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Nanotechnology for Cancer Therapy on Various Sectors

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ABSTRACT: - Diagnosing, treating and monitoring the progress of therapies for each form of cancer that occurs has long been a vision among oncologists and has recently grown closer to genomics, proteomics and cell biology developments. It has been discovered, according to recent research in the US, that one in five deaths in a developing country is due to the cancer. A new technology has been adopted from nanotechnology called Nano medicine for early detection of this cancer. A lot of work is currently underway to develop new nanodevices capable of detecting cancer at its earliest stages, defining its position inside the body and explicitly supplying anticancer drugs. Our paper uses nanowires and cantilevers etc to examine various improved treatments of this cancer. These nanos identify the malignant tumor cells, and are aimed for destruction. Our paper explains clearly what work is being done in this area. Various issues arising from these nanos are also studied. Data from the Nano Cancer Institute is gathered. If this nanomedicine is used properly in the coming years, that cancer will be identified early and human life can be saved.

KEYWORDS: Cancer Therapy, Nanowires, Nanoshells, and Image detection

I. INTRODUCTION

Nanoscience refers to the handling of radioactive, molecular, and macromolecular materials, systems, and devices, while nanotechnology is the cluster of techniques involved in the design, synthesis, analysis , and implementation of structures, materials, devices , and systems through nanometer-scale manipulation of shape and size. Nanometer-scale monitoring and manipulation of the fundamental molecular structure allow for the regulation of the material and device's bulk macroscopic chemical and physical properties [1]-[5].

With the advancement of the nanotechnology of the previous few eras in the areas of materials science, chemistry and engineering remained exploited in all fields where insignificant scale plays a crucial part in deciding fundamental properties. Specific polymer-based encapsulation and delivery systems have been designed to enhance bioavailability, the protection of active food components and the ability to deeply penetrate tissues [6]-[10]. Nano-encapsulation protects food ingredients during various processing, manufacturing and storage processes from heat, moisture and degradation; it also improves the stability of different compounds inside the device.

For the past decades, Nontechnology has been active in the food industry to enhance the consistency, taste, and texture of food and to protect it from pathogen infestations. Nanotechnology is used to extend the shelf-life and increase food material safety by preventing microbial infestations. Nanoparticles encapsulation gives improved release and productivity in food industry and medicine, in addition to masking the odour and bitter taste [11]-[15].

Nanotechnology is responsible for significant improvements in food products as they enhance the consistency and the taste of the food. It controls interactions between the ingredients and the food matrix with the active agent being distributed controlled Nano-based food packaging have numerous advantages over traditional packaging methods as they provide

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improved packaging with enhanced mechanical strength, antimicrobial films for pathogen detection, and barrier properties for safety status of food[16]-[18].

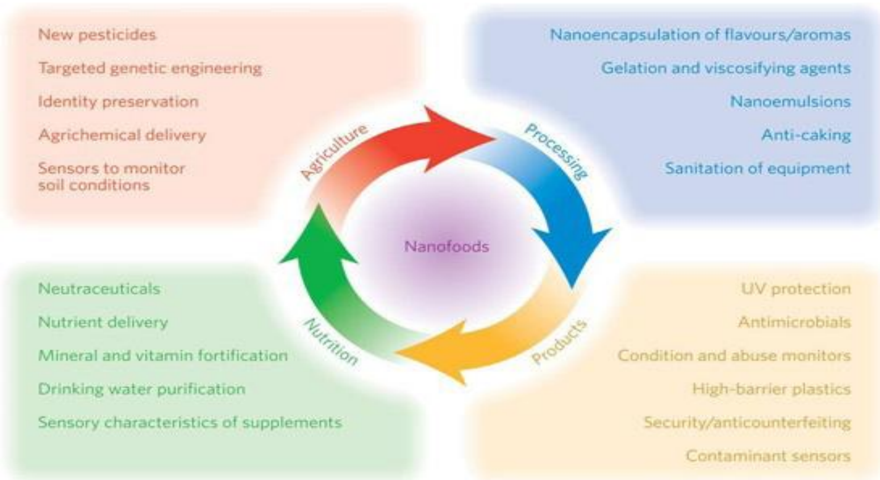

Fig.1. Various Sector of Nano Technology

II. IMPROVED DIAGNOSTICS

Nontechnology has been active in the food industry for the past few decades, allowing Nanodevices to rapidly and sensitively identify cancer-related molecules and allowing scientists to identify molecular changes even though they occur only in a small percentage of cells. It will require early cancer detection-a crucial step towards improving cancer care. Nanotechnology will enable screening tools to be reduced which means that many tests can be carried out on a single device. That makes screening for cancer quicker and more cost-effective is shown in Fig.2.

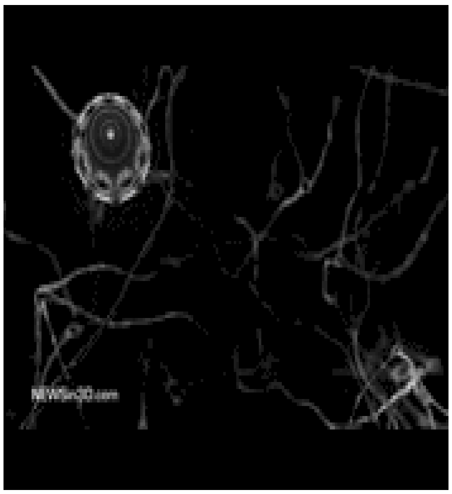

Fig.2. Cancer Therapy of Nanodevices

Immunosensor consists of dimethylsiloxane, which is integrated with specialized antibodies that are immobilised on non-porous alumina membranes that produce electrochemical impedance spectrum for pathogen detection. Nanobiosensors are built to detect microbes in food material production, plants and for quantifying food ingredients, worrying consumers and suppliers about food safety status. Tiny nano-films or sensor chips are loaded into these immunosensors with different molecules of antibodies, antigens, or proteins. Biosensors based on carbon nanotubes are famous for their easy recognition, simplicity and cost-effectiveness. These are used for microbial identification, waterborne contaminants and various tarnished products in food and beverages.

Changed Quartz crystal surfaces often detect small molecules. Nano-materials and nano-medicine applications include fluorescent biological labels, detection of amino acids, lipids and proteins, drug delivery and other macromolecules, pathogen detection, DNA structure testing, tumor identification and detection, and tissue engineering, MRI contrast enhancement, and biological molecule purification. Nano-medicine development and advancement in biomedical engineering provide a podium that effects nanoscale imaging, elucidating the molecular mechanisms inside the living cells.

III. NANOWIRES

By nature, nanowires possess incredible selectivity properties and specificity Nanowires can be designed to sense and pick up cancer cell molecular markers.

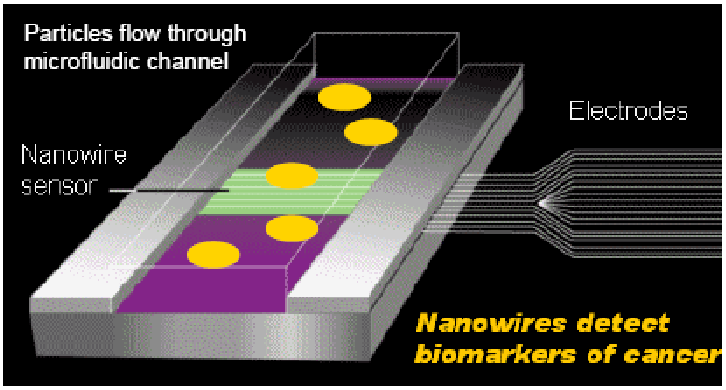

Fig.3. Nanowires Detect Cancer

The wires are able to detect gene presence and transmit the information to doctors and researchers through electrical connections. This technology can aid in detecting changes in cancer genetics. Nanowires can be coated with a probe like an antibody that binds to a protein that is the target. Proteins which bind to the antibody will change the electrical conductance of the nanowires and a detector can unmeasured. A nanowire detector was developed by Jim Heath, a nanotechnology researcher at California Institute of Technology. Every nanowire bears a different antibody or ligonucleotide, a short stretch of DNA which can be used to recognize sequences of specific RNA.

Cancer cells contain dye used to generate atomic oxygen and kill only the tumour cells that are exposed to laser radiation without harming normal cells. During cancer treatment tumour cells are killed by laser-generated atomic oxygen. A porous nanoparticle is used to enclose the hydrophobic dye molecule to avoid adverse effects on normal cells which prevents it from spreading to other parts of the body. In biological assays, multicolour optical coding with continuously increasing genomics and proteomics work that assembles accumulated amount of sequence data increases the need for the production of high-performance screening technologies is shown in Fig.3.

IV. CANTILEVERS

Nanoscale cantilevers are designed using the lithographic techniques of semiconductors. This can be filled with molecules (such as antibodies) that can bind to different molecules that secrete only cancer cells.

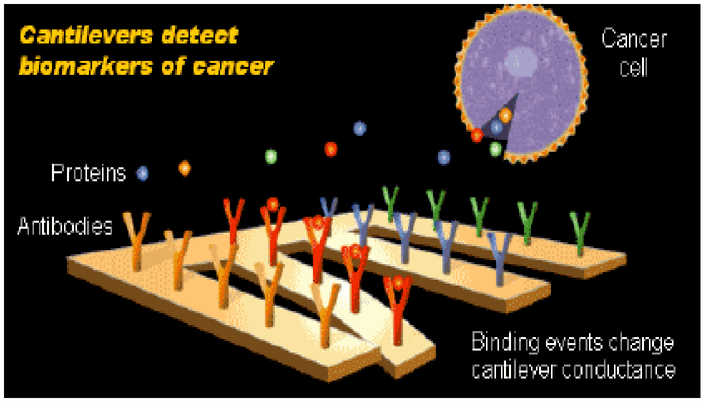

Fig.4. Cantilevers

When the target molecule binds on the cantilever to the antibody, it can detect a physical property of the cantilever, and the change. Researchers can study the binding real-time, and quantitative analysis may also be possible with the information. The cantilevers of nanometer size are extremely sensitive, and can detect single DNA or protein molecules. Thus providing fast and sensitive methods of detection for molecules related to cancer. TiO2 nanotubes on the surface of rat mesenchymal stem cells with a spacing of approximately 15-30 nm provide optimal conditions for integrant formation, clustering, cell proliferation induction, stem cell differentiation and oestrogenic line migration is shown in Fig.4.

Despite the tremendous therapeutic potential of progenitor cells, stem cell therapy faces many obstacles. Stem cells can produce infinite growth morphology of all cell types and tissues. The key trend in the future production of nano-materials is to make them versatile by manipulating the generated signals for numerous applications and thereby transforming them into nano-devices. The multidisciplinary field of nanotechnology and its applicability to discover novel analogy and exploit the available techniques can have the potential of enhancing health care. There are few advances in the application of nano-samples remote control, such as the removal of magnetic nanoparticles.

In a relatively short period of time, nanotechnology has emerged as a powerful instrument in modern medicine. Nanotechnology is likely to embellish a vital weapon toward serious and infectious diseases in the near future. In addition, a further potential outlook includes the catalysis and development of biologically inspired nano-biomaterials.

V. IMAGING AND DETECTION

Contrasting agents for nanoparticles are being produced for the identification of tumours. In diagnostic procedures such as computed tomography and nuclear magnetic resonance imaging, labeled nanoparticles and non-labeled particulates are already being studied as imaging agents. The magnetic resonance imaging (MRI) uses super paramagnetic nanoparticles is shown in Fig.5. consist of an inorganic center of iron oxide, or not filled with polymers such as dextran.

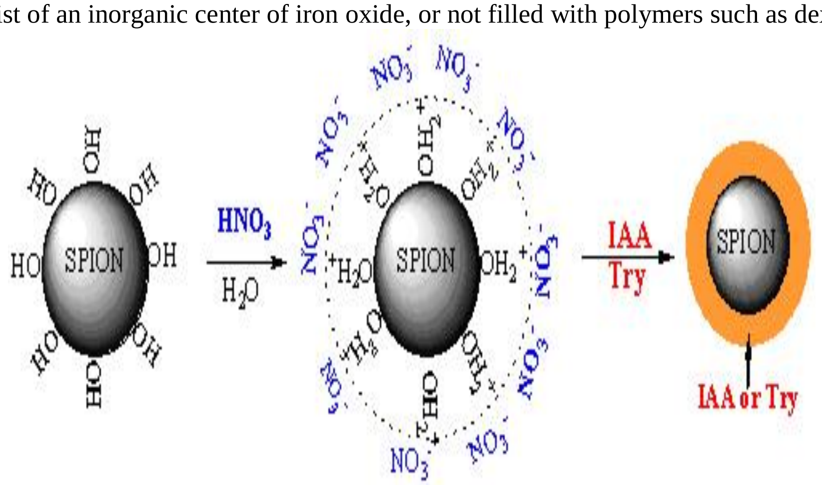

Fig.5. Imaging and Detection

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VI. CANCER THERAPHY

Nanoscale devices have the potential to radically change cancer therapy by increasing the number of therapeutic agents that are very effective. Nano particles may serve as flexible, guided vehicles for the delivery of drugs capable of ferrying chemotherapeutic agents or therapeutic genes into malignant cells while sparing healthy ones. Because the medications are administered directly to the target tissue, this can require smaller doses of toxic substances. Doctors can also be able to administer the toxin in a controlled manner and with time release. Nanotechnology adjunct with molecular imaging provides a multifunctional stage for developing nanoprobes with remarkable potential and enhanced precision, sensitivity and signal.

Increased light sensitivity, increased 3D resolution and the ability to scatter data in biological systems at the subcellular level allow nanoparticle molecular imaging. Due to the development of gill scar tissue around the nanomaterial, as well as the lack of compatibility and adequate electrical and mechanical properties to facilitate nerve tissue repair, the use of neuronal prostheses is mainly limited. Nano-devices for neural tissue repair should be cell-compatible, and should have excellent mechanical and electrical properties. Meningeal cells and glial scar tissue are formed in brain and CNS astrocytes, preventing axon growth and its medicinal applications.

VII. TARGETING

Cancer fighting medications are actually toxic to both tumor and normal cells, and the drug's side-effects also hinder the effectiveness of chemotherapy. Some nano-scale delivery devices such as dendrites (spherical, branched polymers), silica-coated micelles, ceramic nanoparticles, and cross-linking liposome may be targeted at cancer cells. This will increase drug selectivity towards cancer cells and decrease the toxicity to normal tissue. It is achieved by attaching the legends of monoclonal antibodies or cell surface receptors which specifically bind to the cancer cells is shown in Fig.6.

Some cancer targeting molecules have shown higher specificity for cancerous human cells, including high affinity folate receptor, luteinizing hormone releasing hormone and integrating some folate nanoparticles research into. Additionally, the folate nanoparticles improved the absorption of the encapsulated drugs it carried. Surface modification of nanoparticles may also improve the permeability of drugs to create cancer therapies based on high-permeability nanoparticles. Barriers to cancer drugs can be in the form of plasma membrane or cell epithelial or endothelial layers.

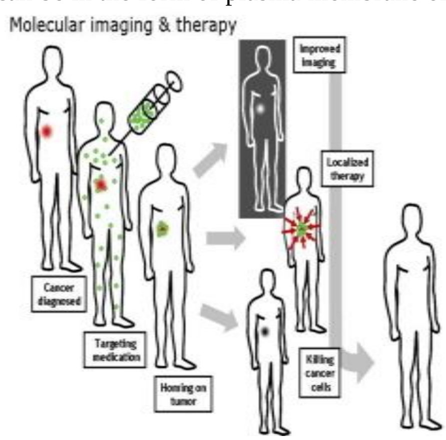

Fig.6. Cancer Imaging Therapy

VIII. NANOSHELLS

The benefits of using thermal therapy are that most treatments are non-invasive, fairly straightforward and are capable of treating tumors where surgery is not feasible. However, energy sources may infiltrate healthy tissues to enter underlying tumours, frequently killing healthy tissue. Nanoshell-assisted thermal phototherapy (NAPT) is a simple , non-invasive treatment for selective removal of photo thermal tumour.

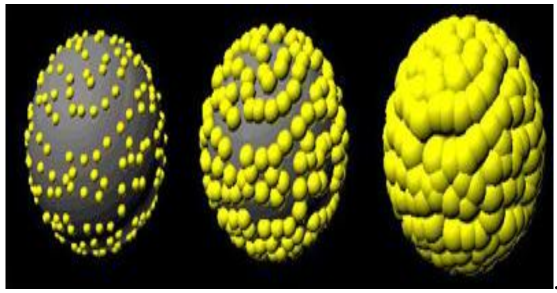

Fig.7. Nanoshell

However, something smaller than 200 nm is no longer absorbed by phagocytes and nanoparticles can migrate and pass randomly through the blood. Total study of any emerging nanomedicine to thoroughly identify the new product should be performed is shown in Fig.7. Exogenous particles or foreign substances entering the bloodstream are usually absorbed by specialized phagocytes responsible for protecting the body from foreign substances. Nano-sized particles are capable of evading detection by the body's immune system and of moving through the blood brain barrier.

IX. CONCLUSION

This paper concludes that nanotechnology will radically alter the way diagnose, treat and prevent cancer to help achieve the goal of eliminating cancer suffering and death. Nanotechnology can provide the technical power and tools that will allow those developing new knowledge diagnostics, therapeutics and preventives to keep pace with today's knowledge explosion. In addition to food packaging and processing, cancer therapy, in regenerative medicine and so on, the role of nanotechnology may gain long-term visibility to contribute to competitive and innovative methods. In addition, nanosensors for the characterization of food, water purification, mineral and vitamin fortification & nutrient delivery are the nanotechnology contributions to nutrition. In agriculture, nanotechnology is concerned with novel pesticides, agrochemical distribution, soil condition monitoring sensors and targeted genetic engineering.

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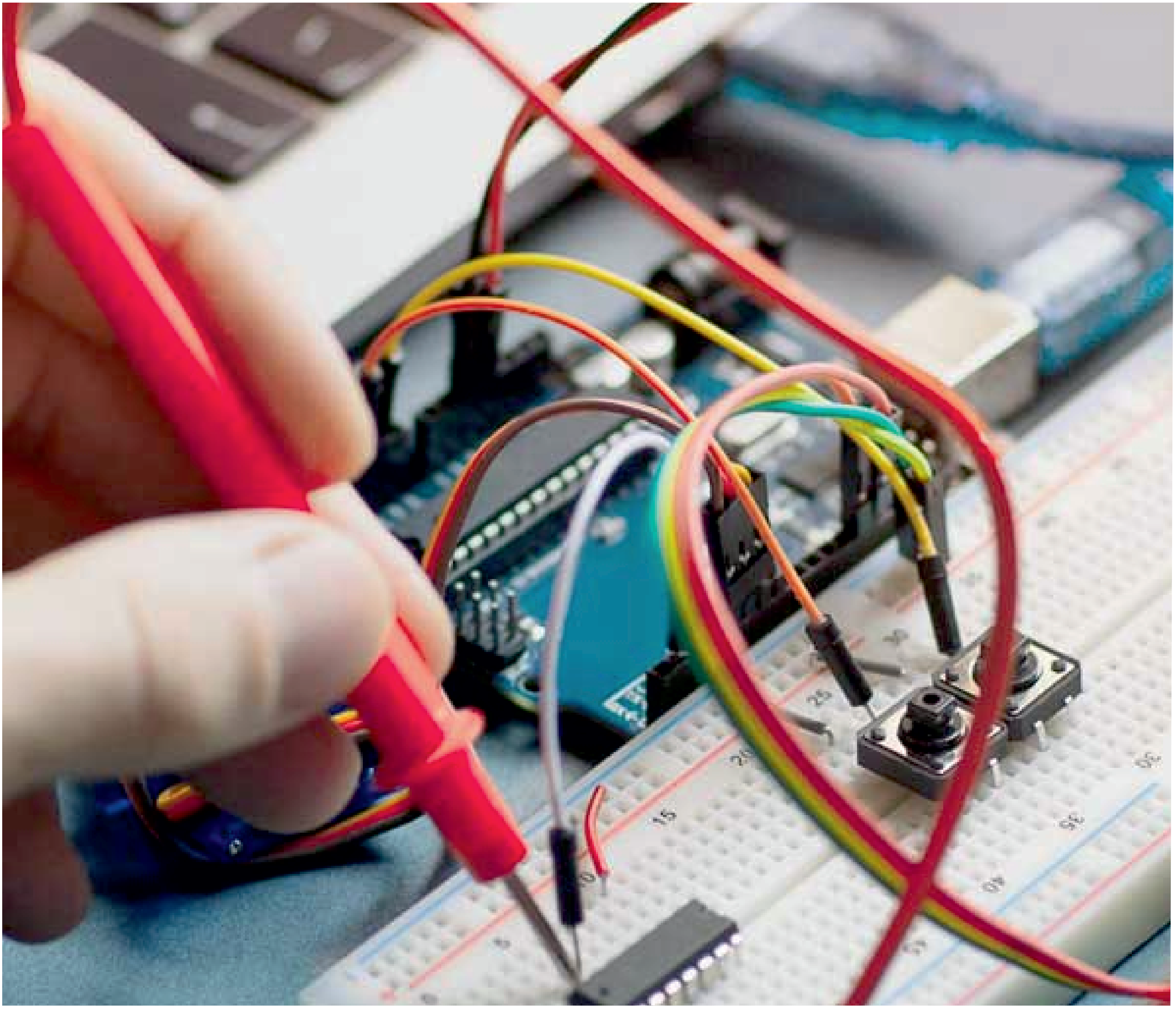

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