NIH Extramural Support in Bacteriology Research

May 3, 2005

Biodefense Research Funding

- Mandated by Congress and Administration
- NIH received $1.5 Billion in 2003 for Biodefense research. These funds were added to the overall NIH budget and were not redirected from existing funds, which provided additional research opportunities for bacteriology and other areas.

Definition Used in the Search Strategy for Bacteriology Research Grants

- Bacterial molecular and cellular biology
- Genetics
- Genomics
- Proteomics
- Physiology and metabolism
- Pathogenesis
- Host-pathogen interactions

*The following terms are needed to capture grant applications that would have gone to MBC or BM study sections

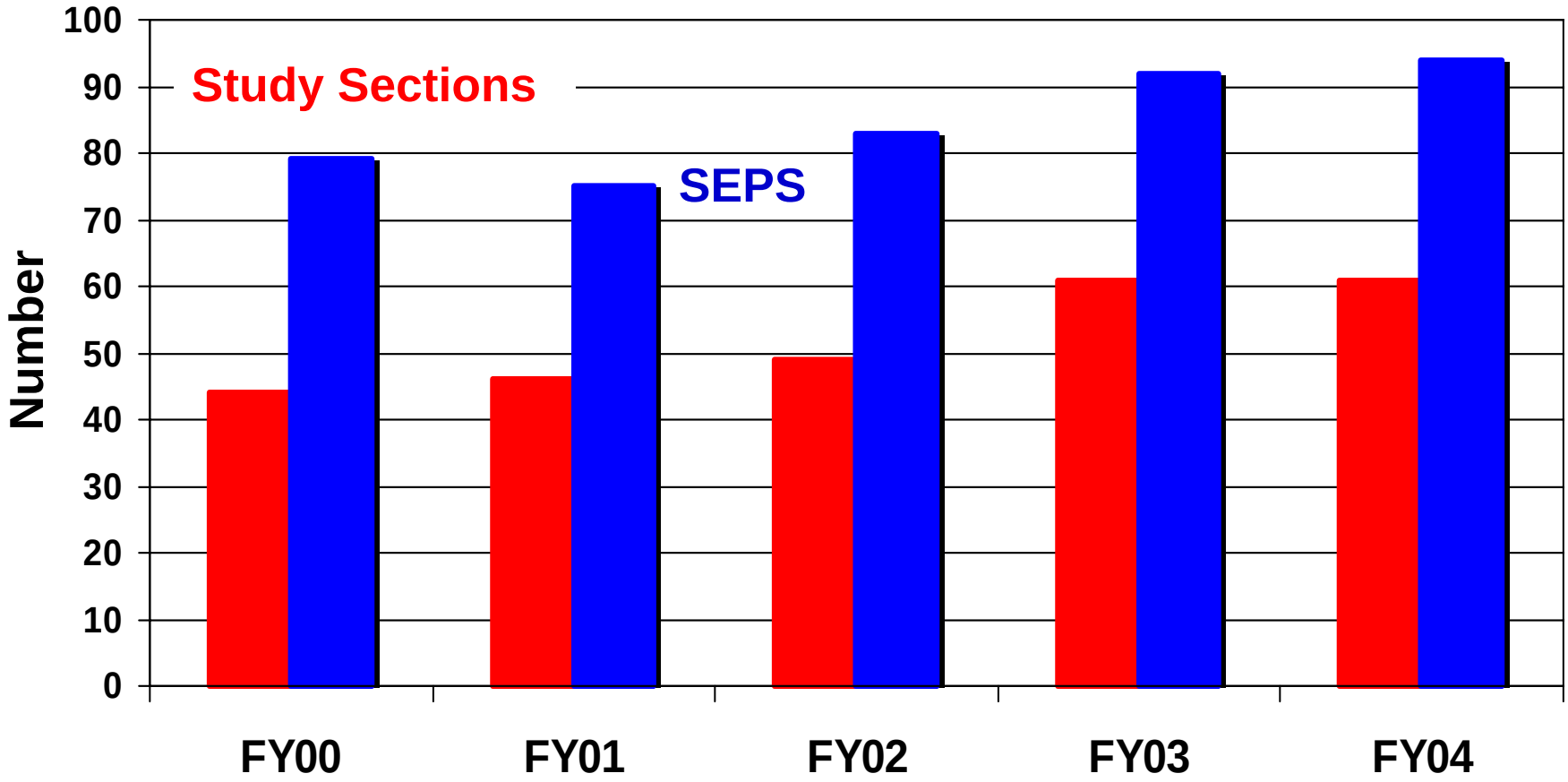
CRISP Search Terms

- bacterial capsule TN: 0367-8572
- bacteriolysis TN: 0370-1048
- bacterial genetics TN: 1258-9998
- bacterial protein TN: 2446-3500
- adhesin TN: 2446-3600
- flagellin TN: 2446-3700
- permease TN: 2447-8000
- pilin TN: 2446-3800
- bacterial DNA TN: 2101-9835
- bacterial RNA TN: 2102-2310
- bacterial pigment TN: 2328-3526
- bacteriorhodopsin TN: 2328-3889
- bactericidal immunity TN: 1553-5631
- antibacterial antibody TN: 1556-2329
- bacterial antigen TN: 1556-6948
- bacterial polysaccharide TN: 2378-9124
- lipopolysaccharide TN: 2379-0369
- peptidoglycan TN: 2237-8729
- teichoate TN: 2379-0733
- bacterial somatic antigen TN: 1557-0063
- flagellum antigen TN: 1556-9173
- bacteria characteristic TN: 4003-0005
- aerobic bacteria TN: 1928-6382
- anaerobic bacteria TN: 1928-6477
- bacteria infection mechanism TN: 4008-0012
- bacterial capsule TN: 0367-8572
- enteric bacteria TN: 0334-5176
- gram negative bacteria TN: 0339-5747
- Campylobacter TN: 5003-0006
- Francisella tularensis TN: 5002-0054
- gram positive bacteria TN: 0339-7620
- Listeria TN: 0334-3303
- oral bacteria TN: 1926-0132
- photosynthetic bacteria TN: 0349-1270
- Cyanophyta TN: 2340-9845
- sulfur metabolizing bacteria TN: 0355-9583
- bacterial vaccine TN: 3055-0503
- anthrax vaccine TN: 5003-0003
- cholera vaccine TN: 3055-6111
- dental caries vaccine TN: 3055-1440
- gonorrhea vaccine TN: 3055-6488
- Haemophilus influenzae vaccine TN: 3055-6866
- Neisseria meningitidis vaccine TN: 3055-7425
- pertussis vaccine TN: 3055-7984
- Salmonella vaccine TN: 3056-1733
- Shigella vaccine TN: 3056-5478
- Streptococcus vaccine TN: 3056-7447
- Streptococcus pneumoniae vaccine TN: 3055-9857
- trachoma vaccine TN: 3058-7952
- tuberculosis vaccine TN: 3057-1097
- Bacillus Calmette Guerin vaccine TN: 3055-2365
- bacterial toxicology TN: 2948-4979
- bacterial toxin TN: 1556-7171
- Anthrax toxin TN: 5004-0003
- bacteriocin TN: 0192-9190
- colicine TN: 0195-3539
- Clostridium perfringens epsilon toxin TN: 5002-0057
- endotoxin TN: 1556-8283
- enterotoxin TN: 1556-8432
- cholera toxin TN: 1556-7705
- shiga toxin TN: 5002-0060
- Staphylococcal enterotoxin TN: 1556-8581
- exotoxin TN: 1556-8728
- botulinum toxin TN: 1556-7393
- diphtheria toxin TN: 1556-7838
- staphylococcal exotoxin TN: 1557-1398
- streptokinase TN: 1557-1843
- tetanus toxin TN: 1557-2773
- flagellum antigen TN: 1556-9173
- pertussis toxin TN: 1556-9619
- bacterial disease TN: 0368-2318
- Actinomycetales infection TN: 0368-2354
- Leprosy TN: 0368-2390
- nocardiosis TN: 0368-2462
- tuberculosis TN: 0368-2498
- anthrax TN: 0368-2534
- bacterial cytopathogenic effect TN: 0368-2633
- bacterial food poisoning TN: 1178-5361
- botulism TN: 5000-0060
- Salmonella food poisoning TN: 1178-5818
- bacterial meningitis TN: 2042-5411
- bacterial pneumonia TN: 2596-5280
- mycoplasmal pneumonia TN: 2596-5678
- bacteriuria TN: 3045-9976
- chlamydial disease TN: 0638-2797
- inclusion conjunctivitis TN: 1114-8463
- Lymphogranuloma venereum TN: 0638-3112
- trachoma TN: 1115-1322
- clostridial infection TN: 0368-2583
- clostridial tetanus TN: 0368-2622
- diphtheria TN: 0368-2696
- Enterobacteriaceae disease TN: 0368-2705
- bacillary dysentery TN: 1248-4621
- Escherichia coli infection TN: 0368-2714
- Salmonella infection TN: 0368-2732
- Salmonella food poisoning TN: 1178-5818
- typhoid TN: 0368-2741
- Yersinia pestis disease TN: 0368-3331
- gonorrhea TN: 0368-2885
- latent bacterial disease TN: 0368-3011
- Legionellosis TN: 0368-3108
- Listeria infection TN:0368-3200
- Pertusis TN: 0368-3326
- Rickettsiales disease TN: 2623-6984
- ehrlichiosis TN: 4009-0003
- Q fever TN: 2623-7518
- Rocky Mountain spotted fever TN: 2623-7785
- typhus TN: 2623-8052
- septicemia TN: 5003-0039
- spirochetes disease TN: 0368-3335
- borreliosis TN: 0368-3338
- Lyme disease TN: 0368-3340
- Treponema infection TN: 0368-3344
- syphilis TN: 0368-3362
- yaws TN: 0368-3371
- Staphylococcus infection TN: 0368-3389
- toxic shock syndrome TN: 0368-3426
- Streptococcus infection TN: 0368-3452
- rheumatic fever TN: 0368-3578
- tularemia TN: 5000-0061
- vibriosis TN: 0368-4082
- cholera TN: 1248-3959
- bacterial endocarditis TN: 1393-3487
- antibacterial agent TN: 0715-1818
- aminoacridine TN: 0033-0116
- tetrahydroaminoacridine TN: 0033-0786
- antitubercular agent TN: 0715-4562
- ethambutol TN: 0118-9990
- isoniazid TN: 0316-4065
- kanamycin TN: 0191-8004
- p aminosalicylate TN: 2270-2522
- rifabutin TN: 4007-0110
- streptomycin TN: 0191-8943
- tubercidin TN: 0210-1974
- ciprofloxacin TN: 5004-0016
- dapsone TN: 2840-6854
- sulfanilamide TN: 2832-5379
- sulfamethoxazole TN: 2832-6127
- trimethoprim TN: 2517-6492
- antibiotic TN: 0189-5476
- aminoglycoside antibiotic TN: 0191-7378
- amphotericin B TN: 0191-9825
- gentamicin TN: 0191-7691
- kanamycin TN: 0191-8004
- neomycin TN: 0191-8317
- streptomycin TN: 0191-8943
- bacteriocin TN: 0192-9190
- colicine TN: 0195-3539
- beta lactam antibiotic TN: 0199-5177
- cephalosporin TN: 0199-6901
- penicillin TN: 0199-8025
- ampicillin TN: 0199-5608
- methicillin TN: 0199-7894
- chloramphenicol TN: 0194-6047
- chlorhexidine TN: 1357-0106
- defensin TN: 4007-0035

CRISP Terms (continued)

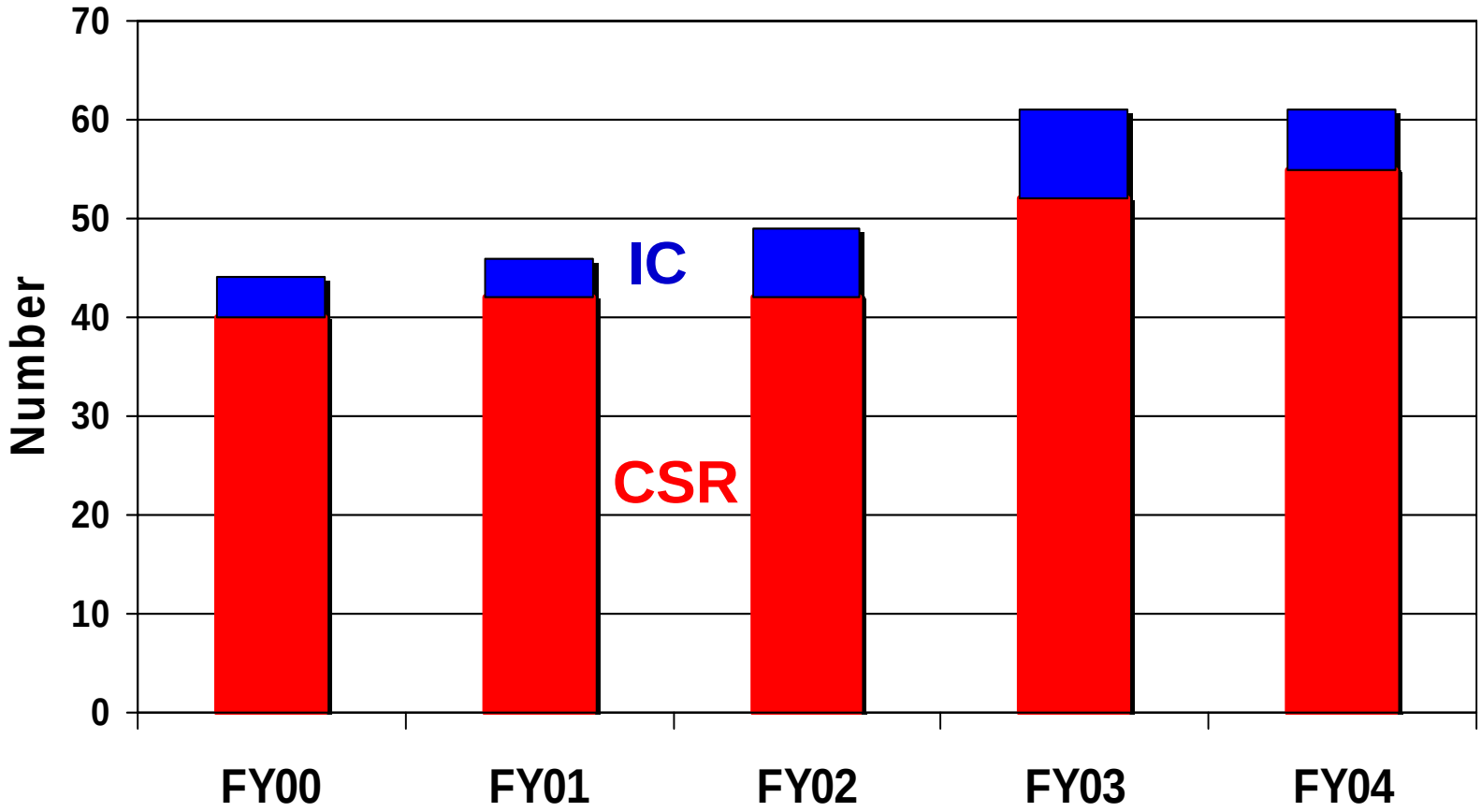
- gramicidin TN: 0198-5380
- ionomycin TN: 0198-9100
- macrolide antibiotic TN: 0200-5669
- azithromycin TN: 4006-0007
- clarithromycin TN: 4006-0025
- erythromycin TN: 0200-6292
- oligomycin TN: 0204-1570
- netropsin TN: 0202-8459
- novobiocin TN: 0203-4078
- rifamycin TN: 0206-9495
- ristocetin TN: 0207-1538
- tetracycline TN: 0209-5887
- vancomycin TN: 0210-3379
- bacteria TN: 0321-0322
- Actinomycetales TN: 0321-9782
- Actinomyces TN: 0321-9879
- Corynebacterium TN: 0333-5811
- Corynebacterium diphtheriae TN: 0333-7684
- Mycobacterium TN: 0322-0461
- Mycobacterium avium TN: 0322-0491
- Mycobacterium bovis TN: 0321-9976
- Mycobacterium intracellulare TN: 0322-0521
- Mycobacterium leprae TN: 0322-0558
- Mycobacterium smegmatis TN: 0322-0849
- Mycobacterium tuberculosis TN: 0322-0946
- Nocardiaceae TN: 5004-0060
- Streptomyces TN: 0322-1237
- Agrobacterium TN: 0354-7460
- Agrobacterium tumefaciens TN: 0354-9333
- Azotobacter TN: 0322-3431
- Azotobacter vinelandii TN: 0322-5304
- Bacillaceae TN: 0322-7177
- Bacillus TN: 0323-0923
- Bacillus anthracis TN: 5002-0049
- Bacillus cereus TN: 0323-8415
- Bacillus megaterium TN: 0324-4034
- Bacillus stearothermophilus TN: 0324-7780
- Bacillus subtilis TN: 0325-1526
- Clostridium TN: 0325-3399
- Clostridium botulinum TN: 5002-0052
- Clostridium difficile TN: 4003-0009
- Clostridium perfringens TN: 5004-0018
- Bacteroidaceae TN: 0326-8383
- Bacteroides TN: 0327-0256
- Bacteroides gingivalis TN: 0327-1196
- Brucellaceae TN: 0328-2480
- Bordetella pertussis TN: 0328-8986
- Brucella TN: 5002-0050
- Brucella abortus TN: 0329-2732
- Capnocytophaga TN: 0347-7186
- Caulobacter TN: 0350-6254
- Chlamydiaceae TN: 0638-0313
- Chlamydia trachomatis TN: 0638-2187
- Chlamydophila psittaci TN: 0638-1250
- coryneform bacteria TN: 0333-2065
- Corynebacterium TN: 0333-5811
- Corynebacterium diphtheriae TN: 0333-7684
- Listeria TN: 0334-3303
- Coxiella burnetii TN: 5002-0053
- Desulfovibrio TN: 0351-3746
- Enterobacteriaceae TN: 0334-8922
- Escherichia TN: 0335-8547
- Escherichia coli TN: 0336-0160
- Escherichia coli 0157:H7 TN: 5000-0068
- Escherichia coli k12 TN: 0336-2033
- Klebsiella TN: 0336-5779
- Klebsiella pneumoniae TN: 0336-7652
- Proteus TN: 0337-1398
- Salmonella TN: 0337-3271
- Salmonella typhi TN: 0337-8890
- Salmonella typhimurium TN: 0338-0763
- Serratia TN: 0338-4509
- Serratia marcescens TN: 0338-6382
- Shigella TN: 0338-8855
- Shigella dysenteriae TN: 0339-0128
- Yersinia TN: 5004-0084
- Yersinia pestis TN: 0339-1065
- Enterococcus TN: 0355-5898
- Flavobacteriaceae TN: 0321-7812
- Francisella tularensis TN: 5002-0054
- Fusobacterium TN: 0327-4002
- Fusobacterium nucleatum TN: 4000-0188
- Halobacteriaceae TN: 0339-8556
- Helicobacter TN: 4001-0063
- Lactobacillaceae TN: 0340-6985
- Lactobacillus TN: 0341-0731
- Lactobacillus casei TN: 0341-4477
- Legionella TN: 0339-6060
- Methanobacteriaceae TN: 0345-0064
- Micrococcaceae TN: 0345-1937
- Micrococcus TN: 0345-5683
- Staphylococcus TN: 0346-1302
- Staphylococcus aureus TN: 0346-3175
- Staphylococcus epidermidis TN: 0346-5048
- Mycoplasmatales TN: 0347-0667
- Mycoplasma TN: 0347-2540
- Mycoplasma genitalium TN: 5004-0053
- Mycoplasma pneumoniae TN: 0347-4413
- Myxococcales TN: 0347-6286
- Myxococcus TN: 0347-8159
- Neisseriaceae TN: 0348-1905
- Moraxella TN: 0348-3312
- Neisseria gonorrhoeae TN: 0348-6567
- Neisseria meningitidis TN: 0348-7524
- Pasteurellaceae TN: 4001-0102
- Actinobacillus TN: 0339-5904
- Actinobacillus actinomycetemcomitans TN: 4000-0106
- Haemophilus TN: 0330-3970
- Haemophilus ducreyi TN: 5004-0037
- Haemophilus influenzae TN: 0330-5843
- Pasteurella TN: 0331-1462
- Pasteurella multocida TN: 0331-5208
- Propionibacteriaceae TN: 0349-5016
- Propionibacterium TN: 0349-8762
- Pseudomonadaceae TN: 0350-2508
- Burkholderia TN: 5002-0051
- Pseudomonas TN: 0352-1238
- Pseudomonas aeruginosa TN: 0352-3115
- Rhizobiaceae TN: 0355-1206
- Agrobacterium TN: 0354-7460
- Agrobacterium tumefaciens TN: 0354-9333
- Rhodopseudomonas TN: 0355-2458
- Rhodospirillales TN: 0355-1519
- Rhodospirillum TN: 0355-2771
- Rickettsiales TN: 2624-0730
- Ehrlichia TN: 4009-0004
- Rickettsia TN: 2624-8135
- Bartonella TN: 5004-0009
- Rickettsia prowazekii TN: 2624-8847
- Rickettsia rickettsii TN: 5002-0055
- Spirochaetales TN: 0355-3081
- Borrelia TN: 0355-3200
- Leptospira TN: 5004-0046
- Treponema TN: 0355-4020
- Treponema pallidum TN: 0355-4333
- Streptococcus TN: 0355-5585
- Streptococcus agalactiae TN: 0355-7453
- Streptococcus lactis TN: 0355-6211
- Streptococcus mitis TN: 0355-8245
- Streptococcus mutans TN: 0355-8331
- Streptococcus pneumoniae TN: 0355-8644
- Streptococcus pyogenes TN: 0355-6514
- Streptococcus salivarius TN: 0355-8957
- Streptococcus sanguis TN: 0355-9270
- Vibrionaceae TN: 4004-0009
- Vibrio TN: 0353-4349
- Vibrio cholerae TN: 0353-6222
- Cyanophyta TN: 2340-9845

Number of NIH Study Sections or Special Emphasis Panels (SEPS) that Reviewed Awarded Bacteriology Projects



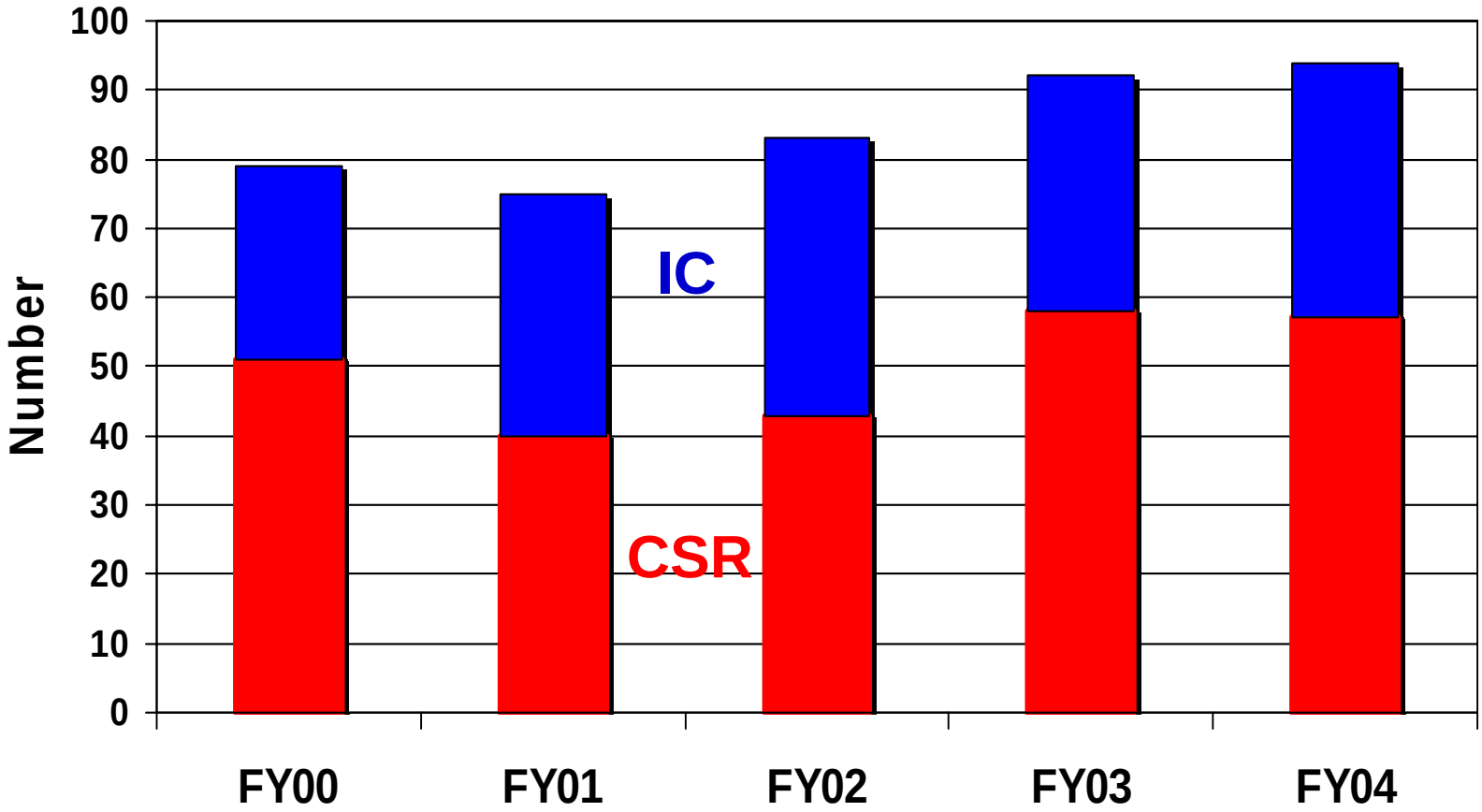
Source: IMPAC2
Includes Competing Research Project Grants

Number of CSR and IC Study Sections that Reviewed Awarded Bacteriology Projects



Source: IMPAC2
Includes Competing Research Project Grants

Number of CSR and IC Special Emphasis Panels that Reviewed Awarded Bacteriology Projects



Source: IMPAC2
Includes Competing Research Project Grants

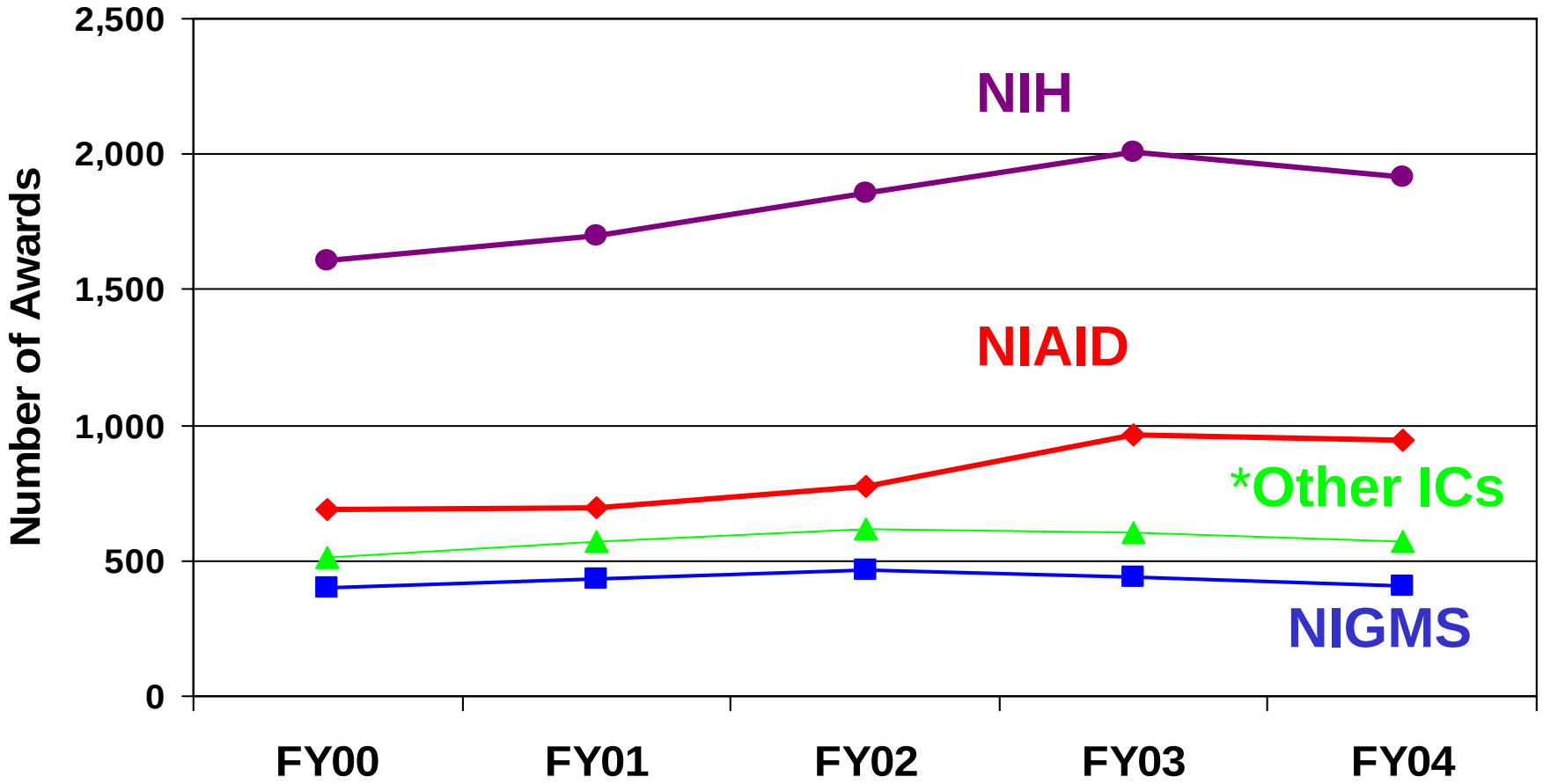
Search Strategy Based on:

- Analysis of CRISP primary indexing terms on awards reviewed by NIH study sections from FY 2000-2004
- Analysis captures time period before and after FY 2003 biodefense funding increase
- Analysis tools used could not be applied to data prior to FY 2000

CRISP = Computer Retrieval of Information on Scientific Projects

NIH Support in Bacteriology Research

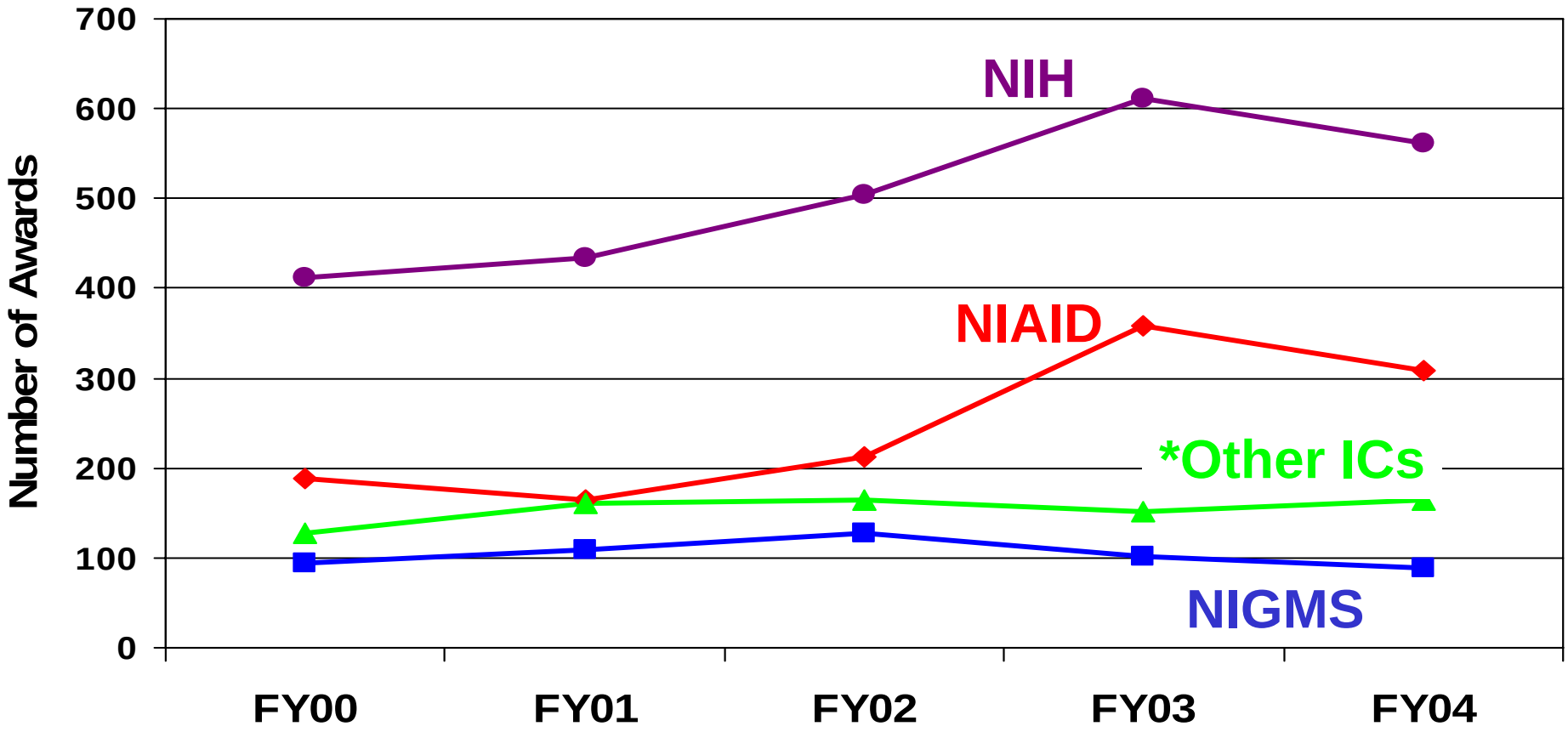
Research Project Grants
Competing and NonCompeting Awards



•Other ICs include:
NIAAA,NIA,NIAMSNCCAM,NCI,NIDA,NIDCD,NIDCR,NIDDK,NIBIB,NIEHSNEI,NICHD,NHLBI,NIMH,NINR,NINDS,NCRR,FIC
Source: IMPAC2
Research Project Grants included the following Activities from FY00/04: P01, P42, R01, R03, R15, R21, R37, R55, U01, U19, and UC1

NIH Support in Bacteriology Research

Competing Research Project Grants



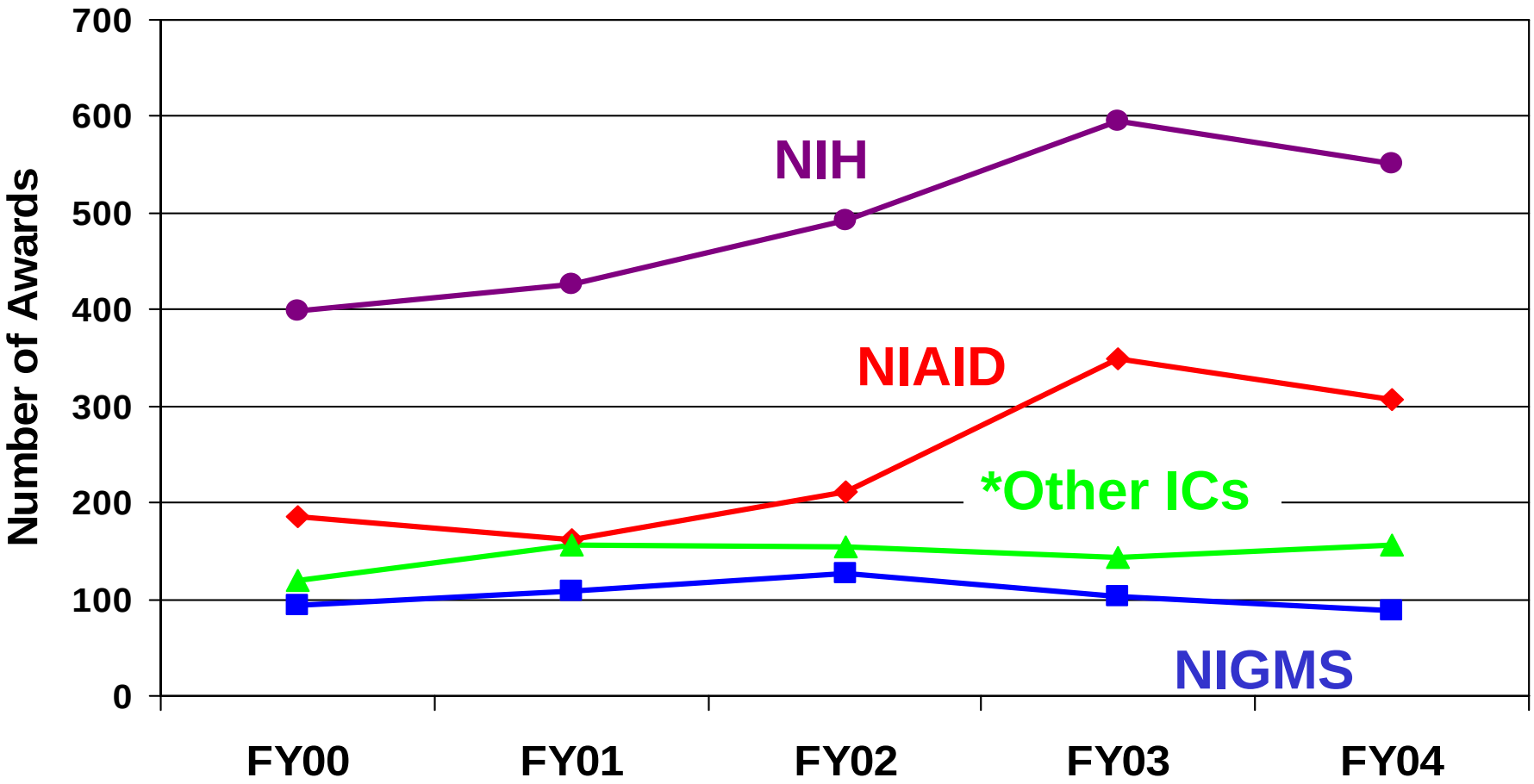
*Other ICs include:
NIAAA,NIA,NIAMSNCCAM,NCI,NIDA,NIDCD,NIDCR,NIDDK,NIBIB,NIEHSNEI,NICHD,NHLBI,NIMH,NINR,NINDS,NCRR,FIC Source: IMPAC2

Research Project Grants included the following Activities from FY00/04: P01, P42, R01, R03, R15, R21, R37, R55, U01, U19, and UC1

NIH Support in Bacteriology Research

Excluding Clinical Trials

Competing Research Project Grants



*Other ICs include:

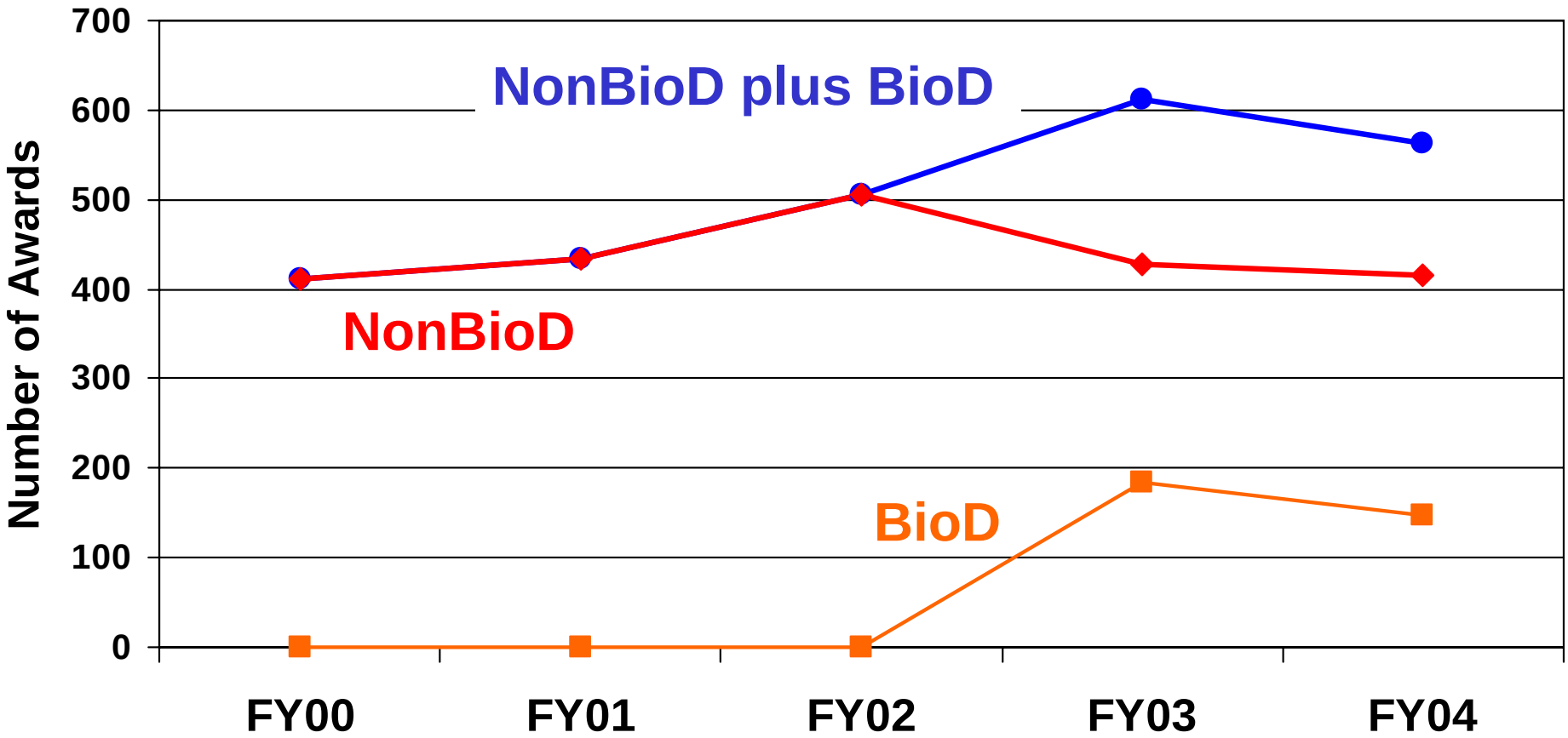
NIAAA,NIA,NIAMSNCCAM,NCI,NIDA,NIDCD,NIDCR,NIDDK,NIBIB,NIEHSNEI,NICHD,NHLBI,NIMH,NINR,NINDS,NCRR,FIC

Source: IMPAC2

Research Project Grants included the following Activities from FY00/04: P01, P42, R01, R03, R15, R21, R37, R55, U01, U19, and UC1

NIH Support in Bacteriology Research

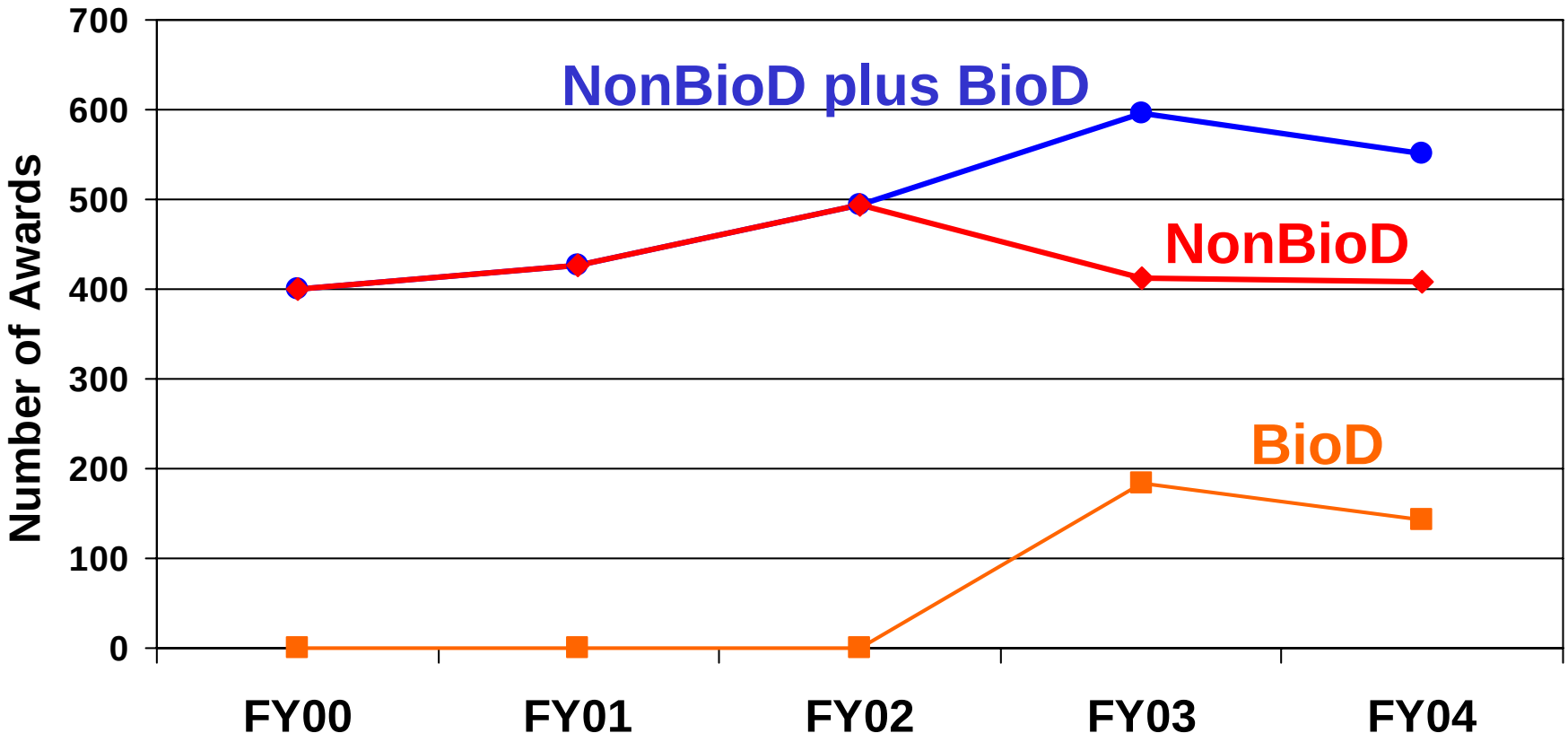
Competing Research Project Grants
Biodefense and Non-Biodefense Awards



Source: IMPAC2
Research Project Grants included the following Activities from FY00/04: P01, P42, R01, R03, R15, R21, R37, R55, U01, U19, and UC1

NIH Support in Bacteriology Research

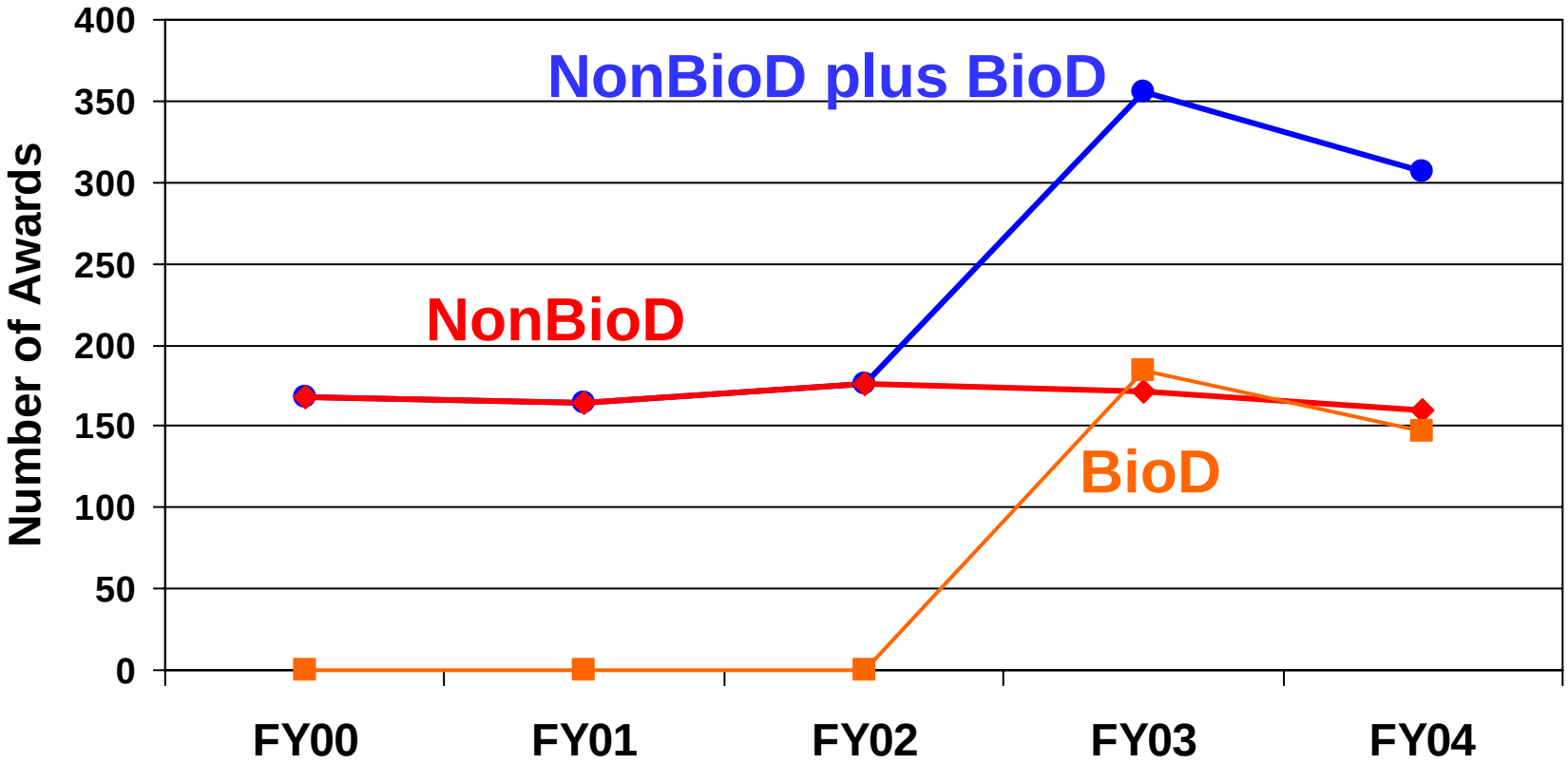
Excluding Clinical Trials
Competing Research Project Grants
Biodefense and Non-Biodefense Awards



Source: IMPAC2
Research Project Grants included the following Activities from FY00/04: P01, P42, R01, R03, R15, R21, R37, R55, U01, U19, and UC1

NIAID Support in Bacteriology Research

Competing Research Project Grants
Biodefense and Non-Biodefense Awards



Source: IMPAC2 and NIAID
Research Project Grants included the following Activities from FY00/04: P01, P42, R01, R03, R15, R21, R37, R55, U01, U19, and UC1

CSR, in Collaboration with Scientific Community, Restructured the Peer Review of Bacterial Research

Prior to FY 05

1. **Bacterial and Mycology (BM)**
2. **Microbial Physiology and Genetics (MBC) Initial Review Groups (IRGs).**

Fall of FY 05

1. **Prokaryotic Cell and Molecular Biology [PCMB]**
2. **Bacterial Pathogenesis [BACP]**
3. **Host Interactions with Bacterial Pathogens [HIBP]**
4. **Pathogenic Eukaryotes [PTHE]**
5. **Clinical Research and Field Studies of Infectious Diseases [CRFS]**
6. **Drug Discovery and Mechanisms of Antimicrobial Resistance [DDR]**
7. **Vector Biology [VB]**
8. **Bacterial Diseases, Food Safety and General Microbiology [IDM]**
9. **Bacterial Biodefense Agents [IDM]**

Summary

- Changes in bacterial research led to a restructuring of how the research is reviewed by CSR
- New monies mandated for biodefense has resulted in an increase in both the number of scientists and basic and clinical bacteriology research projects
- End of doubling of NIH budget has resulted in declines in number of grants funded in bacterial research and across NIH
- What are the scientific gaps or opportunities in bacteriology research?

Additional Backup Slides for Discussion

Applications Reviewed and Awards MBC1, MBC2 and their SEPs

Peer Review Groups - MBC1, MBC2 and their SEPs

FY	2000	2001	2002	2003	2004
Total Applications Reviewed	371	285	259	379	387
Applications Reviewed by MBC1&2	271	262	225	195	203
Applications Reviewed by SEPs of MBC	100	23	34	184	184
Total Grants Awarded	119	97	106	131	86
Grants Reviewed by MBC1&2	90	83	82	67	41
Grants Reviewed by SEPs of MBC	29	14	24	64	45
Awarded by:					
NIAID	25	20	22	26	20
NIGMS	83	72	80	84	65
Other Institutes	11	5	4	21	1

Source: IMPAC2

Applications Reviewed and Awards
BM1, BM2 and their SEPs

Peer Review Groups - BM1, BM2 and their SEPs

FY	2000	2001	2002	2003	2004
Total Applications Reviewed	505	500	482	594	595
Applications Reviewed by BM1 and BM 2	452	478	443	256	309
Applications Reviewed by SEPs of BM1 and BM 2	53	22	39	338	286
Total Grants Awarded	157	158	158	210	156
Grants Reviewed by BM1 and BM 2	132	145	143	77	78
Grants Reviewed by SEPs of BM1 and BM 2	25	13	15	133	78
Awarded by:					
NIAID	133	125	134	189	134
NIGMS	11	10	7	3	6
Other Institutes	13	23	17	18	16

Source: IMPAC2

NIAID Category A-C Priority Pathogens

- Research on these pathogens funded with NIAID Biodefense dollars

Category A

- Bacillus anthracis (anthrax)
- Clostridium botulinum
- Yersinia pestis
- Variola major (smallpox) and other pox viruses
- Francisella tularensis (tularemia)
- Viral hemorrhagic fevers
  - Arenaviruses
    - LCM, Junin virus, Machupo virus, Guanarito virus
    - Lassa Fever
  - Bunyaviruses
    - Hantaviruses
    - Rift Valley Fever
  - Flaviruses
    - Dengue
  - Filoviruses
    - Ebola
    - Marburg

Category C Emerging infectious disease threats such as Nipah virus and additional hantaviruses.

NIAID priority areas:

- Tickborne hemorrhagic fever viruses
  - Crimean-Congo Hemorrhagic fever virus
- Tickborne encephalitis viruses
- Yellow fever
- Multi-drug resistant TB
- Influenza
- Other Rickettsias
- Rabies
- Severe acute respiratory syndrome-associated coronavirus (SARS-CoV)
  (Note: SARS-CoV added August 30, 2004)

Category B

- Burkholderia pseudomallei
- Coxiella burnetii (Q fever)
- Brucella species (brucellosis)
- Burkholderia mallei (glanders)
- Ricin toxin (from Ricinus communis)
- Epsilon toxin of Clostridium perfringens
- Staphylococcus enterotoxin B
- Typhus fever (Rickettsia prowazekii)
- Food and Waterborne Pathogens
  - Bacteria
    - Diarrheagenic E.coli
    - Pathogenic Vibrios
    - Shigella species
    - Salmonella
    - Listeria monocytogenes
    - Campylobacter jejuni
    - Yersinia enterocolitica)
  - Viruses (Caliciviruses, Hepatitis A)
  - Protozoa
    - Cryptosporidium parvum
    - Cyclospora cayatanensis
    - Giardia lamblia
    - Entamoeba histolytica
    - Toxoplasma
    - Microsporidia
- Additional viral encephalitides
  - West Nile Virus
  - LaCrosse
  - California encephalitis
  - VEE
  - EEE
  - WEE
  - Japanese Encephalitis Virus
  - Kyasanur Forest Virus