

**Biotech Patent Summary**

October 2021

Recently, one of the largest metro regions in the nation asked if [Patent Index](#) could tell them how their region ranked nationally relative to Biotech patents. That request spawned a series of questions which this report seeks to answer:

1. What is the ranking, nationally, of the metros doing biotech innovation?
2. How fluid are these rankings? Are there 'rising stars'?
3. What is the mix of patents going to primary research via universities & governments, versus applied via commercial enterprises?
4. Where does the biotech innovation talent reside? (Is it the same as patent owners or different?)
5. Are there any clues in the data that speak to why one community does better than another?

Seeing an opportunity to do a social good, Patent Index (via The Inventiveness Index) is releasing this Biotech Patent Summary report.

To the answers!... (published at [www.InventivenessIndex.com/](http://www.InventivenessIndex.com/))

1) What is the ranking, nationally, of the metros doing biotech innovation?

Ranking of the Top 25 Biotech Metro Regions (2014-Sep 2021) (Overlap method)

		Rank in 2020	Rank 2014-Now	74514 Tot Patents	78.9% Avg Yr Invtrs	22893	79.3%	9626 Assignees	71.5%
1st Tier	Boston-Cambridge-Quincy, MA-NH	1	1	9621	12.9%	3027	13.2%	995	10.3%
	New York-Northern New Jersey-Long Island, NY-NJ-PA	3	2	8859	11.9%	2724	11.9%	861	8.9%
	San Francisco-Oakland-Fremont, CA	2	3	8344	11.2%	2534	11.1%	817	8.5%
2nd Tier	San Diego-Carlsbad-San Marcos, CA	4	4	4827	6.5%	1509	6.6%	606	6.3%
	Washington-Arlington-Alexandria, DC-VA-MD-WV	5	5	3471	4.7%	1127	4.9%	558	5.8%
	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	6	6	3190	4.3%	916	4.0%	414	4.3%
	San Jose-Sunnyvale-Santa Clara, CA	7	7	3064	4.1%	941	4.1%	394	4.1%
	Chicago-Naperville-Joliet, IL-IN-WI	8	8	1954	2.6%	665	2.9%	242	2.5%
	Los Angeles-Long Beach-Santa Ana, CA	9	9	1422	1.9%	379	1.7%	299	3.1%
	Seattle-Tacoma-Bellevue, WA	10	10	1249	1.7%	416	1.8%	200	2.1%
3rd Tier	Houston-Sugar Land-Baytown, TX	12	11	1219	1.6%	327	1.4%	210	2.2%
	Trenton-Ewing, NJ	13	12	1155	1.6%	399	1.7%	81	0.8%
	Austin-Round Rock, TX	14	13	1107	1.5%	364	1.6%	119	1.2%
	Indianapolis-Carmel, IN	18	14	1006	1.4%	345	1.5%	72	0.7%
	Baltimore-Towson, MD	11	15	1006	1.4%	328	1.4%	94	1.0%
	Durham, NC	16	16	989	1.3%	316	1.4%	101	1.0%
	Atlanta-Sandy Springs-Marietta, GA	17	17	862	1.2%	250	1.1%	153	1.6%
	Madison, WI	19	18	853	1.1%	268	1.2%	71	0.7%
	Cincinnati-Middletown, OH-KY-IN	15	19	805	1.1%	216	0.9%	54	0.6%
	Dallas-Fort Worth-Arlington, TX	21	20	699	0.9%	159	0.7%	152	1.6%
	Pittsburgh, PA	20	21	675	0.9%	191	0.8%	102	1.1%
	New Haven-Milford, CT	27	22	647	0.9%	158	0.7%	61	0.6%
	Oxnard-Thousand Oaks-Ventura, CA	22	23	627	0.8%	270	1.2%	47	0.5%
	Miami-Fort Lauderdale-Pompano Beach, FL	29	24	599	0.8%	123	0.5%	122	1.3%
	Ann Arbor, MI	25	25	562	0.8%	211	0.9%	56	0.6%

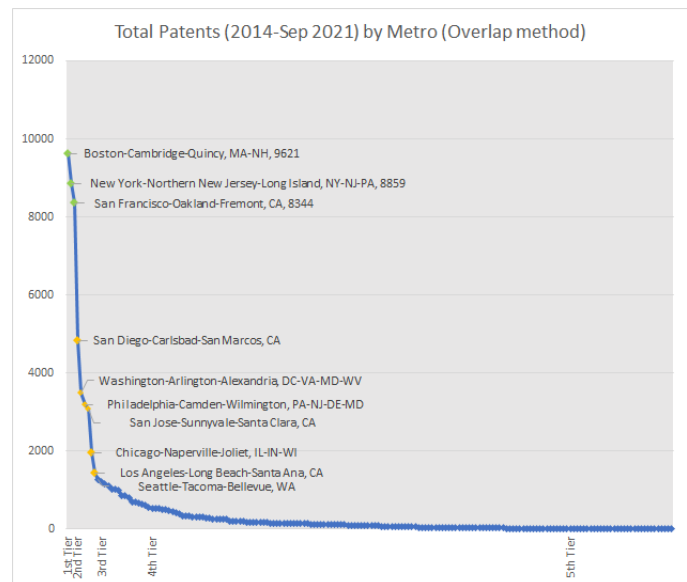
As the adjoining table (ranked by overall patents during the sample period of 2014 to present) and the following chart illuminate: only three metro areas (greater Boston, New York City and San Francisco) dominate this space with 36% of all the patents nationally in biotech, as well as 36% of the annual inventors and over 27% of all the assignees (patent owners). San Diego is a contender placing consistently in 4<sup>th</sup> or 5<sup>th</sup> place (see charts

Figure 1 - Top 25 Ranking of Metros - by overall patent counts

beginning on page 12). Rounding out the Top 10 are metro DC, Philadelphia, San Jose, Chicago, LA and Seattle. Collectively, these ten metros have produced almost 62% of all the patents in biotech nationally. The Top 25 collectively have produced 78.9% of the patents by 79.3% of all the biotech inventors and assigned to 71.5% of all the assignees. 155 other communities collectively produced the balance.

Figure 2 - Total Patents by Metro - Plot

Figure 2 shows another way to look at the total biotech patent volume. Boston, NYC and San Francisco hold a commanding lead on patent production (innovation) in biotech. It's a steep slope down to around tenth or eleventh place where the slope shifts to a much more horizontal one. Testifying that it's about "the top ten and then everyone else".



## 2) How fluid are these rankings? Are there 'rising stars'?

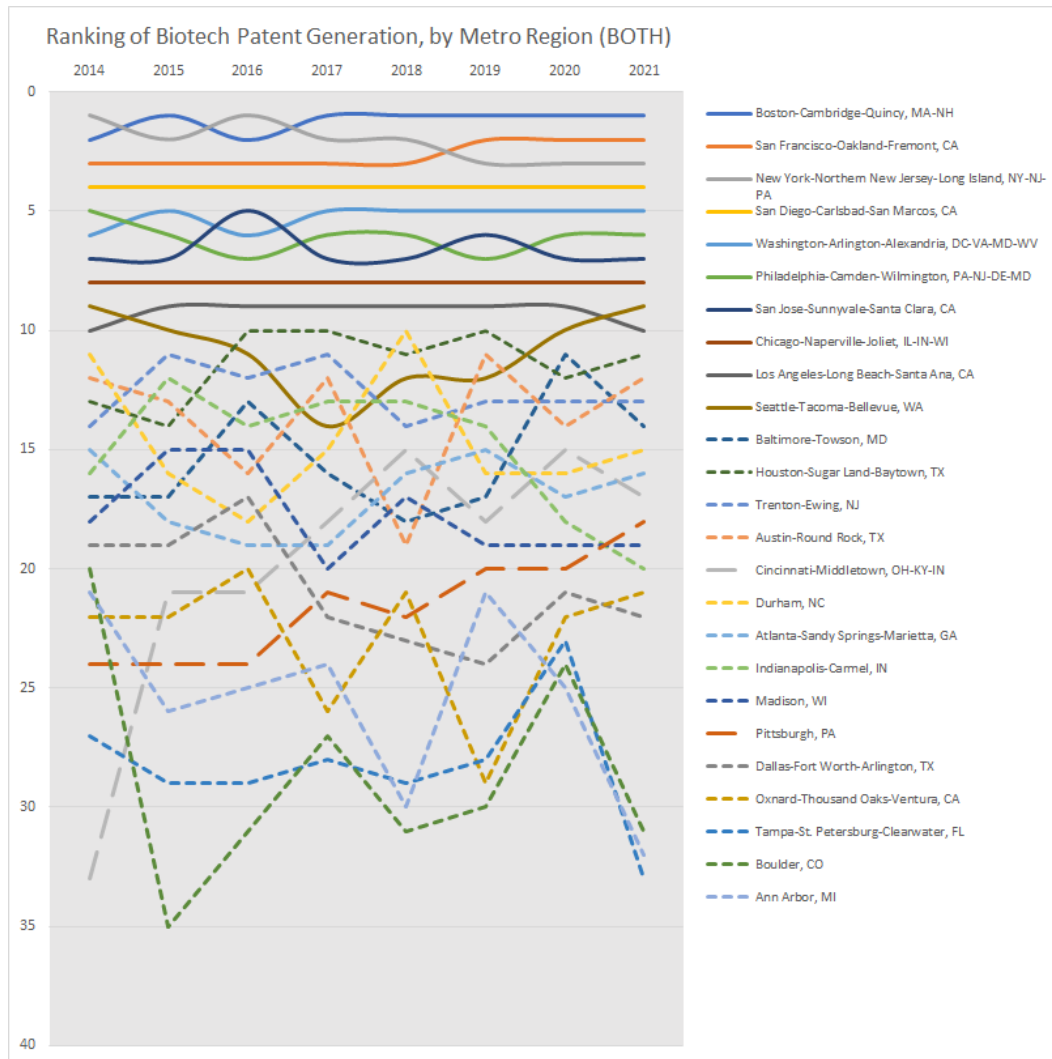


Figure 3 - Top 25 rankings year by year

- Cincinnati-Middletown, OH-KY-IN (moved from 33<sup>rd</sup> to 17<sup>th</sup>)
- Pittsburgh, PA (from 24<sup>th</sup> to 18<sup>th</sup>)
- Minneapolis-St. Paul-Bloomington, MN-WI (from 42<sup>nd</sup> to 25<sup>th</sup>)

Why are these metro regions on the rise? It is unclear. All we know is that each of them has, over the eight years, had an appreciably rising quantity of biotech patents. Who is generating these patents?

The adjoining chart illustrates that there is not much fluidity in the “top ten” metro regions (solid lines). There is some fluidity within these ten, but it’s not like there are metro regions popping in and out of the list.

As shown in Figure 1, the top ten metros generated 61.7% of all the patents assigned to 52% of all the assignees, in the 2014 to present sample period.

Below the top ten there is a lot of fluidity (top 25 metros shown in Figure 3).

In that fluidity, are there any rising stars? There are three:

In the Cincinnati metro area, the largest increases in patent rates go to:

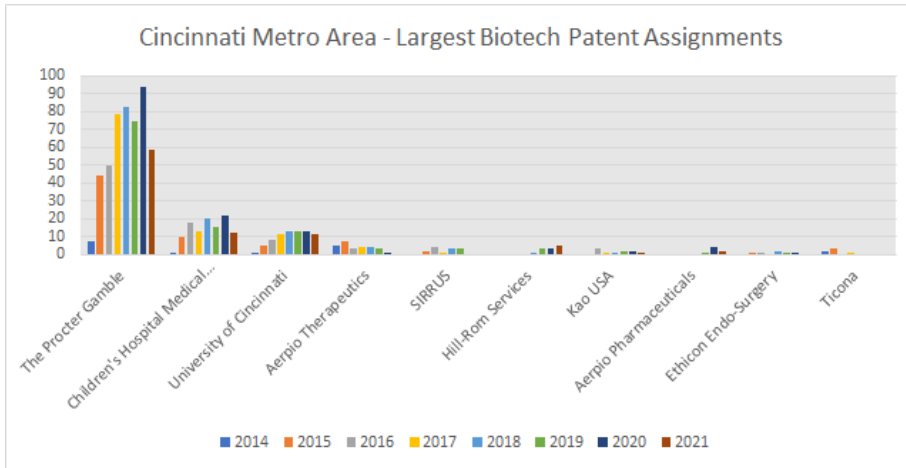


Figure 4 - Cincinnati Metro Top Biotech Patent Producers

In the Pittsburgh metro area, the largest increases in patent rates go to:

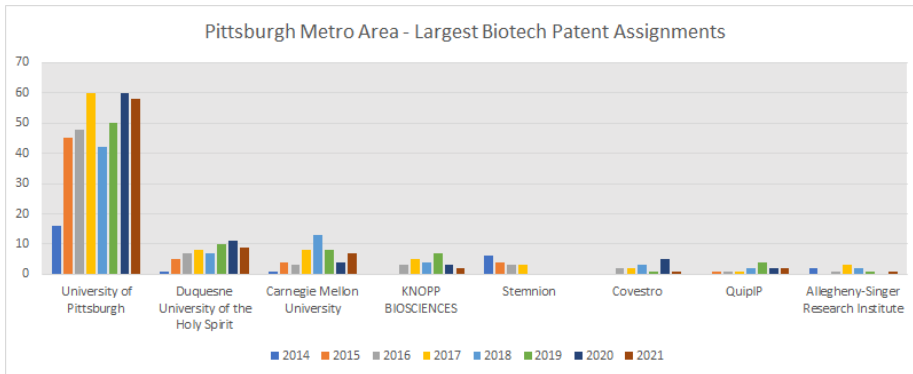


Figure 5 - Pittsburgh Metro Top Biotech Patent Producers

In the Minneapolis-St. Paul metro area, the largest increases in patent rates go to:

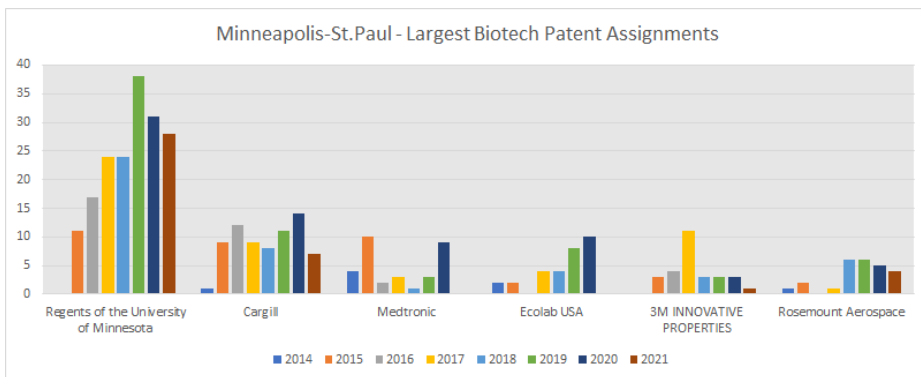


Figure 6 - Minneapolis-St. Paul Metro Top Biotech Patent Producers

With the exception of Procter and Gamble in the Cincinnati area, the majority of patent increases seem to have been in major universities.

Could the rising ranking be a result of more than usual university biotech patent production (primary research)?

Compare this with Boston as an example (note the scale on the y-axis relative to the other metros):

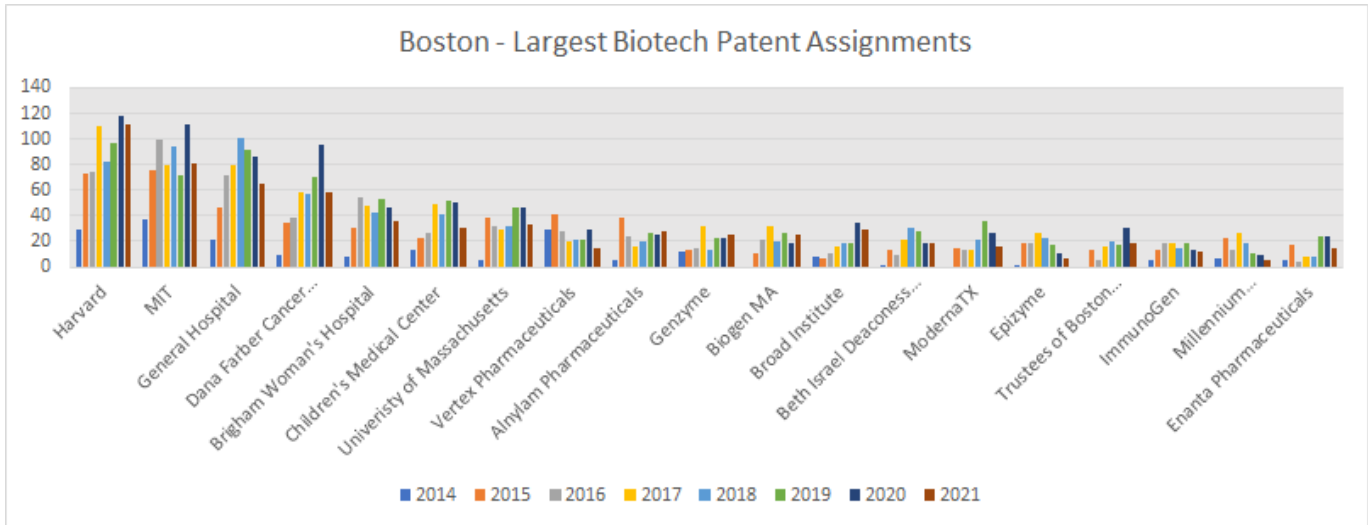


Figure 7 - Boston Metro Top Biotech Patent Producers

Clearly Boston has a high volume of academically-based patent production. Could this account for its consistently #1 position?

What about a “relatively flat performer” (similar number of patents year over year in the 50’s & 60’s):

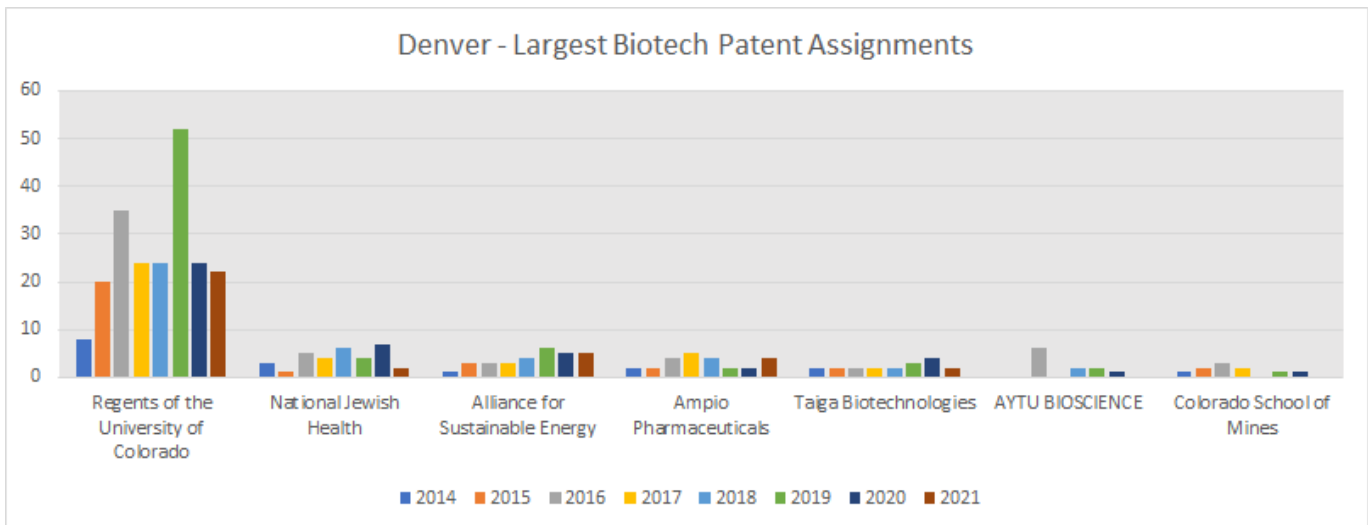


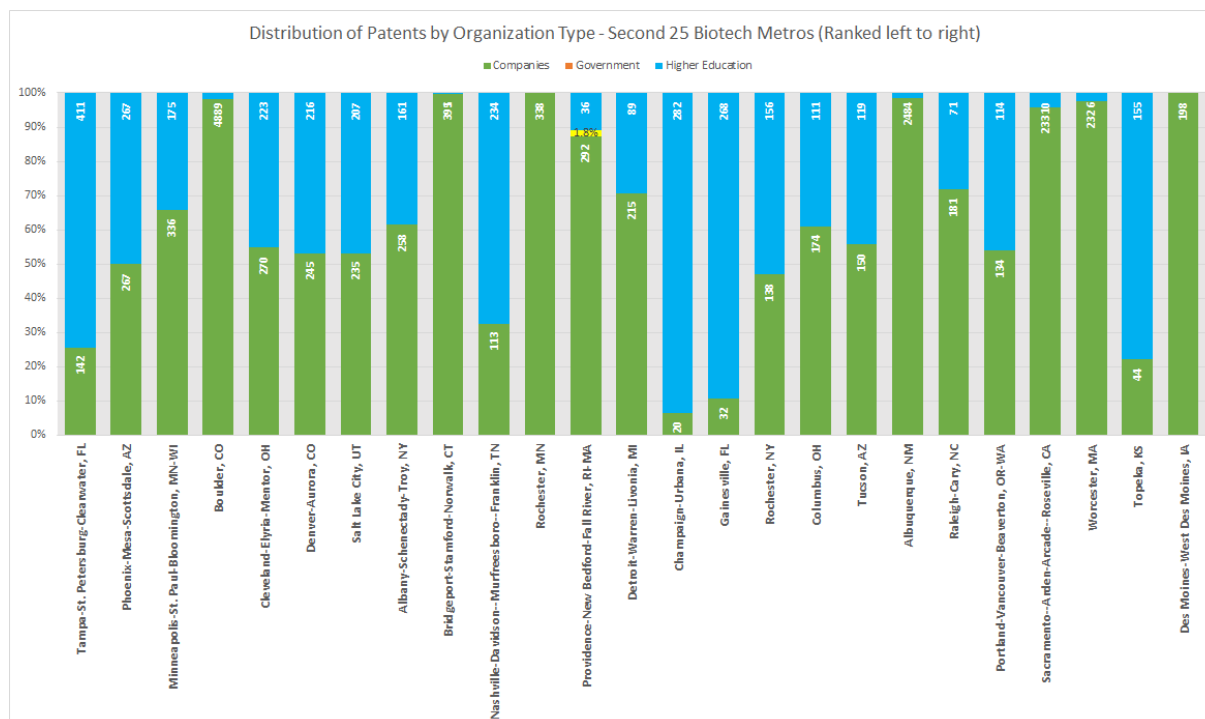
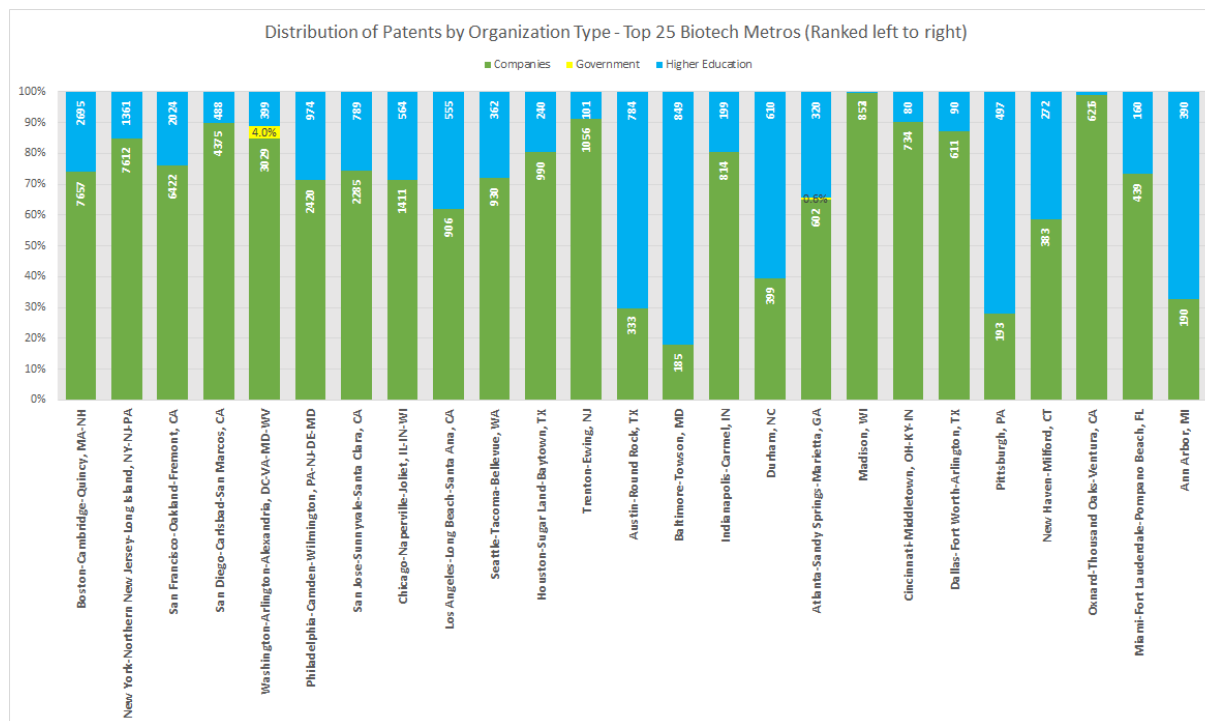
Figure 8 - Denver Metro Top Biotech Patent Producers

What do these contrasts suggest?

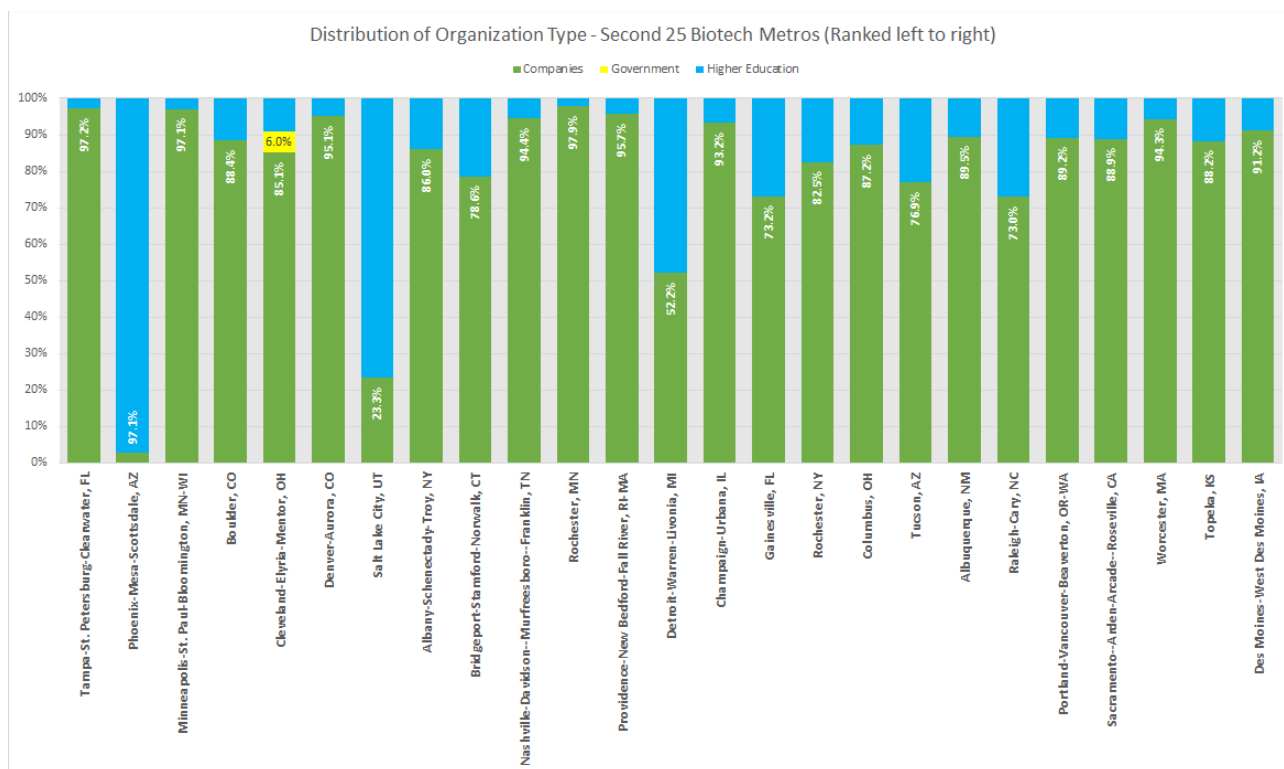
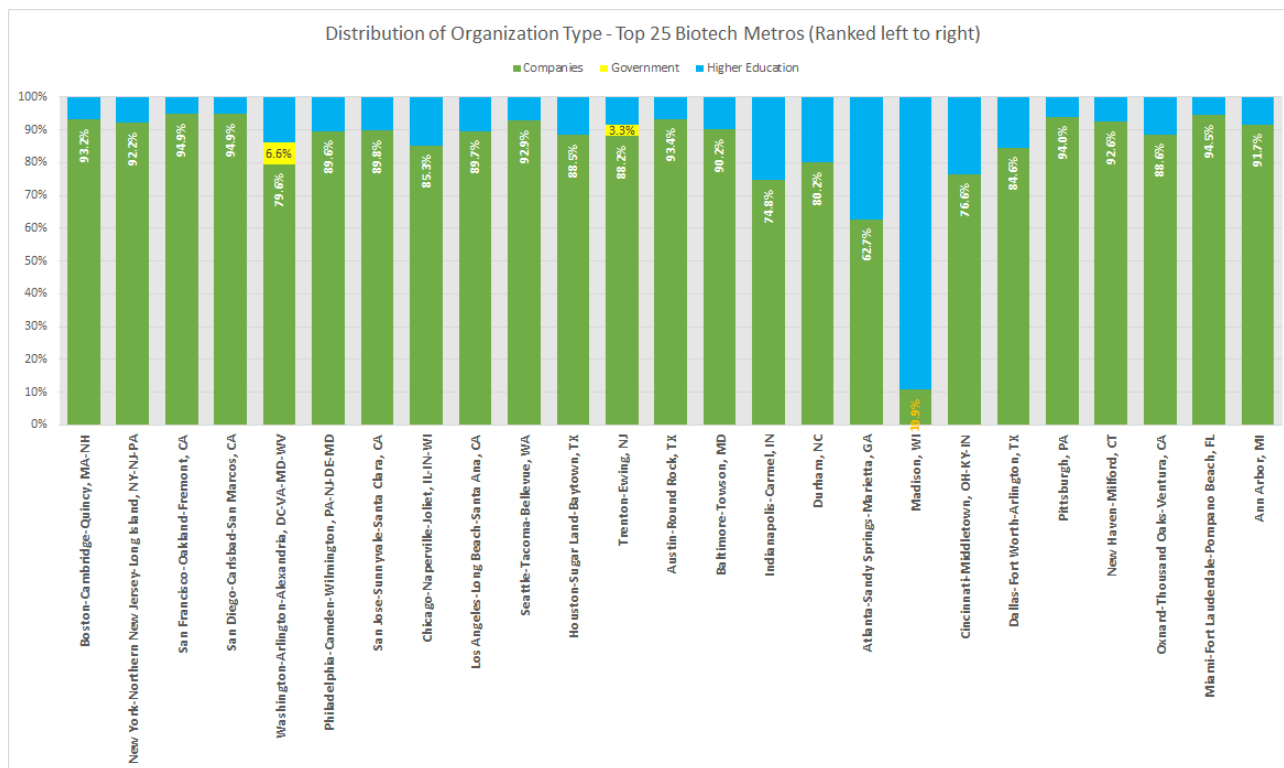
What role does academia play in biotech patents? Is it correlated to overall innovation?

### 3) What is the mix of patents going to primary research via universities & governments, versus applied via commercial enterprises?

Does the mix of patents assigned to Company, Government or Higher Education matter to the biotech success of a metro region? Here are the first and second 25 metros (50 altogether) and showing the number of patents assigned by type of organization:



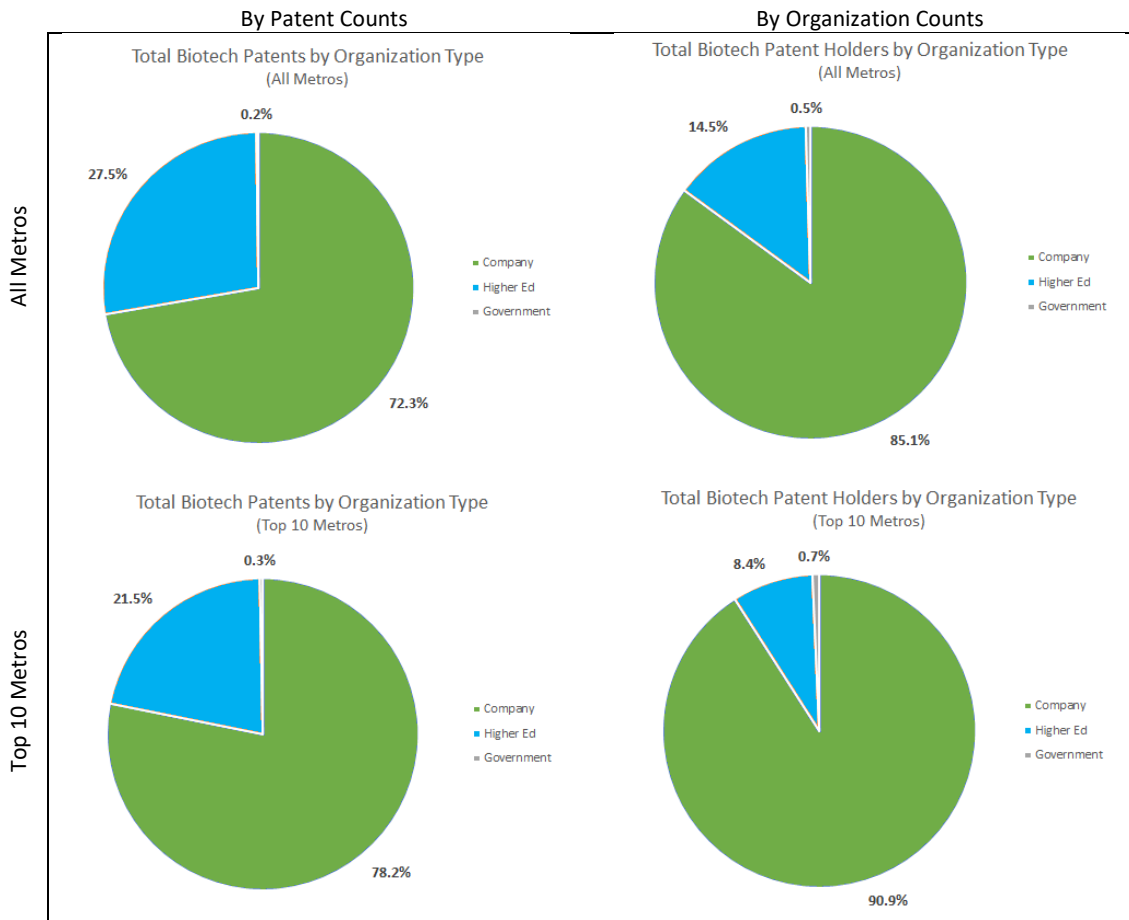
These charts seem to suggest that there is no correlation between “success” (measured by volume of patents) and the patent generation of the three types of organizations (if it did there would be a clear trend in the blue/green mix). It must come from another cause. Perhaps it isn't patents by organization type, perhaps it is the number of organizations by type?



If we compare 1<sup>st</sup> ranked Boston with 13<sup>th</sup> ranked Austin, we see that the percentage of biotech patenting organizations that are companies is virtually equal (93.2% vs 93.4%) but the total patent counts differ by a factor of 8 or 9. However, while the percentage mix of companies and higher education are the same, the volume of patents generated by those two bodies is nearly inverted (29.8% corporate for Austin and 74% corporate for Boston).

Conversely, we see 26<sup>th</sup> and 27<sup>th</sup> ranked metro regions, side by side with inverted mixes of organization concentrations (Phoenix is 97.1% higher ed whereas Tampa is 97.2% corporate). But their patent volume by organization type does not parallel either Boston or Austin. So, having a high density of companies relative to higher education research – doesn't seem to guarantee any particular volume of patents.

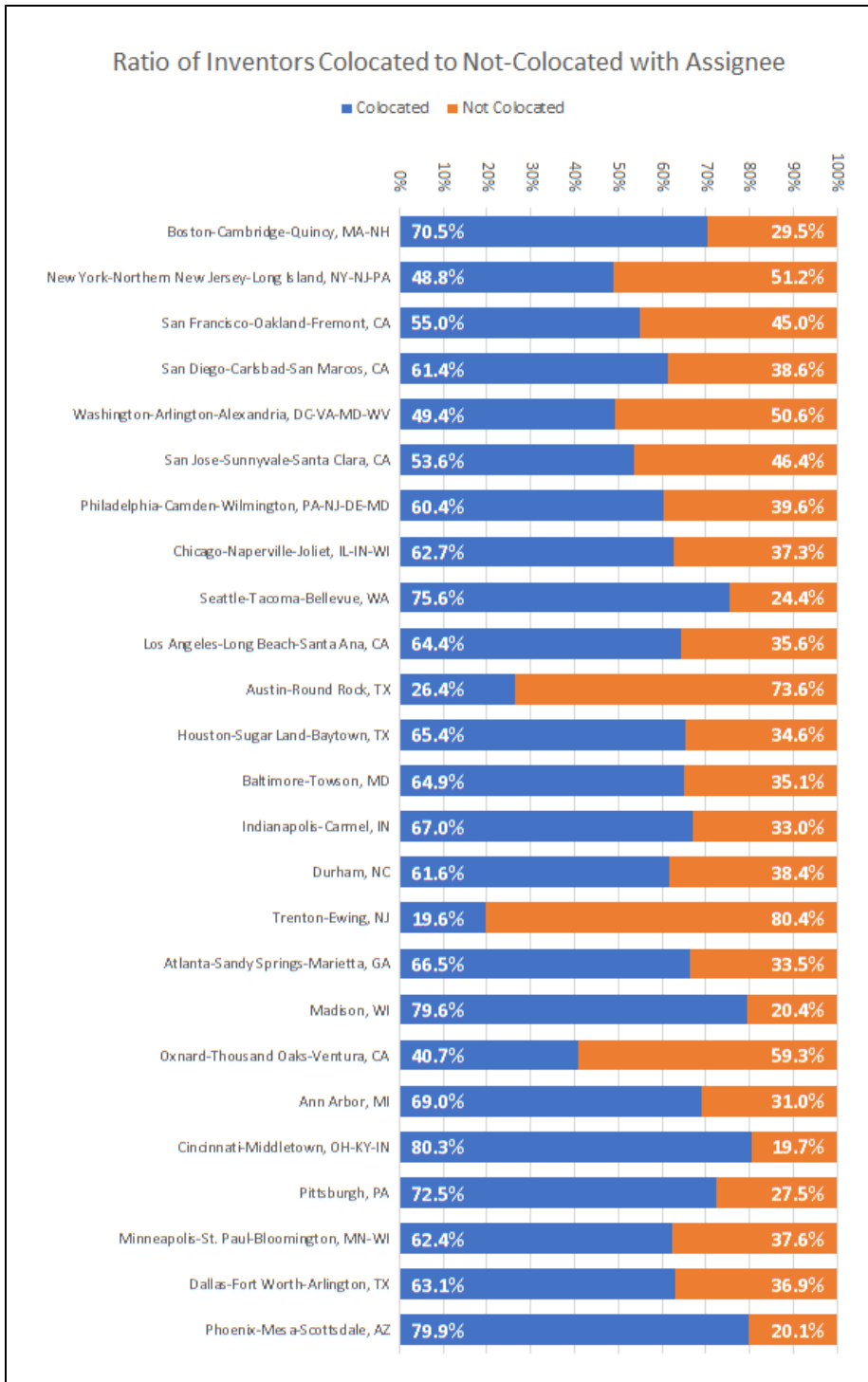
Viewing it another way:



What we learn from these charts is that companies occupy a disproportionate percentage of both the total patent production and the number of patent-holding organizations in the top 10 metros – when compared to the total biotech invention universe. Could this be demonstrating the “obvious speculation” that the top ten are the top ten because free enterprise drives innovation?



#### 4) Where does the biotech innovation talent reside? (Is it the same as patent owners or different?)



Companies who obtain patents, do so because of the innovation of their employees. Those employees, however, do not necessarily have to reside in the same metro area as their company. Overall, among the 219 metro areas having at least one patent in biotech, the primary inventors are located in the same metro region as the company 59.1% of the time. That percentage, for the top three metros is 58.4%; for the top ten it is 58.6% and the top 25 it is 58.7%. So, this suggests that whether the inventors reside in the same metro region as their company – is not correlated to the overall success in biotech for that region.

## 5) Are there any clues in the data that speak to why one community does better than another?

*“Correlation is not {necessarily} causality”* is the battle cry of many in business and other disciplines. And that is certainly also true here. However, correlation can be useful in the process of finding causality. In that spirit, we have examined three questions:

- Could the presence of, or mix of, academic to commercial patents be an indicator?
- Could the presence of, or mix of, academic to commercial entities be an indicator?
- Does the “coresidency” of inventors to their employers be an indicator?

In all three cases, the answer is “apparently not.”

This suggests that, potentially, the “success” of biotech in a region has to do with factors OUTSIDE of the patents themselves, the assignees themselves or their nearby academic research institutions.

- Could it be Economic Development entities?
- Could it be public policy support?
- Could it be “collaboration” between all the players in a region (companies, econ dev, pub policy, academia)?
- Something else?

This report cannot answer these questions.

**How, then, can or does a region like Cincinnati or Pittsburgh break into that robustly defended top ten list? How can any metro region materially increase innovation in biotech (assuming patent production as a proxy for measuring innovation in a discipline)?**

## Methods:

In most cases, such analysis is straightforward. However, in this case, there is a small wrinkle that makes a conclusive ranking challenging: *“What kind of patent constitutes a Biotech one?”*

The US Patent and Trademark Office (USPTO) declares the following patent classes to be Biotech patent classes: (USPC classifications):

- Class 424, Drug, Bio-Affecting and Body Treating Compositions; subclasses 40-42, 66-68, 84-85.7, 130.1-283.1, 93.1-94.67, 520-583, 114-126, 195.15-195.18, 725-780, 800-900
- Class 514, Drug, Bio-Affecting and Body Treating Compositions; subclasses 2.1-21.92, 44R, 44A
- Class 435, Chemistry: Molecular Biology and Microbiology; all subclasses
- Class 530, Chemistry: Natural Resins or Derivatives; Peptides or Proteins; Lignins or Reaction Products Thereof; subclasses 300-399
- Class 536, Organic Compounds -- Part of the Class 532-570 Series; subclasses 23.1-25.34
- Class 800, Multicellular Living Organisms and Unmodified Parts Thereof and Related Processes; all subclasses

These crosswalk to the more widely used CPC Classifications of: A01G, A01H, A61K, A61P, A61Q, B01F, B01J, B81B, B82B, B82Y, G01N, G16H, C05\*, C07\*, C08\*, C09\*, C11\*, C12\*, C13\*, C25\*, C40\*

Based on the above classifications, Patent Index extracted all the patents in the top 250 US Metro Regions. Then, being thorough, Patent Index used as a proxy: all the publicly traded biotech companies as a classification source. Put another way: for known significant biotech companies filing patents – in which patent classes are these companies being awarded patents? If the USPTO classifications are accurate – the classifications should largely overlap. Of the 61 USPTO classifications and the derived 37 Patent Index classifications (A01K, A01N, A61B, A61F, A61J, A61K, A61L, A61M, A61N, A61Q, B01L, B03C, B05B, B65D, B81B, B82Y, C07C, C07D, C07F, C07H, C07J, C07K, C08B, C08G, C12M, C12N, C12P, C12Q, C12Y, G01G, G01N, G06F, G06T, G16B, G16H, H01J, H01R), there are only 19 classifications in common (A61K, A61Q, B81B, B82Y, C07C, C07D, C07F, C07H, C07J, C07K, C08B, C08G, C12M, C12N, C12P, C12Q, C12Y, G01N, G16H). This resulted in the two lists having 74,655 patents in common. The USPTO list (101,879 patents) had 27,224 patents not on the Patent Index list. The Patent Index list (114,388 patents) had 39,733 patents not found in the USPTO list.

If patents issued to active and certified Biotech companies – are not appearing in the USPTO list, based on the USPTO Biotech Classification Method, then what? Does that mean that these expressly Biotech companies are patenting outside their domain? Does that mean that the USPTO’s definition of a Biotech patent is incomplete? Or some other explanation?

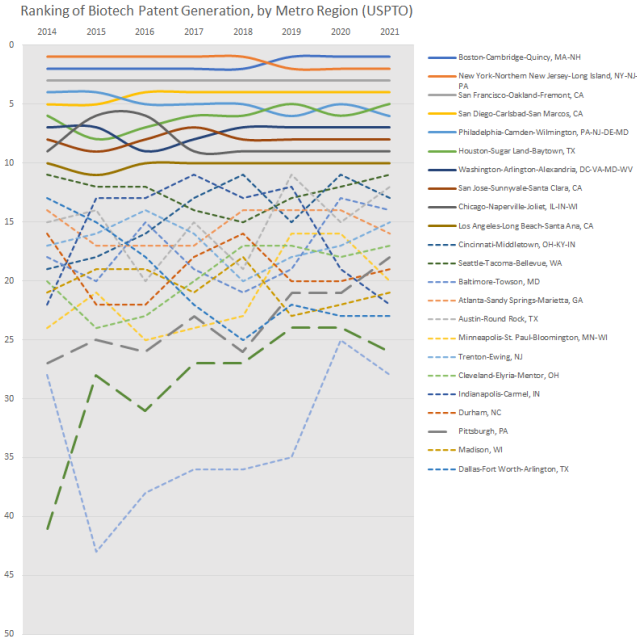
NOTE: Location of a patent is based on the location of the organization to which the patent is assigned. Location of an inventor is based on the location of the inventor (not the patent owner) which is often (about 40%) not the same as the owner.

It is impractical to examine each of the non-overlapping patents deemed biotech by either the USPTO or Patent Index and individually classify them as biotech or non-biotech. So, Patent Index herein simply shows all three outcomes:

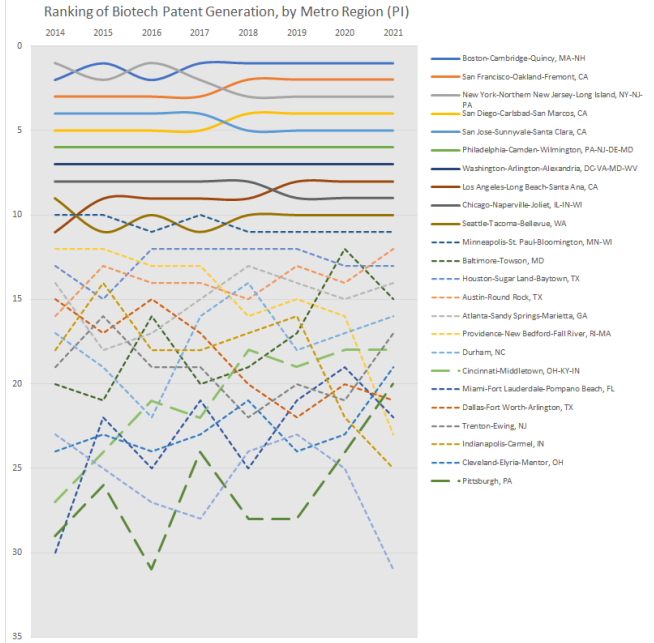
- The US PTO list based on their classifications
- The Patent Index list based on what real biotech companies are patenting
- **The list based on the patents that both lists hold in common (preferred)**

### Ranking of Biotech Patent Generation by Year and Metro Region (All Three Methods)

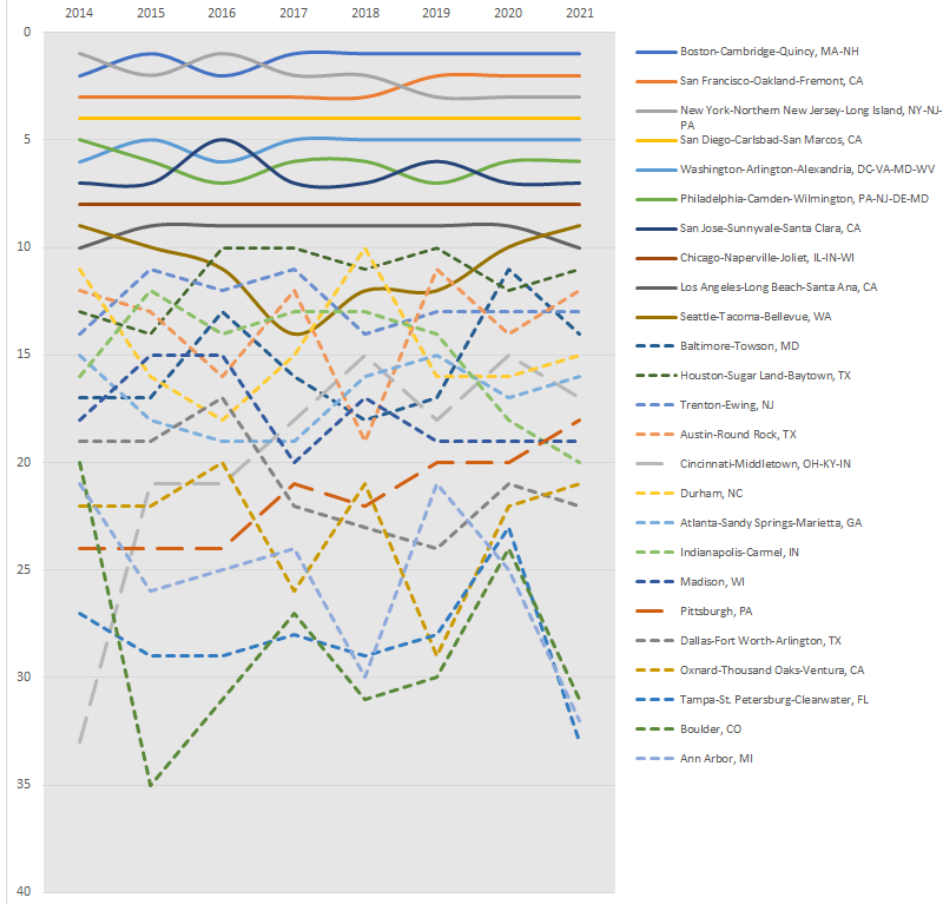
**Method: US Patent & Trademark Office**



**Method: Patent Index, LLC**

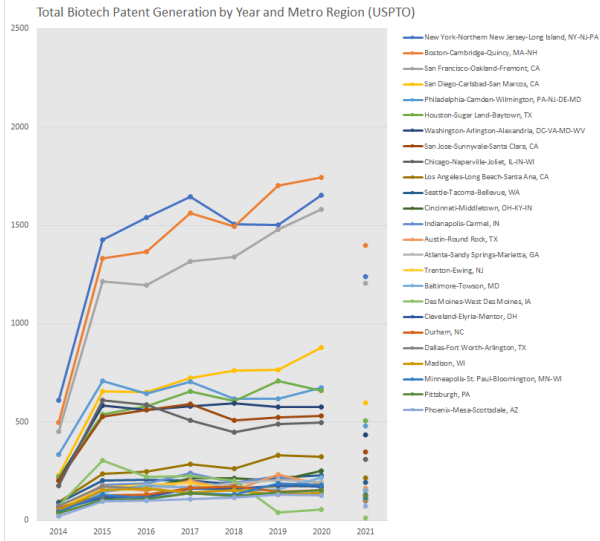


**Ranking of Biotech Patent Generation, by Metro Region (BOTH)**

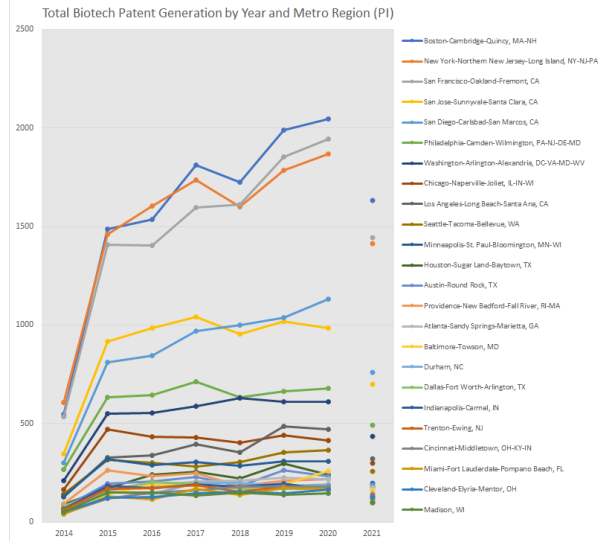


### Biotech Patent Generation by Year and Metro Region (All Three Methods)

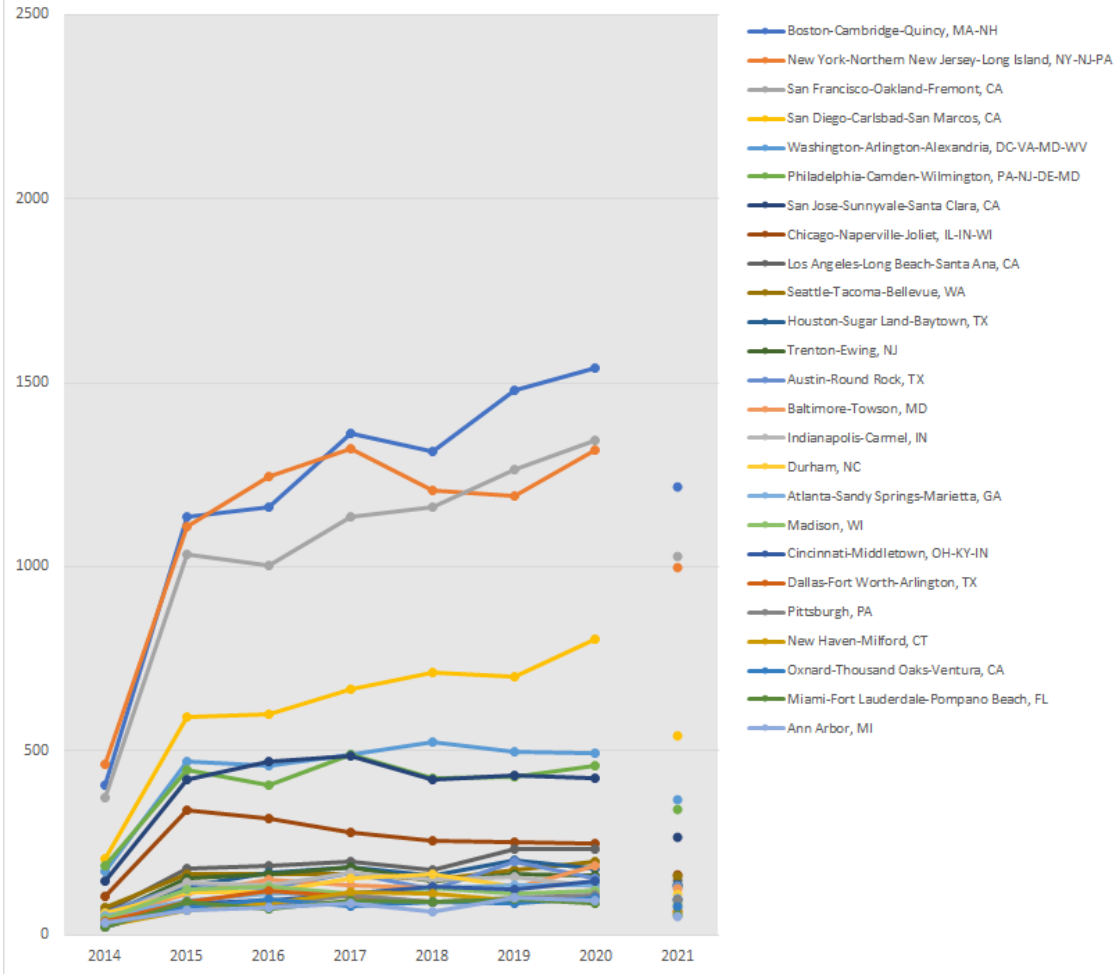
Method: US Patent and Trademark Office



Method: Patent Index, LLC



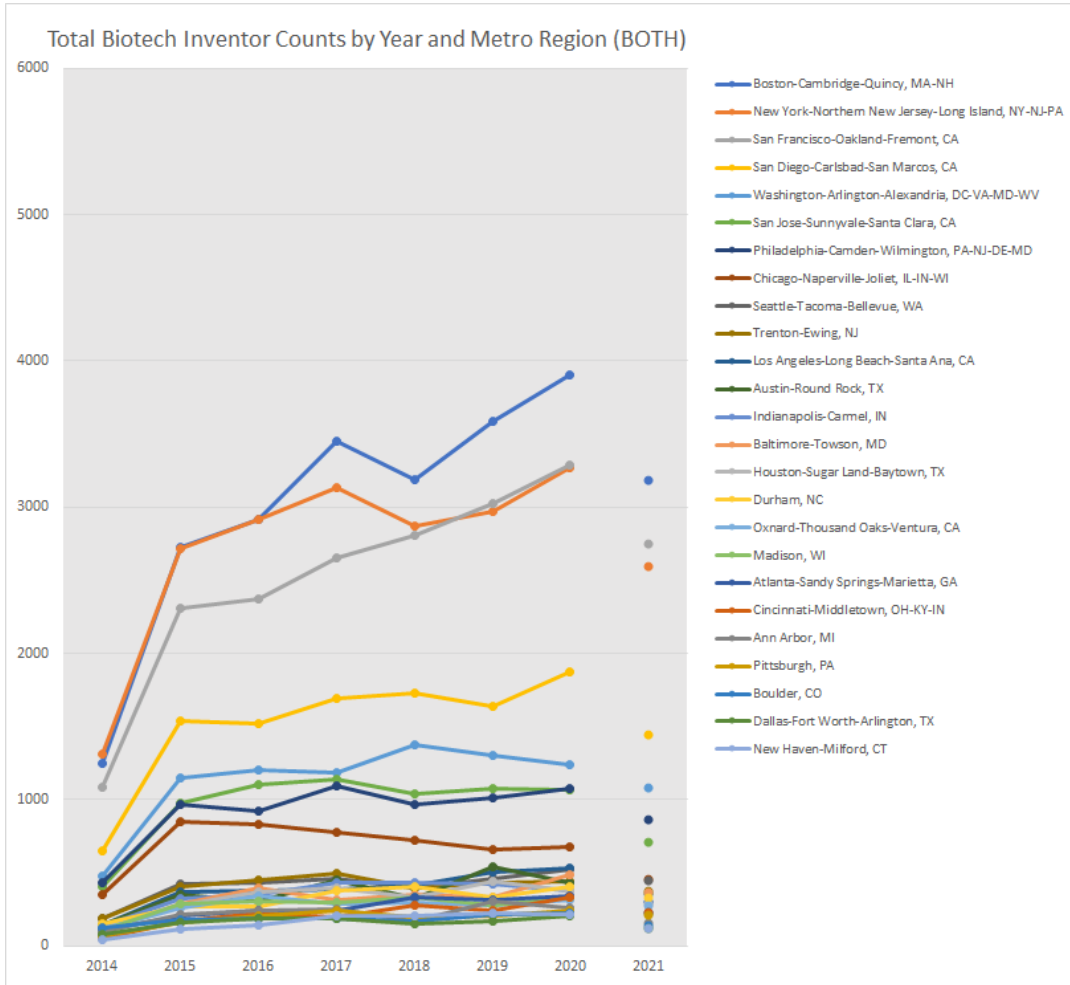
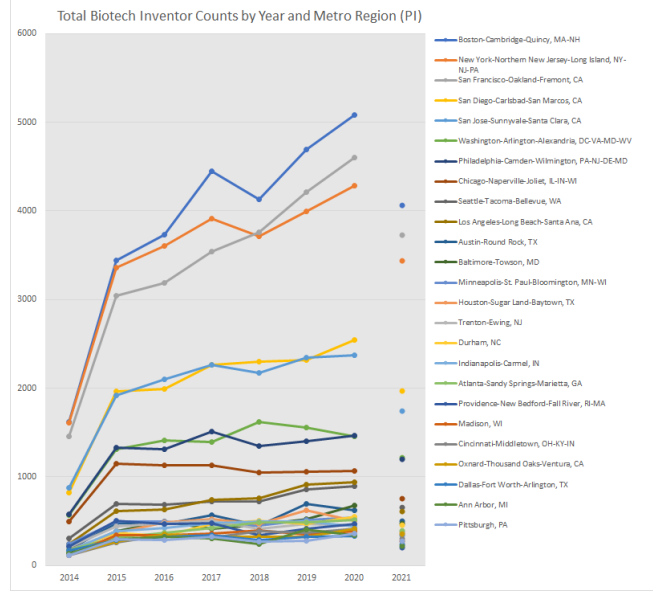
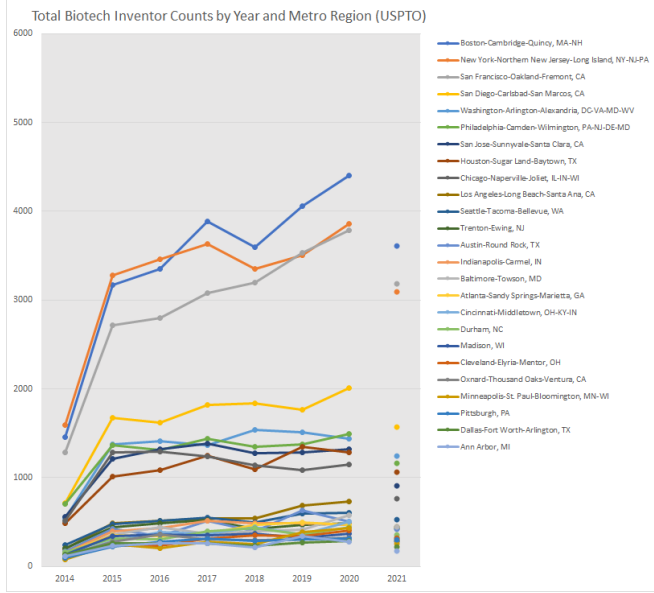
Total Biotech Patent Generation by Year and Metro Region (BOTH)



### Biotech Annual Inventor Counts by Year and Metro Region (All Three Methods)

Method: US Patent and Trademark Office

Method: Patent Index, LLC



---

## About Patent Index and the Inventiveness Index:

[Patent Index](#) provides patent law firms, economic development entities, publishers and corporations with patent-related data feeds, weekly email alerts and expert custom analysis. The [Inventiveness Index](#) is a “social-good” vehicle for analysis that Patent Index finds more broadly useful to the cause of advancing innovation in the USA; like the first ever [Gender in Invention](#) report (August of 2017) and others.

Learn more at [www.PatentIdx.com](http://www.PatentIdx.com) and [www.InventivenessIndex.com](http://www.InventivenessIndex.com)