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Supervision of Laboratory Animal in Barrier Enviroment and Pre-warning System

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***Abstract*—Animals are the most widely used experimental individuals in scientific research. According to the requirements of the national standards of the People's Republic of China, the barrier environment is an indispensable environment for breeding animals and using them for scientific research. It is increasingly applied in China. This paper briefly describes the design mode and importance of the monitoring, early warning and communication system in the barrier environment of the experimental animal, so as to provide information for the standardization, informatization and digital management of the barrier environment of the experimental animal.**

Keywords—supervision; barrier enviroment; laboratory animal; pre-warning system

I. INTRODUCTION

The purpose of monitoring is to control and manage the barrier environment. In their routine, the staff observed the experimental animals in close proximity [1]. Because the experimental animals were disturbed and frightened, what they observed was not the normal ecological behavior of the animals themselves, but various stressful gestures and behaviors. To solve this problem, the cable TV system can be used for indirect monitoring, select view a better position to install some cameras, observe the non-working time lighting laboratory animal activity and behavior, can use infrared camera or the grade of high infrared camera [2]. In the case of limited funds, the low illumination lighting can be used to assist ordinary camera to observe. Considering the environmental sudden conversion between light and shade can cause for experimental animals of the discomfort or panic, it should set the intensity of illumination adjustable auxiliary lighting system [3]. The system can set the prescribed brightness, and can also switch between light and dark slowly and smoothly, reducing the interference to the animal's ecological behavior and normal physiological activities.

II. DYNAMIC MONITORING

A. Monitoring of Bacteria and Dust Particles in Barrier Animal Facilities

The stability of the environment of the large scale experimental animal barrier system is the basic condition to guarantee the large-scale production, supply and animal quality of experimental animals [4]. The environmental microorganism control in the barrier system is related to the source of the production population, the cleanliness of the air, the disinfection or sterilization of articles, and the inlet and outlet and operation of personnel. In the current national standards of laboratory animal facilities and environment, only the basic conditions or standards that the barrier system should meet under the static condition are specified, while there is no clear stipulation on the barrier system in dynamic operation. In a production-type barrier system, the changes of bacteria and dust particles in the barrier will vary according to the breed, density and feeding work of the animal [5]. This experiment select two raised the barrier of system of different species of animals, at different times on the barrier system to determine the air drops bacterium and dust particles, microbial research production-oriented barrier system dynamic environment and the changing rule of the dust particles, and analyzed the influence of the production activities on the environmental indicators, for dynamic environment of laboratory animal barrier system to provide the reference for quality standards [6].

B. Maintaining the Integrity of the Specifications

Some experimental reports took the barrier facilities of large experimental animals as the research object, and analyzed the dynamic change rules of environmental microorganisms and dust particles in the barrier facilities and the relevant influencing factors [7]. The method was to determine the amount of airborne bacteria and dust particles in different functional areas of the barrier at different times and under different working conditions. The variation rules of bacteria and dust particles in the barrier system were as follows. The bacteria and dust particles in the air in the barrier system were significantly increased after feeding, and significantly decreased after spray disinfection. The number of airborne bacteria and dust in the rearing chamber of mice and rats increased significantly in the early hours of the morning, while that in the rabbit rearing chamber was lower in the early hours of the morning [8]. The bacterial content in the cleaning corridor and the pollution corridor increased obviously in the working state, but remained at a low level in the non-working state. Therefore, the dynamic changes in the number of environmental microorganisms and dust particles in the barrier system of experimental animals are related to animal species, air disinfection, personnel entry and exit, and feeding operations in animal houses [9].

C. *Information Technology*

With the rapid development of information technology, information technology into various fields, life science is no exception. Life science itself has entered a multidisciplinary cross systems biology era, mainly integrated information science, mathematics, statistics and biology discipline advantage to clarify and understand the meaning of biomedical, so that people will be able to understand the whole biological medicine, and precise, quantitative prediction of biomedical system behavior [13]. As the main method of biomedicine, system methodology provides a new way of thinking for the study of life science, which will make our way of thinking experience a profound change. Guided by the thought of systematic management and driven by information technology, the scientific research and management of experimental animal welfare will be a significant change. The development of experimental zoology will be towards the direction of systematization and digitalization, which will give new vitality to the development of experimental zoology. Based on the establishment of the welfare management system of experimental animals, the quality control level of experimental animals will be higher and higher, and the production and use of conventional experimental animals will be less and less. Management is constantly standardized and legalized. Form the pattern that produces supply specialization, industrialization.

III. THE CURRENT STUDIES AND EXISTING PROBLEMS

The laboratory animal monitoring institute shall undertake the task of monitoring the quality of all kinds of laboratory animals in the province. Monitoring of experimental animals in accordance with the quality standards of experimental animals in China and the local standards of experimental animals are carried out in various provinces [10]. The Guangdong province laboratory animal monitoring institute has tested 2,393 laboratory animals raised in an open environment, and has detected the zoonotic bacteria salmonella, gypsum, shigella and mycobacterium. Among the 501 animals raised in the semi-barrier system, bacillus pneumophila, bacillus bronchus and bacillus Pasteur were detected. Among the 91 mice raised in the barrier system or isolator, pseudomonas aeruginosa had a high detection rate, followed by klebsiella pneumoniae, streptococcus haemolyticus b, staphylococcus aureus and pasteurella pneumophila. Zoonotic pathogens have been detected in animals raised in an open environment. It was never detected in the barrier. The detection rate of psoriasis gypsum in rabbits was significantly higher than that in mice, rats and monkeys [11]. This study provides the basis for standard revision, testing project setting and method establishment. At the same time, a series of measures have been taken to eliminate unqualified animal populations, improve the standards of environmental facilities, strengthen internal self-management and control the quality of provenance, so as to ensure the quality of experimental animals in various industries such as life, medical research and drug inspection [12].

A. *Specific Devices*

Service-oriented architecture (SOA) is a rapidly developing technology in the field of computer software. With the maturity of technologies and related products, such as Web Service and BPM workflow, which are the basic technical standards supporting SOA, new attempts for SOA based application architecture are emerging in all industries [14]. Due to the characteristics of loose coupling, cross-platform, interface standard, self-description and access based on HTTP protocol, Web Service is very suitable as the interface standard of animal welfare management system. BPM standard can flexibly arrange and schedule the Web Service and has the characteristics of exception handling and compensation transaction mechanism, which is very suitable for the definition of various exchange and Shared processes in the exchange platform [15]. Therefore, the adoption of SOA technology and method to realize the exchange and sharing of animal experiment information can better solve the problem of heterogeneity and cross-region between animal experiment management systems. In this paper, based on the current non-digital animal welfare resources, and the lack of effective integration and utilization of the backward situation as the background, in view of the shortcomings of the current management model, the introduction of SOA in the field of methods and technologies, to explore a suitable for the integration and access of animal welfare animal experiment management.

B. *Specific Systems*

Workflow is based on a series of process rules, documents, information or tasks that can be transferred and executed between different executors [16]. By using software tools to organize people and applications to manage the process across functional modules, the purpose of efficient automation process is achieved. The definition of workflow is described in non-formal language, although there are different, but basically reached a consensus: workflow is a computer implementation of business processes, and workflow management system is for this implementation of the software environment [17]. Workflow definition respectively reflect the business process in the following several problems, namely what is business process (composed of which activities, tasks, also is the definition of structure), how to do it, ask the execution conditions, rules and information interaction, which is the definition of control flow and information flow), who will do (or calculate the soap application, also is the definition of organizational role), how do (through the work flow management system for monitoring).

C. *Information Management System*

Information management system is a modern and new subject that develops constantly. With the progress of computer technology and network communication technology, information management system is constantly updated. At the present stage, it is generally believed that information management system is composed of people and computer equipment or other information processing means and is used for the management of information. In current information management system has been in the life sciences has been widely used, especially in medicine health care industry, such as hospital information management system, medical expert system, electronic medical record system, hospitals, office automation, drug research and development management, etc., and has quietly infiltrate into every corner in the field of the whole life science, that people think it is ubiquitous, laboratory animal management is no exception [18]. At present, the

quality of animal laboratory personnel and feeding managers in China is uneven, and the overall level is not high. Without the integration of modern management concepts and GLP standard management ideas, systematic integrated management cannot be achieved. The gap between experimental animal GLP construction and foreign countries is not only in hardware, but mainly in software, so it is urgent to strengthen software construction.

D. Animal Welfare System

In view of the backward situation of non-digitalization and lack of effective integrated utilization of animal experiments in China at present, computer informatics technology, network technology and data storage technology are adopted to carry out the research and development of animal welfare system, and access and integration schemes are provided for drug research and development institutions and research institutes. Promote the integration and resource sharing of animal experimental resources and even drug information system, and promote the development of computer-aided experimental technology. The establishment and operation of animal welfare management system will promote the informatization of experimental animal management, drug research and development, and test data, which is embodied in the automation of information storage, rapid information transmission, data integration and scientific decision-making management. The sharing of experimental animal information and data facilitates the unified planning, rational division of labor and reduction of repeated experimental Settings and projects in the management of experimental animals. Provide information support for managers to improve the scientific and rational decision-making. Speed up information flow and automation process, provide timely and accurate information inquiry, statistics, analysis and other services for drug research and development, scientific research and production, and improve the efficiency of staff.

IV. CONCLUSION

In scientific experiments, substitutes should be used where possible if they can be used. If experiments must be carried out on experimental animals, injuries to experimental animals should be avoided to the greatest extent and the number and frequency of the use of animals should be reduced. If the experiment may cause severe pain to animals, it should be effectively anesthetized. If the nature of the experiment determines that anesthetic cannot be used, the experiment must be justified and the experiment must be conducted only when necessary. The repeated use of an experimental animal is prohibited when it is not necessary. The frequency of use of experimental animals and the purpose of the experiment shall be clearly recorded and the person in charge shall be responsible for it. Staff engaged in animal experiments shall receive professional training and obtain a certificate of practice. Experimental animals must be protected and must not be teased or mistreated.

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