Patent Research Analyst: Tasks and Responsibilities

Thesis submitted in partial fulfilment of the requirements for the

Degree of

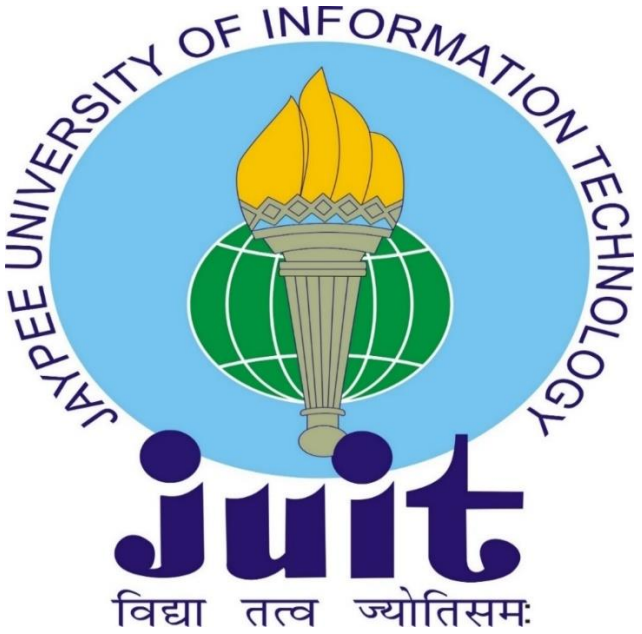
MASTER OF TECHNOLOGY

IN

BIOTECHNOLOGY

By

Yashkirti Garg (212554)



Department Of Biotechnology and Bioinformatics

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I would like to take this opportunity to thank the organization for providing me with this valuable learning experience and for entrusting me with significant responsibilities during my training.

The training has been an excellent learning opportunity for me, and I am grateful for the experience.

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TO WHOMSOEVER IT MAY CONCERN

It is to certify that **Yashkirti Garg** (Employee Code: TTC- 700) is working with Talwar & Talwar Consultants Pvt. Ltd. since 1 February 2023. Her current designation is **Intern- Patent Research Wing.** The internship is going to complete on 31 July 2023.

Till now, her performance has been satisfactory.We wish her all the best for future endeavors.

For Talwar & Talwar Consultants Pvt. Ltd.,

Sna Rikhi
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Date: Tue May 02 12:52:37 IST
2023

Authorized Signatory

DECLARACTION

I hereby declare that I Yashkirti Garg have completed my M. Tech major project under Dr. Hemant Sood (Associate professor) on the topic "Comparative Studies on Micropropagation and Metabolic Production in *Hypericum Perforatum*". This project was carried on for the duration of June 2023, to December 2023.

Thereafter the project was carried out at TT consultants on the topic "Patent Research Analyst: Tasks and Responsibilities" for the duration of Feb 2023 to July 2023 under the supervision of Mrs. Vinita Pathania (Client Account Manager).

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This is to certify that the above statement made by the candidate is true to the best of their knowledge.

Dr. Hemant Sood

Associate Professor

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CERTIFICATE

This is to certify that the work which is being presented in the project report **"Patent Research Analyst: Tasks and Responsibilities"** in partial fulfilment of the requirements for the award of the degree of M.Tech in Biotechnology and submitted to the Department of Biotechnology And Bioinformatics, Jaypee University of Information Technology, Waknaghat is an authentic record of work carried out by Yashkirti Garg during the period of February 2023 to May 2023 under the supervision of Mrs. Vinita Pathania, Dr. Neeraj Maurya, Mrs. Neha Chadha, TT Consultants, Unit 502, 5th Floor, Tower A, Bestech Business Towers, Sector 66, Mohali, Punjab.

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The above statement made is correct to the best of my knowledge.

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TABLE OF CONTENTS:

ABSTRACT:

By encouraging people and organisations to invest in the creation of novel concepts and technology, IPR aims to promote innovation, creativity, and economic growth. It gives authors and inventors the sole authority to make use of, copy, distribute, and profit from their creations, innovations, or brands. They may recover their investments, make money, and keep their competitive edge in the market thanks to this exclusivity. This report contains an internship project completely based on the different types of searching that help companies and researchers in bringing forth the best innovation and solutions to the market.

Keywords: IPR, patentability, invalidity, infringement, prior art, prosecution, patents, copyrights.

Chapter 1:

INTRODUCTION TO COMPANY PROFILE

A leading supplier of top-notch intellectual property and innovation support services, TT Consultants helps customers reach their potential and get over challenges. The business has worked with a variety of clients over the years to offer excellent patent prosecution services and litigation assistance for patents, including invalidity/validity searches, patentability searches, patent drafting, etc. Along with providing other reasonably priced legal support services to corporations, lawyers, law firms, research institutions, and universities around the world, we also specialise in Patent Analytics, Technology Transfer, and Licencing. Our main goal is to develop a one-stop platform for the entire cycle of technological innovation related to patent searches.

At TT Consultants, which is famous for its unique combination and consortium of an international patent search agency and an international patent analytics organisation, the top experts from all over the world are collected. They have established themselves as one of the top IP firms in India, serving a growing list of satisfied clients worldwide for the past 8 years. The business is committed to innovation and constantly enhances its offerings by putting in place new systems and technologies designed to give customers solutions of a higher calibre. [1]

1.1. Patent Services provided by TT consultants:

Prior art searches: Search include those for patentability/state of the art, patent invalidation, freedom to operate, patent infringement, and searches for structure and sequence that look for previous art. Our study offers state-of-the-art search reports that include an industry-unique key feature analysis chart and several value add-ons.

Patent analytics: Patent analytics also includes technology landscape, whitespace analysis, competition monitoring, and patent portfolio management. We find, sort, and analyse data for you, then show it graphically with dynamic charts that are clickable for every category. We perform a "whitespace analysis" to find technological gaps, which helps clients focus on their R&D activities.

Patent Prosecution: Our partners (sister concern) Talwar Advocates handle patent prosecution services such as filing patent applications in India, responding to office actions, filing, searching, and monitoring trademark applications. A skilled team of registered patent agents and other Para Legal staff members supervise the filing of patents and trademarks.

Innovative patent tools: (XL Scout) That our devoted professionals have created. Some of our in-house tools, like the Invalidator Tool, Patent landscaper, Project Allocation System, and PAIR Tracking Platform, produce results that are just as exhaustive as a manual search. [1]

Chapter No. 2

INTRODUCTION

A legal notion known as intellectual property (IP) relates to mental works for which exclusive rights are granted.

2.1. Intellectual Property Rights (IPR)

IPR stands for Intellectual Property Rights. It alludes to a group of legal privileges bestowed upon inventors and owners of intangible property, including inventions, literary and artistic creations, trademarks, and trade secrets. These rights give the owners and creators the ability to manage and profit from their works while preventing unauthorised use by others. Intellectual property rights are important because they provide protection to creators and innovators, which encourages them to invest time, resources, and efforts in developing new ideas and inventions. Without IPR protection, creators and innovators would have little incentive to invest in new ideas, as they would not have the ability to profit from their creations. [2]

2.1.1 Types of IPR

There are several types of intellectual property rights, including:

PATENTS
COPYRIGHTS
TRADEMARK
TRADESECRET
GEOGRAOHICAL INDICATION
INDUSTRIAL DESIGN

Patent: When an inventor creates a new product or process that offers a novel solution to a problem or a unique way of doing something, they may receive a patent, which grants them the exclusive right to their invention for 20 years.

Patenting your innovation has following advantages:

1. Prevents others from entering the market and creates your monopoly.
2. Limits competition in the market
3. Produces income via licencing or sales of manufactured product.
4. Gives legitimacy to your product.

Disadvantages of patenting:

1. **Cost:** Getting a patent can be a time-consuming and expensive procedure. To maintain the patent, further fees and legal charges may be necessary. For newly established companies or small enterprises with little resources, this can be a considerable financial strain.
2. **Disclosure:** The technology needs to be made public in order to receive a patent. This implies that rivals could be able to research the technology and possibly develop workarounds, or even question the validity of the patent.
3. **Limited Timespan:** The typical life span of a patent is 20 years beginning on the date of filing. After a patent expires, the creation becomes part of the public domain and may then be used by anybody without the original patent owner's permission.
4. **Enforcement:** Enforcing a patent can be challenging and expensive, even if it may offer legal protection. Even if the patent holder prevails in the case, they might not be able to recoup all of their legal expenses because patent infringement suits can be protracted and costly.
5. **Innovation:** Patents, according to some detractors, can inhibit innovation by discouraging teamwork and preventing the free exchange of ideas. Instead of using patents to develop new goods or services, businesses occasionally hold onto them to keep rivals out of the market.

2.1.2 Types of patents: [3]

Utility patents	Design Patents	Plant Patents
A utility patent is a type of patent that protects the development of a novel or enhanced useful machine, technique, or product. A utility patent, also called a "patent for invention," forbids anyone from producing, using, or offering the invention for sale without permission.	A design patent is a type of legal defence for the distinctive aesthetic features of a produced good. If the product has a distinctive configuration, distinctive surface decoration, or both, a design patent may be obtained.	A plant patent is an intellectual property protection that prevents others from buying, using, or copying a novel and distinctive plant's essential traits. By barring competitors from using the plant, a plant patent can assist an innovator in securing higher income during the duration of the patent protection.

Non-patentable things

Laws of nature: natural phenomena, such as the behaviour of gravity or the laws of thermodynamics, cannot be patented.

Abstract ideas: abstract concepts, such as mathematical formulas or algorithms, cannot be patented.

Natural products: products that occur in nature, such as minerals, plants, and animals, cannot be patented.

Inventions that are not useful: inventions that have no practical application or are purely aesthetic in nature cannot be patented.

Inventions that are immoral or illegal: inventions that are deemed immoral or against the law cannot be patented.

Inventions that are already known: if an invention is already known or has been previously disclosed to the public, it cannot be patented.

Inventions that are obvious: inventions that would be obvious to someone skilled in the relevant field cannot be patented.

Parts of Application

- Title
- Abstract
- Field of invention
- Background
- Summary
- Brief description of drawing
- Detailed description of drawing
- Claims
- Drawing

Important Dates in Patent Application

DATE	
Date of invention	The time an innovation was finished
The filing date	The date on which you filed your further application in a particular country or territory.
Priority date	The first date of filling of application anywhere in the world
Issue date	Grant date the date on which the patent is issued from patent office
Expiration date	The date when a patent term ends.
Publication date	The date on which patent information is made available to public 18 months after priority date.

2.1.3. Types of Patent Applications:

Ordinary Application: An application submitted to a Patent Office that makes no claims to priority in a convention nation or to any earlier applications already being considered there. Ordinary applications fall under this classification.

Convention application: An application that rests its priority date on applications filed in one or more "convention countries," or nations that have ratified the Paris Convention for the Protection of Industrial Property, is referred to as a convention application.

PCT-International Application: You can get worldwide patent pending status by filing a single utility patent application in accordance with the PCT. The PCT application does not immediately grant you rights to use foreign patents. The trip has only just begun. In the end, you must complete the national step, which involves submitting individual patent applications in the targeted nations. However, a PCT application is an efficient and helpful way to continue having the opportunity of obtaining foreign patent rights while reducing costs.

PCT-National Phase Application: The (PCT) national phase application is a one-time submission used to submit a patent application through PCT signatory nations. This streamlined procedure offers patent protection while observing the unique criteria of each country. It is retroactive to the initial filing date.

Continuation application: An inventor may submit a "continuation application" in order to pursue further claims for an invention that has already been disclosed in a prior application that has not been granted or abandoned. This application, which claims priority based on the parent application's filing date, makes use of the same specifications as the parent application and names at least one of the inventors mentioned therein. When a patent examiner approves some claims but rejects others, or when the inventor wants to cover various iterations of the invention, this kind of application is helpful. However, while the continuation application is being litigated, other changes to the specification cannot be made.

Continuation in part: A patent application also referred to as a "CIP" or "CIP application" adds details not previously revealed in the parent patent application, rephrases a sizable amount of the parent's specification, and shares at least one inventor with the parent application. It is simple to assert improvements made after the parent application was filed by using the CIP application. These patents, which were previously "additional improvement" patents, have been replaced.

Divisional Application: It is a type of patent application that incorporates content from an earlier application that was submitted. This previously filed application is known as a parent a parent application. Even though a divisional application was filed later and has a later filing date than the parent application, it frequently nonetheless asserts the same priority. When a parent application may not have a single unified innovation, divisional applications are

frequently used.; in these situations, the parent application must be divided into one or more divisional applications, each of which can only claim one invention, according to the applicant.

2.1.4. Claims [2]

The claims in a patent are legally binding statements that establish the scope of protection provided. These claims describe the specific innovation or invention being patented and its technical features. The claims of a patent set the boundaries for the protection it offers and describes what the inventor has claimed to have invented. It is important to write patent claims with precise language and technical terminology to ensure that they are clear and unambiguous. They are the most critical aspect of a patent.

Types of Claims

1. **Independent Claims:** Independent claims define the innovation without referencing any other claims and stand alone. These claims are often broader than dependent claims and provide the broadest scope of protection.
2. **Dependent Claims**: Independent claims are referred to by dependent claims, which add additional restrictions or specifics to the invention. These claims are narrower in scope than independent claims.

2.1.5. PCT: The Patent Cooperation Treaty (PCT) [2] is a global agreement that offers a streamlined procedure for submitting patent applications across various nations. Through the PCT, applicants can submit a single international patent application for protection in more than 150 nations.

It is looked after by the World Intellectual Property Organization (WIPO) and has been in force since 1978. The treaty allows inventors to delay the filing of individual national or regional patent applications for up to 30 months after the priority date of the international application, allowing them enough time to consider the possible market for their invention and the necessity of obtaining patent protection in several nations.

The PCT application process starts with the filing of an international form, which must include a description of the invention, claims, and any necessary drawings. The international application is then reviewed by an international search authority, which provides a written opinion on the patentability of the invention. Applicants can use the written opinion to decide whether to pursue patent protection in different countries.

The PCT offers a standardised process for submitting patent applications but does not grant patents. After the worldwide application has been submitted, the patent application is handled in each country or territory in accordance with the relevant local laws and regulations. By offering a centralised application process, the PCT can save inventors time and money by eliminating the need for many translations and legal expenditures.

Options and steps for filing under PCT:

The following are the procedures for submitting a patent application via (PCT) system:

1. **Determine eligibility:** The first stage is to determine whether the innovation is eligible for patent protection and whether the applicant is eligible to submit a PCT application.
2. **Prepare the application**: The PCT application must be written by the applicant and include all necessary claims, illustrations, and an explanation of the invention. The application must abide by all PCT standards as well as any extra ones set forth by the receiving office.
3. **Choose a receiving office:** The applicant must choose a receiving office where the PCT application will be filed. The receiving office can be a national patent office or an international authority.
4. **Pay fees:** The applicant must pay the required fees for filing the PCT application and for any additional services, such as a search or examination.
5. **Receive the international search report:** After the application is filed, an international search report is issued by the International Searching Authority (ISA). Any prior art that would be crucial to determining whether the invention can be patented would be identified in the report.
6. **Optionally request an international preliminary examination:** The applicant may choose to request an international preliminary examination (IPE) after the international search report is issued. The IPE provides a more detailed analysis of the patentability of the invention.
7. **Enter national phase:** In each nation where patent protection is required, the applicant must enter the national phase within the allotted time frame which is usually 30 months from the priority date.

8. **Prosecute the application:** The national or regional patent office in each nation where protection is requested then reviews the patent application. Any objections or rejections made by the patent office must be addressed by the applicant, who may also need to make changes to the application.

9. **Grant of patent:** If the patent application is found to meet the national or regional patent office's requirements for patentability, a patent is granted for the invention in that country.

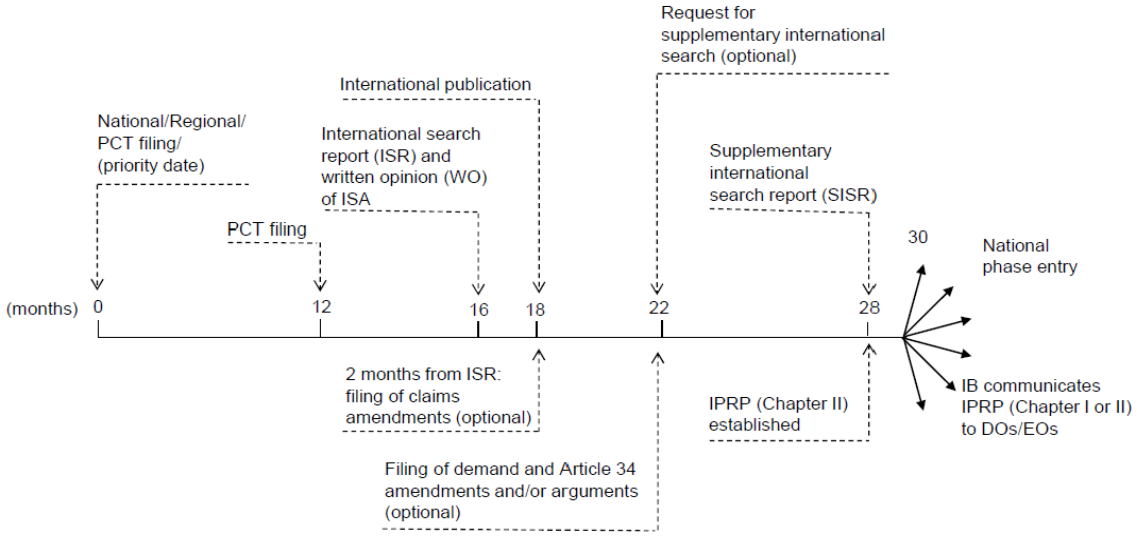

Fig: PCT Timeline

2.1.6. Patent Classification System:

A patent classification is a system that categorizes documents, including published patent applications, based on the technical aspects of their content. In addition to tracking technological advancements in patent applications, this method is utilised by patent office examiners and others to look for prior disclosures that are comparable to or associated with the invention for which a patent is being granted.

Classification-based searching is a type of patent search that involves using a patent classification system to locate relevant patents. Patent classification systems organize patents into categories based on the tech domain or subject matter of the invention. Several patent classification systems are currently in use, such as the International Patent Classification system and the Cooperative Patent Classification system. These systems use a hierarchical

structure of codes and sub-codes to classify patents into various categories based on the technical features and subject matter of the invention.

To perform a classification-based patent search, the searcher must first identify the appropriate classification codes and sub-codes for the invention's subject matter. Then, they can use a patent database or search engine to locate patents classified under these codes and sub-codes. Classification-based searching is beneficial because it can help locate relevant patents that may not be easily found through keyword-based searching. By focusing on the technical features and subject matter of the invention, classification-based searching can identify patents that are related to the invention even if they use different terminology or language.

Limitations

- patents may be classified under multiple codes or sub-codes.
- may not always be up-to-date or consistent, which can lead to inaccuracies in search results.

Types Of Classification [2]

International Patent Classification (IPC): It divides technical disciplines into eight parts (A–H), each of which contains around 75,000 subparts, and each of which is represented by a symbol made up of Latin alphabet characters and Arabic numerals that is language-independent.

The IPC has several hierarchical layers. The subgroup level is indicated by a certain number of dots; a greater number of dots denotes a lower subgroup level.

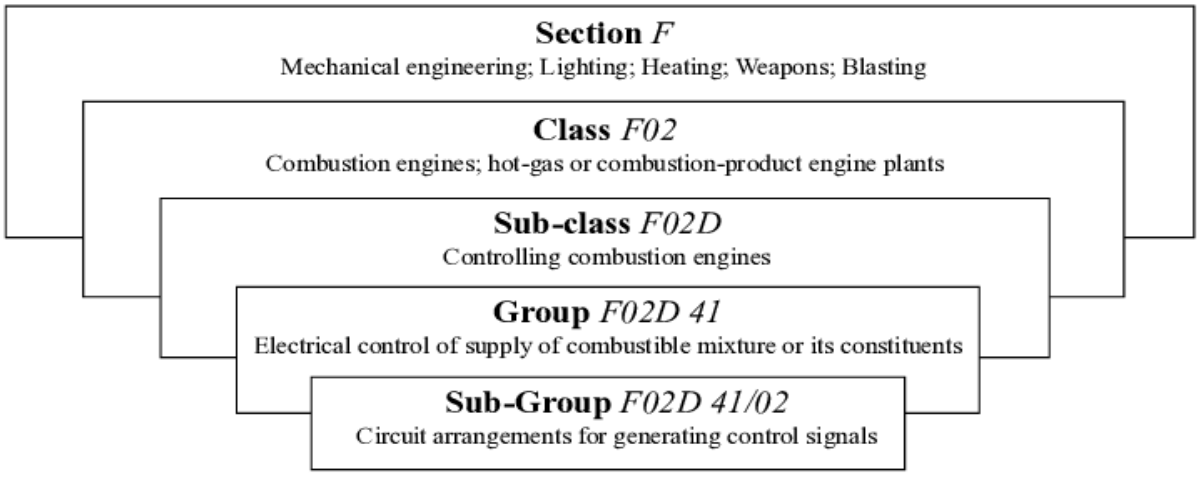

Fig: grouping of classes under IPC

Sections:

A	**Human Necessities**
B	**Performing Operations**
C	**Chemistry; Metallurgy**
D	**Textiles; Paper**
E	**Fixed Constructions**
F	**Mechanical; Lighting; Heating; Weapons**
G	**Physics**
H	**Electricity**

European Patent Classification (ECLA): It divides technical disciplines into eight parts (A–H), each of which contains around 75,000 subparts.

The IPC has levels that are hierarchical. The subgroup level is represented by a number of dots; a greater number of dots denotes a lower subgroup level. CPC, which stands for cooperative Patent classification, has taken its place.

Limitations:

- **Complexity:** The CPC system can be complex and difficult to understand for people who are not familiar with such system. The system uses a hierarchical structure of codes and sub-codes, which can be confusing for some users.
- **Updating:** The CPC system is updated periodically to reflect changes in technology and new areas of innovation. However, updating the system can be time-consuming and costly.
- **Lack of uniformity:** While the CPC system was designed to be a unified classification system for all patent offices, there may be some differences in how it is applied by different patent offices. This can lead to inconsistencies in classification and make it difficult to conduct international patent searches.
- **Limited scope:** The CPC system is primarily focused on technological subject matter and may not be as effective for patents related to other areas such as business methods or software.

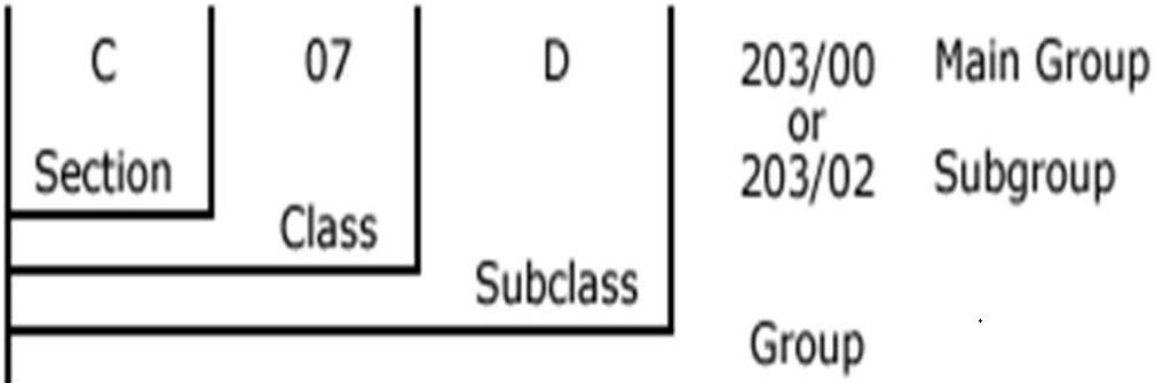

Fig: grouping of classes under CPC

The United States Patent Classification (USPC)

The US Patent and Trademark Office (USPTO) uses this system to classify patents according to the invention's subject matter. The USPC system was established in 1836 and has been revised several times over the years. In 2015, the USPTO began transitioning from the USPC system to the Cooperative Patent Classification (CPC) system, that is a joint system used by patent offices everywhere globally.

The USPC system uses a hierarchical structure of codes and sub-codes to classify patents into various categories based on the technical features and subject matter of the invention. The codes and sub-codes are organized into nine main classes, which cover broad subject areas such as chemistry, electricity, and mechanical engineering. Each main class is then divided into multiple subclasses, which provide more specific classifications for the subject matter.

One advantage of USPC system is that it is tailored specifically to the US patent system and meets the needs of US patent searchers and examiners. However, the system is becoming outdated and is being replaced by the CPC system, which is more up-to-date and harmonized with the classification systems used by other patent office's globally.

1. **Limited scope:** USPC system is primarily focused on technical subject matter, and may not be as effective for patents related to other areas such as business methods or software.
2. **Lack of harmonization:** The USPC system is unique to the United States patent system, and may not be consistent with the classification systems used by other patent offices around the world. This can make it difficult to conduct international patent searches.

3. **Complexity**: Users who are unfamiliar with the USPC system may find it confusing and challenging to utilise. The system uses a hierarchical structure of codes and sub-codes, which can be confusing for some users.
4. **Limited availability**: The USPC system is only available through the USPTO, which may limit access for patent searchers and examiners in other countries or regions.

2.1.7. US Patent Laws [4]

- **35 USC 101:** Invention must be useful.
- **35 USC 102:** Invention must be novel.
- **35 USC 101:** Invention must be non-obvious.
- **35 USC 112:** Invention must be fully disclosed.

35 USC 101: Inventions patentable refers to the first section of Title 35 of the United States Code, that is the primary body of law governing patents in the United States. for an invention to be eligible for protection, it must be a part of one of the following categories.

Process: A new and useful process, such as a method of performing a task or a series of steps.

Machine: A new and useful machine, such as a device or apparatus that performs a specific function.

Manufacture: A new and useful article of manufacture, such as a physical object or material.

Composition of matter: A brand-new and practical composition of matter, such a chemical mixture or compound.

In addition to falling into one of these categories, the invention must also be new, useful, and non-obvious.

35 USC 102 Refers to the second part of Title 35 of the US Code, which outlines the standards for innovation that an invention must meet in order to get for patent protection. According to 35 USC 102(a), a person is not eligible for a patent if:

1. This approach is used by the US Patent and Trademark Office (USPTO) to classify patents based on the inventions they cover; or

2. The claimed invention was disclosed in a patent issued, or in a patent application published or deemed published, by another inventor who had not abandoned, repressed, or hidden the invention, prior to the claimed invention's effective filing date.

35 USC 103 makes reference to the third part of Title 35 of the US code, which outlines the non-obviousness requirement for an invention to be eligible for patent protection in the country. According to 35 USC 103(a), If the differences between the claimed invention and the previous art are such that the claimed invention would have been obvious to a person of ordinary ability in the relevant field at the time it was created, the invention is not eligible for patent protection.

Chapter No. 3

DESCRIPTION OF THE JOB

3.1 Types of Searching

Patentability Search: Also known as Prior Art Search or Novelty Search. Finding references of any kind that show an invention that is the same as or significantly similar to the invention under consideration is the main goal of a patentability search. The goal of a patentability search is to determine the possibility that an invention will be granted a patent, particularly in regard to the international norms of novelty and non-obviousness. The goal of the study is to find references that are related to the current invention as prior art by searching both patent and non-patent literature. The scope of the invention can then be changed for subsequent searches based on the references found if the patentability search reveals papers disclosing inventions similar to the invention examined.

Validity search:

A validity search is a type of patent search conducted to evaluate the validity of an existing patent. The goal of a validity search is to find out whether a patent is valid, and whether it meets the legal requirements for patentability. The analyst will conduct a thorough and in depth examination of prior art (i.e., existing patents, published articles, and other technical literature) to determine whether the invention claimed is novel, non-obvious, and useful. The attorney or agent may also review the patent file history to identify any issues that may affect the patent's validity, such as mistakes or omissions in the application or prosecution process.

A validity search is often conducted by:

- Companies or individuals who are considering licensing or purchasing a patent.
- Who may be facing litigation related to the patent. The results of a validity search can help them make informed decisions about the strength of the patent, and whether it is worth investing in or defending.

Invalidity search: Is carried out to determine whether an existing patent is still valid. Finding the validity of a patent and whether it reassures the legal standards and status for patentability are the objectives of an invalidity search.

The attorney or agent may also review the patent file history to identify any issues that may affect the patent's validity, such as mistakes or omissions in the application or prosecution process.

An invalidity search is often conducted by:

- Companies or individuals who are facing litigation related to a patent,
- Who believe that a patent may be preventing them from developing or commercializing their own products or processes. Invalidity search can help them identify potential weaknesses in the patent and build a case for its invalidity.

Infringement search: Is a type of patent search conducted to evaluate the risk of infringing on existing patents or other intellectual property rights. During an infringement search, a patent analyst will examine the claims of existing patents and other relevant literature to determine whether a product or process may infringe on those patents.

The results of an infringement search can help companies or individuals identify potential infringement risks and make informed decisions about whether to proceed with the development or commercialization of a product or process. By identifying potential infringement risks early in the development process, companies can avoid costly litigation and protect their intellectual property rights.

3.1.1. Boolean Operators Used to Carry Out Searches

Boolean operators are commonly used in patent searches to help refine search queries and narrow down the results to more relevant patents. Here are the three main Boolean operators used in patent searching:

AND: The AND operator is used to search for patents that contain all of the search terms entered. For example, if you are searching for patents related to "electric cars" and "battery technology," you could enter the query "electric cars AND battery technology" to find patents that mention both of those terms.

OR: The OR operator is used to search for patents that contain any of the search terms entered. For example, if you are searching for patents related to "electric cars" or "hybrid cars," you could enter the query "electric cars OR hybrid cars" to find patents that mention either of those terms.

NOT: To remove certain terms from the search results, use the NOT operator. For example, if you are searching for patents related to "electric cars" but want to exclude any patents related to "hybrid cars," you could enter the query "electric cars NOT hybrid cars" to find patents that mention electric cars but do not mention hybrid cars.

Chapter 4

Objectives

Objectives 1:

- To carry out a patentability case on Orbit, Patsnap and Google Scholar.
- Find Relevant Prior Art
- Map the Relevant Prior Art in the Search report.

Objective 2:

- To carry out an Invalidation Case on the subject patent provided by the client.
- Carry out patent search on Orbit, Patsnap and XLScout; NPL search on Google Scholar.
- Find and scan relevant Prior Art.
- Map the relevant prior art in the search report.

Chapter 5

MATERIAL AND METHODS:

Databases: XLScout. Google patents, Orbit, Patsnap, Espacenet, Google scholar.

Case study of patentability search:

Procedure:

Our client first provided us with very little information about their invention. They never reveal their entire creation, but they help us get the right citation when we search several databases.

Now let us suppose, the client has given us the following information regarding their invention.

1. Read the disclosure carefully, identify the novel point of the creation.
2. Create a key feature chart based on the disclosure provided. Divide the various steps of the invention into different key features.
3. Create Keywords with all synonyms.
4. Run query in databases like Orbit or XLScout.
5. Control the number of hits received.
6. Scan results for the particular query.
7. Extract IPC, CPC classifications.
8. Run query with classes.
9. Scan results.
10. Sort results based on relevant, potential and additional.

Results:

Key Features of the Invention Based on Information

	Key Features
KF1	Identify pre-existing methods of treating ocular conditions, especially glaucoma, by expressing mutant heat shock proteins in the eye.
KF1.1	Where delivery of the mutant protein is specific to retinal ganglion
KF1.3	Where the mutant protein is a heat shock protein, such as HspB1
KF1.4	Where the mutant protein is a phosphomimetic mutant. While any number of mutations are of interest, a triple phosphomimetic mutant of HspB1 would be the most relevant.

Fig: Key Features of the invention created after reading the disclosure.

Query Example 1: [Orbit] (Glucoma? OR cataract? OR uveitis OR vasculitis) AND (Retina+ 2d Gangl+) AND (Heat 2d shock) AND (mutation? OR mutant? OR alteration?? OR Change?? OR transform+)/Ti/ab/Clm

Query Example 2: [Orbit] (Retina+ 2d Gangl+) AND (Heat 2d shock) AND (mutation? OR mutant? OR alteration?? OR Change?? OR transform+)/ ti/ab/clm OR A61F9/00 OR A61F2009/00891

Query Example 3: [Google Scholar] (ocular OR eyes OR glaucoma OR Cataract) AND (“Heat Shock Protein”) AROUND(5) (Mutation OR mutant OR alternation OR change)

2.1 Details of Patent Citations

Result 1: WO2022178410A1

Searcher's comment: The mapped citation discloses gene therapy using adeno-associated virus-Type 2 vector comprising a nucleic acid sequence encoding at least one biologically active heat shock protein and a promoter sequence positioned upstream of the nucleic acid sequence for the treatment of retinal injury such as glaucoma.

Patent Citation Number	WO2022178410A1
Title	Viral Vector-Based Gene Therapy For Ocular Conditions
Assignee(s)	University Colorado Regents
Inventor(s)	Nagaraj Ram H | Nahomi Roohan B
INPADOC Family Member(s)	Link
Abstract	

Gene therapy for a retinal disease, injury, or condition in a subject involves administering to the subject a pharmaceutical composition containing a recombinant adeno-associated viral vector encoding at least one heat shock protein, such as Hsp27. A recombinant adeno-associated viral vector can include a promoter sequence that induces production of a heat shock protein specifically in retinal ganglion cells. The loss of such cells

shock protein, such as Hsp27. A recombinant adeno-associated viral vector can include a promoter sequence that induces production of a heat shock protein specifically in retinal ganglion cells. The loss of such cells causes retinal damage and loss of eyesight in patients afflicted with an ocular condition. The disclosed viral vector may be included in pharmaceutical compositions that may be administered intravitreally using an administration device. A single injection may be therapeutically sufficient for treating various ocular conditions.

Relevant Section(s)

Claim(s):

1. A method of treating, reducing the risk of, preventing, or alleviating at least one symptom of a retinal

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disease, injury, or condition in a subject, the method comprising: administering to the subject a therapeutically effective amount of a composition comprising a recombinant adeno-associated viral vector, the vector comprising: a nucleic acid sequence encoding at least one biologically active heat shock protein, wherein the at least one biologically active heat shock protein comprises Hsp27; and a promoter sequence positioned upstream of the nucleic acid sequence, wherein the promoter sequence induces expression of the nucleic acid sequence in retinal ganglion cells.

2. The method of claim 1, wherein the retinal ganglion cells comprise mammalian retinal ganglion cells.

6. The method of any one of claims 1 to 5, wherein the adeno-associated viral vector comprises an adeno-associated virus-Type 2 vector.

7. The method of any one of claims 1 to 6, wherein the retinal disease, injury, or condition is glaucoma.

8. The method of any one of claims 1 to 6, wherein the retinal disease, injury, or condition is selected from the group consisting of: macular degeneration, diabetic eye disease, retinal detachment, and retinitis pigmentosa.

10. The method of any one of claims 1 to 9, wherein the retinal disease, injury, or condition comprises a loss of retinal ganglion cells, an increase in intraocular pressure, or both.

12. The system of claim 11, wherein the retinal disease, injury, or condition is glaucoma.

13. The system of claim 11 or 12, wherein the retinal disease, injury, or condition comprises a loss of retinal ganglion cells, an increase in intraocular pressure, or both.

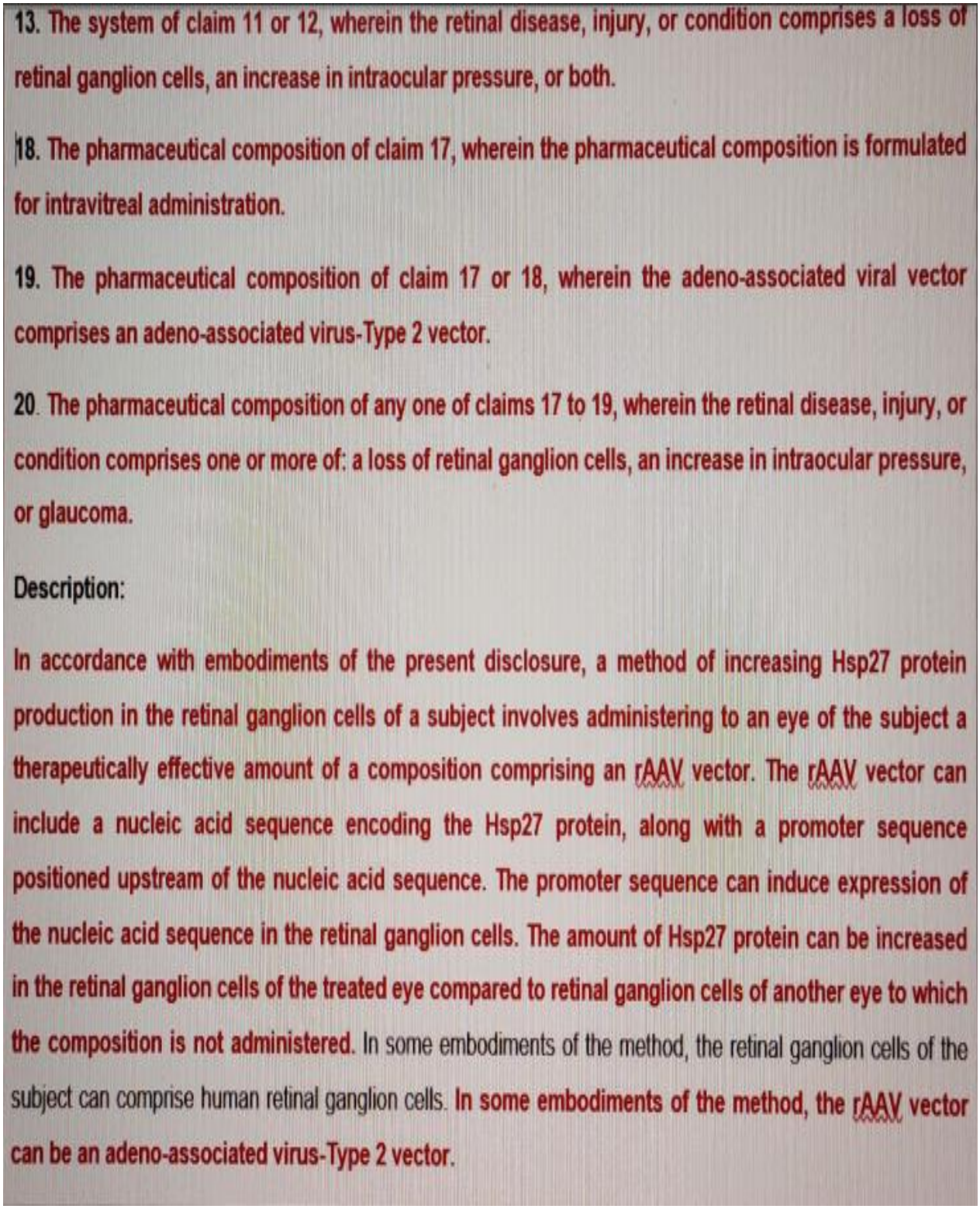
18. The pharmaceutical composition of claim 17, wherein the pharmaceutical composition is formulated for intravitreal administration.

19. The pharmaceutical composition of claim 17 or 18, wherein the adeno-associated viral vector comprises an adeno-associated virus-Type 2 vector.

20. The pharmaceutical composition of any one of claims 17 to 19, wherein the retinal disease, injury, or condition comprises one or more of: a loss of retinal ganglion cells, an increase in intraocular pressure, or glaucoma.

Description:

In accordance with embodiments of the present disclosure, a method of increasing Hsp27 protein production in the retinal ganglion cells of a subject involves administering to an eye of the subject a therapeutically effective amount of a composition comprising an rAAV vector. The rAAV vector can include a nucleic acid sequence encoding the Hsp27 protein, along with a promoter sequence positioned upstream of the nucleic acid sequence. The promoter sequence can induce expression of the nucleic acid sequence in the retinal ganglion cells. The amount of Hsp27 protein can be increased in the retinal ganglion cells of the treated eye compared to retinal ganglion cells of another eye to which



13. The system of claim 11 or 12, wherein the retinal disease, injury, or condition comprises a loss of retinal ganglion cells, an increase in intraocular pressure, or both.

18. The pharmaceutical composition of claim 17, wherein the pharmaceutical composition is formulated for intravitreal administration.

19. The pharmaceutical composition of claim 17 or 18, wherein the adeno-associated viral vector comprises an adeno-associated virus-Type 2 vector.

20. The pharmaceutical composition of any one of claims 17 to 19, wherein the retinal disease, injury, or condition comprises one or more of: a loss of retinal ganglion cells, an increase in intraocular pressure, or glaucoma.

Description:

In accordance with embodiments of the present disclosure, a method of increasing Hsp27 protein production in the retinal ganglion cells of a subject involves administering to an eye of the subject a therapeutically effective amount of a composition comprising an rAAV vector. The rAAV vector can include a nucleic acid sequence encoding the Hsp27 protein, along with a promoter sequence positioned upstream of the nucleic acid sequence. The promoter sequence can induce expression of the nucleic acid sequence in the retinal ganglion cells. The amount of Hsp27 protein can be increased in the retinal ganglion cells of the treated eye compared to retinal ganglion cells of another eye to which the composition is not administered. In some embodiments of the method, the retinal ganglion cells of the subject can comprise human retinal ganglion cells. In some embodiments of the method, the rAAV vector can be an adeno-associated virus-Type 2 vector.

Fig: summary mapping of the relevant patent.

Citation 1: Phosphorylation of HSP27 by Protein Kinase D Is Essential for Mediating Neuroprotection against Ischemic Neuronal Injury

Searcher's Comment: *The present reference discloses viral vectors containing HSP27 mutated at three critical serine residues to either aspartate residues and to examine the role of phosphorylation in neuronal ischemic neuroprotection. Neuronal cultures were infected with the adenoassociated virus under the control of a cytomegalovirus (CMV) promotor. The phosphorylated HSP27 can then associate with ischemia-activated (phosphorylated) ASK1 (apoptosis signal-regulating kinase 1) and inhibit its kinase activity, leading to suppression of MKK4/7 cell death signaling and subsequent cell death.*

Title	Phosphorylation of HSP27 by Protein Kinase D Is Essential for Mediating Neuroprotection against Ischemic Neuronal Injury
Author(s)/Company	R. Anne Stetler | Yanqin Gao | Lili Zhang | Zhongfang Weng | Feng Zhang | Xiaoming Hu | Suping Wang | Peter Vosler | Guodong Cao | Dandan Sun | Steven H. Graham | Jun Chen
Publication Date	22 February, 2012

Abstract

Heat shock protein 27 (HSP27) (or HSPB1) exerts cytoprotection against many cellular insults, including cerebral ischemia. We previously identified apoptosis signal-regulating kinase 1 (ASK1) as a critical downstream target of HSP27 conferring the neuroprotective effects of HSP27 against neuronal ischemia. However, the function of HSP27 is highly influenced by posttranslational modification, with differential cellular effects based on phosphorylation at specific serine residues. The role of phosphorylation in neuronal ischemic neuroprotection is currently unknown. We have created transgenic mice and viral vectors containing HSP27 mutated at three critical serine residues (Ser15, Ser78, and Ser82) to either alanine (HSP27-A, nonphosphorylatable) or

Relevant Section(s)

Abstract:

Heat shock protein 27 (HSP27) (or HSPB1) exerts cytoprotection against many cellular insults, including cerebral ischemia. **We previously identified apoptosis signal-regulating kinase 1 (ASK1) as a critical downstream target of HSP27 conferring the neuroprotective effects of HSP27 against neuronal ischemia. However, the function of HSP27 is highly influenced by posttranslational modification, with differential cellular effects based on phosphorylation at specific serine residues.** The role of phosphorylation in neuronal ischemic neuroprotection is currently unknown. **We have created transgenic mice and viral vectors containing HSP27 mutated at three critical serine residues (Ser15, Ser78, and Ser82) to either alanine (HSP27-A, nonphosphorylatable) or aspartate (HSP27-D, phosphomimetic) residues. Under both in vitro and in vivo neuronal ischemic settings, overexpression of wild-type HSP27 (HSP27) and HSP27-D, but not HSP27-A, was neuroprotective and inhibited downstream ASK1 signaling pathways. Consistently, overexpressed HSP27 was phosphorylated by endogenous mechanisms when neurons were under ischemic stress, and single-point mutations identified Ser15 and Ser82 as critical for neuroprotection.** Using a panel of inhibitors and gene knockdown approaches, we identified the upstream kinase protein kinase D (PKD) as the primary kinase targeting HSP27 directly for phosphorylation. PKD and HSP27 coimmunoprecipitated, and inhibition or knockdown of PKD abrogated the neuroprotective effects of HSP27 as well as the interaction with and inhibition of ASK1 signaling. **Together, these data demonstrate that HSP27 requires PKD-mediated phosphorylation for its suppression of ASK1 cell death signaling and neuroprotection against ischemic injury.**

Results:

Serine phosphorylation is critical for HSP27-mediated neuroprotective effects against neural ischemia in vitro and in vivo

Overexpression of either HSP27 or the phosphomimetic HSP27 (HSP27-D) was protective against cellular damage following OGD in cortical neuronal cultures (Fig. 1B,C). However, the nonphosphorylatable mutant was ineffective at preventing cell death. These results suggest that HSP27 phosphorylation is necessary to exert neuroprotection. To determine the contribution of the specific serine residues toward neuroprotection, we transduced cultures with AAV constructs containing HSP27 mutated at only one of the three serine residues. We found that alanine mutation at either Ser82 or Ser15 significantly blocked neuroprotection against OGD afforded by HSP27 overexpression (Fig. 1D). However, mutation of Ser78 to alanine had no significant effect on HSP27-mediated neuroprotection. **Together, these results indicate that phosphorylation of HSP27 on Ser82 and Ser15 is critical for the full neuroprotective effect of HSP27 against neuronal ischemia.**

Using the phosphomimetic HSP27-D and nonphosphorylatable HSP27-A constructs, we created transgenic mouse lines overexpressing human HSP27 under the control of a cytomegalovirus (CMV) promotor (Fig. 2A). Western blot and immunohistochemical analyses confirmed the presence of the HSP27 transgene protein products in neural tissue, including in neuronal subtypes (Fig. 2B,C). Consistent with our in vitro results, we found that overexpression of the phosphomimetic HSP27-D transgene was equally or more effective at reducing infarct volume following tFCI compared with wild-type HSP27 transgenic mice, even when assessed 21 d following ischemia (Fig. 2D–F), whereas overexpression of nonphosphorylatable HSP27-A was ineffective at decreasing infarct volume. Importantly, cerebral blood flow did not differ between groups when measured by either traditional laser Doppler or two-dimensional laser speckle (Fig. 2G,H). Brain surface vascular anatomy appeared unaffected by transgene expression (Table 1), and physiological variables, such as blood pressure, blood gases, and glucose, did not differ significantly between groups (data not shown).

Fig: summary mapping of the relevant Non patent literature.

3 Patent Citations

S. No.	Citations No.	Title	Publication Date	Assignee(s)	INPADOC Family Members
1.	US20160144055A1	Gene Therapy Vector For Treatment Of Steroid Glaucoma	2016-05-26	University Of North Carolina At Chapel Hill	Link
2.	US20210189430A1	Aav Vectors For Retinal And Cns Gene Therapy	2021-06-24	Genzyme Corp	Link
3.	KR101350868B1	A Pharmaceutical Composition For Inhibiting Angiogenesis Comprising Hsp27 Fragment And A Method Of Screening An Active Material For Inhibiting Angiogenesis	2014-01-14	Korea Institute Of Radiological & Medical Sciences	Link

2 Non-patent Citations

S. No.	Title	Author	Publication Date
1.	Hsp27 Phosphorylation In Experimental Glaucoma	Wei Huang | John B. Fileta | Theodoros Filippopoulos | Arjun Ray | Adam Dobberfuhl | Cynthia L. Grosskreutz	September 2007
2.	Hspb4/Aa-Crystallin Modulates Neuroinflammation In The Retina Via The Stress-Specific Inflammatory Pathways	Madhu Nath | Yang Shan | Angela M Myers | Patrice Elie Fort	28 May, 2021

Fig: List of additional results

Case study of invalidity search:

Suppose the client has given **US9433236B2** Patent for invalidation.

1. Find the cut off date or the earliest priority date of the patent from where the research would start.
2. Create a NOT list. (Not list: Consists of our patent families and its backward citations and their families. Non patent literature cited in the patent list.)
3. Read the File wrapper or the dossier to find the novel point of the patent.
4. Create the key features of the claims of the patent.
5. Create a query and scan the results.
6. Extract classes from the shortlisted results and run a query with those results.

Results:

Subject patent: US9433236B2

Title: Method for fractionating oat, products thus obtained, and use thereof

Cut-off Date: 2007-02-08

Query Example 1: (protein? OR glucan OR starch) AND (Fraction+ OR part+ OR (Air 2d classification)) AND (Oat? OR Wheat? OR Barley OR Cereal?)

Query Example 2: ((defat+ OR (Fat? 2d remov+)) 10d (hexane OR methanol? OR ethanol?)) AND (Oat? OR Wheat? OR Barley OR Cereal?)

Result 1: Enriched Protein- and 18-Glucan Fractions from High-Protein Oats by Air Classification

Searcher's comment: ***The mapped citation discloses the defatting of oat groats with hexane. Further the defatted groats were ground and then air classified into coarse fraction. After subsequent air classification, fine and course fractions were obtained enriched in protein, β-glucan and starch.***

However, the citation doesn't explicitly disclose the defatting of oats with ethanol, a prior step of milling the oat before defatting and a second milling and sieving step.

Title	Enriched Protein- and 18-Glucan Fractions from High-Protein Oats by Air Classification
Inventor(s)	Y. Victor Wu | Arthur C. Stringfellow
Publication Date	14 November, 1994
Abstract	

High-protein oat groats were defatted once (IX) or three times (3X) and air-classified The protein contents of the IX and 3X defatted materials were 23.4 and 23.5%, respectively; the combined high-protein fine fractions from air classification had protein contents of 30.1 and 32.7%. These fractions accounted for 21 and 24% of the weight (and for 27 and 33% of the total protein) of the IX and 3X defatted groats, respectively. The coarse residue fraction (>30um) from air classification of 1X and 3X defatted groats had, β -glucan contents of 16.9 and 17.7%, respectively, compared with 6.1-6.2% in the original defatted groats. These coarse residue fractions accounted for 30 and 28% weight and 82% of total, β -glucan of the IX and 3X defatted groats, respectively. Useful protein shifting was 25% for the IX and 30% for the 3X defatted groats. Useful, β -glucan shifting was 104% for the IX and 107% for the 3X defatted groats. Air classification of high-protein oat groats may have

glucan concentration of the cell wall-enriched fraction was 33.9% as compared to 17.1% without lipid removal. This was probably due to more efficient milling yielding smaller particles, and release of starchy material from cellular structures during milling of defatted oats, resulting in better classification. The removal of lipids also enabled separation of an oat protein concentrate with a protein concentration of 73.0% and a mass yield of 5.0%. A trial with 2310 kg of oat groats showed that the process based on defatting and dry fractionation was also industrially applicable.

Relevant Section(s)

The aim of this work was to **study the effects of lipid removal on dry fractionation of oats and on the properties of the fractions obtained, especially in order to produce products with high b-glucan concentration.** The fractionation process was also demonstrated on an industrial scale.

2.2. Overall description of the extraction and fractionation processes

For pilot scale studies (2 kg batch size), **oat groats were first flaked to 0.2-0.3 mm thickness**, whereas for the industrial scale trial (2310 kg batch size), **they were milled to oat grits in a conventional roller mill. Lipids were then extracted by SC-CO2 with or without ethanol as a polar modifier. The defatted oat**

materials were then fine milled with a pin disc mill and subsequently fractionated by an air classifier. After the first air classification, the coarse fraction was milled and air classified again to further concentrate the b-glucan fraction. The same process was also performed without lipid extraction (Fig. 1). A highly concentrated protein fraction was separated from defatted endosperm flour by re-classifying the fine fraction after the first air classification.

2.3. Lipid extraction with SC-CO_2

On a pilot scale, the SC-CO2 extraction of lipids was performed in a Multi-Use SFE Plant with a pressure vessel of 10 l (Chematur Ecoplanning, Rauma, Finland). The extraction method of oat flakes was based on the work described earlier by Aro et al. (2007). **The extraction was performed either with SC-CO_2 alone (one step) or with SC-CO_2 followed by SC-CO_2 and 10% ethanol extraction (two steps)**. On the industrial scale, a pressure vessel of 250 l (NATECO2 GmbH & Co, Wolnzach, Germany) was used. The industrial scale extraction was performed only with SC-CO2. The process parameters are presented in Table 1.

2.4. Fine milling and air classification

On the industrial scale, **the defatted oat grits were first milled in a Hosokawa Alpine Contraplex 250 CW mill.** The rotation speeds of the mill discs were 11,200 and 5600 rpm for two stainless steel discs rotating in opposite directions (tip speed 250 m s^{-1}). The feed rate was 250 kg h^{-1}. **The milled flour was subsequently air classified in a Hosokawa Alpine 315 ATP classifier**, using an air flow of 1200 m^3 h^{-1} and rotor speed of 2200 rpm. **The first coarse cell wall fraction, separated by air classification, was milled and air classified again with the same parameters to yield a cell wall concentrate enriched in b-glucan and endosperm flour rich in starch. The separation of the protein-enriched fraction from the first fine fraction was made only for the industrial scale trial**, using a Hoso-kawa Alpine 200 ATP NG air classifier with air flow 400 m^3 h^{-1}, feed rate 100 kg h^{-1} and rotor speed 6600 rpm.

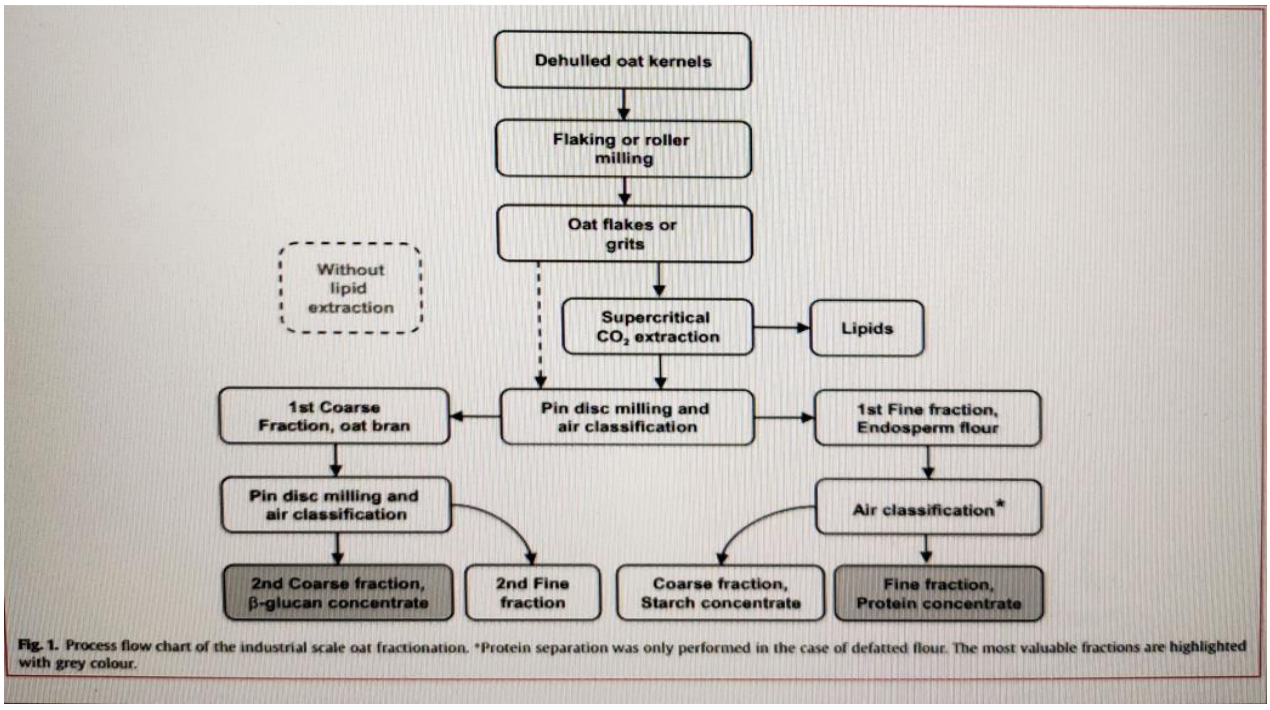


Fig. 1. Process flow chart of the industrial scale oat fractionation. *Protein separation was only performed in the case of defatted flour. The most valuable fractions are highlighted with grey colour.

Fig: Summary mapping of the results

Result 1: Enriched Protein- and 18-Glucan Fractions from High-Protein Oats by Air Classification

Searcher's comment: ***The mapped citation discloses the defatting of oat groats with hexane. Further the defatted groats were ground and then air classified into coarse fraction. After subsequent air classification, fine and course fractions were obtained enriched in protein, β-glucan and starch.***

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Relevant Section(s)

Knuckles et al (1992) used grinding and sieving to enrich 13- glucan content from barley, rolled oats, and oat bran. Hohner and Hyldon (1977) used a wet process to obtain protein, starch, and gum fractions from oat groats. Wood et al (1989) similarly extracted a f3-glucan-rich oat gum from oat bran using sodium carbonate at pH 10. Wu and Stringfellow (1973) reported the air classification of oat flours of normal and high-protein contents and found that the fine fraction had increased protein content. Wu et al (1994) reported that air

Preparation of Defatted Oat Groats

Otee oats, lot number WM-DM-2, (23.5% protein, db) are high-protein spring oats developed cooperatively by the Illinois Agricultural Experiment Station and the U.S. Department of Agriculture. The oats were dehulled in an Alpine 160Z Kolloplex pin mill at 1,445 rpm, and the groats separated from hulls by screening and aspirating. **The groats were defatted once or three times with a hexane-groats ratio of 2.3:1 (v/w) and air-dried.** The once and three-time defatted groats were designated IX and 3X, respectively.

Air Classification

The defatted groats were ground three times at 14,000 rpm in an Alpine pin mill, and then air-classified into a fine and a coarse fraction in a Pillsbury model 1 laboratory classifier set for a 15μm cut point. **The air classifier was adjusted to cut points of 18, 24, and 30μm for successive passes to classify the previous coarse fraction; it gave three additional fine fractions and a coarse residue.** The resulting classified fractions were arranged in order of increasing particle size and designated IB through 5B. In addition, two ultra-fine fractions, exceptionally high in protein content and designated as fractions IA, and 2A-5A, were collected in an air-filter bag attached to the classifier.

TABLE I
Air Classification of Defatted Otee Groats (% db)

	1X Defatted						3X Defatted					
Fractions	Yield[a]	Starch	Protein (N × 6.25)	β-Glucan	Fat	Ash	Yield	Starch	Protein (N × 6.25)	β-Glucan	Fat	Ash
1A, exhaust bag	1		80.1 A[b]	ND[c]	ND	1.9 D	1		65.8 C	ND	ND	1.9 D
2A-5A, exhaust bag			81.3 A	ND	ND	2.0 D	1		75.4 B	ND	ND	1.7 E
1B[d]	20	58.2 B	27.7 D	0.6 H	3.3 D	1.6 F	22	54.8 B	29.0 D	0.6 H	2.2 H	1.5 F
2B	14	66.5 A	22.0 E	0.9 G	3.0 EF	1.5 F	18	65.5 A	19.6 F	1.0 G	2.0 HI	1.5 F
3B	26	67.4 A	16.1 G	2.1 F	3.2 DE	1.8 DE	23	70.7 A	14.0 H	2.2 F	1.9 I	1.7 E
4B	9	57.4 B	14.5 H	3.1 E	2.8 FG	1.8 DE	7	65.7 A	13.7 H	3.7 D	2.0 HI	1.8 DE
5B, coarse residue	30	14.8 C	28.1 D	16.9 B	5.1 A	4.4 B	28	15.3 C	28.2 D	17.7 A	4.1 B	4.6 A
Groats			23.4 E	6.2 C	3.7 C	2.5 C			23.5 E	6.1 C	2.6 G	2.6 C

[a]Yield values are rounded off to the nearest percent.
[b]Means with the same letter in each column, such as protein are not significantly different ($P > 0.05$).
[c]Not determined due to small sample weight.
[d]Fractions 1B through 5B are in order of increasing particle size.

Chapter 6

CONCLUSION

Protecting intellectual property is vital for fostering innovation, as it allows individuals and businesses to fully realize the benefits of their ideas and invest in research and development. Intellectual property is a significant contributor to economic growth and competitiveness at both national and state levels. By ensuring the authenticity and quality of products, IP rights provide consumers and markets with trust and confidence. Additionally, the protection of know-how critical to the original patented invention facilitates the free flow of information and leads to the emergence of new ideas and improvements to existing ones. Intellectual property rights also encourage entrepreneurs to persevere through difficult times and pursue new breakthroughs. Conducting a thorough patent search can save time and money by identifying existing innovations and potential infringement or invalidation of competitor patents. It can also help improve an idea by providing insight into what else is available and allowing for necessary adjustments.

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[3] J. Runge, "What are the different types of patents?," Legalzoom.com, 05-Aug-2016. [Online]. Available: https://www.legalzoom.com/articles/what-are-the-different-types-of-patents. [Accessed: 11-May-2023].

[4] Professor United States Congress, United States House of Representatives, and Committee on the Judiciary, United States patent and trademark office. North Charleston, SC: Createspace Independent Publishing Platform, 2017.