastoma and rare desmoplastic small round cell tumor cases (the latter reported in 1/12 cases, in 25-50% of cells).

- As with other transcription factor markers, strong nuclear labeling in over 50% of cells is most sensitive and specific.
NKX2.2: Ewing Sarcoma
NKX2.2: Ewing Sarcoma
Adipophilin
Sebaceous
Carcinoma.

NKX2.2 Pulmonary small cell ca
NKX2.2 Neuroblastoma
NKX2.2 negative

Lymphoblastic lymphoma

Desmoplastic small round cell tumor
NKX2.2 negative: Merkel cell tumor
NKX2.2 negative: Merkel cell tumor

Phox2b

- Phox2b is expressed in neuroblastoma with great specificity amongst small round cell malignancies. It is a nuclear transcription factor responsible for autonomic nervous system development.

- It will also label ganglioneuroblastoma, ganglioneuroma and up to 50% of paragangliomas (potentially useful in a panel with GATA3, S-100 and neuroendocrine markers).

- Rare cases of Merkel cell, Wilms and CIC-rearranged sarcomas may label a minor population of cells.
Phox2b: Neuroblastoma; rabbit mono: clone EP312
Phox2b: Neuroblastoma
Phox2b: Neuroblastoma - met to BM
Phox2b: Neuroblastoma - rare cells - BM clot
Phox2b: treated Neuroblastoma
Phox2b: negative BM
TLE1: Transducin-Like Enhancer of Split 1

TLE1 is a transcription regulator of Wnt signaling.

TLE1 is involved in lateral inhibition, segmentation, eye development, sex determination, neuronal development and hematopoiesis.

Normally expressed in basal keratinocytes, adipocytes, perineural cells, endothelial cells and mesothelial cells

Found to be overexpressed in synovial sarcomas (SS) by GEP

82-97% of SS immunoreactive, usually in majority of or all tumor cells with strong intensity.
TLE1: Transducin-Like Enhancer of Split 1

Also expressed in nerve sheath tumors (MPNST 15-18%) and 8% of SFT. Occasionally in other sarcomas. Usually weak or focal, non-homogeneous in these tumors.

Greater specificity reported with monoclonal than polyclonal antibodies.


TLE1 Clone 1F5
Mesothelial cells
TLE1
Synovial sarcoma biopsy
TLE1
Synovial sarcoma
TLE1
Synovial sarcoma
TLE1
Synovial sarcoma
TLE1 Synovial sarcoma
TLE1
metastatic synovial sarcoma to lung
TLE1 neg
Ewing sarcoma
TLE1 neg
Ewing sarcoma met to lung mesothelial cells reactive
TLE1 neg. embryonal rhabdomyosarcoma

TLE1 weakly + emb. rhabdomyosarcoma
TLE1
vaginal sarcoma
Solitary fibrous tumor

STAT6

TLE1
TLE1 nasal glomangiopericytoma
Adipophilin protein is localized to the lipid membrane (member of the PAT or perlipin family).

Expressed in sebaceous cells, lipoblasts, adrenal cortex, Sertoli and Leydig cells, lactating mammary acinar cells, steatotic hepatocytes but not mature fat.

Useful in identifying sebaceous neoplasms and some liposarcomas. It will also label a subset of clear cell renal cell carcinomas.

The IHC labeling pattern should be a membranous vesicular one, outlining small vesicles to be specific. Granular staining without this pattern is not specific for sebaceous or lipogenic differentiation.
Adipophilin in benign sebaceous glands. Note the vesicular pattern.
Adipophilin
Sebaceous Carcinoma.
Adipophilin Sebaceous Carcinoma.
Sebaceous ca- adipophilin
Sebaceous ca- adipophilin: membranous vesicular
Adipophilin neg. adnexal tumor- NS granular
Adipophilin neg. BCC- NS granular
Adipophilin - De-diff. liposarcoma

PRAME (PReferentially expressed Antigen in MElanoma): melanoma-associated antigen that was isolated from a melanoma patient.

IHC for PRAME in 400 melanocytic tumors, including 155 primary and 100 metastatic melanomas, and 145 melanocytic nevi:

**Diffuse nuclear + in 87% metastatic/ 83.2% primary melanomas**

94.4% acral, 92.5% superficial spreading, 90% nodular melanomas, 88.6% lentigo maligna, and 35% desmoplastic melanomas.

Expressed in both situ and non-desmoplastic invasive melanoma components where present.

140 cutaneous melanocytic nevi, 86.4% were completely negative
PRAME expression correlated with genetic alterations present in melanoma by FISH and SNP arrays in a series of 110 "diagnostically challenging melanocytic lesions."

IHC + in a minor subpopulation of melanocytes, in 13.6% of nevi. Rare isolated junctional melanocytes + in solar lentigines and benign non-lesional skin.

Expressed in cutaneous melanoma, ocular melanoma; Expressed in seminoma, non-small cell lung cancer, breast carcinoma, renal cell carcinoma, ovarian carcinoma, leukemia, synovial sarcoma, and myxoid liposarcoma.

PRAME IHC can be used in the workup of atypical melanocytic lesions.

PRAME
Metastatic Melanoma clone
RBT-Prame
PRAME Metastatic melanoma
PRAME

cutaneous melanoma
PRAME
Seminoma positive
PRAME
Spitz nevus
Negative
PRAME
Vulvar
Pagets
Weak +
PRAME
Met ca
Fluid CB
Weak/focal positive
Acknowledgements

My colleagues in Pathology at BTMC/ BUMC/ PSA for sharing their cases.

Jacqui Ketterer:  IHC Technical Supervisor and the IHC technical staff at our central lab, Sonora-Quest Laboratories, for their assistance and dedication to the performance of high quality results for our patients.
Honey Island Swamp Band. Jazz Fest 2019