Phospholipids and Sphingolipids of Milk

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Objective

To create a technology landscape report on **Phospholipids and Sphingolipids of Milk**<

◊ Identify market players with prolific IP activity in the technology area
◊ Segment the players by the industry they belong to

Note: *This report is just a template and gives an indication of what the paid report contains.*
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Background

Introduction

Error creating thumbnail: /var/www/htdocs/dolcera.com/wiki/includes/limit.sh: line 101: 17253 Aborted /usr/bin/timeout $MW_WALL_CLOCK_LIMIT /bin/bash -c "$1" 3>&-

Error code: 134



MFGM_Str
MFGM: Milk fat globule membrane (MFGM) is a protein-lipid biopolymer that originates from the apical surface of mammary epithelial cells and surrounds fat globules in milk. While MFGM is in all dairy products containing milk fat, it is especially enriched in churn **buttermilk**, a co-product of butter production. The phospholipids and membrane glycoproteins found in MFGM likely interact extensively with the gut epithelia during digestion, both physically and biochemically. Moreover, MFGM has a relatively high concentration of sphingolipids, which in purified form have been demonstrated to be protective against colon cancer.Hintze et al

Phospholipids and sphingolipids fall under the category of **polar lipids**. The polar lipid content of raw milk is reported to range between **9.4 and 35.5 mg per 100 g** of milk Rombaut and Dewettinck. The major phospholipid fractions are phosphatidylethanolamine**(PE)** and phosphatidylcholine**(PC)** followed by smaller amounts of Phosphatidylserine**(PS)** and phosphatidylinositol**(PI)**. The major sphingolipid fraction is **sphingomyelin** with smaller portions of **ceramides** and **gangliosides**. These polar lipids are mainly(~60%) located in the milk fat globule membrane **(MFGM)**,rest are located in skim milk phase.Lars Wiking
The phospholipids and sphingolipids in milk are gaining interest due to their nutritional and technological qualities. Sphingolipids and their derivatives are highly bioactive compounds with anti-cancer, bacteriostatic and cholesterol-lowering properties.Rombaut and Dewettinck

Nutritional Aspects/ Biological Effects of Some Polar Lipids of MFGM				
MFGM Component	**Sphingolipids and Metabolites**	**Phosphatidylserine (PS)**	**Phosphatidylcholine (PC)**	**Lyso-Phosphatidylcholine (lyso PC)**
Nutritonal	1) Reduction in the number of aberrant crypt foci(clusters of abnormal tube-like glands in the lining of the colon and rectum) and adenocarcinomas(Epithelium Cancer).	1) Restore normal memory on a variety of tasks.	1) Reduction of necrotising enterocolitis	1) Bacteriostatic and bactericidal capacity

	2) Shift in tumor type (malignant ? benign)	2) Positive effects on alzheimer patients.	2) Support liver recovery from toxic chemical attack or viral damage
	3) Anti-cholesterolemic.	3) Improve exercise capacity of exercising humans	3) Protects the human GI mucosa against toxic attack
	4) Protection of the liver from fat- and cholesterol-induced steatosis(abnormal retention of lipids within a cell).		
	5) Suppression of gastrointestinal pathogens.		
	6) Neonatal gut maturation.		
	7) Myelination of the developing central nervous system.		
	8) Associated with age-related diseases and the development of Alzheimer.		

Mohamed Mansour El-Loly

Phospholipids

Phospholipids are fat derivatives in which one fatty acid has been replaced by a **phosphate group** (PO_4^-) and one of several nitrogen-containing molecules. These play a major role in milk due to their **amphiphilic** properties, i.e. they contain both hydrophobic tail(hydrocarbon chain) and hydrophilic head regions. Phospholipids represent a major portion of total lipids of buttermilk and skim milk, reflecting presence of proportionately larger amounts of membrane materials in these products Fox and McSweeney(Pg 71). **MGFM** phospholipids contain high levels of **palmitic** and **oleic** acid, while the short and medium-chain fatty acids are present in very low levels. Lars Wiking
Dairy phospholipids are important structurally, because they are able to:

- stabilize emulsions and foams,
- form micelles and membranes.

Phospholipids also have the potential to be **pro-oxidants**, because they contain **mono-unsaturated** and **poly-unsaturated** fatty acids and have the ability to attract metal ions. **Phosphatidyl ethanolamine** binds copper strongly and is believed to be important in **copper induced oxidation** in milk Fox and McSweeney(Pg 580). The polyunsaturated fatty acids and metal ions accelerate lipid oxidation, especially when heat is applied; hence, phospholipids can be degraded during the processing of milk. Fox and McSweeney(Pg 20)

Sphingolipids

Sphingolipids are composed of a **ceramide core**, which in turn, is composed of a **sphingosine**(12-22 C-atoms) backbone with a fatty acid covalently bonded via an **amide linkage**. Several different head groups may be covalently attached to the ceramide, each resulting in a different class of sphingolipid. **Examples** include **sphingomyelin**, with a phosphocholine headgroup, **glycosphingolipids** with one or more monosaccharides in the headgroup and **gangliosides**, which have at least three sugars in head group including at least one sialic acid. Like phospholipids, sphingolipids are also amphiphilic in nature. Hintze et al

Sphingolipids and their derivatives are **highly bioactive** compounds with **anti-cancer**, **bacteriostatic** and **cholesterol-lowering** properties. Rombaut and Dewettinck One significant source of dietary sphingolipids is the milk fat globule membrane **(MFGM)** Hintze et al. Milk contains (per L) 39?119 mg of sphingomyelin, 6?11 mg of glucosylceramide, 6.5?15 mg of lactosylceramide and ~11 mg of gangliosides. Rombaut and Dewettinck

Concept Table

ENGLISH KEYWORDS

Concept 1	Concept 2	Concept 3	Concept 4
Polar Lipid		Milk Fat **********	Dairy
Phospholipid	Sphingolipid	Milk Fat Globule Membrane	Milk
Phospha*****	******	*****	****
*********	*****	*******	***

◊ *An indicative list of terms to show how a concept table is generated. View paid report for complete list.*
◊ *Concept Table was enriched by searches related to phospholipids and sphingolipisd of milk from relevant patents, scientific articles and various thesauri*

Relevant Class Code Definitions

IPC/ECLA

Milk Classes (IPC/ECLA)

IPC/ ECLA	DEFINITION
A23C	DAIRY PRODUCTS, e.g. MILK, BUTTER, CHEESE; MILK OR CHEESE SUBSTITUTES; MAKING THEREOF.
A23C9/00	Milk preparations; Milk powder or milk powder preparations
****	****

US Class

Milk Classes (US)

US Class Code	DEFINITION
426	FOOD OR EDIBLE MATERIAL: PROCESSES, COMPOSITIONS, AND PRODUCTS.
426/34	Of milk or milk product: Processes wherein the substrate fermented is milk or a lacteal derived source.
*****	**********

Phospholipids and Sphingolipids Classes (US)

US Class Code	DEFINITION
514	DRUG, BIO-AFFECTING AND BODY TREATING COMPOSITIONS.
514*****	**********

F-Terms

Milk F-Terms

F-Theme	Definition	View Point	Definition	F-Term	Definition
4B018	COLORING FOODS AND IMPROVING NUTRITIVE QUALITIES	LB	APPLICABLE FOOD	LB07	Dairy Product
		MD	NUTRITION MODIFYING SUBSTANCES AND FUNGI	MD71	Milk
*****	******	****	****	******	******

Phospholipids and Sphingolipids F-Terms

F-Theme	Definition	View Point	Definition	F-Term	Definition
4C083	COSMETICS	AD	ORGANIC INGREDIENTS CHARACTERIZED BY STRUCTURES	AD57	Phospholipids (Lecithins or the like)
*****	******	****	****	******	******

◊ *An indicative list of various class codes used for the IP search. View paid report for complete list.*

Search Strategy

Search Engine: Thomson Innovation
Timeline: 01/01/1991 - 08/26/2011 (mm/dd/yyyy)

Search Strategy Using English Keywords

Database Covered: US Grant, GB App, US App, FR App, WO App, DE Util, EP Grant, DE Grant, EP App, DE App, JP Util, JP Grant, JP App, CN Util, CN App, KR Util , KR Grant, KR App, Other, DWPI

English Keywords					
S.NO	Scope	Concept	Strategy	INPADOC	Total Hits
1	Title, Abstract Claims	Phospholipid **OR** Sphingolipid Keywords	(Polar ADJ1 Lipid*1) OR *******	###	#####
2	Full Text	Milk Keywords	Milk OR Dairy OR ********	###	#####
3	Title, Abstract Claims	Phospholipid Keywords	(Polar ADJ1 Lipid*1) OR **********	###	#####
4	Title, Abstract Claims	Sphingolipid Keywords	(Polar ADJ1 Lipid*1) OR *******	###	#####
5	IPC **OR** ECLA **OR** US	Milk Classes	A23C000900 OR A23C0001** OR *******	###	#####
6	IPC **OR** ECLA **OR** US	Phospho and Sphingolipid classes	A23J000700 OR A61*****	###	#####
7	Combination Queries	All Keywords	1 AND **	###	#####
8	Combination Queries	Phospholipid Kws **AND** Milk Classes	3 AND **	###	#####
9	Combination Queries	Sphingolipid Kws **AND** Milk Classes	** AND 5	###	####
10	Combination Queries	Milk KWs **AND** Phospho and Sphingolipid Classes	2 AND **	###	#####
11	Combination Queries	Final Query	7 OR ** OR **	###	##### (No Relevant Hits)

Search Strategy Using French Keywords

Database Covered: FR App, WO App, EP Grant, EP App, DWPI

French Keywords					
S.NO	Scope	Concept	Strategy	INPADOC	Total Hits
1	Title, Abstract Claims	Phospholipid Keywords	Phospholipid*1 OR ********	###	#####
2	Title, Abstract Claims	Sphingolipid Keywords	Sphingolipides*1 OR *******	###	#####
3	Full Text	Milk Keywords	(Membrane*1 *****)	###	#####
4	IPC **OR** ECLA	Milk Classes	A23C000900 OR A23C00********	###	#####
5	IPC **OR** ECLA	Phospho and Sphingolipid classes	A23J00700 OR A6*******	###	#####
6	Combination Queries	Phospholipid Kws **AND** Milk IPC/ ECLA	1 AND **	##	####
7	Combination Queries	Sphingolipid Kws **AND** Milk IPC/ ECLA	** AND 4	##	###
8	Combination Queries	Milk KWs **AND** Phospho and Sphingolipid IPC/ ECLA	** AND 5	##	###
9	Combination Queries	Final Query	** OR 7 OR 8**	##	#### (No Relevant Hits)

Search Strategy Using German Keywords

Database Covered: WO App, DE Util, EP Grant, DE Grant, EP App, DE App, DWPI

German Keywords					
S.NO	Scope	Concept	Strategy	INPADOC	Total Hits
1		Phospholipid Keywords		###	#####

	Title, Abstract Claims		Phospholipid*1 OR *******		
2	Title, Abstract Claims	Sphingolipid Keywords	Sphingolipid*1 OR ******	##	###
3	Full Text	Milk Keywords	(((Milch ADJ2 *******)	###	#####
4	IPC **OR** ECLA	Milk Classes	A23C000900 OR A23********	###	#####
5	IPC **OR** ECLA	Phospho and Sphingolipid classes	A23J00700 OR ******	###	####
6	Combination Queries	Phospholipid Kws **AND** Milk IPC/ ECLA	** AND 4	##	####
7	Combination Queries	Sphingolipid Kws **AND** Milk IPC/ ECLA	2 AND **	##	##
8	Combination Queries	Milk KWs **AND** Phospho and Sphingolipid IPC/ ECLA	3 AND **	##	##
9	Combination Queries	Final Query	** or ** or 8	###	#### (No Relevant Hits)

Search Strategy Using F-Terms

Database Covered: JP Util, JP Grant, JP App, DWPI

F-Term Search					
S.NO	**Scope**	**Concept**	**Strategy**	**INPADOC**	**Total Hits**
1	Title, Abstract Claims	Phospholipid Keywords	((Polar ADJ1 Lipid*1) OR **********)	###	#####
2	Title, Abstract Claims	Sphingolipid Keywords	((Polar ADJ1 Lipid*1) OR **********)	###	###
3	Full Text	Milk Keywords	(Milk ADJ1 Fat ADJ Globule *******)	###	#####
4	F-terms	Milk F-Terms	4B001AC06 OR 4B0*******	###	####
5	F-terms	Phospho and Sphingolipid F-Terms	4C086DA41 OR 4C*********	##	###
6	Combination Queries	Phospholipid Kws **AND** Milk F-terms	1 AND **	##	###
7	Combination Queries	Sphingolipid Kws **AND** Milk F-terms	2 AND **	#	##
8	Combination Queries	Milk KWs **AND** Phospho and Sphingolipid F-terms	3 AND **	###	####
9	Combination Queries	Final Query	**6 or ** or ****	**###**	**####** (No Relevant Hits)

Final Query

S.NO	**Scope**	**Strategy**	**INPADOC**	**Total Hits**
1	Final Query	English **OR** French **OR** German **OR** F-Term(Japanese)	###	#### (No Relevant Hits) (#.#% Relevancy)

Taxonomy

```
.markmap-node {
    cursor: pointer;
}

.markmap-node-circle {
```

```
        fill: #fff;
        stroke-width: 1.5px;
    }

    .markmap-node-text {
        fill:  #000;
        font: 10px sans-serif;
    }

    .markmap-link {
        fill: none;
    }

    pre, .mw-code{
      background-color: transparent;
    }
d3.xml("https://www.dolcera.com/wiki/images/Phospholipids_and_sphingolipids_of_milk.mm", function(error, data) {
        if (error) throw error;

        markmap("svg#mindmap_810bbb5ddee384e777eb29b8f23fc6f0", data, {
            preset: "colorful",
            linkShape: "diagonal"
        }, "xml");
      });
```

Relevant Patents (Sample Set)

Control Patents

S.No.	Patent No.	Publication date	Asignee/ Applicant	Title	Dolcera Summary
1	WO2011069987A1	6/16/2011	NESTEC S.A.	Infant Formula With Probiotics And Milk Fat Globule Membrane Components	Formulation of infant feed (or nutritional product for patients in need) including probiotics and MFGM components along with other nutrient ingredients for improvising immune system and gut comfort. The MFGM components are recovered by ultrafiltration or microfiltration recovered buttermilk, or from whey protein concentrate, sweet whey, acid whey, whey cream, etc.
2	EP2308324A1	4/13/2011	Arla Foods amba	Phosphatidylserine Enriched Milk Fractions For The Formulation Of Functional Foods	Extraction of Phophatidylserine from natural source i.e. bovine buttermilk, butter oil serum, etc., following steps of centrifugation of cream, homogenizing to break resulting emuslion, collection of serum phase, and separation of fat by ultrafiltration including dialfiltration and finally spray drying. This composition can be used as nutraceutical composition in foods.

Sample Analysis

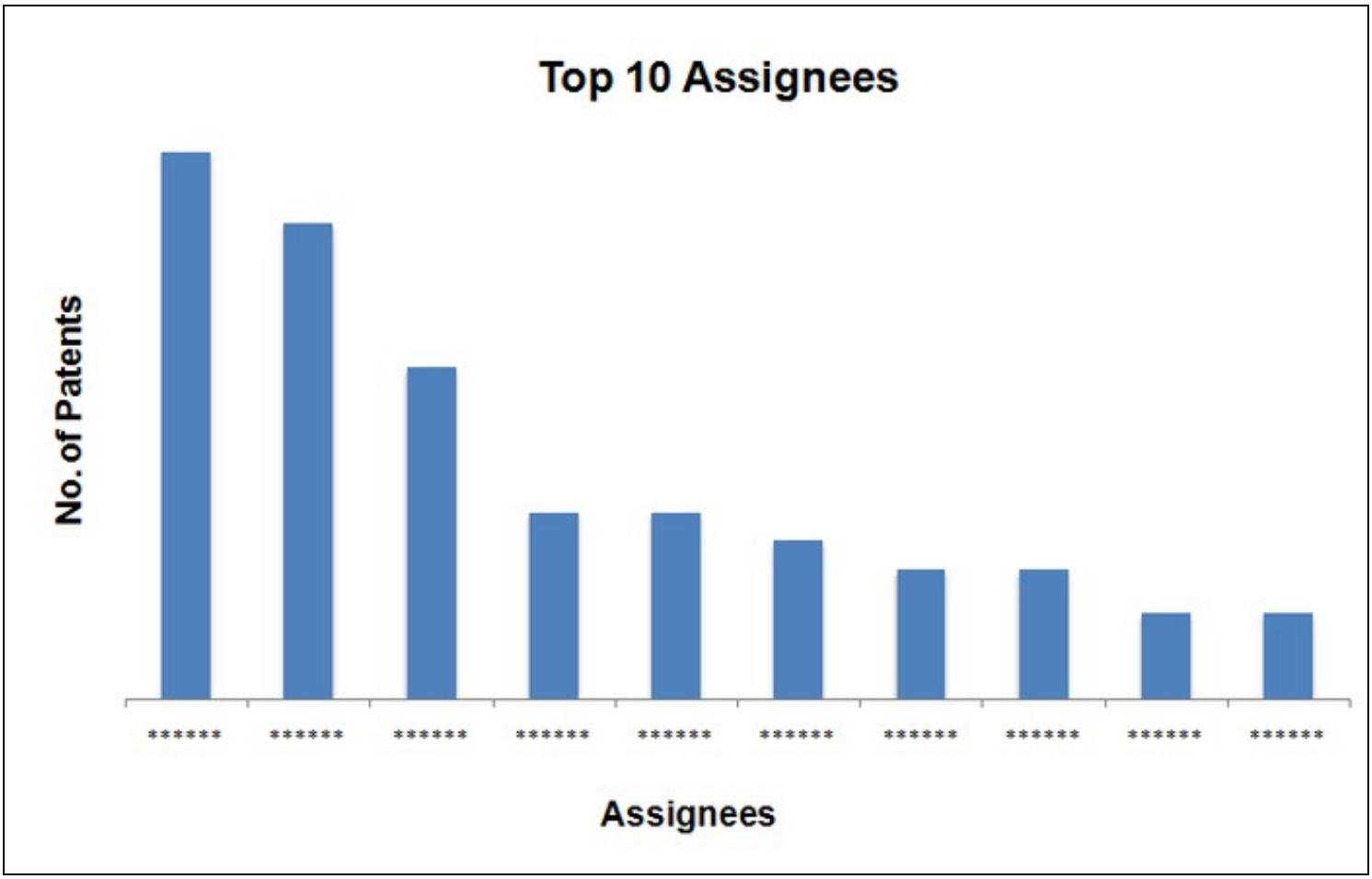
Click here for Sample__Patent_Analysis_Sheet

Assignee Analysis and IP Activity

◊ *Labels for all the charts below are available in the paid report.*

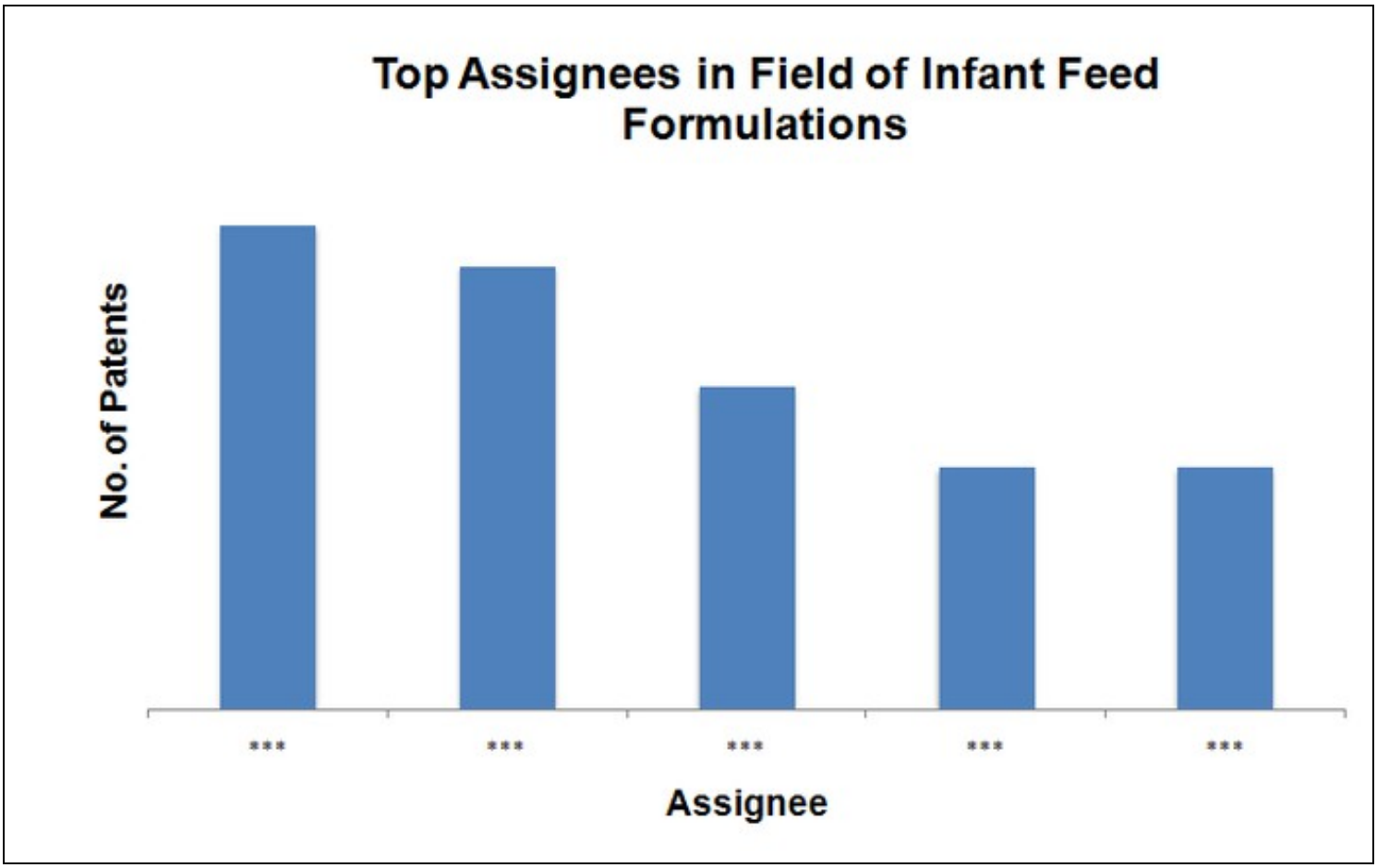
Top Assignees

◊ **The following graphs explain the placement of the different assignees in this technology area.**

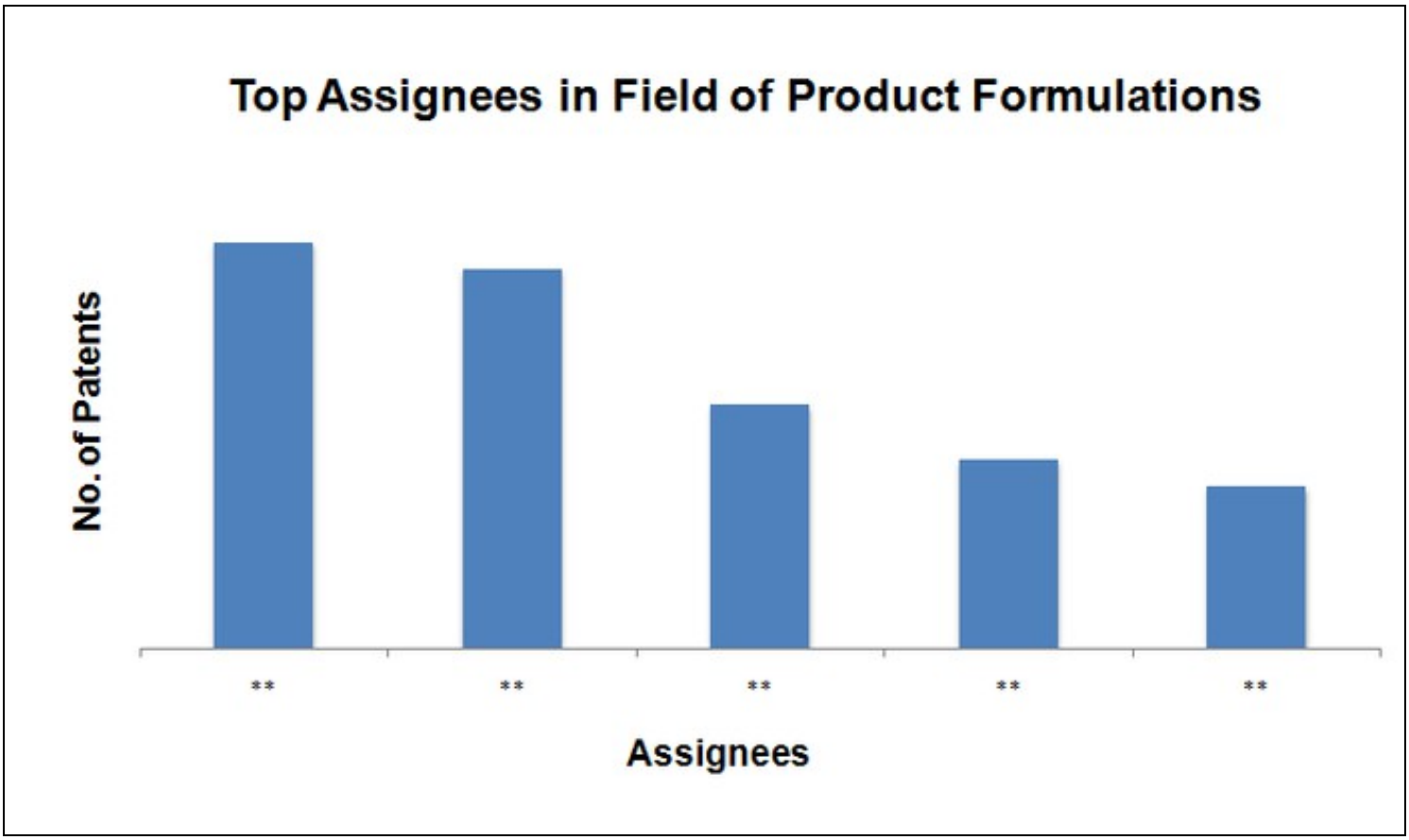


Top 10 Assignees

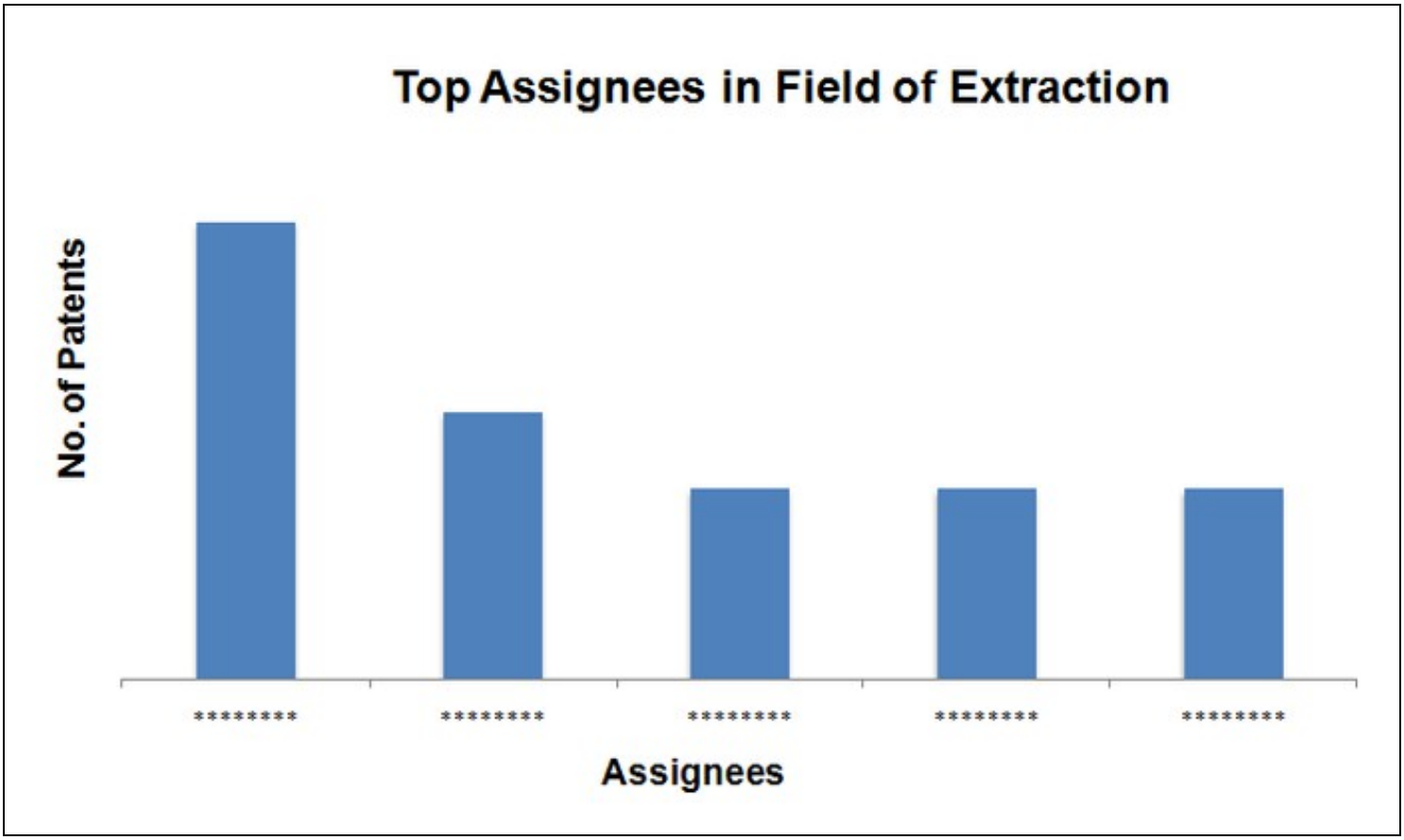
◊ **Top players in field Infant Feed Formulations, Products(other then Infant Formulations) Formulations and Extraction.**



Assignees in Filed of Infant Feed Formulation



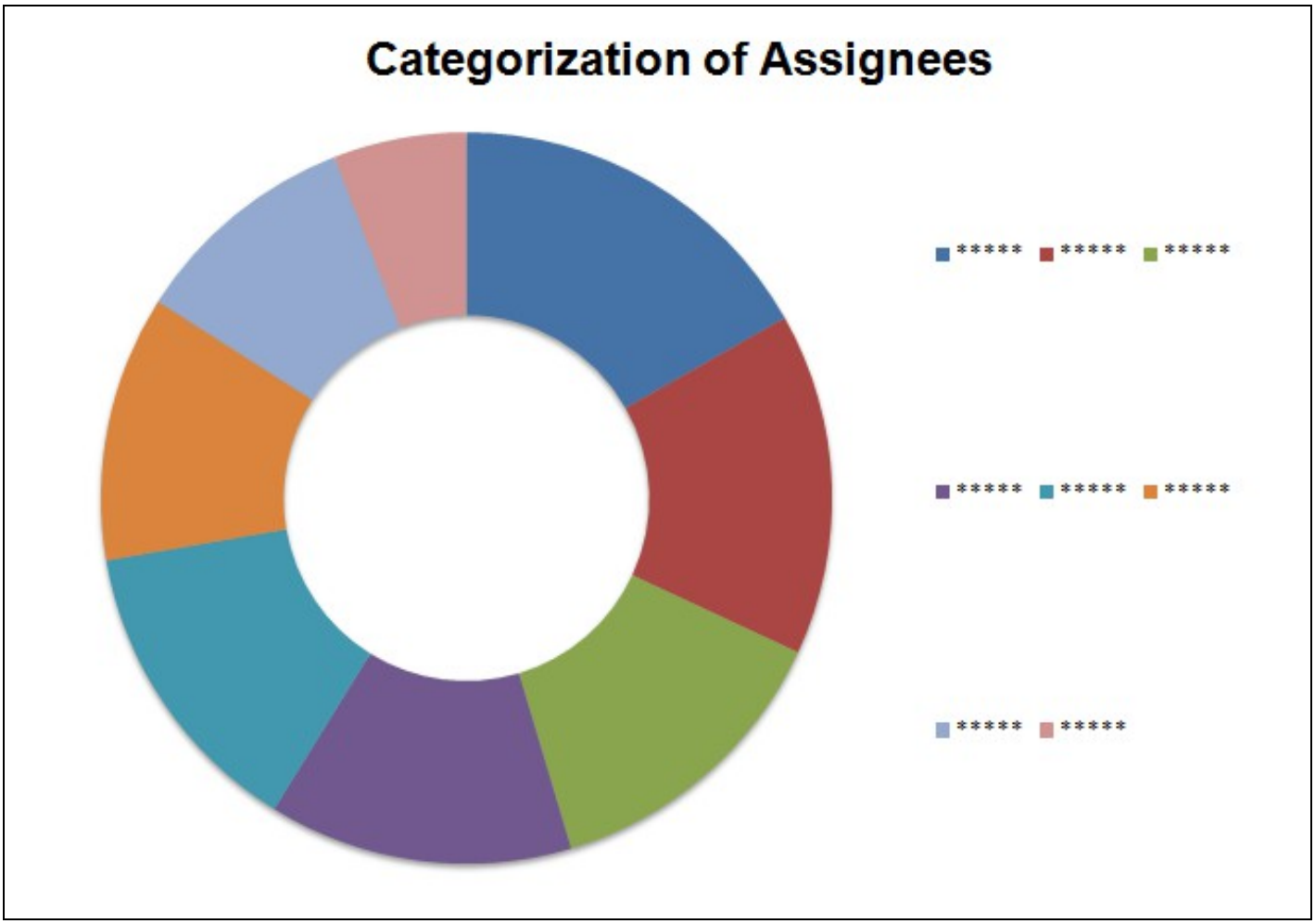
Assignees in Filed of Product Formulation



Assignees in Filed of Extraction

Assignee Categorization

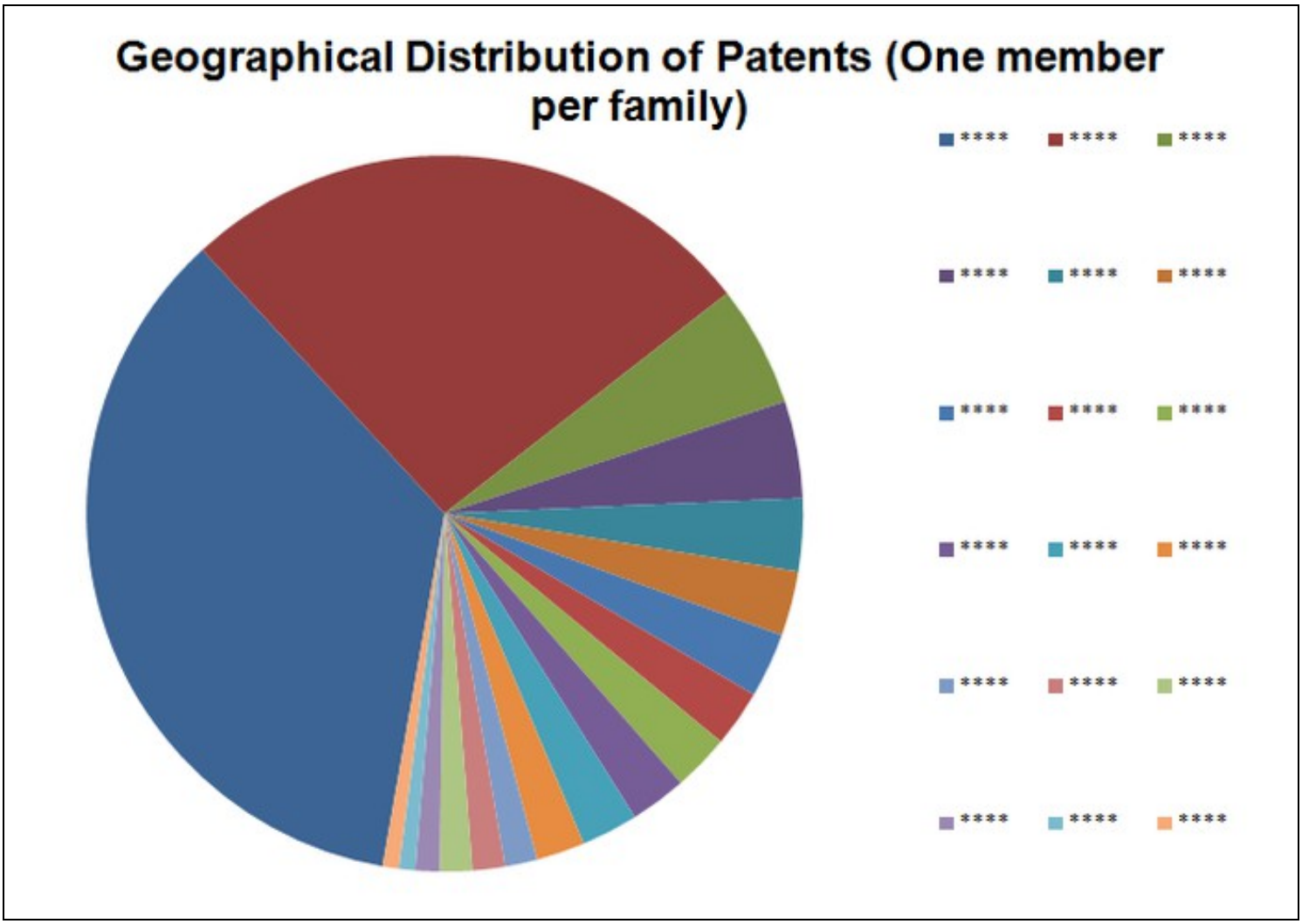
- **The assignees have been categorized into following areas**:
  - ◊ Pharmaceutical Companies
  - ◊ Food Processing Companies
  - ◊ Dairy Industries
  - ◊ Cosmetic Companies
  - ◊ Nutraceutical Companies
  - ◊ Chemical Suppliers
  - ◊ Universities/ Research Institutes
  - ◊ Other Technology Partners



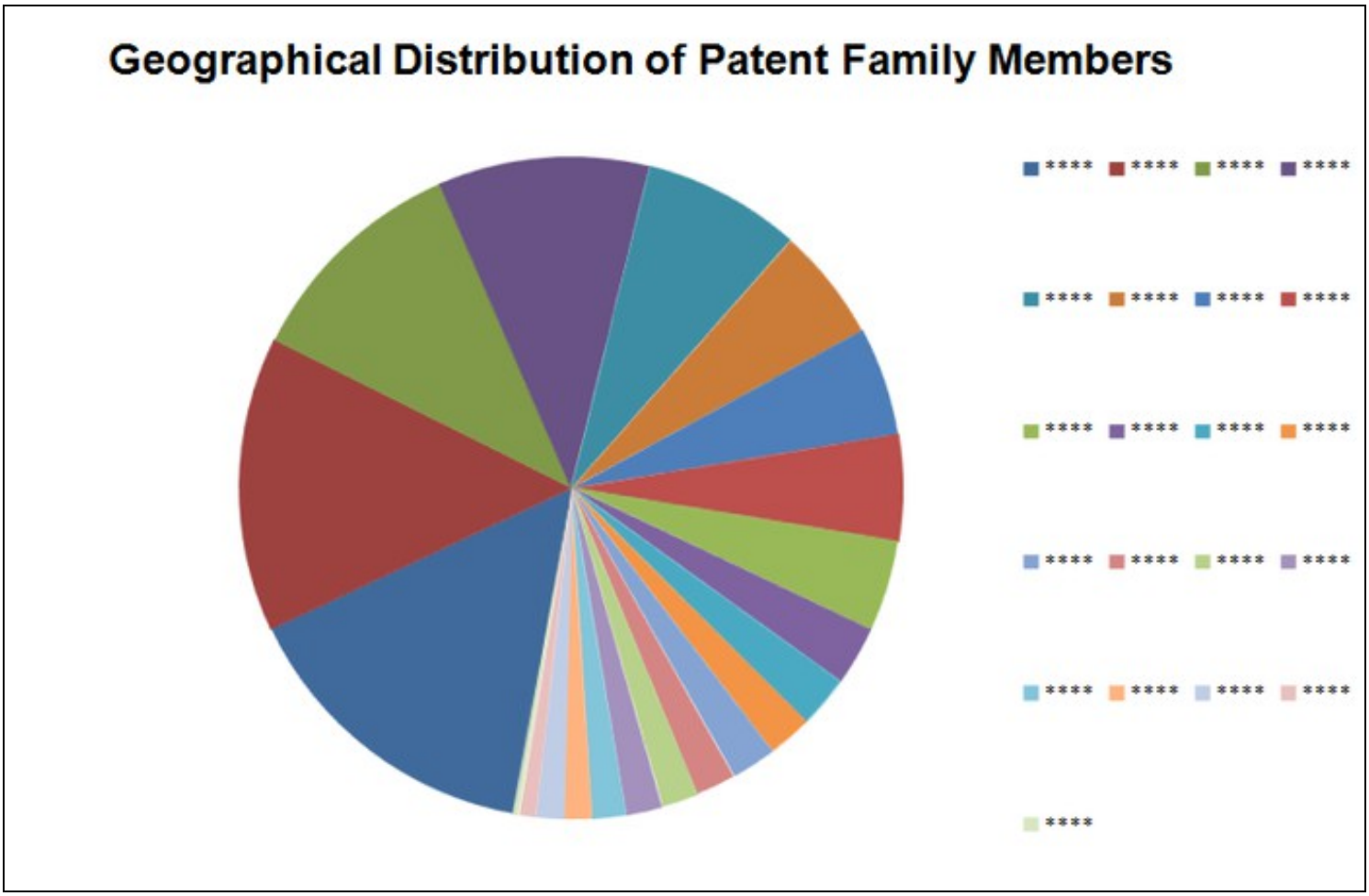
Assignee Categorization

Geographical Distribution

- **The following graphs explain the geographical distribution of patents.**

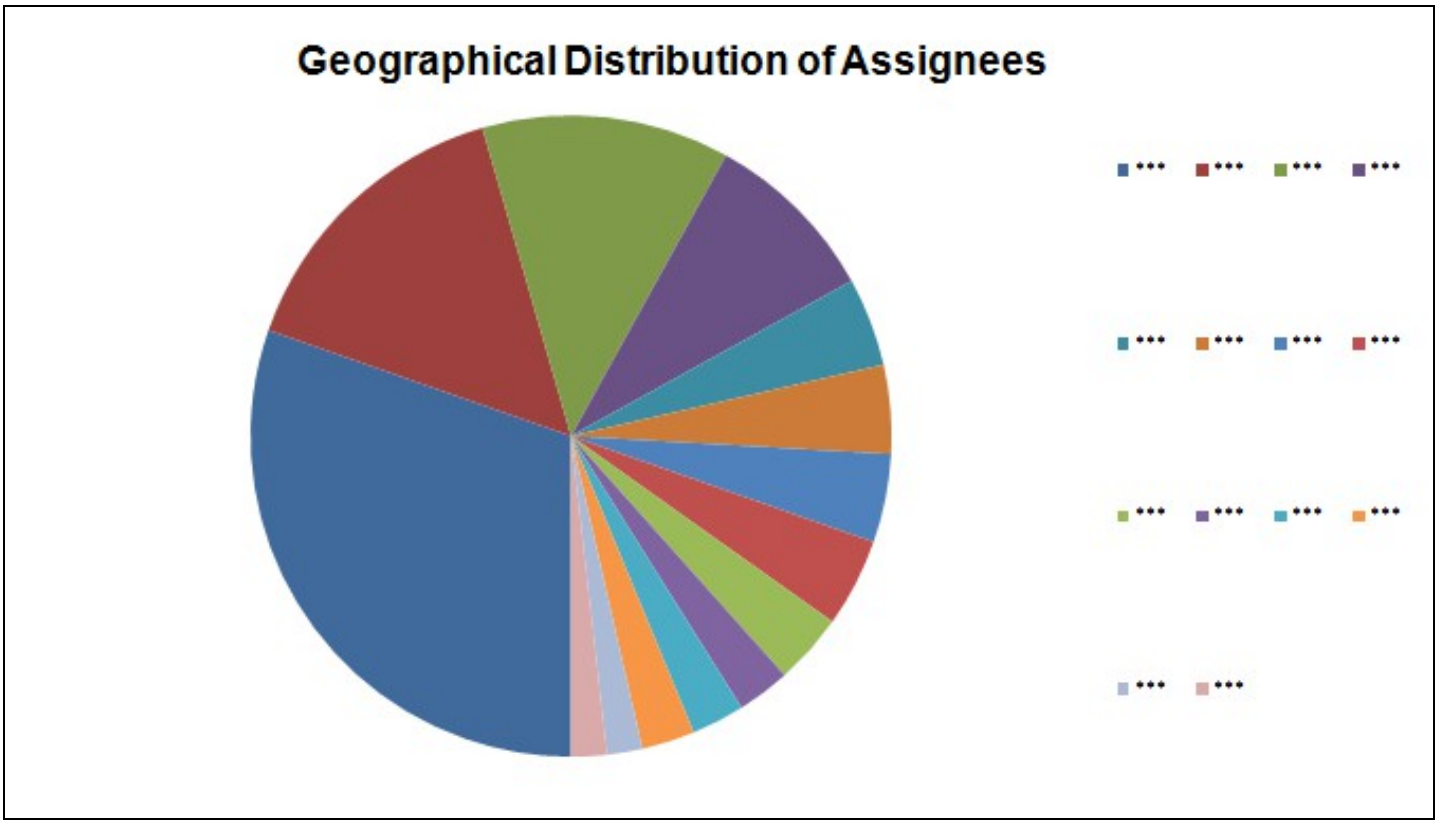


Geographical Distribution of Patents



Geographical Distribution of Patents Family Members

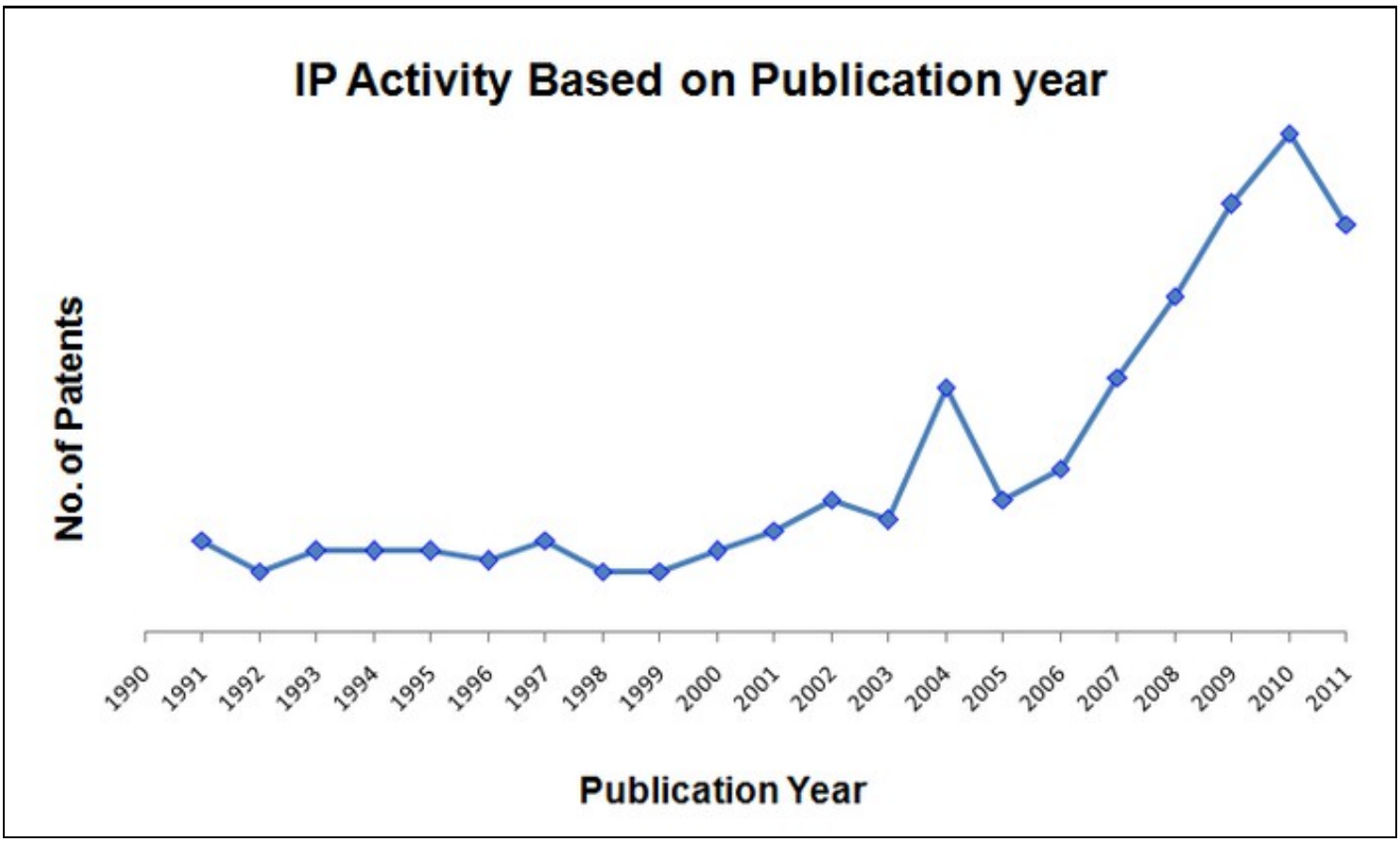
◊ **The following graph explain the geographical distribution of assignees.**



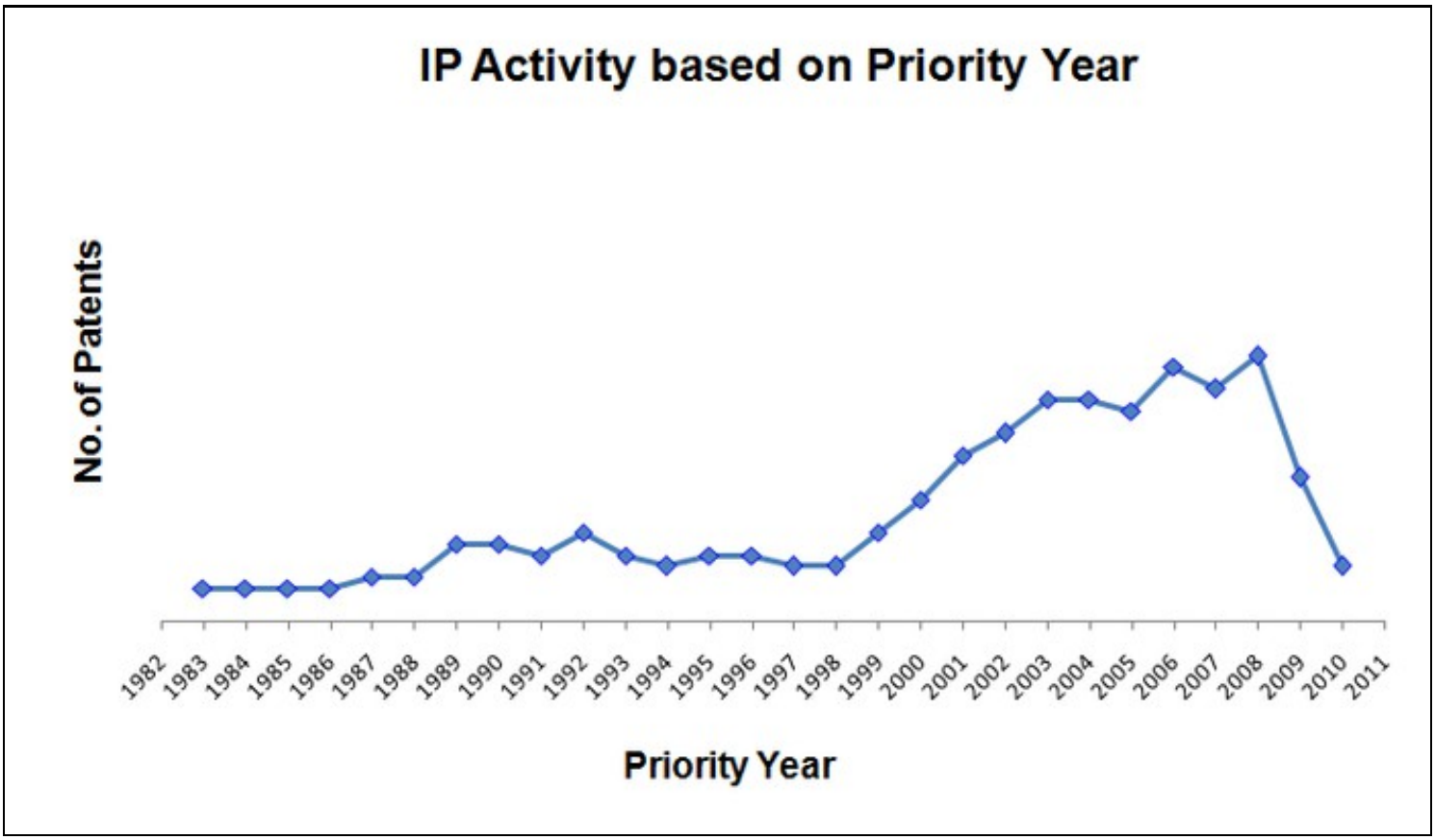
Geographical Distribution of Assignees

IP Activity

◊ **The following graphs explain the IP activity based on Priority year and Publication Year**



IP Activity Based on Publication Year



IP Activity Based on Priority Year

Patent-Product Mapping

S.No	Patent no.	Title	Assignee	Products	Product Description
1	US20110182943A1	METHODS OF IMMUNE OR HEMATOLOGICAL ENHANCEMENT, INHIBITING TUMOUR FORMATION OR GROWTH, AND TREATING OR PREVENTING CANCER, CANCER SYMPTOMS, OR THE SYMPTOMS OF CANCER TREATMENTS	FONTERRA COOP GROUP LTD	Phospholac 600 T.M.	
2	US20090123630A1	PHOSPHATIDYLSERINE ENRICHED MILK FRACTIONS FOR THE FORMULATION OF FUNCTIONAL FOODS	ARLA FOODS AMBA	LACPRODAN PL-20	

Scientific Articles

Search Strategy

- **Database** : Scirus
- **Timeline** : 1991 - 2011
- **Subject Areas** : Agricultural and Biological Sciences; Chemistry and Chemical Engineering; Engineering, Energy and Technology; Life Sciences; Medicine and Pharmacology.
- **Information Types** : Abstracts, Articles, Articles in Press, Books, Conferences and Reviews.

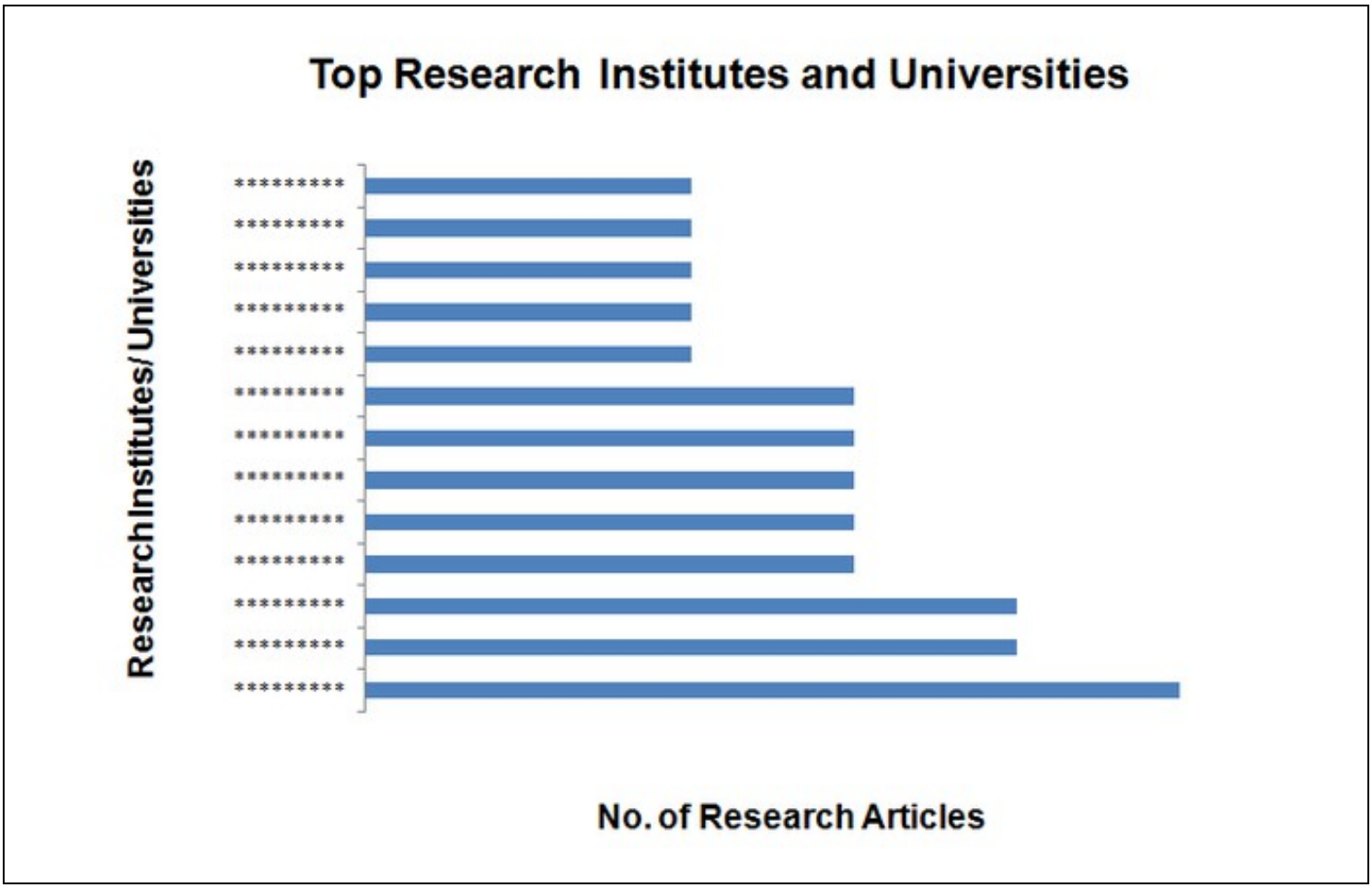
S.No	Scope	Concept	Strategy	Total Hits
1	**Complete Document**	(Phospholipids **OR** Sphingolipids) Keywords	("Polar Lipid*" OR Phospholipid* OR ********** Sphingolipid* OR **********)	**####** (No Relevant Articles)
			AND	
	Keyword(s)	Milk Keywords	("Milk Fat Globule Membrane*" ******** OR Milk* OR *********)	

Relevant Scientific Articles

◊ Click here to download relevant Scientific Articles Sheet

- **The following graphs explain the placement of different Research Institutes and Universities in this technological area.**

◊ Patents with the maximum number of forward citations were determined and the graph shows the top 13 patents with corresponding assignees.

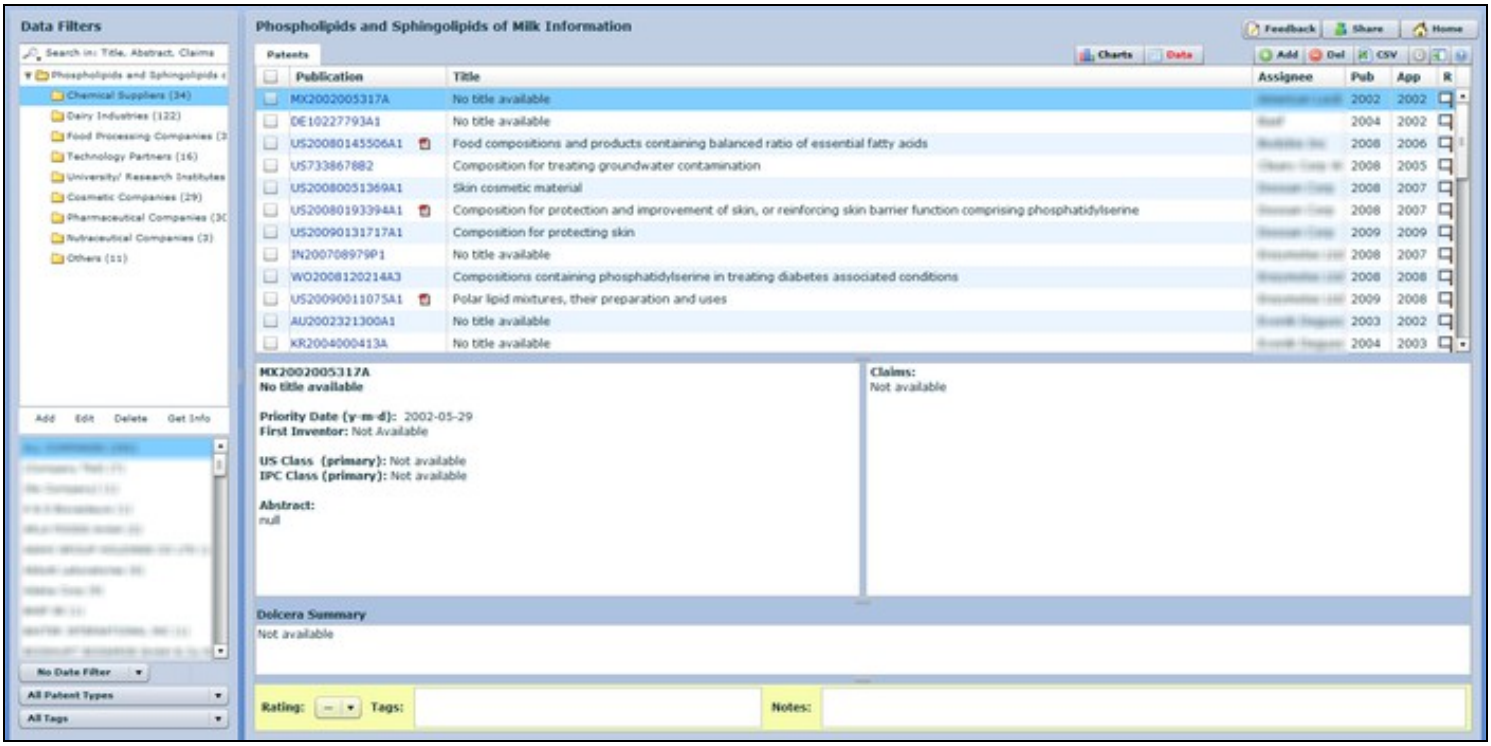


Top Research Institutes/ Universities

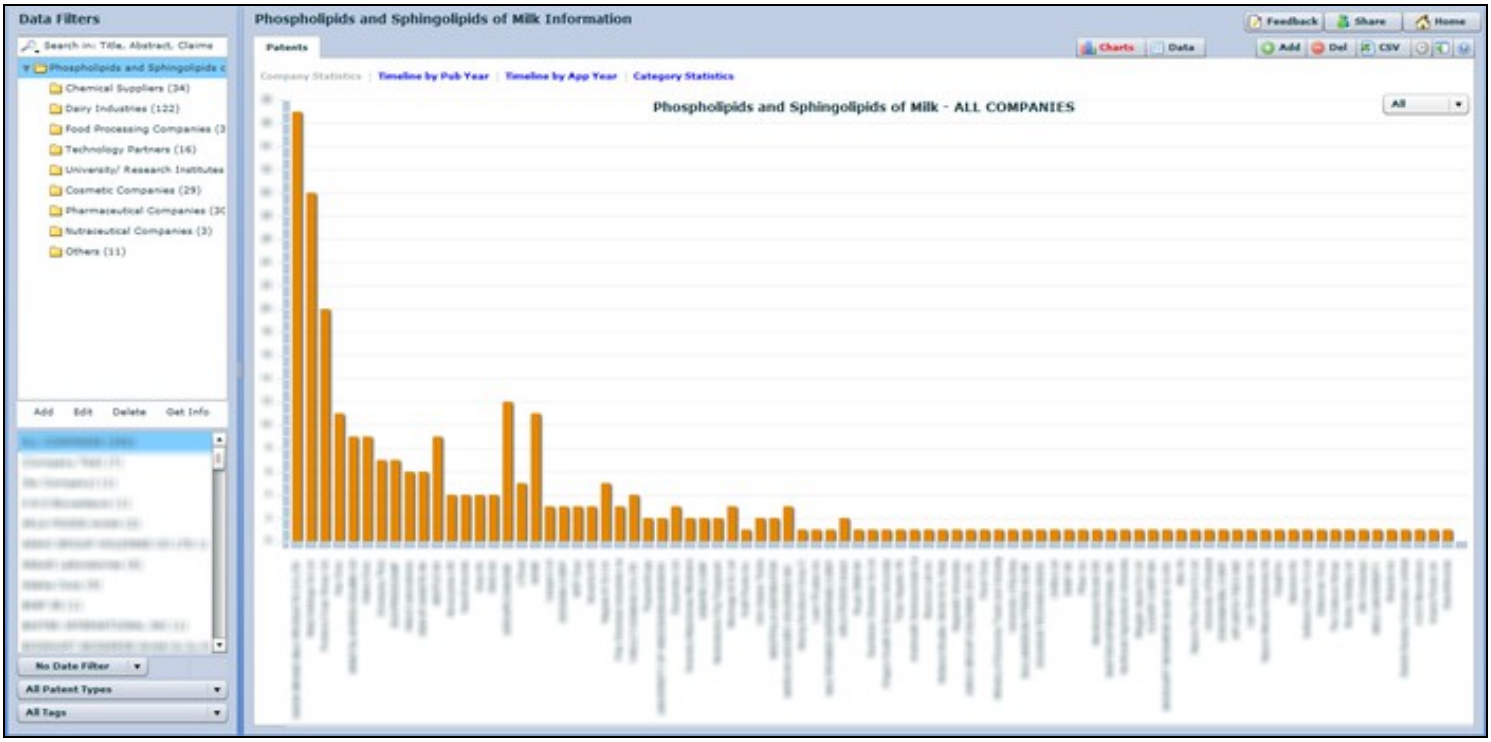
Dolcera Dashboard

Assignees were categorized based on the type of their Major Business Domians viz. food processing companies, cosmetic companies, pharma companies, nutraceutical companies, chemical suppliers, research and educational institutions, other technological partners, etc. and their patents have been shown in the Dolcera Interactive Dashboard.

◊ A data preview of the dashboard is shown below:



◊ A chart preview of the dashboard is shown below:



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