

```

call
apoc.load.jdbc("jdbc:mysql://localhost:3306/disbiome?serverTimezone=EST5EDT&user=*****
&password=*****", "disbiome_view") yield row
merge (o:Organism {organism_id: row.organism_id,
organism:row.organism_name,location:row.location_id,sample_name:row.sample_name,
organism_ncbi_id:row.organism_ncbi_id})
merge (d:Disease {disease:row.disease_name, disease_id:row.disease_id, meddra_level:
row.meddra_level, meddra_id:row.meddra_id})
merge (h:Host {host_id:row.host_id, host_type:row.host_type,
control_name:row.control_name})
merge (o)-[:Assoc {publications:row.num_publications}]->(d)
merge (o)-[:lives_in]->(h)
return o, d, h

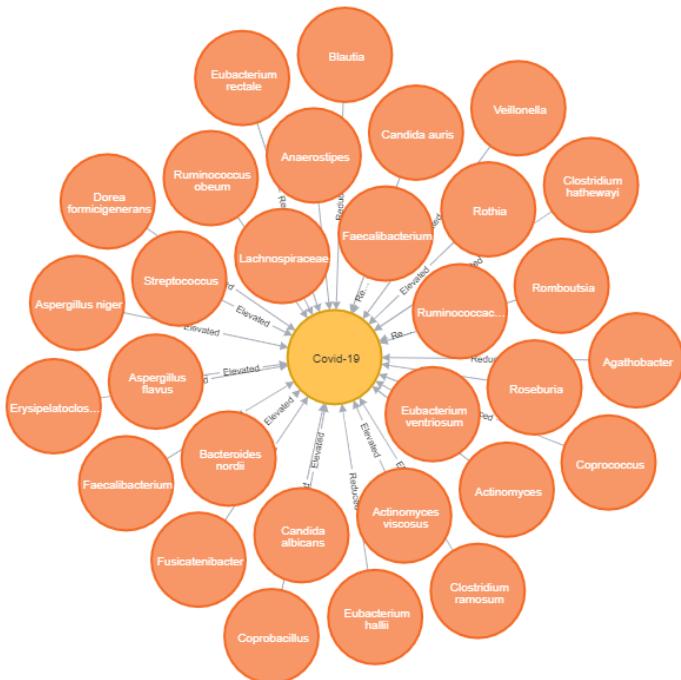
```

### Which bacteria are linked to Covid-19?

```

match (o:Organism)-[a:Assoc]->(d:Disease {disease:"Covid-19"})
return o, a, d

```



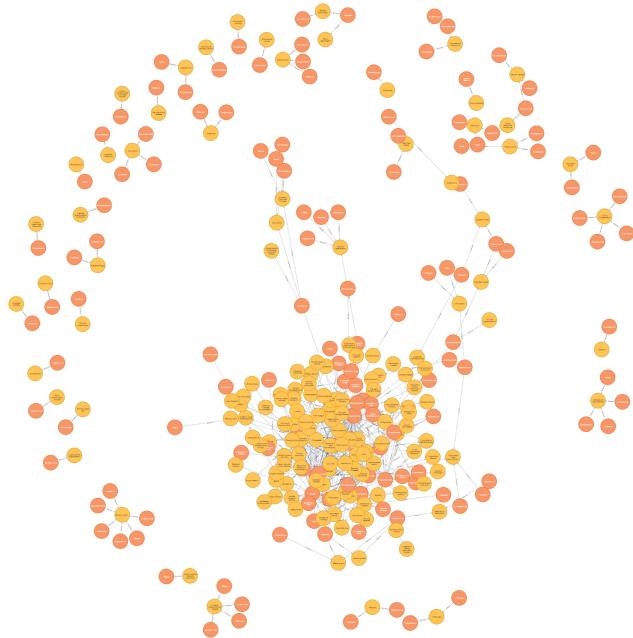
"organism_name"	"disease_name"
"Streptococcus"	"Covid-19"
"Bacteroides nordii"	"Covid-19"
"Blautia"	"Covid-19"
"Actinomyces"	"Covid-19"
"Eubacterium ventriosum"	"Covid-19"
"Clostridium ramosum"	"Covid-19"
"Aspergillus niger"	"Covid-19"
"Faecalibacterium prausnitzii"	"Covid-19"
"Candida albicans"	"Covid-19"

## What diseases are associated with bacteria linked to Covid-19?

```

call {
  match (o:Organism)-[a:Assoc]->(d:Disease {disease:"Covid-19"})
  return collect(o.organism) as bacteria
}
match (o:Organism)-[a:Assoc]->(d:Disease)
where o.organism in bacteria
return o, a, d

```



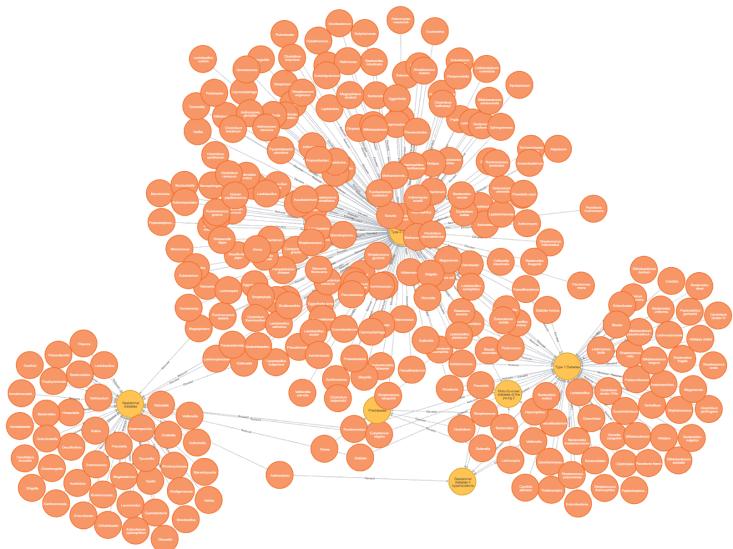
"disease_name"
"Cystic Fibrosis"
"Crohn's Disease"
"Systemic sclerosis"
"Colon adenomas"
"Colorectal cancer"
"Chronic Obstructive Pulmonary Disease"
"Bacterial vaginosis"
"Chronic kidney disease"

## Which bacteria are linked to diabetes (any type)?

```

match (o:Organism)-[a:Assoc]->(d:Disease)
where d.disease =~ ".*diabetes.*" or d.disease =~ ".*Diabetes.*"
return o, a, d

```



"organism"	"disease"
"Olsenella"	"Type 2 Diabetes"
"Ruminococcus gnavus"	"Type 2 Diabetes"
"Phascolarctobacterium"	"Type 2 Diabetes"
"Streptococcus"	"Type 2 Diabetes"
"Dorea"	"Type 2 Diabetes"
"Ruminococcaceae"	"Type 2 Diabetes"
"Verticillium"	"Type 1 Diabetes"
"Acidaminococcus"	"Type 1 Diabetes"
"Roseburia faecis"	"Type 1 Diabetes"
"Bacteroides vulgatus"	"Type 1 Diabetes"
"Akkermansia muciniphila"	"Type 1 Diabetes"
"Bifidobacterium longum"	"Type 1 Diabetes"

## Bacteria in common among the diabetes types

\*nothing for gestational diabetes or prediabetes

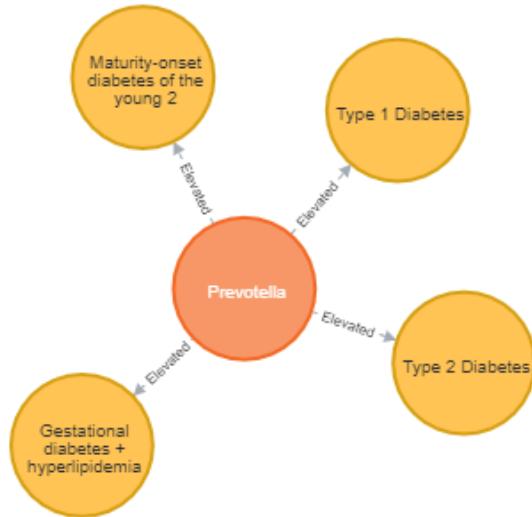
match (o:Organism)-[a]->(d:Disease{disease:"Type 2 Diabetes"})

match(o)-[a2]->(d2:Disease{disease:"Type 1 Diabetes"})

match(o)-[a3:Assoc]->(d3:Disease{disease:"Maturity-onset diabetes of the young 2"})

match(o)-[a4:Assoc]->(d4:Disease{disease:"Gestational diabetes + hyperlipidemia"})

return o, a, d, d2, a2, d3, a3, d4, a4



## Which diseases are most linked to specific gut bacteria?

match (o:Organism)-[a:Assoc]->(d:Disease)

where a.publications > 1

return o.organism as organism, sum(a.publications) as npubs, d.disease as disease

order by npubs desc

"organism"	"npubs"	"disease"	"outcome"
"Fusobacterium"	17	"Colorectal cancer"	"Elevated"
"Fusobacterium nucleatum"	14	"Colorectal cancer"	"Elevated"
"Faecalibacterium prausnitzii"	13	"Crohn's Disease"	"Reduced"
"Porphyromonas gingivalis"	13	"periodontitis"	"Elevated"
"Tannerella forsythia"	12	"periodontitis"	"Elevated"
"Streptococcus"	10	"Colorectal cancer"	"Elevated"
"Megasphaera"	10	"Bacterial vaginosis"	"Elevated"
"Bacteroides"	9	"Colorectal cancer"	"Reduced"
"Roseburia"	9	"Crohn's Disease"	"Reduced"
"Prevotella"	9	"Bacterial vaginosis"	"Elevated"
"Bifidobacterium"	9	"Obesity"	"Reduced"
"Lactobacillus"	9	"Obesity"	"Reduced"

**Which bacteria do neurodegenerative diseases have a common link to?**

**Alzheimer's Disease, Parkinson's Disease, Amyotrophic lateral sclerosis, Multiple Sclerosis**

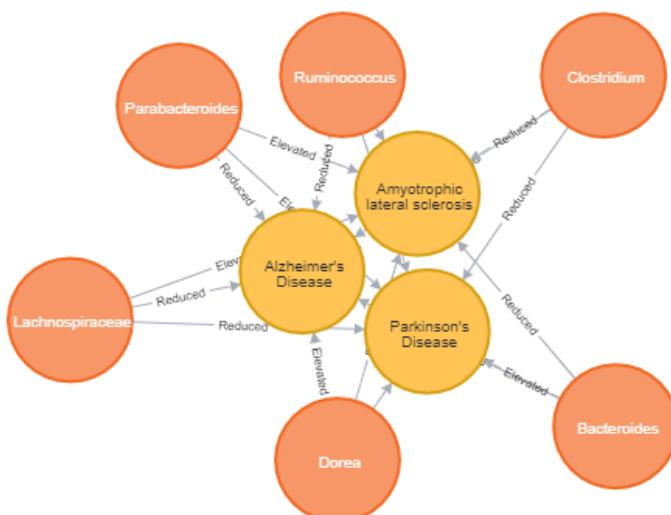
match (o:Organism)-[a:Assoc]->(d:Disease {disease:"Alzheimer's Disease"})

match(o)-[a2:Assoc]->(d2:Disease {disease:"Parkinson's Disease"})

match(o)-[a3:Assoc]->(d3:Disease {disease:"Amyotrophic lateral sclerosis"})

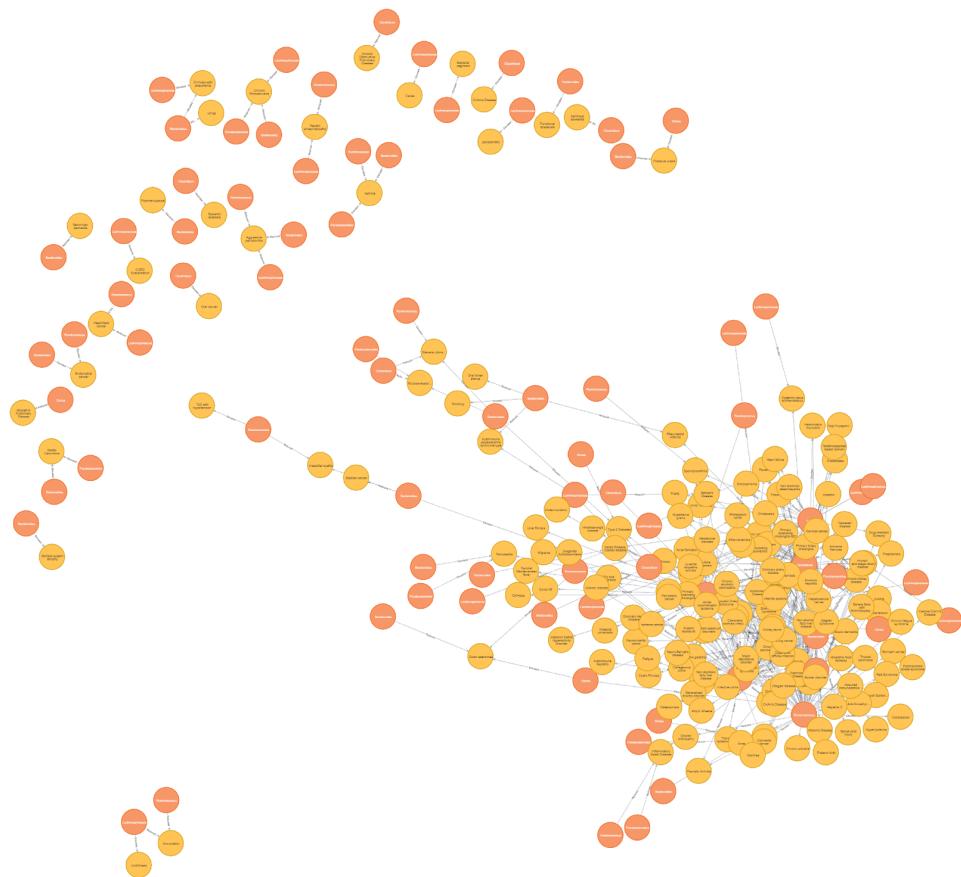
match(o)-[a4:Assoc]->(d4:Disease {disease:"Multiple Sclerosis"})

return o, a, d, d2, a2, a3, d3, a4, d4



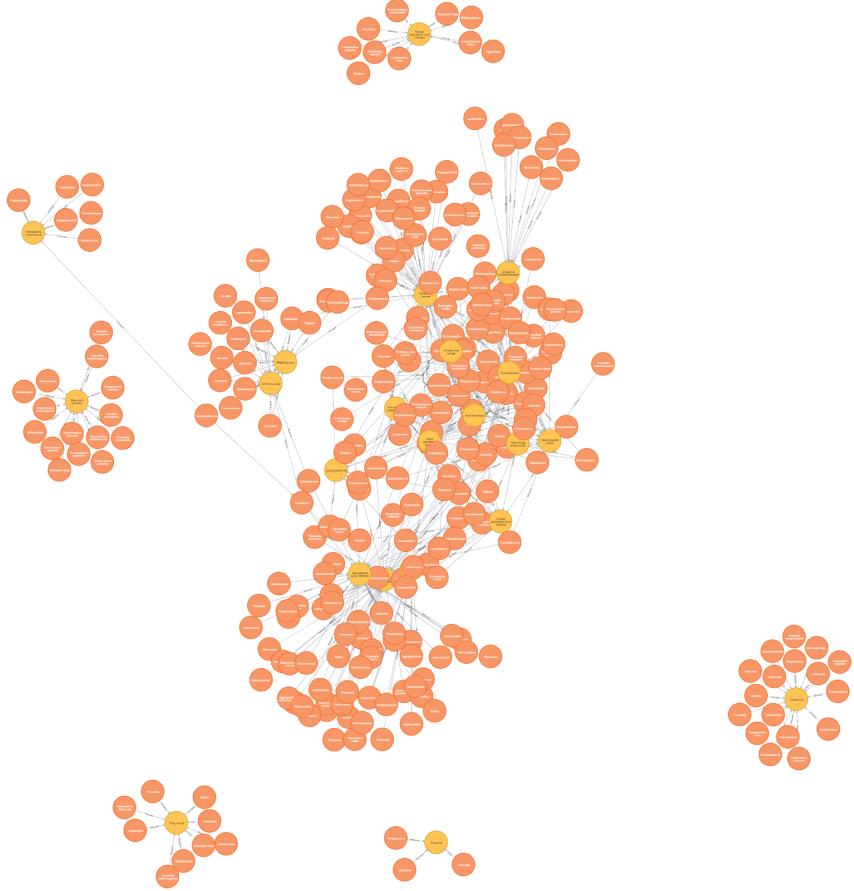
**Which diseases are connected to the bacteria linked to the 3 neurodegenerative diseases listed above?**

```
call {
  match (o:Organism)-[a:Assoc]->(d:Disease {disease:"Alzheimer's Disease"})
  match(o)-[a2:Assoc]->(d2:Disease {disease:"Parkinson's Disease"})
  match(o)-[a3:Assoc]->(d3:Disease {disease:"Amyotrophic lateral sclerosis"})
  match(o)-[a4:Assoc]->(d4:Disease {disease:"Multiple Sclerosis"})
  return collect(o.organism) as bacteria
}
match (o:Organism)-[a:Assoc]->(d:Disease)
where o.organism in bacteria
return o, a, d
```



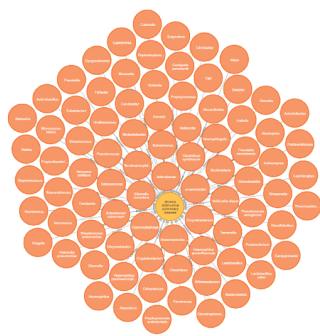
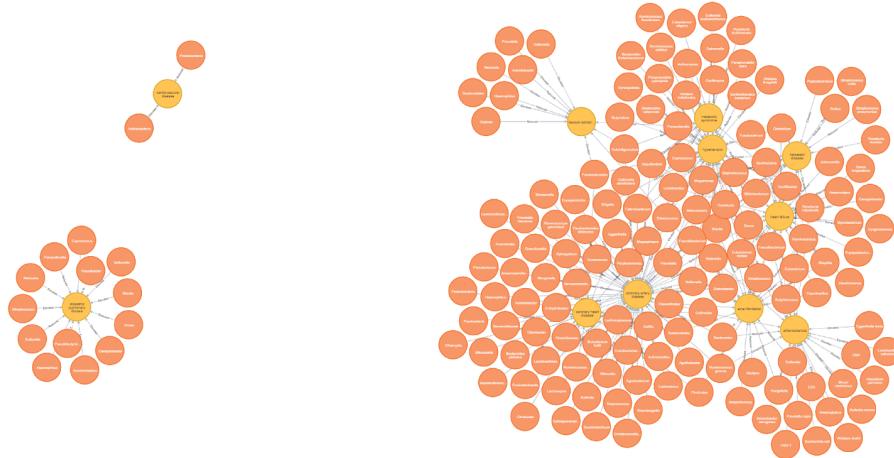
## What diseases are associated with bacteria linked to cancer?

```
call {
  match (o:Organism)-[a:Assoc]->(d:Disease)
  where d.disease =~ ".*cancer.*" or d.disease =~ ".Cancer.*"
  return collect(o.organism) as bacteria
}
match (o:Organism)-[a:Assoc]->(d:Disease)
where o.organism in bacteria
return o, a, d
```



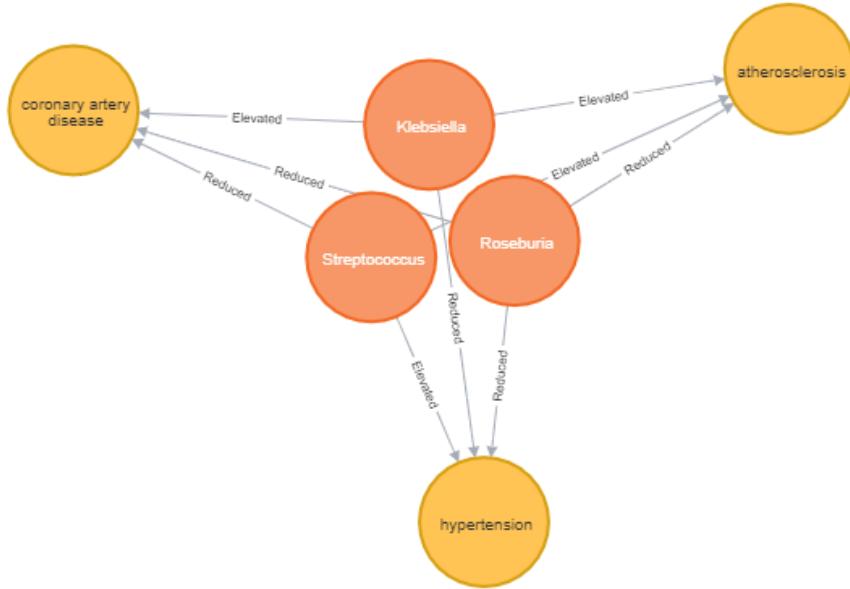
**Which bacteria are associated with cardiovascular diseases?**

match (o:Organism)-[a:Assoc]->(d:Disease {class:"CARDIOVASCULAR"})  
return o, a, d

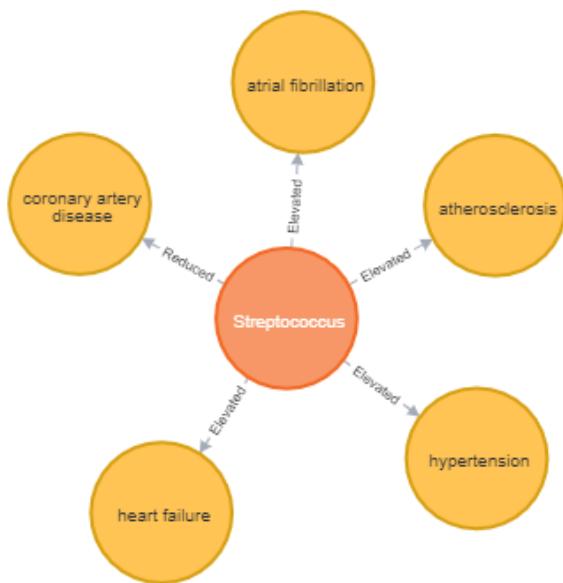


### Common bacteria among cardiovascular diseases?

```
match (o:Organism)-[a:Assoc]->(d:Disease {disease:"hypertension"})  
match(o)-[a2:Assoc]->(d2:Disease {disease:"atherosclerosis"})  
match(o)-[a3:Assoc]->(d3:Disease {disease:"coronary artery disease"})  
return o, a, d, d2, a2, d3, a3
```



```
match (o:Organism)-[a:Assoc]->(d:Disease {disease:"hypertension"})  
match(o)-[a2:Assoc]->(d2:Disease {disease:"atherosclerosis"})  
match(o)-[a3:Assoc]->(d3:Disease {disease:"coronary artery disease"})  
match(o)-[a4:Assoc]->(d4:Disease {disease:"heart failure"})  
match(o)-[a5:Assoc]->(d5:Disease {disease:"atrial fibrillation"})  
return o, a, d, d2, a2, d3, a3, a4, d4, a5, d5
```



## Which bacteria are most highly linked to mental health disorders?

```
match (o:Organism)-[a:Assoc]->(d:Disease)
where d.disease =~ ".*anxiety.*" or d.disease =~".*depressive.*"
or d.disease =~ ".*Bipolar.*"
return o, count(a)
order by count(a) DESC
```

"organism"	"count"
{"organism":"Bacteroides"}	4
{"organism":"Faecalibacterium"}	4
{"organism":"Bacteroidetes"}	3

## What diseases are associated with the organisms most highly linked to mental health disorders?

```
call {match (o:Organism)-[a:Assoc]->(d:Disease)
where d.disease =~ ".*anxiety.*" or d.disease =~".*depressive.*"
or d.disease =~ ".*Bipolar.*"
with o, count(a) as count
order by count DESC limit 3
return collect(o.organism) as bacteria}
match (o:Organism)-[a:Assoc]->(d:Disease)
where o.organism in bacteria and a.publications > 1
return o,a,d
limit 5
```

