In October 2016, MilliporeSigma collaborated with KBioHealth New Drug Development Center (NDDC) to organize the 5th BioExcellence conference with the theme “Renaissance in Immunotherapy” in Osong, South Korea. The goal of the event was to provide guidance on the journey from drug discovery to commercial manufacturing and to engage in dialogue with the emerging biotechnology community focused on developing immunotherapies. Conference topics included regulatory affairs, fundraising opportunities and partnership development.

MilliporeSigma’s collaboration with South Korean government incubators is part of a long-term strategy to help ensure success of the emerging biotechnology industry in this country. This white paper summarizes key takeaways from the conference.

Overview

Dr. Youngsun Sohn, Ph. D., Abcontek & University of Suwon, described Immunotherapy as the treatment of disease by inducing, enhancing, or suppressing an immune response, and described two types of immunotherapies: suppression and activation. The field of immunotherapy has been under evaluation for more than a century, but only recently has it entered a renaissance phase with the approval of multiple agents for the treatment of cancer. Therapies targeting PD-1, PD-L1 and PD-L2 are at the forefront of immunotherapy, and are being developed by all of the multinational pharmaceutical companies, including GlaxoSmithKline, Novartis, Roche, and Merck & Co. Globally, there are more than 300 trials targeting PD-1 and PD-L1, and more than 200 trials targeting CTLA-4.

Dr. Inpyo Choi, KRIBB, discussed current issues in natural killer (NK) cell biology and therapy, and shared a case study developed at the Immunotherapy Convergence Research Center. A particular focus was placed on the need for partnerships and collaboration.

Dr. Kiweon Cha, KBioHealth New Drug Development Center (NDDC), shared his perspective about the need for partnerships to advance immunotherapy in South Korea. Today, corporate venture capitalists are looking for collaboration among academic drug discovery centers and corporate mini-labs in universities. But questions remain. What does the future of collaboration look like? Who will share the risks of immunotherapy drug discovery and commercial development? How can competitive grants cooperate? These questions remain unanswered.

Approved Stem Cell Products

7 stem cell therapies have been approved in the world, 4 of which are in Korea, thanks to the strong regulatory support through favorable government policies.

<table>
<thead>
<tr>
<th>Approval</th>
<th>Drug</th>
<th>Company</th>
<th>Country</th>
<th>Treatment</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Hearticellgram®-AMI</td>
<td>Pharmacell Co., Ltd.</td>
<td>Korea</td>
<td>Acute myocardial infarction</td>
<td>Autologous BM derived MSC</td>
</tr>
<tr>
<td>2012</td>
<td>CARTISTEM®</td>
<td>MEDIPOST Co., Ltd.</td>
<td>Korea</td>
<td>Cartilage injury</td>
<td>Allogeneic umbilical cord blood derived MSC</td>
</tr>
<tr>
<td>2012</td>
<td>Cupistem®</td>
<td>Anterogen Co., Ltd.</td>
<td>Korea</td>
<td>Anal Fistula Crohn’s disease</td>
<td>Autologous adipose MSC</td>
</tr>
<tr>
<td>2012</td>
<td>Prochymal®</td>
<td>Osiris Therapeutics Inc.</td>
<td>Canada</td>
<td>Acute GvHD</td>
<td>Allogeneic BM derived MSC</td>
</tr>
<tr>
<td>2014</td>
<td>NEURONATA-R®</td>
<td>CORESTEM Inc.</td>
<td>Korea</td>
<td>Lou Gehrig’s disease</td>
<td>Autologous BM derived MSC</td>
</tr>
<tr>
<td>2015</td>
<td>Holoclar®</td>
<td>Chiesi Farmaceutici S.p.A.</td>
<td>Europe</td>
<td>Severe limbal stem cell deficiency</td>
<td>First stem cell therapy in Europe</td>
</tr>
<tr>
<td>2015</td>
<td>TEMCELL® HS</td>
<td>JCR Pharmaceuticals Co., Ltd.</td>
<td>Japan</td>
<td>Acute GvHD (Acute graft versus host disease)</td>
<td>Autologous BM derived MSC</td>
</tr>
</tbody>
</table>

Figure 1: Approved stem cell products and their treatment

Source: Company website and publications

The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the U.S. and Canada.
Gi Hyun Kim, Ministry of Food and Drug Safety (MFDS), described global and South Korean trends in the development of gene and stem cell therapies, and noted there are currently four stem cell therapies that have been approved (Figure 1). This represents a shift in South Korea from developing biosimilars towards developing innovative therapies.

**Global Spending and Growth 2008-2017**

![Global Spending and Growth 2008-2017](chart)

Figure 2: Global and Republic of Korea trends in A) gene therapies, and B) stem cell therapies

There has been significant growth within the pharmaceutical industry over the past 10 years (Figure 2) and throughout this time monoclonal antibodies have comprised most of the top 10 drugs. Immunotherapy is receiving a significant amount of investment by multinational pharmaceutical companies; in the last two years alone, $600 million USD has been invested, and this market is expected to reach $10 billion USD within the next five years (Figure 3).

**Global Immunotherapy Market**

![Global Immunotherapy Market](chart)

Figure 3. Global immunotherapy market: global market size and product pipeline

Source: Seed Planning: METI; Kuick Research; Med Market Diligence; Transparency Market Research

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**Partnering with MilliporeSigma**

From drug discovery through commercial production, many challenges remain to be addressed in order to deliver these innovative immunotherapies to patients. MilliporeSigma is combining industry-leading capabilities across the entire upstream and downstream process to help overcome these challenges through customized solutions (Figure 4). It is MilliporeSigma’s desire to work with all emerging biotech companies in South Korea to develop innovative therapeutics and to help scale-up for commercial production of immunotherapies.

MilliporeSigma understands the needs of emerging biotech companies and is dedicated to helping these companies advance their molecules in development through a range of products, services and programs. Among our offering is a library of our former development or research compounds and derivatives thereof, within the framework of our Open Innovation Initiative. MilliporeSigma Biopharma is also seeking to build collaborations within the fields of oncology, immuno-oncology, and immunology and multiple sclerosis.

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Source: IMS Institute, 2014.2

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Source: IMS Institute, 2014.2
Conclusion

According to Daniel Stamm, Senior Vice President of Process Solutions Commercial for the Life Science business of Merck KGaA, Darmstadt, Germany, “the South Korean government is keen on turning the country into a biotech hub in Asia and around the world. They have a clear and focused plan to transform South Korea into a place that will attract industry leaders, experts, scientists and credible organizations.” That dynamic market will result in the development of innovative therapies and will prove valuable to investors.

MilliporeSigma will continue to offer programs helping these companies develop and advance their compounds such as our Emerging Biotech grant program in the United States, EU and China. Moreover, MilliporeSigma will leverage our M Lab™ Center for Emerging Biotech Day in 2017. Located in South Korea and around the world, MilliporeSigma M Lab™ Collaboration Centers provide a manufacturing environment where customers work closely with MilliporeSigma scientists and engineers to solve their toughest biomanufacturing challenges and help accelerate development of medicines. Customers can use these centers to explore the latest technologies and apply best practices and new approaches to develop, optimize and scale-up processes, and simplify global technology transfer.

It is clear from discussion at this event that now is the right time to invest and develop the South Korea emerging biotech market.

References