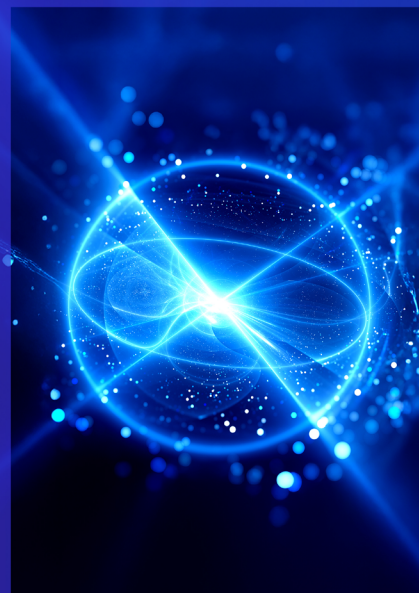




Quantum sensing in pharma

Accelerating drug discovery
and precision medicine

Dr. Aaron Kemp and Brian Miske



Quantum sensing for commercial applications

Imagine a world where technology not only meets our expectations but exceeds them, where the limits of what we thought possible are shattered by the profound capabilities of quantum sensing. Welcome to “Quantum Sensing for Commercial Applications,” an article that will take you on an inspiring journey through the transformative potential of this groundbreaking technology in the pharma sector.

“Quantum sensing represents a transformative shift in pharmaceutical research, enabling us to cut through the noise and focus on what truly matters—faster drug discovery and better patient outcomes. Through the Chicago Quantum Exchange, KPMG is helping clients harness the power of this technology to streamline the development process and bring life-changing treatments to market more quickly and effectively.”

Jeff King

Chicago Managing Partner, KPMG LLP

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We will explore specific use cases that illuminate how quantum sensors can enhance our understanding and interaction with the world around us. We will also confront the challenges that accompany these innovations, examining how businesses can navigate the complexities of implementation while considering the broader implications for society.

As we embark on this exploration, our goal is to provide you with insights that are not just informative but also actionable. Quantum sensing is not merely a technological advancement—it is a catalyst for innovation and growth. Together, let's unlock new opportunities and reimagine what's possible in the commercial landscape.

Healthcare and pharmaceutical

In the realm of healthcare, time is often a matter of life and death. The pharmaceutical industry stands at a crossroads, grappling with the challenges of lengthy drug development timelines and escalating costs. Imagine if we could harness the power of quantum sensing to revolutionize this landscape—accelerating drug discovery and enabling precision medicine like never before.

In this article, we will explore how quantum sensing technologies can transform pharmaceutical processes by providing high-resolution imaging and real-time monitoring capabilities. We'll highlight specific use cases that demonstrate their effectiveness while also addressing the hurdles pharmaceutical companies face in integrating these advanced technologies into their workflows.

But this is more than just an exploration—it's an invitation to envision the future of healthcare. By participating in a KPMG Ignition Discovery

Defining quantum sensing

Quantum sensing leverages the principles of quantum mechanics, such as entanglement and superposition, to achieve unprecedented precision in measuring physical quantities. This technology holds transformative potential across various sectors, particularly in telecommunications, by enhancing the accuracy and reliability of position, navigation, and timing (PNT) systems. Quantum sensors can operate effectively even when traditional systems such as GPS are unavailable or unreliable due to interference. This capability opens new financial opportunities by enabling more resilient communication networks, improving synchronization for financial transactions, and supporting advanced applications such as autonomous vehicles and smart infrastructure management. As these sensors become more affordable and scalable, they promise to drive significant advancements in both commercial and strategic areas.



The future of various sectors lies in quantum sensing, enabling rapid advancements, more precise diagnostics, and groundbreaking innovations in application suites.”

Dr. Aaron Kemp,
Director, Enterprise Innovation, US Quantum
Leader, Emerging Solutions, KPMG LLP

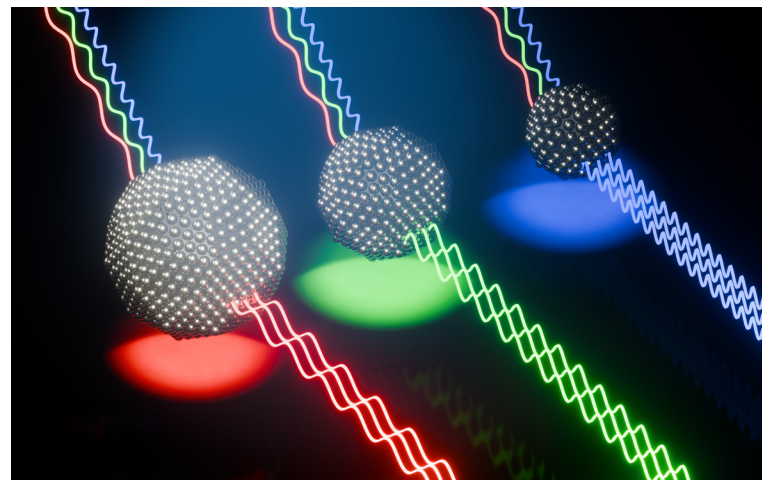
Session, you can experience firsthand how these innovations can be applied to your organization. Together, we can turn disruption into opportunity and pave the way for groundbreaking advancements in healthcare.

Exploring quantum sensing

Quantum sensing leverages the principles of quantum mechanics to measure physical quantities with unprecedented precision. In pharmaceuticals, this technology can significantly enhance drug discovery and precision medicine. By providing extremely sensitive detection capabilities, quantum sensors can identify molecular interactions and structural changes at a scale previously unattainable. This enables researchers to understand complex biological processes more deeply, facilitating the development of targeted therapies and personalized medicine approaches. As a result, quantum sensing has the potential to transform how pharmaceutical companies approach drug development, leading to more effective treatments and improved patient outcomes.

High-resolution imaging and real-time monitoring

Quantum sensors offer high-resolution imaging capabilities that are crucial for pharmaceutical research. These sensors can detect minute changes in magnetic fields or other physical properties, allowing scientists to visualize molecular structures with exceptional clarity. This level of detail is invaluable for understanding the intricate mechanisms of drug-target interactions and cellular processes. High-resolution imaging can accelerate the identification of promising drug candidates by providing clear insights into their efficacy and potential side effects. Consequently, quantum sensing not only enhances the accuracy of imaging but also reduces the time required for preclinical testing, ultimately speeding up the drug development pipeline.



Real-time monitoring is a critical advantage of quantum sensing in pharmaceuticals. Quantum sensors can continuously track biochemical reactions and physiological changes as they occur, offering immediate feedback on drug interactions and metabolic processes. This capability is particularly beneficial for optimizing dosage regimens and assessing drug safety in clinical trials. By providing instantaneous data, quantum sensing allows researchers to make informed decisions quickly, reducing the risk of adverse effects and improving patient safety. Real-time monitoring also facilitates adaptive clinical trial designs, enabling more efficient use of resources and faster progression through trial phases.

Use cases in pharmaceuticals

Several use cases illustrate the successful integration of quantum sensing in pharmaceuticals. For example, quantum sensors have been employed to enhance magnetic resonance imaging (MRI) techniques, providing clearer images with lower doses of contrast agents. Additionally, they have been used in spectroscopy to analyze complex biological samples with high precision, aiding in the identification of biomarkers for disease diagnosis and treatment monitoring. Another promising application is in monitoring drug delivery systems at the nanoscale, helping ensure that therapeutics reach their intended targets effectively. These examples demonstrate how quantum sensing can improve both the efficiency and accuracy of pharmaceutical research.

Quantum sensing can significantly reduce drug discovery timelines by providing faster and more accurate data on molecular interactions and biological processes. Traditional methods often involve lengthy trial-and-error approaches; however, quantum sensors offer precise measurements that can quickly identify promising compounds or rule out ineffective ones. This accelerates the initial phases of drug development, allowing researchers to focus resources on candidates with higher success potential earlier in the process. Furthermore, real-time monitoring capabilities enable rapid adjustments during clinical trials, minimizing delays caused by unforeseen issues or adverse reactions.



By harnessing the power of quantum sensing, we can revolutionize drug discovery and enable precision medicine, dramatically accelerating timelines and reducing costs in the pharmaceutical industry.”

Brian Miske,
US Ignition Leader, Americas
Space Leader, KPMG LLP



The incredible accuracy of quantum sensors can transform our approach to measurements, opening new horizons in scientific research and commercial applications.”

**Dr. Aaron Kemp,
Director, Enterprise Innovation, US Quantum Leader,
Emerging Solutions, KPMG LLP**

Quantum sensing plays a pivotal role in advancing precision medicine by enabling highly detailed analyses of individual patient profiles. With its ability to detect subtle molecular differences between patients, quantum sensing supports the development of tailored treatment plans based on genetic makeup and disease characteristics. This personalized approach improves therapeutic efficacy and minimizes side effects by helping ensure that patients receive treatments best suited to their unique conditions. As a result, quantum sensing not only enhances patient care but also contributes to more efficient healthcare systems by reducing trial-and-error prescribing practices.

Challenges and solutions

Despite its potential, integrating quantum sensing into pharmaceutical workflows presents challenges such as high costs, technical complexity, and the need for specialized expertise. To overcome these hurdles, companies can invest in collaborative partnerships with academic institutions and technology firms specializing in quantum technologies. Additionally, developing standardized protocols for using quantum sensors can streamline their adoption across different research settings. Training programs to build expertise among scientists and engineers are also essential for successful implementation. By addressing these challenges proactively, pharmaceutical companies can harness the full potential of quantum sensing to drive innovation.

Future of healthcare

The widespread adoption of quantum sensing technologies promises a transformative future for healthcare. By integrating these advanced sensors into pharmaceutical research and clinical practice, we can expect more rapid drug development cycles and personalized treatment options that improve patient outcomes significantly. Quantum sensing will likely become a cornerstone technology in precision medicine initiatives, driving innovation across diagnostics, therapeutics, and disease management strategies. As these technologies mature and become more accessible, they will pave the way for a healthcare landscape where treatments are not only more effective but also more equitable and tailored to individual needs.



According to the latest *KPMG Futures Report*, Quantum Computing is positioned as a horizon disruption.* With postquantum encryption standards set to emerge this year, quantum encryption is expected to be the most immediate priority in this space. While general-purpose quantum computers may still be years away, experimenting with quantum use cases today offers companies a strategic advantage in preparing for the opportunities this technology will unlock.

At **KPMG Enterprise Innovation**, we have been closely tracking the quantum computing frontier. Through strategic partnerships with organizations such as the *Chicago Quantum Exchange* and *IBM*, we are exploring how quantum can accelerate real-world solutions.

**Horizon disruption is change that is poised to happen for a time, and then finally does.*

KPMG can play a pivotal role in helping pharma companies navigate the complex quantum computing landscape by providing guidance in a variety of areas:

Strategic advisory and consulting

Technology integration

Cybersecurity services

Talent and skills development

Proof-of-concept experimentation and R&D

Risk management and compliance

Richard Entrup,

Managing Director, Enterprise Innovation, Head of Emerging Solutions, KPMG LLP

Experience and learn more — KPMG Ignition Discovery Session

Unlock the transformative potential of quantum sensing for your business. Join us at [KPMG Ignition](#) for a Discovery Session and elevate your team's knowledge and opportunities in this groundbreaking field. Together, let's turn innovation into reality and lead the charge in commercial applications.

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