

Medical Equipments in Biomedical Engineering of China: Development and Application



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Received:  August 24, 2018; **Published:**  September 04, 2018

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Introduction

As a new frontier disciplinary, biomedical engineering is developed on the basis of the combination of life science, medicine science and engineering. Its development helps to enhance the research of medical equipment's and materials, so as to fully meet the actual demand for clinical diagnosis and treatment in biomedical field. In recent years, with the continuous development of science and technology in China, some engineering technology has been widely applied to the medical field, and a lot of medical equipment has been derived, which has made a great contribution to the further development of China's biomedical industry [1].

The Development of Modern Medical Equipment in China

With the development of biomedical engineering in China, medical equipment's has become more simplified, mechanized and precise, and have made considerable progress in the following fields:

- a) **Robots:** Medical robots have higher accuracy in diagnosing and treating patients. The usage of medical robots through surgeons' manipulation can minimize the surgical trauma suffered by patients.
- b) **Genetic Therapy:** For example, the cell separator for purifying malignant marrow cells can achieve good results for some genetic diseases.
- c) **Family Self-Treatment:** With the continuous improvement of living standards of Chinese people in recent years, they put forward higher requirements for simplicity of treatment. The family self-healing equipment such as rehabilitation appliances can improve the convenience of patients' rehabilitation by allowing patients to complete the rehabilitation work at home.
- d) **Biosensors:** The existing biosensors such as blood oxygen meter and DNA analysis biomolecular integrated circuit chip can monitor the patients *in vivo* or *in vitro* perfectly.

e) **Laser Diagnosis and Treatment:** Laser diagnosis and treatment is an effective optical diagnosis and treatment mode of diseases. For example, the surgical laser knife in the operation can not only effectively reduce the surgical trauma suffered by patients but also enhance the therapeutic effect.

f) **Artificial Organs:** At present, mature artificial organs include prosthetic limbs and heart valves, etc. These medical equipment's can replace or supplement the patient's original organ or system.

g) **Electric Stimulation:** Electric stimulation can act on tissue function through electromagnetic energy. Cardiac pacemaker is a common medical device used in electrical stimulation.

h) **Minimally Invasive or Non-invasive Equipment's:** Minimally invasive and non-invasive equipment's have been widely used in the current medical field, such as endoscopy, laparoscopy and arthroscopy. These medical equipment's can effectively avoid the trauma of patients when they are operated on.

i) **Intelligent Equipment's:** Intelligent equipment's refer to the medical equipment's that can be automatically adjusted after the relevant operating parameters are input, such as implantable cardiac pacemakers.

The Application Field of Medical Equipment in China

Medical equipment includes diagnostic equipment, therapeutic equipment, auxiliary materials and so on, and its detailed classification can query relevant documents of SFDA [2]. The main application fields of medical equipment in China are as follows:

- a) **Medical Imaging:** X-ray and fluoroscopy, CT, MR, DSA, CR, DR, US imaging, ECT, PET.
- b) **Clinical Examination and Analysis, Molecular Biology:** blood cell analyzer, biochemical analyzer, enzyme immunoassay analyzer, flow cytometry analyzer, hemagglutination analyzer,

fluorescence analyzer, radioimmunoassay analyzer, PCR, DNA analyzer.

c) Detection and Monitoring of Electrophysiological Information: ECG, EEG, EMG, blood flow, blood sugar, pH value, multi-channel physiological monitor (blood pressure, blood oxygen, ECG, heart rate, impedance respiration, body temperature), 24-hour dynamic monitor (ECG, EEG blood pressure), surgical monitoring equipment, maternal and infant monitor, fetal monitor, sleeping monitor.

d) Physical Therapy: radiotherapy and stereotactic radiosurgery (gamma knife, X knife, particle knife), ultrasound therapy (high intensity focused ultrasound, ultrasound extracorporeal lithotripsy, ultrasound hemostasis), electromagnetic wave hyperthermia (extracorporeal thermotherapy, intracavitary thermotherapy, thermocoagulation therapy), High energy tumor hyperthermia Technology (high intensity focused ultrasound hyperthermia, radiofrequency hyperthermia machine, microwave hyperthermia machine).

e) Minimally Invasive: endoscopy, robotics, navigation and positioning.

f) Artificial Organ Replacement: artificial kidney, artificial liver and extracorporeal circulation.

g) Scalpel: electric knife, ultrasonic scalpel and blood vessel ligation.

h) Biomedical Materials: surgical sutures, artificial skin, contact lenses, artificial blood vessels, artificial tendons, teeth, bone prosthesis, implants, catheters, stents, etc.

i) Medical Information System: PACS (Picture Archiving and Communication System), DICOM 3.0 (Digital Imaging and Communication in Medicine, 3.0), IHE (Integrating the Health Care Enterprise)

Recommendations for Developing the Medical Equipment's and Biomedical Engineering of China

Biomedical engineering and medical equipment exist side by side and play a part together. On the one hand, biomedical engineering is the foundation, and its development will lead to

the emergence of new medical equipment; on the other hand, the demand of medical equipment will lead to new research directions of biomedical engineering [3].

Therefore, how to develop China's biomedical engineering and medical equipment needs to be considered comprehensively, the specific recommendations are as follows:

- i. Strengthen communication between scientific research personnel and production enterprises.
- ii. Strengthen the exchange of information among scientific researchers, clinicians and biomedical engineering service personnel in medical units.
- iii. Accelerate the transformation of technology to practical application.

At present, the environmental system is becoming more and more favorable for development of both biomedical engineering and medical equipment, and the transformation of scientific and technological innovation achievements on biomedical engineering has become the basic development direction in China. So, as long as efforts, biomedical engineering and medical equipment development will develop better and better.

Acknowledgement

This work is supported by the National Natural Science Foundation of China (Grant No. 71373061), the National Social Science Fund of China (Grant No. 18BJY102), Humanities and Social Sciences youth project of Ministry of Education (Grant No. 15YJC630119), Postdoctoral Fund to pursue scientific research in Heilongjiang Province in 2014 (Grant No. LBH-Z14067), Philosophy and Social Sciences Youth Project of Heilongjiang Province (Grant No. 16GLC02, 16GLC03, 16GLC05).

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ISSN: 2574-1241

DOI: [10.26717/BJSTR.2018.08.001682](https://doi.org/10.26717/BJSTR.2018.08.001682)

Wang Cheng Dong. Biomed J Sci & Tech Res



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