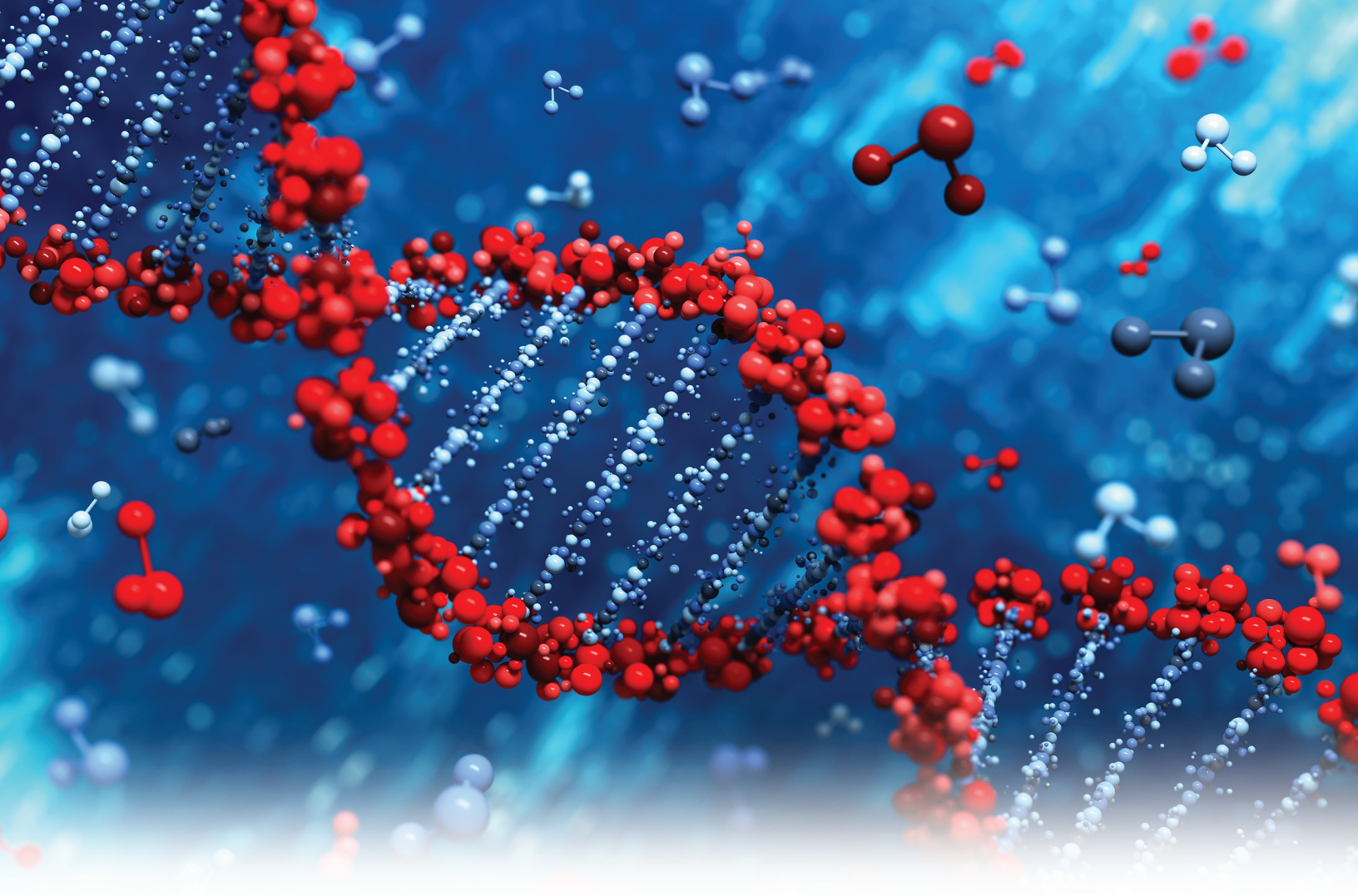

Advancements in Medical Technology: DNA Sequencing

AXIOMTEK®

As medical technology grows with each year, medical treatments are getting better and more advanced, which has led to an increase in life expectancy rates that can be seen in numerous countries around the world. However, even with advanced treatments and procedures, medical professionals are starting to look away from simple treatment options and are actively looking towards prevention and stopping illnesses before they even become a problem.

First generation sequencing technologies emerged in 1970s. In the 1980's, the Human Genome Project was launched and got underway in 1990 by the U.S. Government as an international scientific research project with the end goal of mapping out all of the genes of the human genome to help the scientific community understand the complexity of DNA. The benefit of mapping out the entire human genome was meant to provide scientists and researchers with information that could be used in such fields as human evolution, biotechnology, molecular medicine and more. When the project was completed in 2003, scientists saw that variations in certain gene sequences could show signs of cancer, diabetes, Alzheimer's, and many other diseases and disorders. This has led to the rise of next-generation sequencing technology. That relies upon high performance computer hardware with larger storage and analytical capabilities to deliver detailed DNA sequencing and screening information. Better preventative care or treatment plans based on genetic information are prolonging lives and providing options to prevent life-threatening diseases from developing or progressing. Medical professionals can offer treatment based on specific patient DNA information that will minimize risks and maximize recovery rates.

Because of the major benefits that this industry will have on global healthcare applications such as infectious diseases, prenatal testing, idiopathic diseases, oncology and human leukocyte antigen for matching organ and tissue donors, Grand View Research, Inc. has estimated that the global next generation sequencing market will reach an expected $27.8 billion in annual revenue by 2022. The market was estimated at $2 billion in 2014, leading many to believe that the next generation sequencing market will see exponential growth within the next 10 years.

Next Generation Sequencing Technology's Challenges

The original Human Genome Project started its planning phase in the 1980's and was declared complete in 2003 – meaning that the largest problem that slowed down the project was computing power which was limited by the technology available at the time. At the beginning of the project, processors were considerably slower than today's CPUs. Modern next generation sequencing systems are now being built with the height of CPU technology, allowing for a complete DNA sequence (which is more than three billion DNA strands) to be mapped out in a single week instead of the original 13 years that the Human Genome Project took. These DNA-sequencing machine manufacturers were looking for highly reliable, customized embedded motherboards with powerful CPUs and multiple critical features to fit their complex project needs. The level of personalized customer service, design expertise, assistance from experienced engineering and sales teams were among crucial factors to consider. Axiomtek was chosen by a world renowned DNA machine manufacturer to create a solution that helped ensure them achieving the goals, advanced equipment that can map DNA sequences quickly and efficiently.

Axiomtek's Related Product Features

When the company first approached Axiomtek, their chief concern was processing power since next generation sequencing machines require an enormous amount of CPU power to collect billions of pieces of DNA data. Taking their needs into consideration, Axiomtek designed a single board computer that could support two high performance 1.8 GHz Intel® Xeon® E5-2400 series CPUs. The Intel® Xeon® looked particularly impressive to the next generation sequencing company because each CPU supports 8 cores- giving each board a total of 16 cores. Additional features for the Intel® Xeon® include the Intel® Turbo Boost Technology, effectively "overclocking" the CPU to increase the processor's speed for heavy workloads. The Intel® Xeon® E5-2400 series also supports Intel® Hyper-Threading Technology which enables each core to accomplish multiple tasks at the same time in order to increase time efficiency. Furthermore, the customized board supports DDR3 unbuffered 256GB of memory for increased computing needs.

Axiomtek's Design-In Services

Since the company requested a single board computer (SBC) that was unlike any motherboard available at the time, Axiomtek's design-in services provided crucial help throughout the entire development process for the customer, which resulted in a customized SBC that fit their application needs. Starting from initial planning, design, testing, and validation to the ready-to-ship phase, Axiomtek's design-in services offered key assistance in all facets of the customization process to ensure that the final product worked reliably in mission critical environments. This meant careful design and planning in order to produce an effective prototype for the customer that took into account a variety of critical factors. Key elements such as processing speed, storage needs, OS driver integration were carefully thought out while other refined details were also thoroughly planned and tested. Axiomtek was selected because our teams offered customized and personalized services that went beyond expectations from conceptual to deployment stage. Our custom motherboard met the complex and specific requirements, including two Intel® Xeon® CPUs along with multiple LAN ports, SATA ports for extensive storage of DNA sequence information, numerous USB ports, PCIe lanes and VGA connector and LVDS interface.

To ensure that our product was able to operate reliably in a variety of applications, the customer also opted to utilize our thermal solution service to ensure the SBC had a successful thermal design to prevent failure in extreme temperature conditions. The service included the proven thermal module, the customized thermal solution and design support for customer, in order to ensure that our products were qualified to work in many different temperatures and environments.

Going beyond physical services, our design-in services also provided the customers with software services, including embedded OS development, software API utility and driver support, and BIOS customization. Specifically, the next generation sequencing company utilized our BIOS customization service in order to personalize their product's boot up screen and requested that each board come preinstalled with and embedded version of Windows OS in order to provide users with an easy to use interface.

In addition to offering a fully-customized design, Axiomtek's design-in services are highly scalable. Customers can choose level of involvement, i.e., semi-customized design services or micro-customized design services, which scales down the amount of assistance Axiomtek provides for each project to meet varying degree of the needs for assistance. This is made available for customers who desire to do most of their own designs or need help only for specific areas, i.e., re-configuring minor changes on a motherboard.

Hardware

A wide variety of form factors are available to choose from. These boards range from small form factors with high computing performance to larger form factors with low power consumption and great graphical display.

Our industrial-grade, compact form factors such as COM Express, Pico-ITX, Nano and 3.5” (CAPA) boards support a variety of platforms including x86, RISC, etc. and are able to withstand harsh operating conditions.

Mid-sized form factors such as mini-ITX, ITX or PICMG are preferred by systems integrators whose projects do not require compact form factors – These larger boards have powerful socketed CPUs, great thermal performance as well as richer and greater flexibility for I/O interfaces. Communication capabilities including wireless internet can be offered via PCI or PCIe lanes as well as SIM slots to help the integrated device communicate with other devices or control centers – all in support of the IoT concept. Furthermore, while it was not necessary for the DNA-sequencing machine manufacturer, our embedded motherboards have passed certification such as UL60601-1/EN60601-1, CE and FCC class B for use in medical facilities.

Axiomtek’s design-in services, board and systems customization services and comprehensive product lines can deliver a complete solution to our customers. We can provide them with personalized, worldclass service and the best customized embedded solutions that can meet the many complex demands of systems integrators and medical device manufactures to shorten their time-to-market and deliver a painless experience from the design to deployment process. For more information on Axiomtek’s design-in services for boards and systems, please visit us at www.us.axiomtek.com or email us at solutions@axiomtek.com.