AAAS-ACC WORKSHOP ON THE FUTURE OF CUBA-USA COOPERATION (march 2023)

BIOTECHNOLOGY IN CUBA:

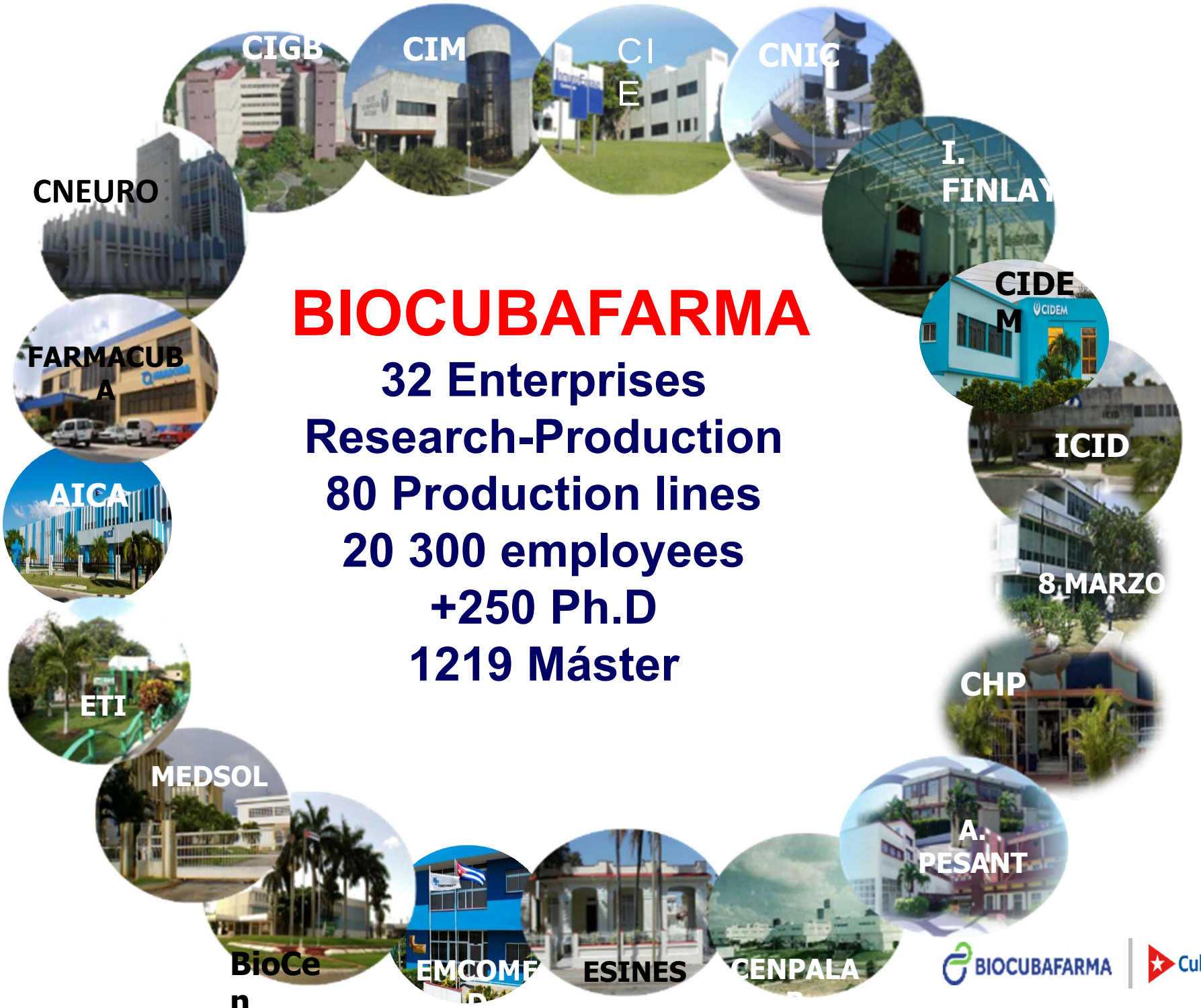
- THE ORIGINS
- THE PERFORMANCE
- THE ENTERPRISES
- THE PRODUCTS
- ¿WHAT COULD WE DO TOGETHER?

BIOTECHNOLOGY IN CUBA: ORIGINS

- 1981: FIRST FACILITY INAUGURATED FOR INTERFERON
  THE CONCEPT OF CLOSED-LOOP ORGANIZATION:
  RESEARCH-PRODUCTION-COMMERCIALIZATION

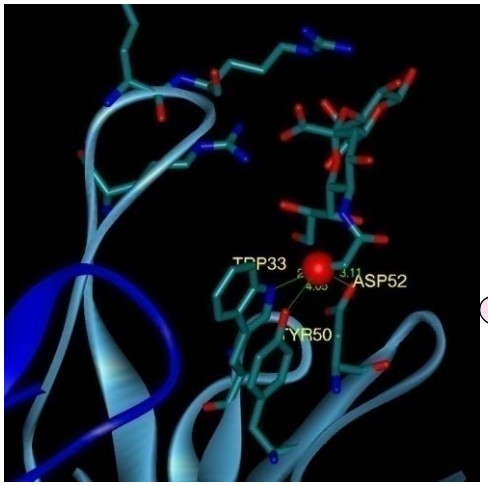
- 1986: THE CENTRE OF GENETIC ENGINEERING AND BIOTECHNOLOGY
- 1986-1995: SEVERAL NEW RESEARCH-PRODUCTION CENTRES

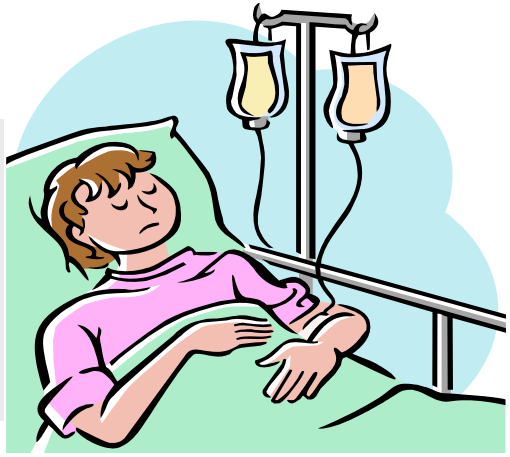
- 1992: THE WEST-HAVANA SCIENTIFIC POLE
  (20 institutions, 10 000 employees, exports to 50 countries)
- 1994: THE CENTRE OF MOLECULAR IMMUNOLOGY
- 2012: MERGE WITH THE PHARMA INDUSTRY-BIOCUBAFARMA
  HOLDING ORGANIZATION



BIOCUBAFARMA | Cuba

The “Closed Loop” Organization





BASIC RESEARCH → **PRODUCT-ORIENTED RESEARCH** → **MANUFACTURING & MARKETING**

BioCuba Farma

GRUPO DE LAS INDUSTRIAS BIOTECNOLÓGICA Y FARMACÉUTICA

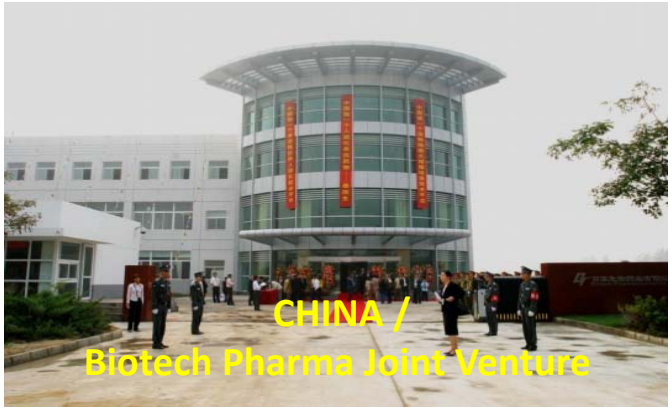
- Supplies 860 products for the National Health System
- 62 % of the List of Essential Medicines (499)
- Owns 893 product registries in 53 countries
- Exports to >50 countries
- Owns >180 invention patents
- Carries 393 Research-Development Projects
- Runs >120 clinical trials (59 in cancer) in 200 clinical sites

6 JOINT VENTURE COMPANIES ABROAD

- **Biotech Pharm, Beijing, China:** Monoclonal Antibodies and Therapeutic Cancer Vaccines.
- **ChangHeber, Changchung, China:** Recombinant Proteins.
- **Lukang-Heber, Shandong, China:** Biotech Products for agriculture.
- **Abinis, Thailand:** Monoclonal Antibodies.
- **Innocimab, Singapore:** Monoclonal Antibodies.
- **Innovative Immunother Alliances CUBA-USA**

iNNOCIMAb
Innovative Monoclonal Antibodies
www.innocimab.com

TECHNOLOGY TRANSFER
South – South Cooperation



today's tensions and conflicts are characterized lizations', than by larger groups feeling threatened and its end-users meant that might otherwise have been the

Cuba's biotech boom

The United States would do well to end restrictions on collaborations with the island nation's scientists.

For a week after Cuba marked the 50th anniversary of its revolution on 1 January, a celebratory 'Caravan of Liberty' carried 50 people, including many university students and scientists, along the triumphal route that Fidel Castro had taken half a century earlier. These people represented the health-care and educational systems of which Cubans are proud, however much they

Castro's interest in the fledgli with Randolph Lee Clark, the f Cancer Center in Houston, Tex to a lab in Finland to learn how cells. The knowledge gleaned fr an industry that developed th 1985, and subsequently a vacci B — the world's first human va

Unfortunately, Cuba's biote limitations of the top-down the Soviet Union fell apart ar

et.

s old; the regime will not last much d America's cold-war perspective on . In August, the state of Florida over- d researchers at its universities from the island. And President-elect Barack ess to talk to his country's enemies. uld be wise to start that conversation January inauguration as possible. The h, of course, and the advantages could s the global centre of biotech, and with s contiguous with Cuba's, the United ith which cross-fertilization of ideas

... Cuba marked the 50th anniversary of its revolution on 1 January, a celebratory 'Caravan of Liberty' carried 50 people ...

... These people represented the health-care and educational systems of which Cubans are proud, ...

... And in no small measure the scientists in the caravan symbolize the foundation of that health-care system in the developing world's most established biotechnology industry, which has grown rapidly even though it eschewed the venture-capital funding model that rich countries consider a prerequisite.

NATURE IMMUNOLOGY VOLUME 9 NUMBER 2 FEBRUARY 2008

Connecting immunology research to public health: Cuban biotechnology

Agustin Lage

The close connection between immunology and public health has been successful in reducing infant mortality and infectious diseases in Cuba. The next challenge is to find treatments for chronic diseases of adulthood and to extend

THE ENTERPRISES:

CENTER OF GENETIC ENG. & BIOTECHNOLOGY
1600 employees
Rec proteins & vaccines

CENTER OF MOLECULAR IMMUNOLOGY
1100 employees
Cancer Immunotherapy

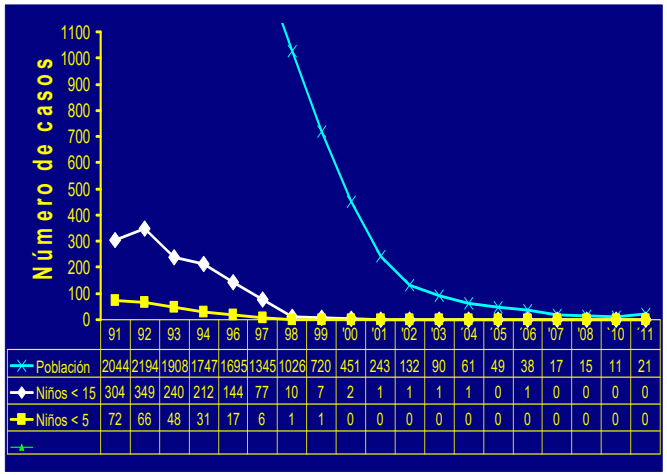
CENTER OF IMMUNOASSAYS
408 employees
Diagnostic Systems

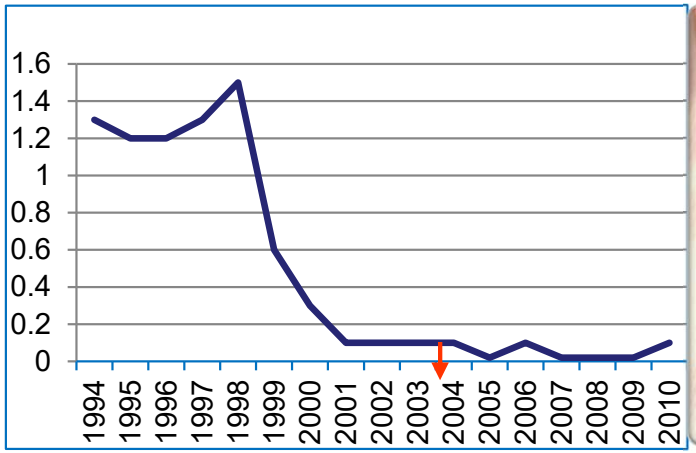
FINLAY INSTITUTE
1600 employees
Rec proteins & vaccines
Vaccines

NEUROSCIENCES CENTER
340 employees
Brain Research
Neuro-diagnostics

NATIONAL CTR OF SCIENTIFIC RESEARCH
552 employees
Natural products

SOME PRODUCTS:

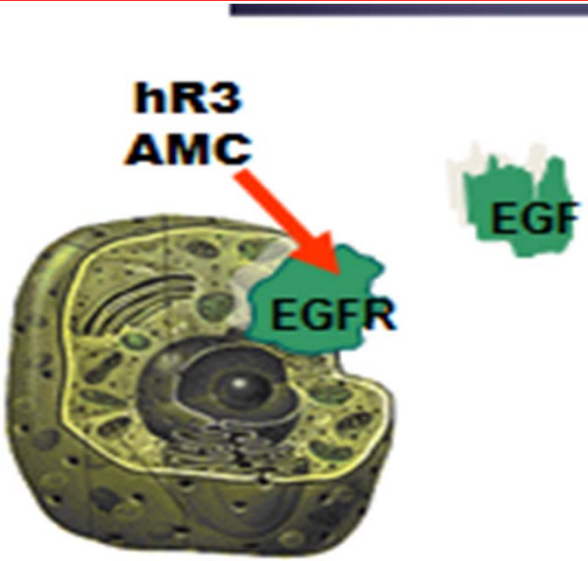


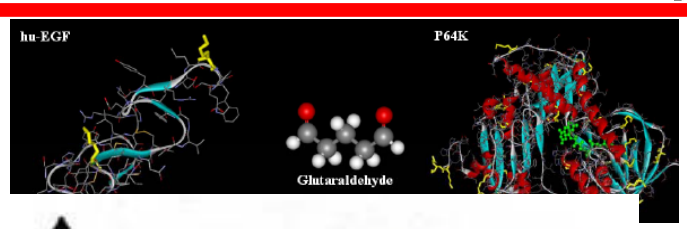


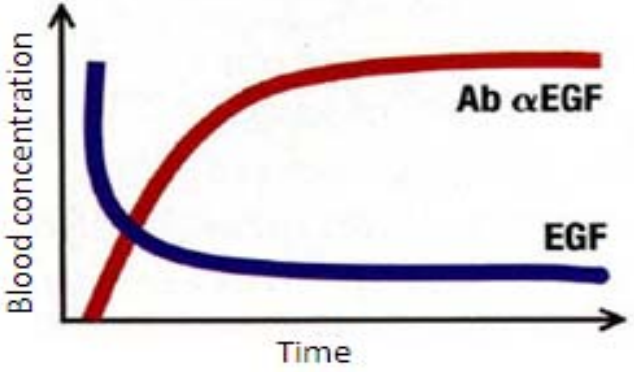
HEPATITIS-B RECOMB. VACCINE

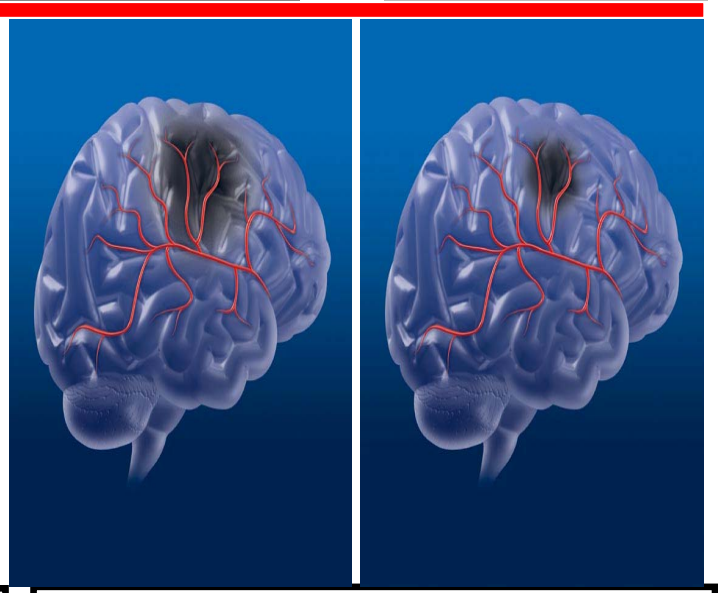
HAEMOPHILUS INFLUENZ SYNTHETIC VACCINE

HEBERPROT-Ulcers of the diabetic foot









NIMOTUZUMAB-Humanized anti-EGFR monoclonal Ab

CIMAVAX-Therapeutic vaccine for lung cancer

NEURO-EPOAtaxia and Alhzeimer disease

THE PRODUCTS:

Agricultural and Veterinary biotechnology

Gavac®

Vaccine against bovine ticks

Cunvac

Vaccine against Rabbit hemorrhagic disease

Porvac

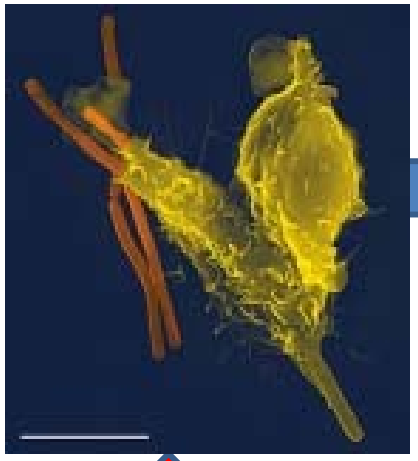
Vaccine against classical swine fever

Salvac

Vaccine against salmon sea lice

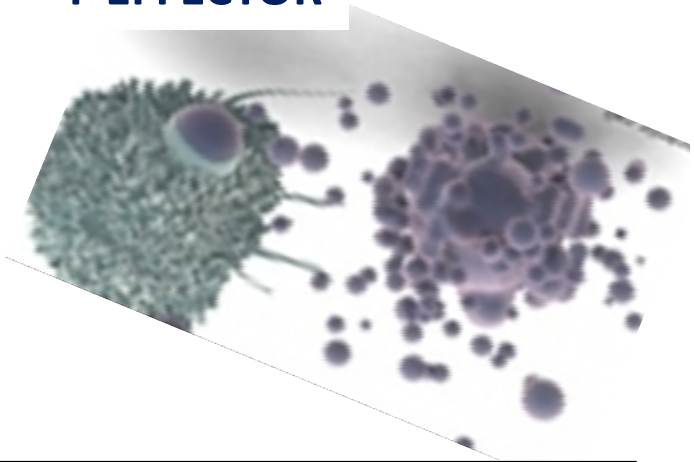
BIOTECHNOLOGY IS ABOUT SCIENCE

>300 PROJECTS----MUTEINS OF INTERLEUKIN-2

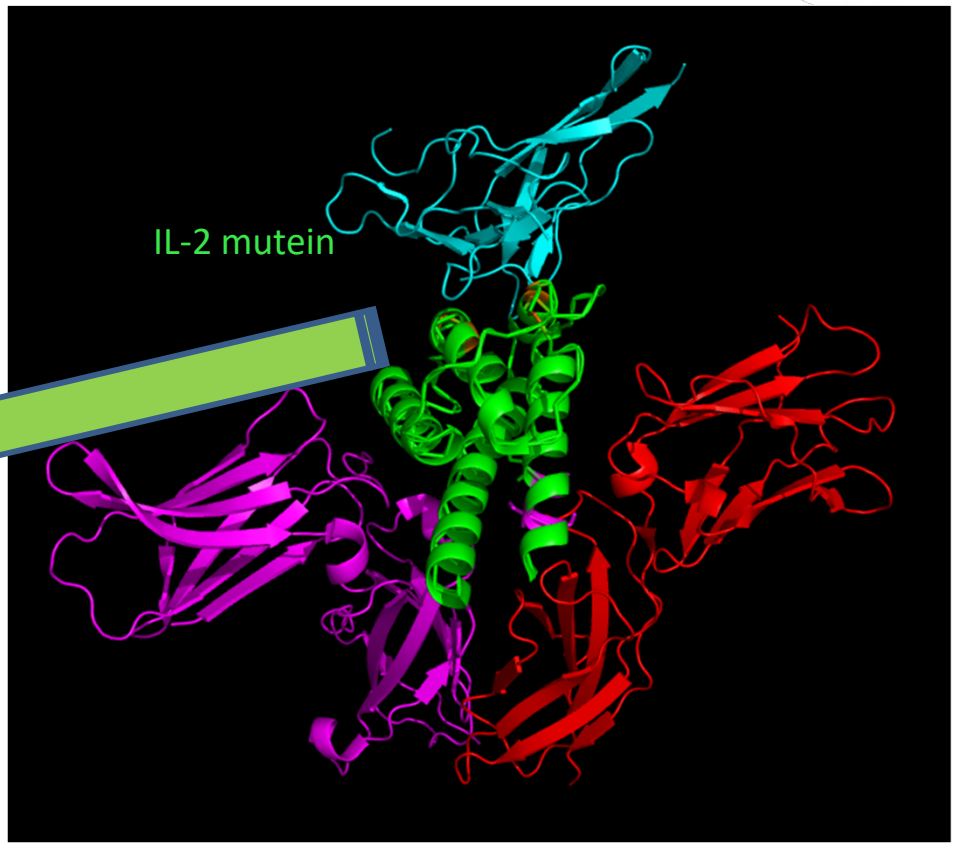


T-NAIVE

T-EFFECTOR



IL-2



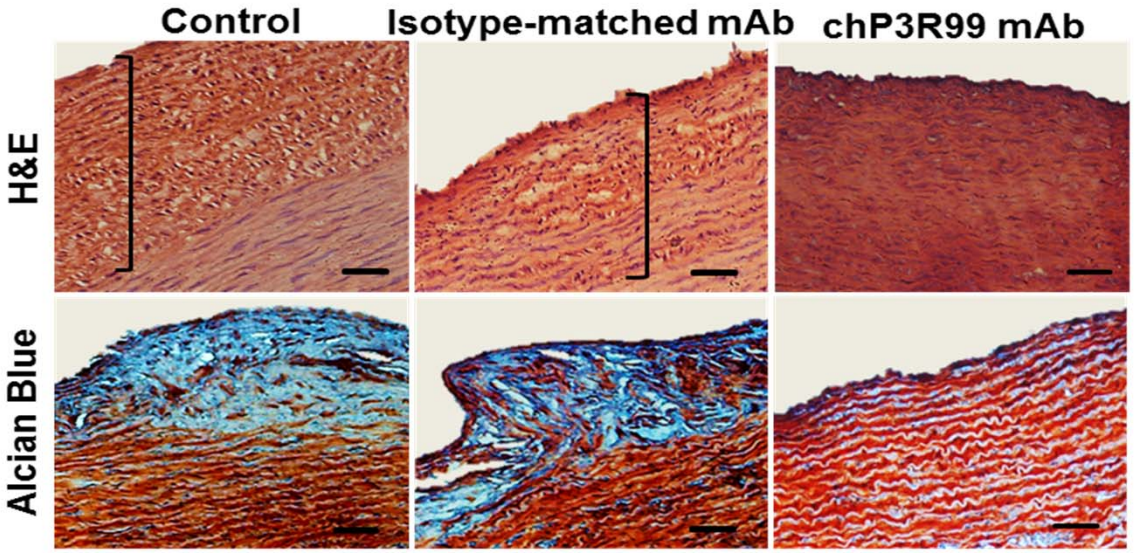
T-REGULATORY

BIOTECHNOLOGY IS ABOUT SCIENCE

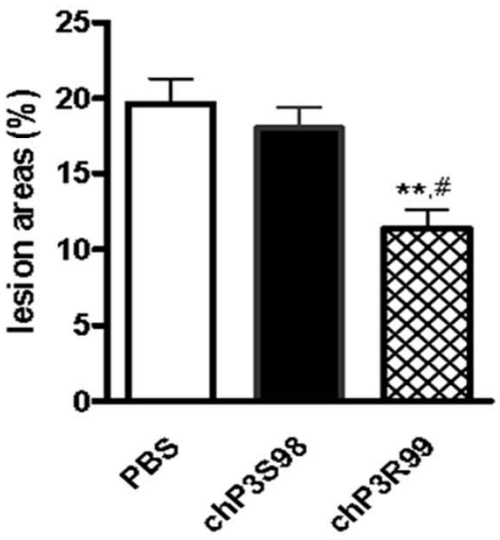
>300 PROJECTS---ANTI-GANGLIOSIDE Ab ATEROSCLEROSIS

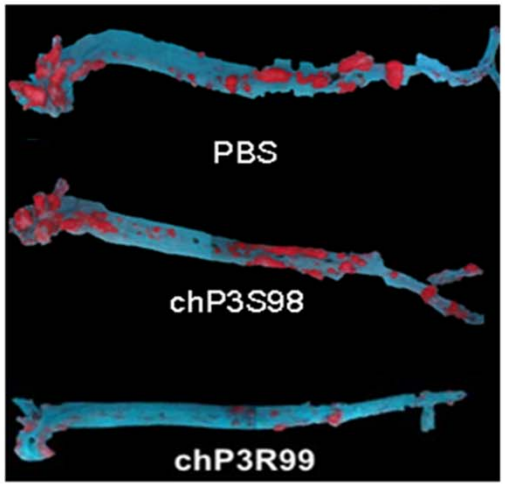
- ✓ Immunization with chP3R99 prevents atherosclerosis development in murine and rabbit models (Preventive setting)

(Soto et al. ATVB. 2012;32:595-604)



(Brito et al. ATVB.2012;32:2847-2854)





BIOTECHNOLOGY IS ABOUT SCIENCE

>300 PROJECTS---HSP PEPTIDE FOR AUTOIMMUNITY

- Peptide derived from Heat Shock Protein HSP60
- In animal models of RA it induces increase in CD4+CD25+FoxP3+ regulatory T lymphocytes
- Open label pilot clinical trial in 20 RA patients
- Reduced disease activity and MRI score
- Reduced IL 17 and IFN g

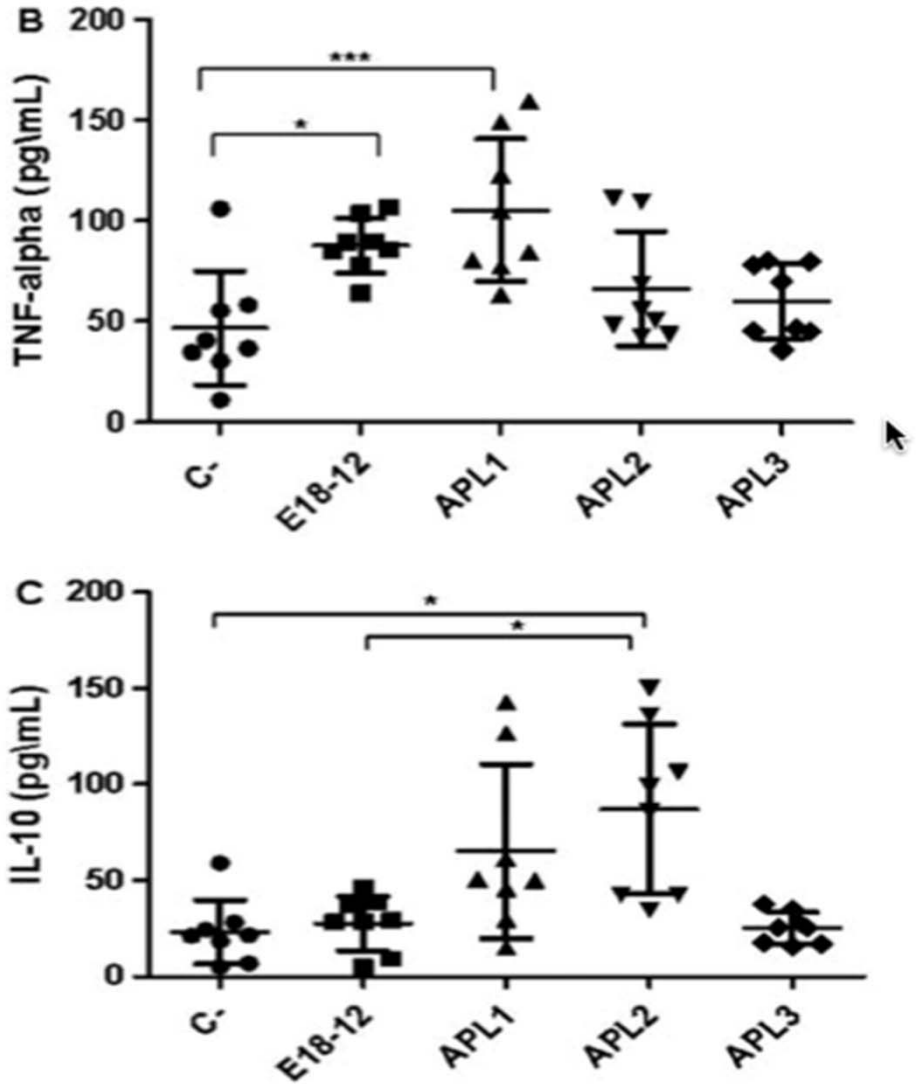
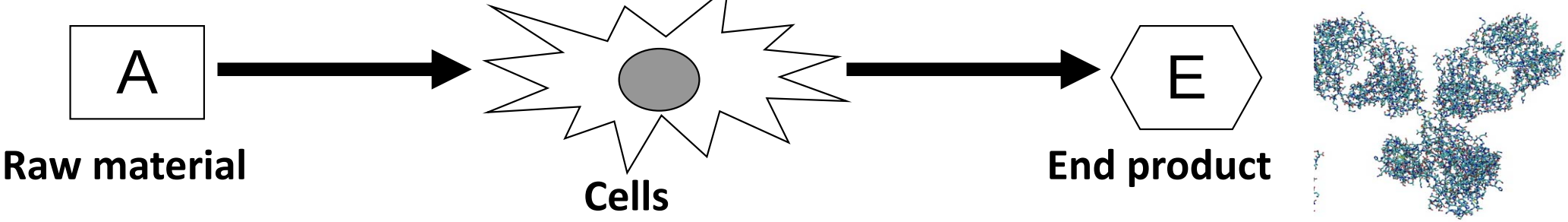


Figure 2. APL-2 increases IL-10 levels and suppresses IL-17 secretion in PBMC from RA patients. PBMC were stimulated with



BIOTECHNOLOGY TIMELINES: U.S.A. AND CUBA

1974	Recombinant DNA technol.
1977	First company **GENENTECH**
1982	First product INSULIN rec
1986	Rec-INTERFERON
1997	Monoclonal Antibody for cancer RITUXIMAB
2003	HUMAN GENOME MAPPING
2013	CANCER IMMUNOTHERAPY: BREAKTHROUGH OF THE YEAR

TODAY

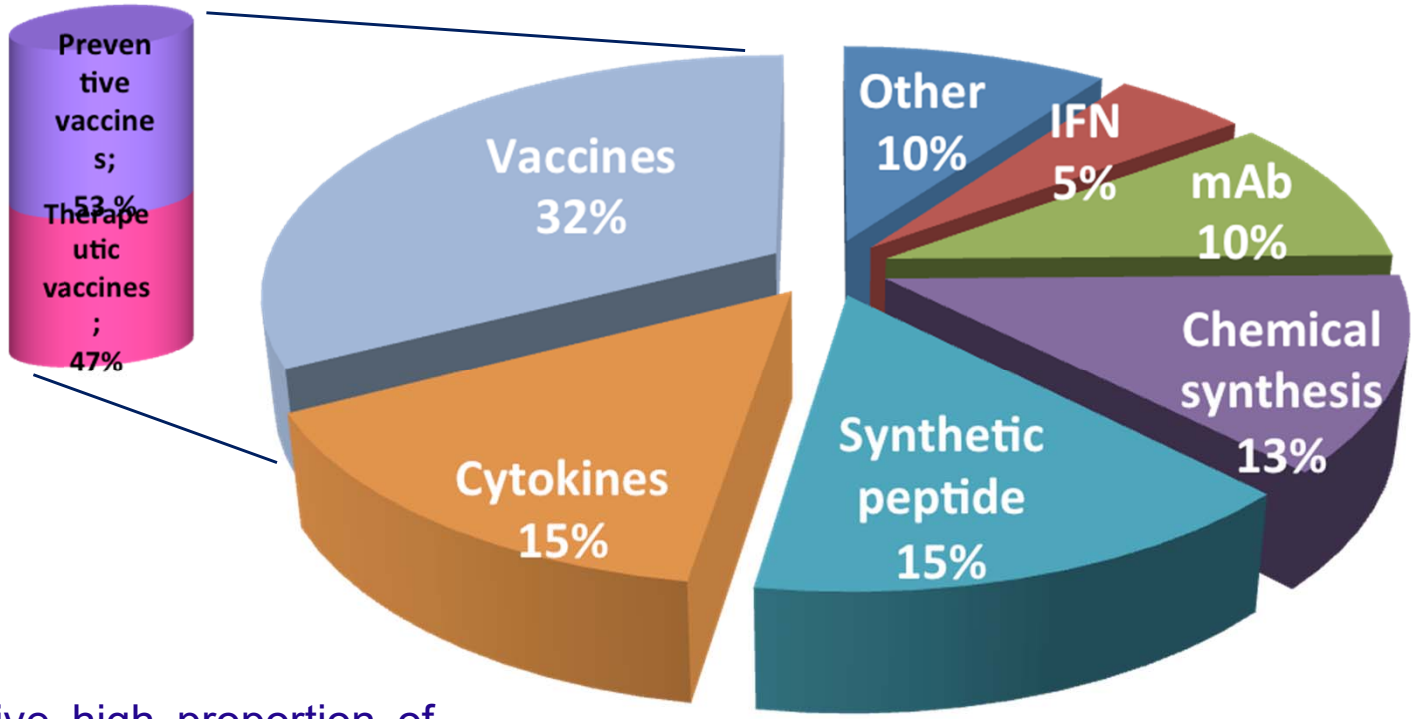
- 2519 Biotech companies
- 110 000 employees
- 261 products
- 93050 million revenues

1981	First organizacion CIB Leukocyte Interferon
1982	First Monoclonal Antibody IOR-T1
1986	Ctr. Genetic Engineering **CIGB**
1987	Rec-Interferon Meningitis B Vaccine
1992	**West Havana Scientific Pole**
1994	Ctr. Molecular Immunology **CIM**
2012	**BIOCUBAFARMA**

TODAY

- 32 Enterprises (Bio)
- 21 785 employees
- Products (182 patents)
- 4000 million revenues (exports to 50 countries)

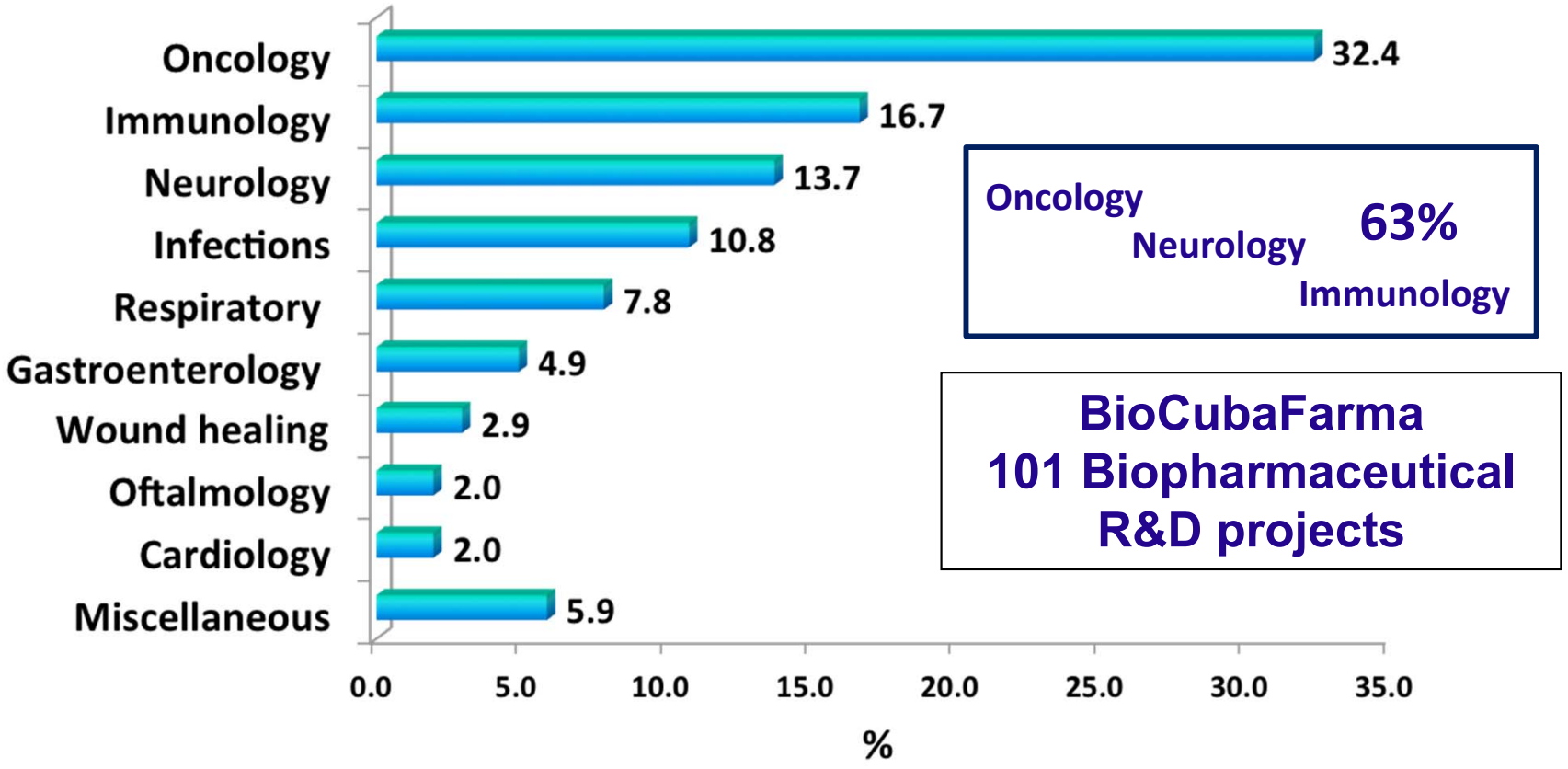
Biopharmaceutical R&D projects by product category



Relative high proportion of synthetic peptides and therapeutic vaccines

BioCubaFarma
101 Biopharmaceutical R&D projects

Biopharmaceutical R&D projects by therapeutic area

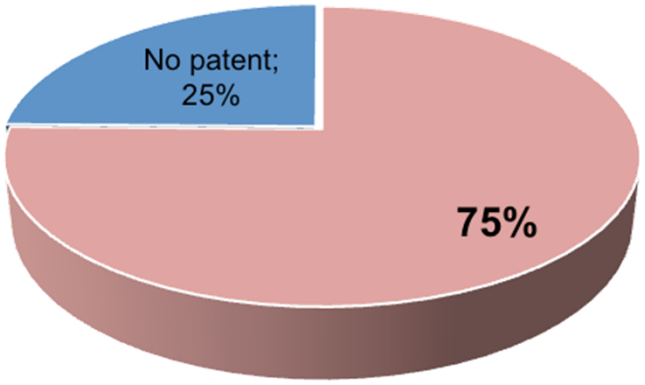


Oncology
Neurology
Immunology
63%

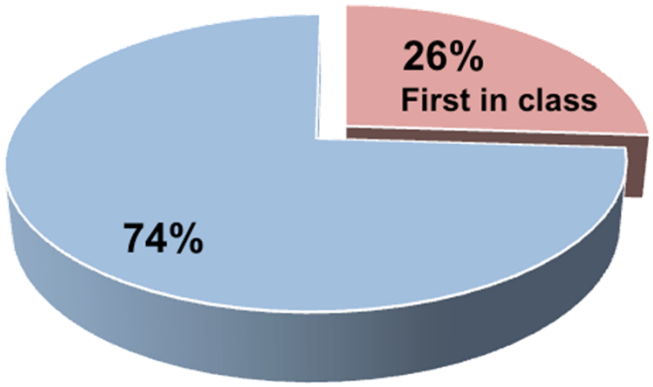
BioCubaFarma
101 Biopharmaceutical R&D projects

Biopharmaceutical R&D projects according to innovative capacity

101 R&D projects

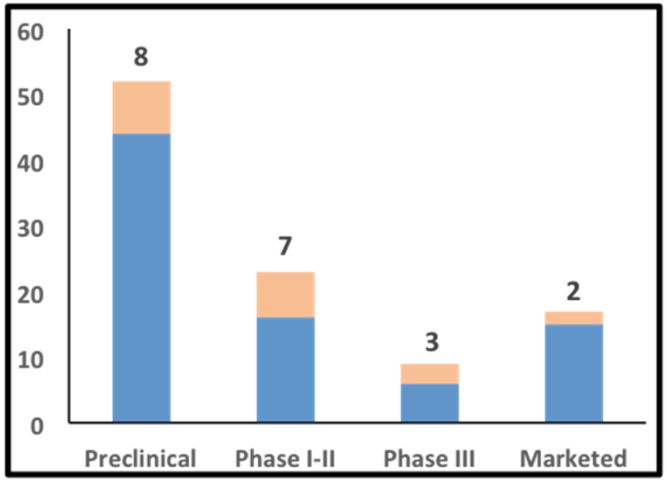


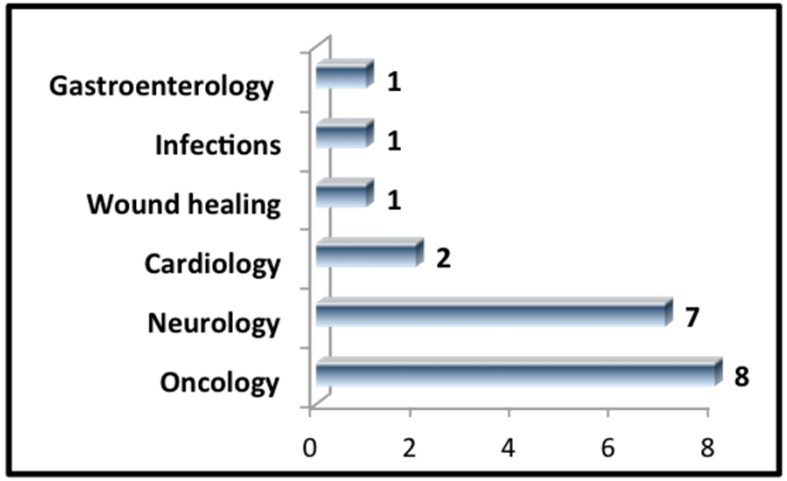
76 innovative R&D projects



26% of innovative projects are potentially first in class products

20 potentially first in class products





CUBA-U.S.A. POTENTIAL COOPERATION IN BIOTECHNOLOGY ¿COULD BE BUILD A "WIN-WIN" COOPERATION?

	DIFFERENCES	SIMILARITIES
U.S.A.	• Size of Economy • Available resources for medical services	• Structure of mortality • Aging population • Priority to biotechnology industry • Cancer products inside biotech
CUBA	• Structure of the health system • Patterns of medical care	

AAAS-ACC WORKSHOP ON THE FUTURE OF CUBA-USA COOPERATION (march 2023)

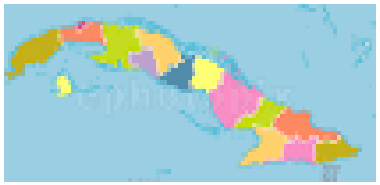
GETTING STARTED:
THE ROSWELL PARK –CIM COOPERATION PROJECT

1. CLINICAL TRIAL EXPERTISE (Validating clinical evidence)
2. STATE OF ART LAB. TECHNOLOGY
3. CONNECTIONS WITH U.S.A. PHARMA
4. INVESTMENT CAPACITY

1. INNOVATIVE PRODUCTS
2. INTELLECTUAL PROPERTY
3. PRODUCTS ALREADY WITH CLINICAL DATA
4. MANUFACTURING CAPACITY

CUBA-U.S.A. COOPERATION IN BIOTECHNOLOGY

THE WAY AHEAD



1. Reinforce and enlarge ongoing projects (CIM-RPCI and others)
2. Expand joint clinical trials
3. Promote technical exchange between regulatory authorities of both countries (FDA-CECMED)
4. Set up a program of joint scientific meetings
5. Lift barriers (embargo and others) for access of novel medicines in both directions
6. Explore options for U.S.A.-investment in joint-ventures in the “Mariel special zone”.
7. Explore the SPV concept.

and the results will follow……