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OMICS Group International is an amalgamation of Open Access publications and worldwide international science conferences and events. Established in the year 2007 with the sole aim of making the information on Sciences and technology ‘Open Access’, OMICS Group publishes 400 online open access scholarly journals in all aspects of Science, Engineering, Management and Technology journals. OMICS Group has been instrumental in taking the knowledge on Science & technology to the doorsteps of ordinary men and women. Research Scholars, Students, Libraries, Educational Institutions, Research centers and the industry are main stakeholders that benefitted greatly from this knowledge dissemination. OMICS Group also organizes 300 International conferences annually across the globe, where knowledge transfer takes place through debates, round table discussions, poster presentations, workshops, symposia and exhibitions.
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OMICS Group International is a pioneer and leading science event organizer, which publishes around 400 open access journals and conducts over 300 Medical, Clinical, Engineering, Life Sciences, Pharma scientific conferences all over the globe annually with the support of more than 1000 scientific associations and 30,000 editorial board members and 3.5 million followers to its credit.

OMICS Group has organized 500 conferences, workshops and national symposiums across the major cities including San Francisco, Las Vegas, San Antonio, Omaha, Orlando, Raleigh, Santa Clara, Chicago, Philadelphia, Baltimore, United Kingdom, Valencia, Dubai, Beijing, Hyderabad, Bengaluru and Mumbai.
Diagnosis of Active TB using Aptamers

Makobetsa Khati, BScMedHons, MPH (UCT) MScMed, DIC (Imperial College London), DPhil (Oxon), Pr.Sci.Nat (RSA)

Email address: Mkhati@csir.co.za

2nd International Conference and Exhibition on Pathology
06th August 2013
Embassy Suites Las Vegas, Nevada, USA
What are Aptamers?

- Aptamers are artificial nucleic acid or peptide ligands selected *in vitro* using the SELEX process.
- They are single stranded DNA, RNA or peptides capable of assuming well defined 3-D structures that can recognize:
  - Surface proteins (e.g. gp120)
  - HIV
  - TB bacillus, Malaria or Bilharzias parasites
  - Diseased Cells (e.g. cancerous cells)

Khati., *Journal of Clinical Pathology*. 2010 (63): 480-487
## Advantages of aptamers over antibodies

<table>
<thead>
<tr>
<th></th>
<th>Antibodies</th>
<th>Aptamers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td>Expensive</td>
<td>Fast, inexpensive</td>
</tr>
<tr>
<td><strong>Stability</strong></td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td><strong>Reusability</strong></td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td><strong>Ease of Modification</strong></td>
<td>X</td>
<td>√</td>
</tr>
</tbody>
</table>
Current TB Diagnostics

**Sputum smear**
- 100 years old: false negative

**Cultures**
- Can take up to six weeks to get results

**DNA tests/NAAT**
- Requires moderate to intense training/lab
- GeneXpert MTB/RIF (PCR based)
- LAMP (Loop-Mediated Isothermal Amplification)

**X-ray**
- Subjective
- Limited to pulmonary TB

**Urine Test**
- eg. LAM, Only performs well in HIV-infected persons with advanced immunosuppression

**Skin Test**
- Reaction to bacterial protein diagnose latent infection

Adapted from Nature Medicine, 2007
Market need

- There is a need for a:
  - Simple
  - Rapid
  - Accurate
  - Affordable

- PoC TB Diagnostic
- For opportune intervention in high HIV and TB prevalence developing countries.
CSIR address the need using the aptamer technology

- Properties of aptamer-based TB Dx:
  - Simple.
  - Rapid.
  - Accurate.
  - Affordable to the end-user.
  - Requires minimal training.
  - Equipment free.
  - Deliverable to the end-user.
  - Can be used at PoC in rural clinics.
  - Under-cut currently available TB Dx.
Aptamers bind to TB antigens with high affinity

Validation in Clinical Sputum Samples (Rotherham et al., PLoS One, 2012)

Sputum samples used in the proof-of-principle study (n = 68)

<table>
<thead>
<tr>
<th>Tuberculosis status</th>
<th>Subjects (n)</th>
<th>Positive for CFP-10</th>
<th>Test Result</th>
<th>Specificity 68.75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sputum samples negative for TB</td>
<td>20</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latent infection</td>
<td>5</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smear negative, culture negative</td>
<td>15</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy laboratory volunteers negative for TB</td>
<td>28</td>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Tuberculosis status

<table>
<thead>
<tr>
<th>Tuberculosis status</th>
<th>Subjects (n)</th>
<th>Positive for CFP-10</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sputum samples positive for TB</td>
<td>20</td>
<td>20</td>
<td>100%</td>
</tr>
<tr>
<td>Smear positive, culture positive</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Smear negative, culture positive</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Latent infection</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Smear negative, culture negative</td>
<td>15</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Presumably Healthy laboratory volunteers (without TB)</td>
<td>28</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

### Specificity

<table>
<thead>
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</tr>
</tbody>
</table>

## Comparison of AptaMax- PoC-TB Dx to Smear Microscopy and GeneXpert™ using ASSURED criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Smear Microscopy</th>
<th>GeneXpert™</th>
<th>AptaMax TB Dx (ELONA)</th>
<th>AptaMax POC TB Dx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affordable</td>
<td>$1/test</td>
<td>&gt;$10/test</td>
<td>$1/test</td>
<td>&lt;$1/test</td>
</tr>
<tr>
<td>Sensitive</td>
<td>35 – 70%</td>
<td>&gt;80%</td>
<td>80 – 100%</td>
<td>90 – 100%</td>
</tr>
<tr>
<td>Specific</td>
<td>&gt; 95%</td>
<td>90 – 100%</td>
<td>68%</td>
<td>&gt;80%</td>
</tr>
<tr>
<td>User-friendly</td>
<td>No</td>
<td>Yes</td>
<td>Almost</td>
<td>Yes</td>
</tr>
<tr>
<td>Rapid and robust</td>
<td>24 hours</td>
<td>&lt; 2 hours</td>
<td>8 hours</td>
<td>&lt; 2 hours</td>
</tr>
<tr>
<td>Equipment-free</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Deliverable to end-users</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
The A-Team

www.csir.co.za
Technology Transfer & Commercialization Partner

AptaMax

An undiagnosed person is one too many

www.csir.co.za
Acknowledgements

- **Collaborators:**
  - UP (Jacques Theron)
  - NICD (Lynn Morris)
  - UCT & GSH (Bongani Mayosi, Trevor Sewell, Keertan Dheda, Jonathan Blackburn)
  - UKZN (Alexander Pym)
  - Harvard University, USA (Eric Rubin & Sarah Fortune)

- **Reagents**
  - Colorado State University, USA
  - Leiden University, Netherlands (Tom H. M. Ottenhoff)
  - Stellenbosch University (NC Gey van Pittius)
  - BEI Resources, VA, USA
  - NIH AIDS Research and Reference Reagent Program, MD, USA

Funding:

- Leiden University, Netherlands (Tom H. M. Ottenhoff)
- Stellenbosch University (NC Gey van Pittius)
- BEI Resources, VA, USA
- NIH AIDS Research and Reference Reagent Program, MD, USA
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