

# *Animation Generation of Anti-Tumor Action Mechanism of Active Components of Astragalus Membranaceus with Computer Navigation*

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**Abstract:** With the continuous development of computer navigation aided technology, this technology has been successfully applied in the medical field in recent years. Computer navigation has experienced the development from low-level to high-level from the initial use of personal computer architecture to the computer platform specially designed for it. Therefore, there are more and more discussions about it at home and abroad. This paper briefly introduces the practical needs of computer-aided navigation, systematically summarizes and summarizes the effective ingredients of Astragalus membranaceus and its mechanism of action, so as to provide a more detailed theoretical basis for the treatment of tumors by Astragalus membranaceus, and further expand the clinical application of Astragalus membranaceus in the treatment of tumors. And the realization of computer-aided animation generation technology for anti-cancer of active ingredients of Astragalus membranaceus.

## **1. Introduction**

Computer navigation is to use computer medical imaging technology and the corresponding high-precision optical tracking and positioning devices and wireless intelligent surgical instruments to provide the spatial position between the device and the mechanism of the patient's tumors, and to achieve real-time and accurate positioning and navigation [1-4]. The occurrence of tumors is caused by changes in gene level or epigenetic changes, such as gene mutation or amplification, in some cells of the body under the combined action of heredity and environment, resulting in the weakening of cell apoptosis and uncontrolled proliferation [5-8]. This series of biological events are accompanied by a variety of signal transduction molecules and signaling pathways promoting or inhibiting each other [9-13]. Astragalus membranaceus has attracted much attention due to its extensive pharmacological effects and potential anti-tumor functions. Astragalus membranaceus plays an anti-tumor role through its mechanisms of tumor immune regulation, cell proliferation

inhibition, induction of apoptosis, inhibition of invasion, migration of tumor cells, and inhibition of neovascularization of tumors [14-15]. This paper briefly introduces the practical needs of computer navigation aided, and the realization of computer navigation aided animation generation technology for anti-cancer of active ingredients of *Astragalus membranaceus*.

## **2. Realistic Requirements of Computer Navigation Assistance**

### **2.1. Data Acquisition and Communication Interface Requirements**

Integrated navigation, which is based on inertial navigation and supplemented by other navigation information sources, is the main realization form of modern navigation system. There are many kinds of other navigation information sources which can be integrated with the inertial system. They have their own advantages. They provide different navigation physical quantities to assist the inertial system. Fig. 1 is a block diagram of a multi-information source integrated navigation system. Inertial sensor IMU provides acceleration and angular rate, GPS provides position and velocity information, airspeed meter, magnetic compass and altimeter are common airborne instruments. They give carrier velocity, course and altitude information respectively. Doppler velocimetry and long-range and short-range radio measurement have always been important information sources of aviation navigation. Astronomical navigation and image matching navigation have attracted more and more attention in recent years. Navigation system receives more navigation information sources, which can increase the combination selectivity and improve the reliability of the system. By choosing the most credible information sources, it is possible to obtain higher accuracy. The integrated navigation system with multiple information sources needs a considerable number and types of peripheral interfaces for computer navigation. Among the navigation information sources in the figure, some of the output signals of sensor devices are analog voltage, others are digital transmission standards such as RS-232. In order to facilitate the test of integrated navigation system and the storage and transmission of integrated navigation results, it is important to design USB and Ethernet interface in computer navigation.

### **2.2. Data Processing Capacity Requirements**

The main tasks of navigation data processing in computer navigation are strapdown inertial navigation and Kalman navigation data processing, which involve a large number of matrix operations. Its characteristics are that the data processing mechanism of floating-point operation intensive and computing computer navigation should have a high-performance processor. From the experience of Navigation Engineering practice, it can be seen that the word length of the processor should not be less than 32 bits, and its main frequency should not be small. In order to adapt to the floating-point-intensive characteristics of navigation operations, computer navigation needs a unit that can process floating-point operations in a hardware manner.

### **2.3. Storage Capacity Requirements**

The increase of navigation information sources, the use of new data fusion algorithms, and the exception handling designed to improve the reliability of operation, etc. have promoted the scale of navigation applications to increase continuously. With the development of storage technology, the density of data storage is increasing rapidly, which provides the condition for the embedded system to expand the scale of memory. Therefore, the storage capacity of non-volatile program memory should be greater than 4MB, and the dynamic memory space of navigation program should be greater than 16MB.

### 3. Anti-tumor Mechanism of Astragalus Membranaceus

#### 3.1. Immunomodulatory Effect

Modern medicine regards immunity as a first-line defense system to inhibit the occurrence, development and metastasis of tumors. At present, many studies have been devoted to anti-cancer interventions, and the improvement of the immune system is the key to restrain the growth of tumors. Immunosuppression can be clearly detected in cancer patients and animals inhibited by tumor cells, which shows that immune regulation plays an important role in the process of anti-malignant tumors. Therefore, it is very important to explore a new type of anti-tumor drug to improve the immunity of the body without damaging the host. Tumor is caused by the combination of internal and external factors. Traditional Chinese medicine believes that the occurrence of tumors is due to the deficiency of human's vital energy, which gives opportunities for invasion of exotic toxins and pathogens. Therefore, strengthening the body and removing pathogens is the most important treatment. Here "upholding" means strengthening autoimmunity to resist exogenous pathogens. Saponins, polysaccharides and flavonoids, the effective components of *Astragalus membranaceus*, have immunomodulatory effects. *Astragalus membranaceus* can inhibit the growth and anti-tumor effect of MKN45 cells. The mechanism may be that *Astragalus membranaceus* promotes the maturation of dendritic cells, up-regulates the expression of Toll-like receptor 4 (TLR4) and activates the autoimmune system. *Astragalus membranaceus* can also up-regulate the expression of anti-PARPp85 fragment antibody of apoptotic protease, caspase 3PAB, which is anti-active, and

#### 3.2. Inhibits the Proliferation of Tumor Cells

The normal proliferative cycle of cells can be divided into four stages: prophase of DNA synthesis, anaphase of DNA synthesis, anaphase of DNA synthesis and mitosis. There is still a relative quiescent stage before the prophase of DNA synthesis after cell division, which is an important stage for cell division or differentiation. Cyclin D (Cyclin D) plays an important role in the regulation of cell cycle. Its main role is in the early stage of DNA synthesis or DNA synthesis. Cyclin D can not only affect the division and proliferation of cancer cells, but also induce apoptosis. Cyclin D plays an important role in both normal cell regulation and carcinogenesis. Upregulation of Cyclin D expression can activate CDK4 or CDK6 activity, shorten the prophase of DNA synthesis, reduce the high dependence of abnormal cell growth on mitogen to a certain extent, and then cause abnormal cell cycle regulation and uncontrolled cell formation. Another closely related to cell proliferation is the Adenosine Monophosphate Activated Protein Kinase (AMPK) cascade, which is a sensor of cellular energy status activated by adenosine phosphate (AMP). The system can also regulate systemic food intake and energy consumption by regulating the effects of hormones and cytokines such as leptin and adiponectin. The negative regulatory target of AMPK pathway, rapamycin (TOR), is responsible for limiting protein synthesis and cell growth and preventing abnormal cell proliferation. The occurrence of tumors is closely related to many gene abnormalities in cell proliferation or differentiation. Gene mutation or abnormal expression can lead to uncontrolled cell proliferation. Abnormal regulation of cell proliferation cycle is an important cause of tumorigenesis.

#### 3.3. Induce Apoptosis

The occurrence of cancer is also closely related to the blockage of apoptosis-related signaling pathways. When the activation of endogenous DNA endonuclease is inhibited, cell apoptosis can be

inhibited, that is, the cell can grow indefinitely. Therefore, promoting the apoptosis of cancer cells has become a hot topic in cancer treatment. Nowadays, p53 gene has become a hot topic in cancer molecular research. It is located in the short arm of chromosome 17 and consists of 11 exons and 10 introns. It belongs to highly conserved genes. It can be divided into mutant and wild type. Wild type p53 (WT-p53) is closely related to the regulation of cell growth cycle, cell transcription, DNA replication and induction of cell apoptosis. It can monitor the internal genes of cells. When DNA replication was damaged, WT-p53 could induce cells to enter the quiescent phase, inhibit cell proliferation and induce apoptosis. The results showed that after 48 hours of treatment with different concentrations of Astragalus polysaccharide, the proliferation of breast cancer cells was stagnated in S phase and then inhibited by Astragalus polysaccharide. When the concentration of Astragalus Polysaccharide changed gradually from low to high, the signs of apoptosis of MCF-7 cells were observed by fluorescence staining. Therefore, APS could not only inhibit the proliferation of human breast cancer MCF-7 cells, but also inhibit the proliferation of human breast cancer MCF-7 cells. It can also induce apoptosis.

### **3.4. Inhibiting Invasion and Migration of Cancer Cells**

Tumor recurrence and metastasis are closely related to the invasion and migration of tumor cells, which is also a complex process. Matrix metallo proteinase (MMP) is a gene closely related to the metastasis of many malignant tumors. MMP-2 and MMP-9 are proteinases with high activity in zinc-dependent endonuclease superfamily. Their main functions are to participate in the degradation of extracellular matrix. The expression and up-regulation of MMP-2 and MMP-9 can promote the migration of cancer cells. Astragalus membranaceus can inhibit the proteins in MMP signaling pathway, thus reducing the invasion and migration of cancer cells to play an anti-tumor role.

### **3.5. Inhibits Tumor Vascular Formation**

Abnormal neovascularization of tumors is closely related to the growth, metastasis and recurrence of tumors. Vascularization provides infinite growth nutrients for tumors, such as oxygen, amino acids, electrolytes, etc. It is also a complex process of interaction of multiple factors. Under normal circumstances, many factors regulating angiogenesis are in a balanced state. When tumors occur, the expression of vascular promoting factors is high while that of inhibitors is low. So angiogenesis of tumors is an indispensable nutritional supply for metastasis and invasion of tumors. Blocking the angiogenesis of tumors has become the main way of interventional surgery. Chinese herbal medicine is used to inhibit the blood of tumors. Tube formation also has broad prospects. These results suggest that tumor necrosis factor (TNF) can inhibit angiogenesis and abnormal growth of tumor cells.

## **4. Animation Generation Technology of Active Components of Astragalus Membranaceus against Cancer Tumor Assisted by Computer Navigation**

### **4.1. Key Frame Interpolation Technology**

The key problem in computer animation motion control research is how to generate realistic animation frame sequence. Key frame technology is the most basic and commonly used method. This concept originated from the traditional cartoon production. Because each frame of the animation should be played continuously at the rate of no less than the frame per second, an action of the object should be composed of multiple frames of continuous pictures. Key frame interpolation technique as shown in 3.1.1. In the early days, skilled animators were responsible for

the design of the key pictures in cartoons, that is, the so-called key frames, and then assistant animators were responsible for the design of intermediate frames. In computer animation, the generation of intermediate frame is completed by computer, and interpolation replaces the animator who designs the intermediate frame. This idea is the most basic and widely used method in computer animation, key frame interpolation technology. Applying this technology to the anti-cancer mechanism of the active ingredients of astragalus, we can see the decomposition of the active ingredients of Astragalus against cancer intuitively.

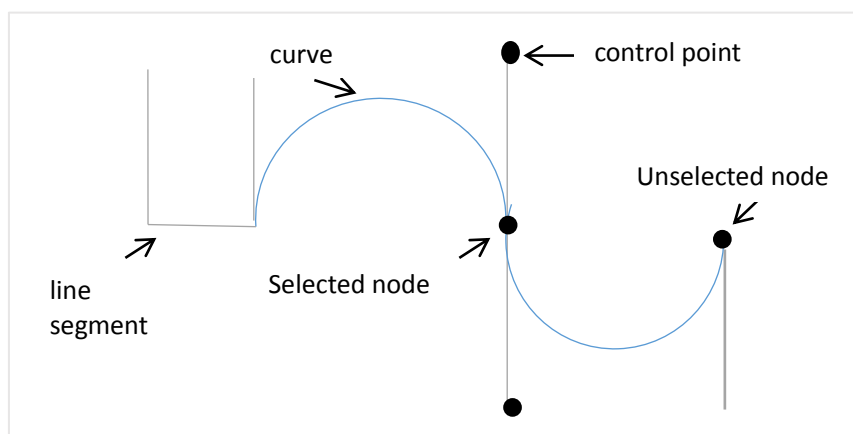


Figure 1. Key Frame Interpolation Concept

## 4.2. Motion Capture System Technology

With the rapid development of computer animation industry, motion capture technology is becoming more and more mature. Motion capture system is more and more used in the production of movies, animations and games. At the same time, it also drives system manufacturers to develop in an all-round way in the direction of improving stability, pursuing operational efficiency, expanding system application flexibility and reducing system cost. The real-time optical data are captured by the motion capture cameras and corresponding devices connected to the network. These data can be widely used in the analysis and application fields of motion capture, including medical, engineering and entertainment manufacturing industries. In the medical field, for example, electromagnetic capture includes the use of a central positioning transmitter and a set of receivers attached to the active ingredient molecules of Astragalus membranaceus. These receivers can measure the spatial relationship with the transmitter, and each receiver will be connected to the synchronization interface to prevent data skewing. The synthetic data stream consists of three-dimensional positions and directions of each receiver.

## 4.3. Video-based Motion Capture Technology

Video-based anti-cancer decomposition of active ingredients of Astragalus membranaceus, capture means tracking the action mechanism of anti-cancer of Astragalus membranaceus from the video sequence first, and then restoring the decomposition motion sequence of anti-cancer of active ingredients of Astragalus membranaceus. Compared with the complexity and cost of traditional motion capture equipment, this method has been greatly improved. In video-based motion capture technology, feature tracking and three-dimensional reconstruction are two key technologies. Feature tracking is to track each feature point of the effective component model of Astragalus membranaceus in each frame image, and match each feature point in the video sequence to generate the motion trajectory of each feature point. That is to say, three-dimensional reconstruction of

image motion model is to use camera calibration or computer vision technology to track the motion information generated by feature tracking.

## 5. Conclusion

Computer navigation aided technology guides the implementation, and animation generation of anti-tumor mechanism of active ingredients of *Astragalus membranaceus*. With the further study of the anti-tumor mechanism of *Astragalus membranaceus*, it will provide more detailed theoretical basis for the treatment of cancer, and further expand the clinical application of *Astragalus membranaceus* in anti-cancer. *Astragalus membranaceus* has the advantages of multi-element, multi-target, multi-direction and little side effects in inhibiting tumors, but the chemical composition of traditional Chinese medicine is more complex, and different geographical influences have a great impact on the content of chemical components in medicinal materials.

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## Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

## Conflict of Interest

The author states that this article has no conflict of interest.

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