Distributed Science Value Proposition

- **Better Science (for Scientists)**
  - Problem: Reproducibility Issues; **20% of U.S. health science research can't be replicated/reproduced***
  - Solution: Improved reproducibility through transparency and immutable audit trail for research data; better quality data from standardization; improved materials; increased meta-analysis capabilities

- **Cheaper Research (for Funders)**
  - Problem: Expensive; decreasing ROI; **$30 billion in U.S. health science on non-replicable research***
  - Solution: Increased return on investment for research dollars spent; reduced data management costs through blockchain/smart contracts, amplified with machine learning/AI; cheaper administration
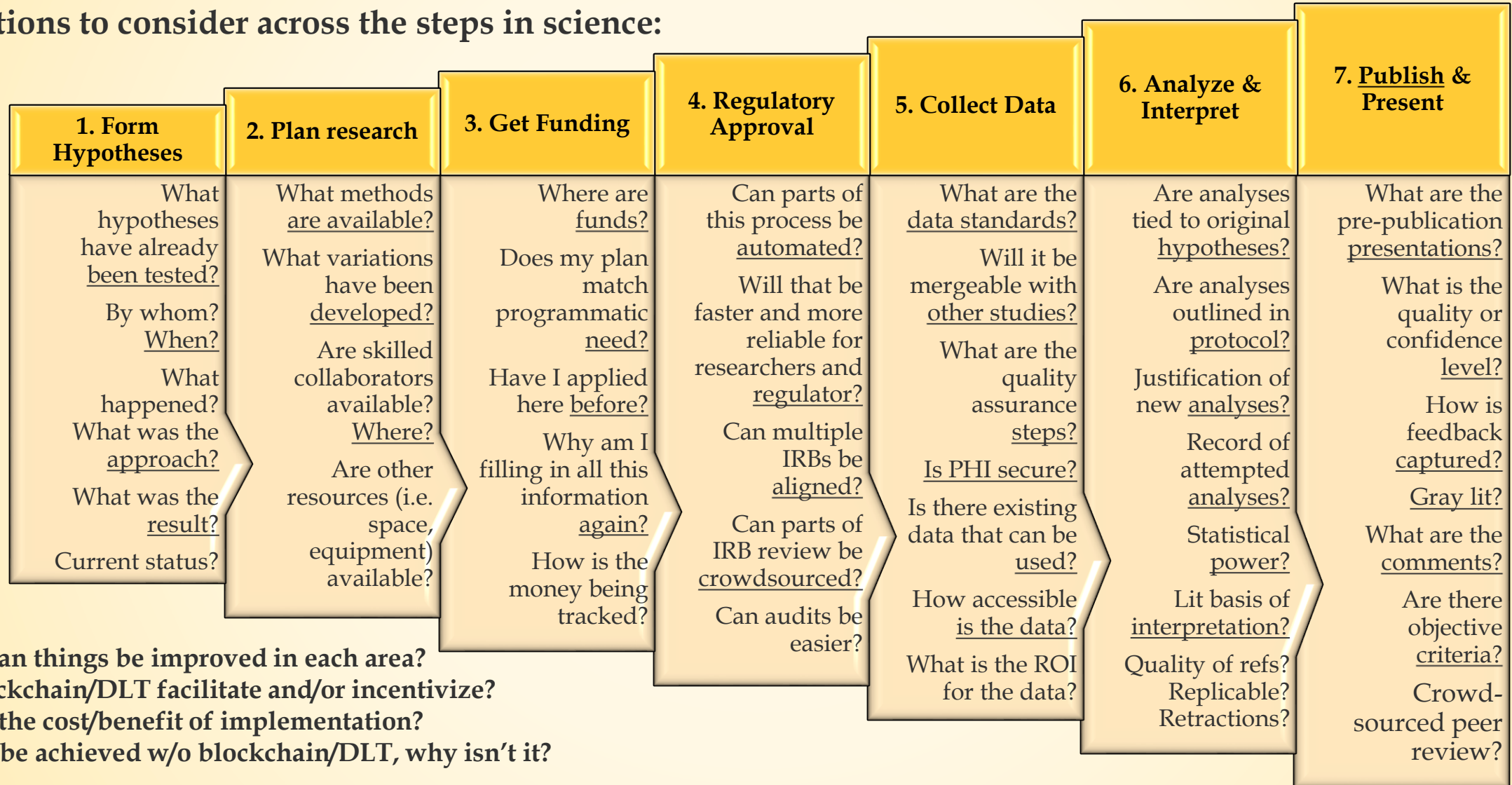
- **Faster Miracles (for Everyone)**
  - Problem: 17 years from bench to bedside; **2-5 years on administrative processes (my estimate)****
  - Solution: Faster time from idea to treatment; improved outcomes with accelerated research and higher quality data; improved tracking of individual contribution allowing for expanded permissioned access of data to more researchers; faster administrative processes (e.g. IRB, grant review)

* "Economics of reproducibility in Preclinical Research" Freedman et al, PLoS 13(6) e1002165, 2015

** "Enhancing Federal Research: Traumatic Brain Injury & Blockchain Technology - Part 1.5, The Why." Manion, Feb 2018
https://www.linkedin.com/pulse/enhancing-federal-research-traumatic-brain-injury-part-sean-manion-1/

Distributed Science Opportunities?

Questions to consider across the steps in science:

1. Form Hypotheses	2. Plan research	3. Get Funding	4. Regulatory Approval	5. Collect Data	6. Analyze & Interpret	7. Publish & Present
What hypotheses have already <u>been tested?</u>	What methods <u>are available?</u>	Where are <u>funds?</u>	Can parts of this process be <u>automated?</u>	What are the <u>data standards?</u>	Are analyses tied to original <u>hypotheses?</u>	What are the pre-publication <u>presentations?</u>
By whom? <u>When?</u>	What variations have been <u>developed?</u>	Does my plan match programmatic <u>need?</u>	Will that be faster and more reliable for researchers and <u>regulator?</u>	Will it be mergeable with <u>other studies?</u>	Are analyses outlined in <u>protocol?</u>	What is the quality or confidence <u>level?</u>
What happened? What was the <u>approach?</u>	Are skilled collaborators available? <u>Where?</u>	Have I applied here <u>before?</u>	Can multiple IRBs be <u>aligned?</u>	What are the quality assurance <u>steps?</u>	Justification of new <u>analyses?</u>	How is feedback <u>captured?</u>
What was the <u>result?</u>	Are other resources (i.e. space, equipment) available?	Why am I filling in all this information <u>again?</u>	Can parts of IRB review be <u>crowdsourced?</u>	<u>Is PHI secure?</u>	Record of attempted <u>analyses?</u>	<u>Gray lit?</u>
Current status?		How is the money being tracked?	Can audits be easier?	Is there existing data that can be <u>used?</u>	Statistical <u>power?</u>	What are the <u>comments?</u>
				How accessible <u>is the data?</u>	Lit basis of <u>interpretation?</u>	Are there objective <u>criteria?</u>
				What is the ROI for the data?	Quality of refs? Replicable? Retractions?	Crowd-sourced peer review?

- **Where can things be improved in each area?**
- **Can blockchain/DLT facilitate and/or incentivize?**
- **What is the cost/benefit of implementation?**
- **If it can be achieved w/o blockchain/DLT, why isn't it?**

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