CENTRE HOSPITALIER UNIVERSITAIRE DE NANTES

CENTRES DE RÉFÉRENCE POUR LES INFECTIONS OSTÉO-ARTICULAIRES COMPLEXES DU GRAND OUEST
CRIOGO

CRCINA
Centre de Recherche en Cancérologie et Immunologie Nantes Angers

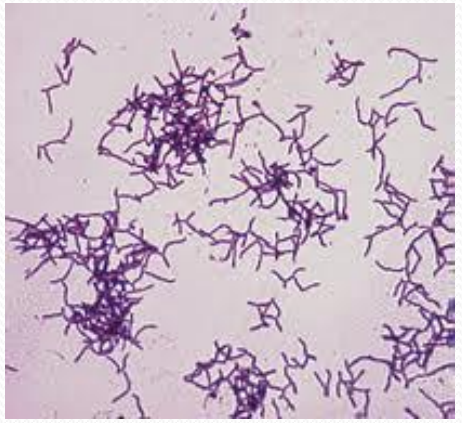
UNIVERSITÉ DE NANTES

Cutibacterium acnes et infection de prothèse d'épaule

Stéphane CORVEC, Service de Bactériologie-Hygiène hospitalière, CHU de Nantes

Cutibacterium acnes, un coupable idéal ? !

- **Bacille Gram +, anaérobie aérotolérant**
- **Pousse en culture lente**
- **Commensale peau et muqueuse buccale**
- **Pathogène opportuniste : infection ostéo-articulaire (+/- sur matériel), ophtalmique, dentaire, valves cardiaques.**



Propionibacterium acnes, an emerging pathogen: From acne to implant-infections, from phylotype to resistance

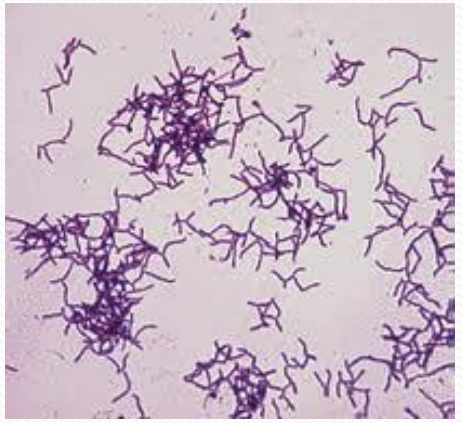
Propionibacterium acnes, *un pathogène émergent : de l'acné aux infections sur matériel, du phylotype à la résistance*

G.G. Aubin [a,b], M.E. Portillo [c], A. Trampuz [d], S. Corvec [a,*,b]

Aubin *et al*, MMI 2014, Portillo *et al* Biomed Res Inter 2013, Achermann *et al*, CMR 2014

Cutibacterium acnes, un coupable idéal ? !

- Bacille Gram +, anaérobie aérotolérant
- Pousse en culture lente
- Commensale peau et muqueuse buccale
- Pathogène opportuniste : infection ostéo-articulaire (+/- sur matériel), ophtalmique, dentaire, valves cardiaques.



Propionibacterium acnes, an emerging pathogen: From acne to implant-infections, from phylotype to resistance

Propionibacterium acnes, *un pathogène émergent : de l'acné aux infections sur matériel, du phylotype à la résistance*

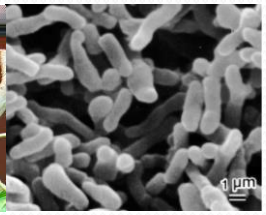
G.G. Aubin [a,b], M.E. Portillo [c], A. Trampuz [d], S. Corvec [a,*,b]

- **Trop souvent considéré comme un contaminant**
- **Différences en termes de métabolisme, d'antigénicité…**

Aubin *et al*, MMI 2014, Portillo *et al* Biomed Res Inter 2013, Achermann *et al*, CMR 2014

Propionibacterium ou *Cutibacterium acnes* ?

P. acnes, une bactérie caméléon !!

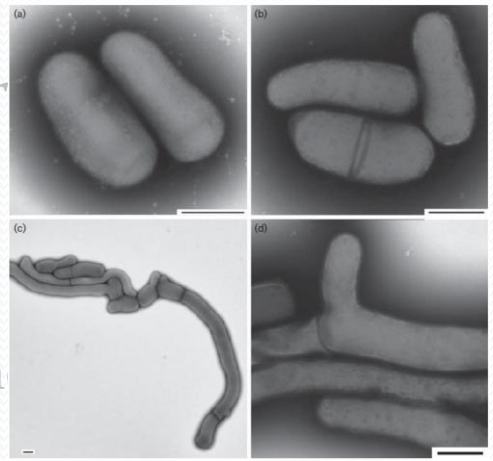


- ✓ **Première description Orla-Jensen 1909 (acné vulgaire) !**
- ✓ **Modification de genre *Bacillus* puis *Corynebacterium*…**
- ✓ **1946 Douglas & Hunter *Propionibacterium***

Propionibacterium ou *Cutibacterium acnes* ?

P. acnes, une bactérie caméléon !!

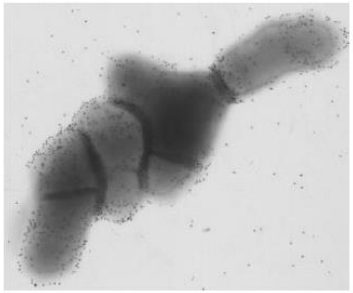
- ✓ Première description Orla-Jensen 1909 ! acné vulgaire
- ✓ Modification de genre *Bacillus* puis *Corynebacter*
- ✓ 1946 Douglas & Hunter *Propionibacterium*
- ✓ 2015-2016, la révolution : *Propionibacterium* cutan



- ✓ ***Cutibacterium acnes* subsp. *acnes* = phylotype I**
  ***Cutibacterium acnes* subsp. *defendens* = phylotype II**
  ***Cutibacterium acnes* subsp. *elongatum* = phylotype III**
- ✓ **Différences morphologiques, phylogénétiques et génomiques !**

Dekio *et al*, IJSEM 2015, McDowell *et al* IJSEM 2016, Scholz *et al*, IJSEM 2016, Aubin *et al*, IJSEM 2016

Existe-t-il un ou des *C. acnes* ?



JOURNAL OF CLINICAL MICROBIOLOGY, Jan. 2005, p. 326–334 Vol. 43, No. 1
0095-1137/05/$08.00+0 doi:10.1128/JCM.43.1.326–334.2005

Propionibacterium acnes Types I and II Represent Phylogenetically Distinct Groups

Andrew McDowell,[1] Susanna Valanne,[1] Gordon Ramage,[1] Michael M. Tunney,[1] Josephine V. Glenn,[1] Gregory C. McLorinan,[1] Ajay Bhatia,[2] Jean-Francois Maisonneuve,[2] Michael Lodes,[2] David H. Persing,[2] and Sheila Patrick[1]*

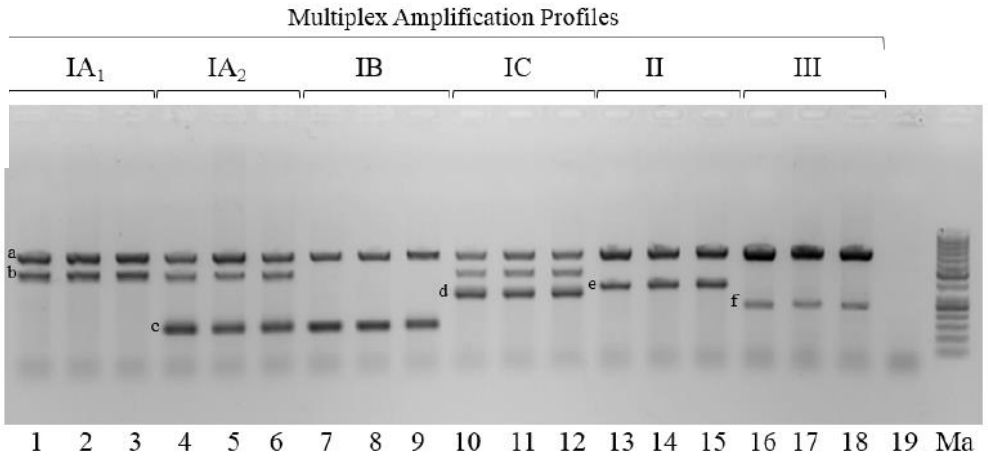
Department of Microbiology and Immunobiology, School of Medicine, Queen's University, Belfast, United Kingdom,[1] and Corixa Corporation, Infectious Disease Research Institute, Seattle, Washington[2]

JCM Journals.ASM.org

Multiplex Touchdown PCR for Rapid Typing of the Opportunistic Pathogen *Propionibacterium acnes*

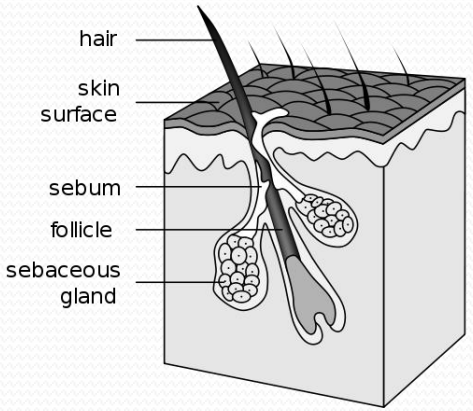
Emma Barnard,[a]* István Nagy,[b] Judit Hunyadkürti,[b] Sheila Patrick,[a] Andrew McDowell[a]*

Centre for Infection and Immunity, School of Medicine, Dentistry and Biomedical Sciences, Queen's University, Belfast, United Kingdom[a]; Institute of Biochemist Biological Research Centre of the Hungarian Academy of Sciences, Szeged, Hungary[b]



- ✓ **Six groupes phylogénétiques majeurs**
- ✓ **Typage moléculaire**
- ✓ **Présence dans les unités pilosébacées**
- ✓ **Risque de travailler sur une seule colonie**

  Communication El Sayed *et al* => **infection polyclonale ?**



McDowell et al, JCM 2005, McDowell et al, JMM 2008, Otberg *et al* JID 2004

Existe-t-il un ou des *C. acnes* ?

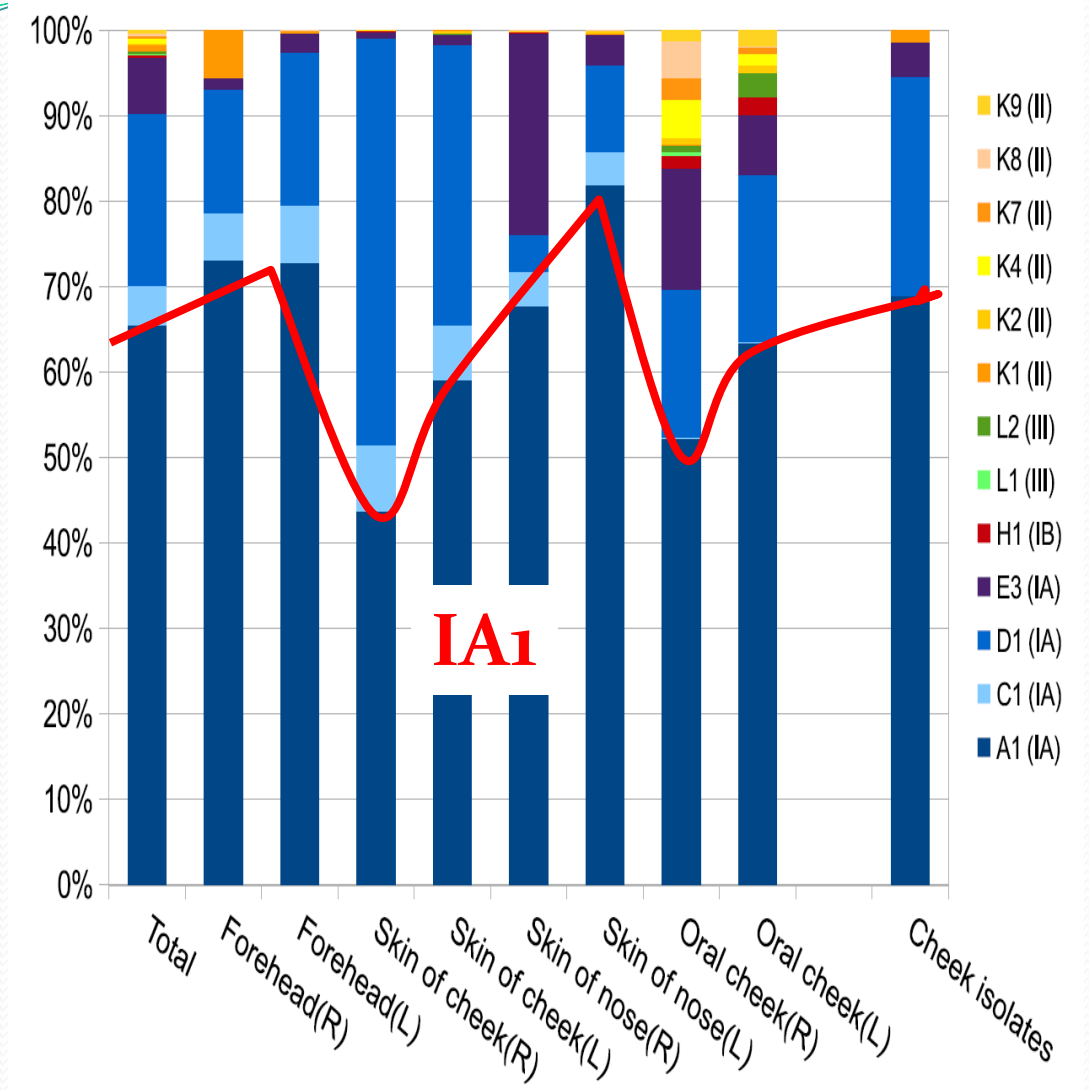
Patient B

Color	ST	23S rRNA	Ery	Clind	16S rRNA	Tet
	3	2058A>G	>256	8-64	1058G>C, 1202A>C	2-32
	18	-	0.5-1	0.064-0.25	-	0.25-0.5
	29	2058A>G	>256	64	-	2-4
	31	-	0.064-1	0.064-8	-	0.125-0.25

tion. Individuals may carry a strikingly complex population of *P. acnes* with diverse virulence potential and antibiotic resistance patterns. These findings provide

Lomholt 1 Kilian, Acta Derma Venerol 2014

Existe-t-il un ou des *C. acnes* ?



biomes. As a proof of concept we have demonstrated that a minimum of six distinct types of *P. acnes* may coexist on the skin and oral mucosa of a healthy subject. We have implemented an

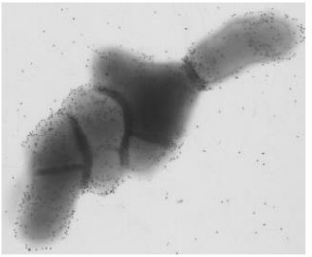
Scholz *et al*, PLoS One 2014

Phylogénie et infection sur prothèse à *C. acnes* ?

DIAGNOSTIC MICROBIOLOGY AND INFECTIOUS DISEASE

Species of *Propionibacterium* and *Propionibacterium acnes* phylotypes associated with orthopedic implants☆

Marta Fernandez Sampedro[a], Kerryl E. Piper[a], Andrew McDowell[d], Sheila Patrick[d], Jayawant N. Mandrekar[b], Mark S. Rouse[a], James M. Steckelberg[a], Robin Patel[a,c,*]



✓ **Phylotype IB est prédominant n=15**

Table 2. Comparison of the population structures of *Cutibacterium acnes* isolates involved in spine instrumentation infection (SpI), prosthetic joint infection (PJI) and acne lesion (AL).

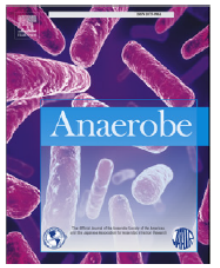
MLST Clonal complex (CC)	Clade	SpI isolates (%) n = 58	PJI isolates (%) n = 14	AL isolates (%) n = 14	p-value
CC18	IA1	32 (55.2)	4 (28.6)	6 (42.9)	
CC3	IA1	1 (1.7)	0 (0.0)	0 (0.0)	
CC28	IA2	15 (25.9)	0 (0.0)	2 (14.3)	
CC36	IB	7 (12.1)	6 (42.9)	4 (28.6)	p = 0.021
CC53	II	2 (3.4)	4 (28.6)	2 (14.3)	
CC107	IC	1 (1.7)	0 (0.0)	0 (0.0)	

Prédominance CC36 et CC53 si prothèse sinon CC18 and CC28 si rachis

Contents lists available at ScienceDirect

Anaerobe

journal homepage: www.elsevier.com/locate/anaerobe



Pathogenesis and toxins

Tropism and virulence of *Cutibacterium* (formerly *Propionibacterium*) *acnes* involved in implant-associated infection

Guillaume Ghislain Aubin [a, b], Jean-Philippe Lavigne [c, d], Yohan Foucher [e], Sarah Dellière [b], Didier Lepelletier [b, f], François Gouin [g], Stéphane Corvec [b, h, *]

- ✓ **Tropisme spécifique et distribution des clones fonction de la localisation**
- ✓ **Clones rachis et acné identiques**
- ✓ **Virulence ?**
- ✓ **Investigation par WGS = génome commun 85%**

Pourquoi certains clones de *C. acnes* semblent dédiés à ces infections ?
Comportement particulier à l'égard des cellules osseuses ?

C. acnes, bactérie à deux visages !

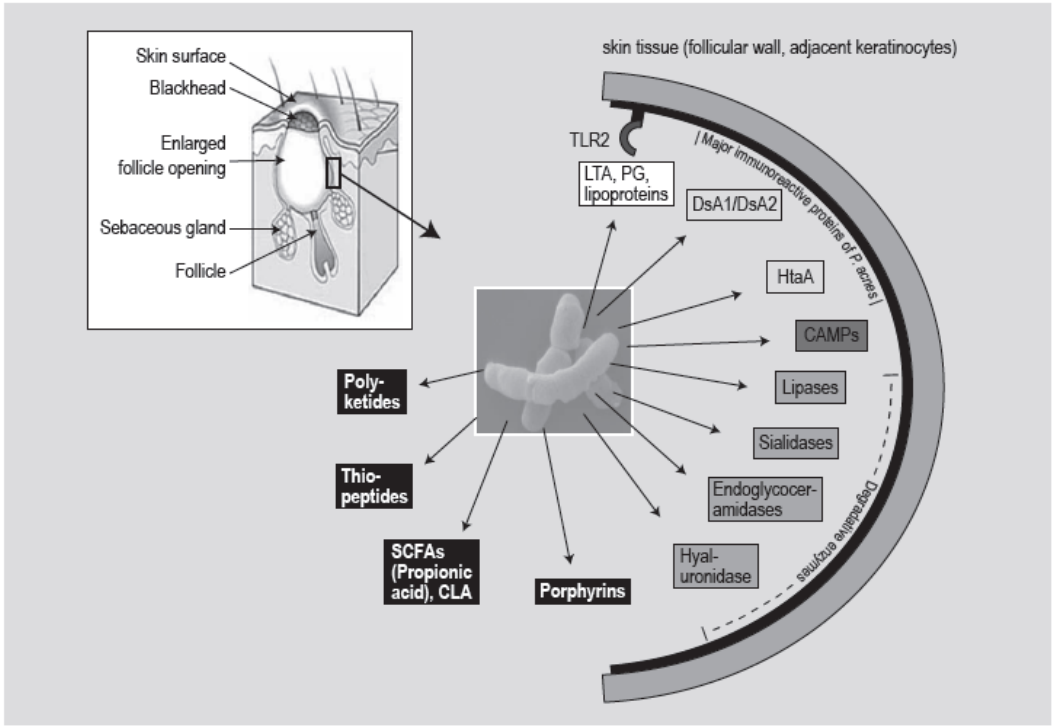
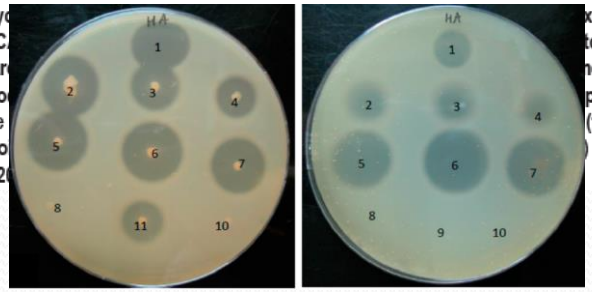
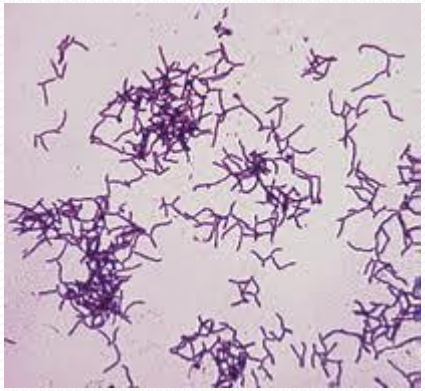


Figure 1. Factors of *Propionibacterium acnes* involved in human skin-bacterium interactions with possible disease- or health-promoting functions. *P. acnes* is able to trigger innate immune responses via Toll-like receptor 2 (TLR2). TLR2 ligands could be cell wall-attached lipoteichoic acids (LTA), peptidoglycan (PG) fragments, and/or cell surface-exposed lipoproteins. Major immunoreactive proteins, i.e. dominant B cell and T cell antigens, of *P. acnes* are: dermatan-sulphate adhesins DsA1 and DsA1 and two HtaA-domain proteins. Degradative enzymes are predicted to degrade human host tissue components. For example, surface-attached endoglyc xposed gangliosides. Christie-Atkins-Munch-Peterson (C totoxins. Putative antimicrobial and/or probiotic factors ar entative products; conjugated linoleic acids (CLA) as pro polyketides (their biosynthesis is predicted from genome (these molecules might have a dual role: induction of pro) (Figure adapted and modified from Brüggemann *et al.*, 2





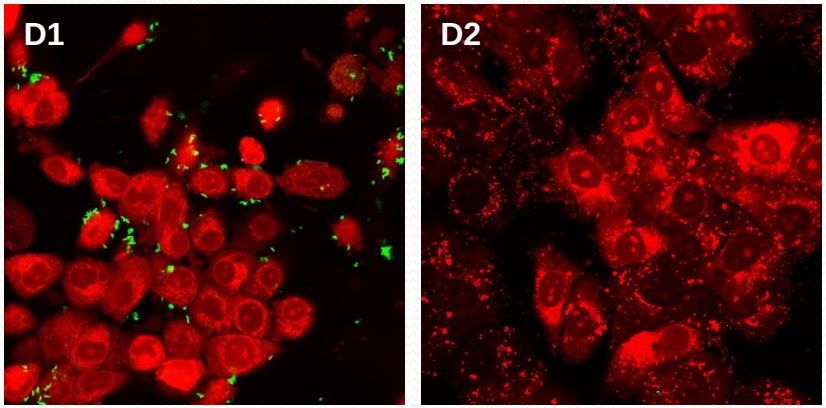
C. acnes :
Peau – acné
Opportuniste implants ?

C. acnes **et virulence** :
Lipases
Hémolysines
Hyaluronidase-lyase :
HYL/IB-II HYL/IA
Sialidases
Etc…

Christensen *et al*, Benef Microbes 2014, Bek-Thomsen *et al*, PLoS One 2014, Nazipi *et al*, Microorganisms 2017

Interactions C. acnes et cellules osseuses

CC18 *C. acnes* **CC36 *C. acnes***

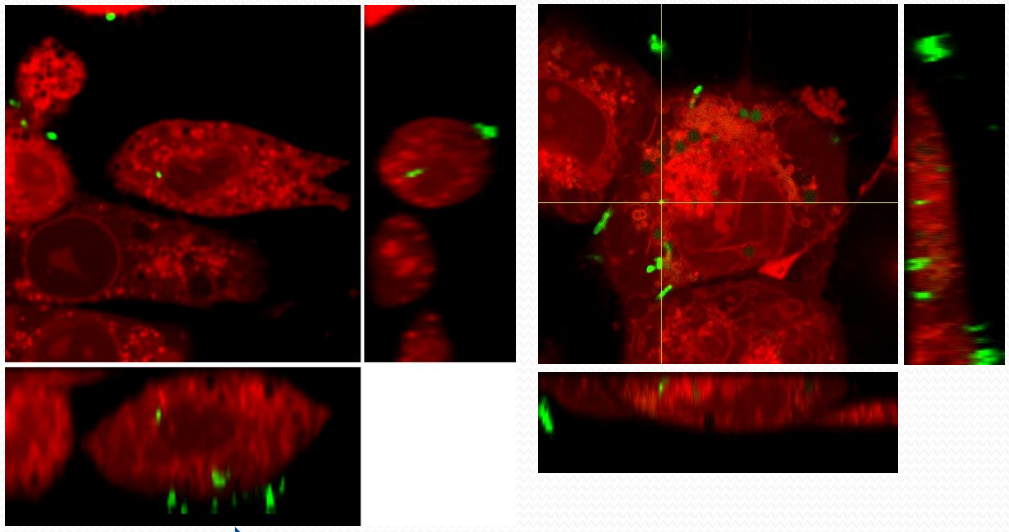


SCIENTIFIC REPORTS

Interaction of *Cutibacterium* (*formerly Propionibacterium*) *acnes* with bone cells: a step toward understanding bone and joint infection development

Guillaume Ghislain Aubin[1,2], Marc Baud'huin[3,4], Jean-Philippe Lavigne[5,6], Régis Brion[3,4], François Gouin[3,7], Didier Lepelletier[1,2], Cédric Jacqueline[1], Dominique Heymann[3,4,8], Karim Asehnoune[1] & Stéphane Corvec[2,9]

CC18 *C. acnes*



Mécanisme d'évasion, infection profonde ?

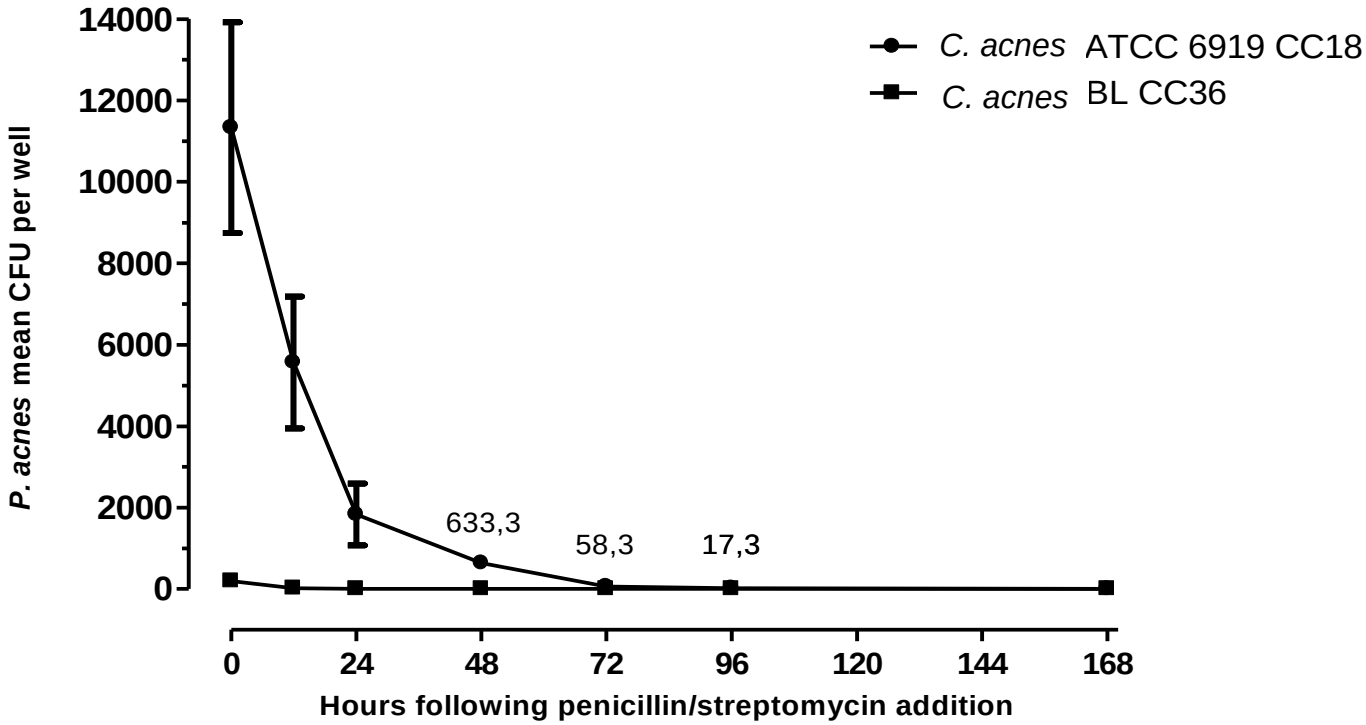
Protection vis-à-vis du système immunitaire : Infection chronique ?

Récepteur ?

Différence d'internalisation en fonction phylogénie

Grange *et al*, Scientific reports 2017, L'heure *et al*, PLoS One 2016

Persistance de *C. acnes* dans les cellules

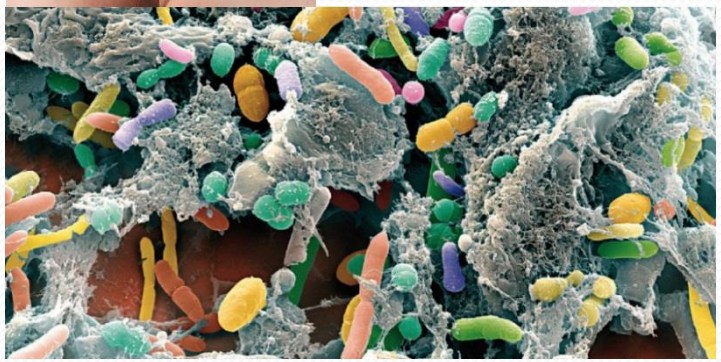


Persistance au sein des ostéoblastes, dans nos conditions

Fischer *et al*, BioMed Res Int 2013, Shiono *et al*, Scientific reports 2016

C. acnes - Infection de prothèse d'épaule

De l'écosystème cutané à l'infection de prothèse



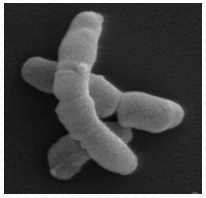
Nat Rev Microbiol. 2011 April ; 9(4): 244–253. doi:10.1038/nrmicro2537.

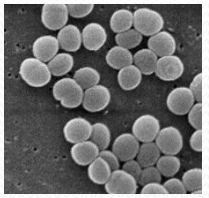
The skin microbiome

Elizabeth A. Grice and **Julia A. Segre**
Genetics and Molecular Biology Branch, National Human Genome Research Institute, National Institutes of Health, Bethesda, Maryland, 20892–4442, USA.

Eviter l'infection de prothèse d'épaule !

De l'écosystème cutané à l'infection de prothèse





C. acnes ***S. epidermidis***

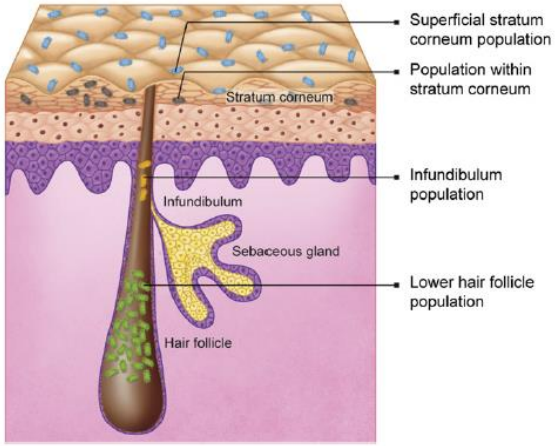
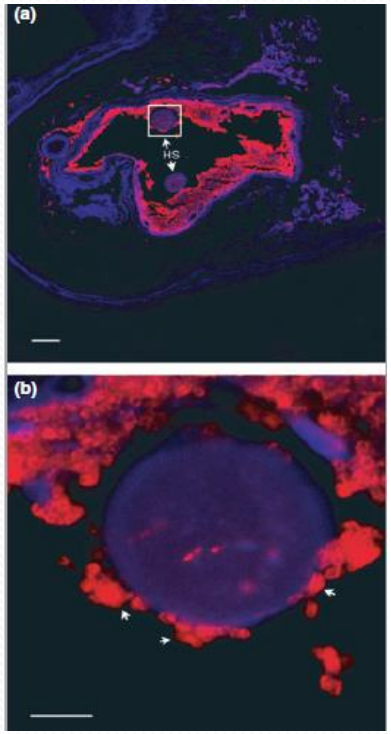


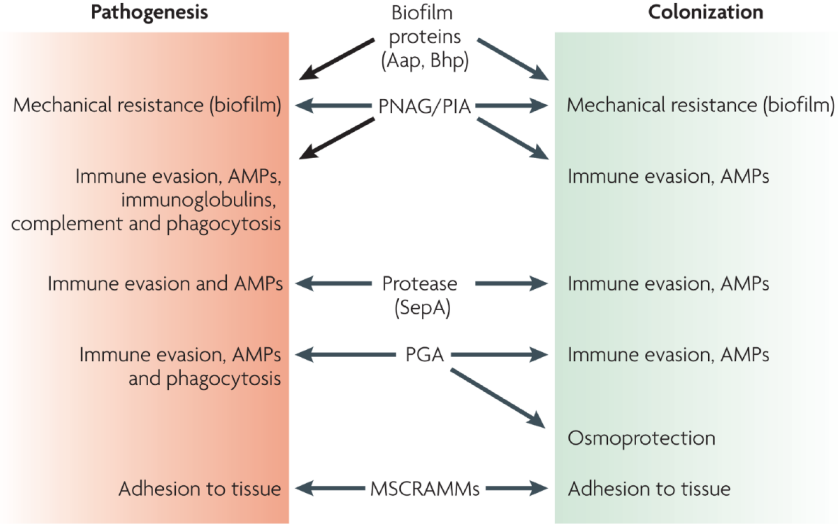
Fig. 1. Schematic overview of anatomically distinct *P. acnes* populations in the skin.



Nat Rev Microbiol. 2009 August ; 7(8): 555–567. doi:10.1038/nrmicro2182.

Staphylococcus epidermidis – the "accidental" pathogen

Michael Otto, Ph. D.
National Institute of Allergy and Infectious Diseases, The National Institutes of Health, 9000 Rockville Pike Building 33 1W10, Bethesda, MD 20892, USA, Phone 301 443 5209, Fax 301 480 3633, motto@niaid.nih.gov



Jahns et al, BJD 2012, Jahns *et al*, Anaerobe 2012, Otto, Nat Rev Microbiol 2009

Prévention : quelle antibioprophylaxie ?

- ✓ **IV téicoplanin + genta et préparation cutanée à la chlorhexidine : 42% de prélèvements positifs**

  Levy *et al*, JSES 2013

- ✓ **IV ceftriaxone + vanco et double préparation cutanée : 15% positif**

  Matsen III *et al*, JSES 2015

- ✓ **IV céfazoline + préparation cutanée = 73% positif**

  Koh *et al*, JSES 2016

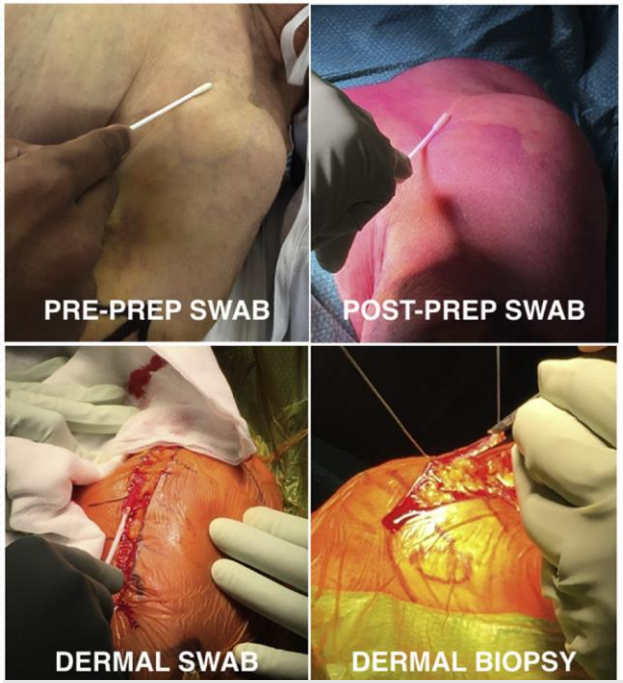
- ✓ **Quel que soit l'antibioprophylaxie préconisée, absence d'élimination de *C. acnes*, même si préparation cutanée adaptée !**

surface preparation.[12,15,21] When the dermal hair follicles and sebaceous glands are transected by the surgical skin incision for shoulder arthroplasty, *Propionibacterium* organisms can seep into the surgical wound where they can participate in the formation of a biofilm on the implant surfaces, potentially leading to arthroplasty failure years later.[1,16]

La présence de C. acnes au niveau du site d'incision pourrait conduire à un risque d'infection retardée et d'échec

Prévenir l'infection et préparation cutanée ?

- **Pouvons-nous vraiment éradiquer avec la préparation cutanée un « résident » de la couche dermique de la peau ?**



Incision chirurgicale
Inoculation de la plaie

Contamination accidentel de l'échantillon : UPC

Phadnis *et al*, JSES 2016

Table I Patient demographic data and results of microbiologic swabs and biopsy specimen

Patient	Age (y)	Sex	Surgery	Revision surgery	Pre-prep	Post- prep	Dermal swab	Dermal biopsy
1	72				*P acnes*	None	*P acnes*	*P acnes*
2	35				None	None	*P acnes*	*P acnes*
3	60				None	None	None	None
4	84				None	None	None	None
5	27				*P acnes*	*P acnes*	*P acnes*	*P acnes*
6	37				*P acnes*	*P acnes*	*P acnes*	*P acnes*
7	68				None	None	*P acnes*	*P acnes*

***C. acnes* n = 4, 6%**
***Abs C. acnes* = 40%**
***C. acnes* dans ¾ sauf le 2 = 20%**
***C. acnes* dans les deux derniers = 12%**

Nouvelles modalités de préparation cutanée ?!

Preoperative doxycycline does not decolonize *Propionibacterium acnes* from the skin of the shoulder: a randomized controlled trial

Surena Namdari, MD, MSc*, Thema Nicholson, MSc, Javad Parvizi, MD, Matthew Ramsey, MD

J Shoulder Elbow Surg (2017) 26, 1495–1499

7 jours de traitement pré-op par TET ne réduisent pas le risque de colonisation à *C. acnes*

Efficacy of topical benzoyl peroxide on the reduction of *Propionibacterium acnes* during shoulder surgery

James R. Sabetta, MD[a], Vishal P. Rana, BS[b], Katherine B. Vadasdi, MD[b], R. Timothy Greene, MD[b], James G. Cunningham, MD[b], Seth R. Miller, MD[b] Paul M. Sethi, MD[b,*]

J Shoulder Elbow Surg (2015) 24, 995-1004

Mieux et utile pour réduire l'inoculum de *C. acnes*!

Table I Rate of positive *P. acnes* culture by individual specimen location

Specimen		Rate of positive culture (%)
Sample 0	Control air swab	4.0
Before surgical skin preparation with ChloraPrep		
Sample 1	Skin anterior deltoid surgical side, BPO treated	16.0
Sample 2	Skin axilla surgical side, BPO treated	8.0
Sample 3	Skin anterior deltoid nonsurgical side, no BPO	32.0
Sample 4	Skin axilla nonsurgical side, no BPO	28.0
After surgical skin preparation with ChloraPrep and BPO		
Sample 5†	Anterior deltoid surgical side	6.0
Sample 6†	Axilla surgical side	6.0
Sample 7	Joint fluid	4.0
Sample 8	Tissue 1 (MGHL)	6.0
Sample 9	Tissue 2 (rotator interval)	2.0
Sample 10	Tissue 3 (bursa/high interval)	6.0
Sample 11‡	Skin anterior deltoid surgical side (end of procedure)	10.0
Sample 12‡	Skin axilla surgical side (end of procedure)	10.0

Nouvelles modalités de préparation cutanée ?!

Benzoyl peroxide and clindamycin topical skin preparation decreases *Propionibacterium acnes* colonization in shoulder arthroscopy

J Shoulder Elbow Surg (2017) 26, 1190–1195

Hailey H. Dizay, DO*, Diana G. Lau, MD, Wesley M. Nottage, MD

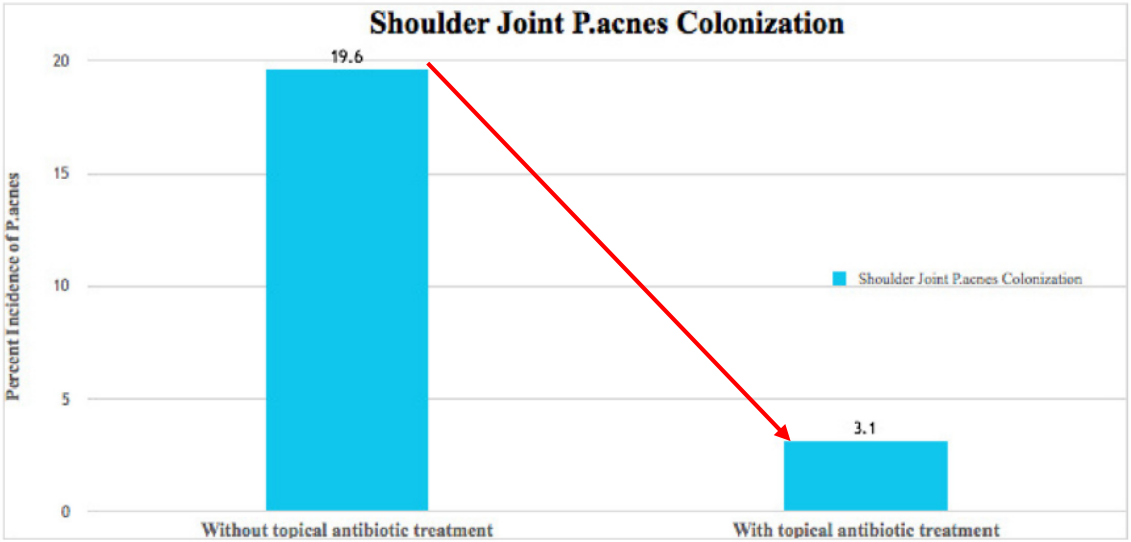


Figure 2 Shoulder joint inoculation with *P. acnes* at the surgical site deep tissue was decreased to 3.1% from 19.6%[5] ($P = .006$) with the use of a topical benzoyl peroxide and clindamycin gel applied preoperatively.

Peut-on réduire ou limiter la colonisation des tissus profonds à *C. acnes*?

(Communication Scheer *et al,* EBJIS 2017)

Infections avérées à *C. acnes* : quel traitement ?

- ✓ **Absence de concentrations critiques dans le EUCAST CA-SFM 2017**
- ✓ **Recommandations basées sur pratique quotidienne !**
- ✓ **Absence de guidelines ?**

Recommendations for bone and joint prosthetic device infections in clinical practice (prosthesis, implants, osteosynthesis)

Gram (+) anaerobes *(P. acnes, Peptostreptococcus)*	Amoxicillin or cefazolin or ceftriaxone or clindamycin (if the strain is susceptible to erythromycin)	clindamycin or amoxicillin

Anaerobic prosthetic joint infection

Neel B. Shah [a], Aaron J. Tande [a], Robin Patel [a, b], Elie F. Berbari [a, *]

[a] *Division of Infectious Diseases, Mayo Clinic, Rochester, MN, USA*
[b] *Division of Clinical Microbiology, Mayo Clinic, Rochester, MN, USA*

Anaerobe 36 (2015) 1–8

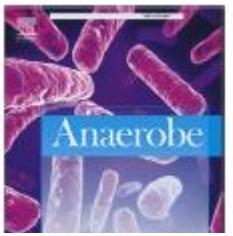


Table 1
Treatment regimens and duration of therapy recommended for various anaerobic organisms causing PJI. When available, dosing and alternative treatment regimens were provided.[a]

Anaerobic organism	Primary treatment/Dose	Alternative treatment/Dose (if data present in literature)	Recommended duration of therapy
P. acnes	Penicillin 20–24 million units IV every 24 h, either continuous infusion or in 6 divided doses or Ceftriaxone 2 g IV every 24 h	Clindamycin 600–900 mg IV every 8 h or Vancomycin 15 mg/kg IV every 12 h	4–6 weeks

Infections avérées à *C. acnes* : et le biofilm ?

Biofilm formation by *Propionibacterium acnes* on biomaterials *in vitro* and *in vivo*: impact on diagnosis and treatment

Roger Bayston,[1] Waheed Ashraf,[1] Robert Barker-Davies,[1] Emily Tucker,[1] Rhys Clement,[1] Juliet Clayton,[2] Brian J.C. Freeman,[3] Bryar Nuradeen[1]
[1]*Biomaterials-Related Infection Group, Faculty of Medicine and Health Sciences, University of Nottingham, Nottingham, England*
[2]*Department of Neurosurgery, University Hospital, Nottingham, England*
[3]*Department of Spinal Surgery, University Hospital, Nottingham, Englan*

Journal of Biomedical Materials Research

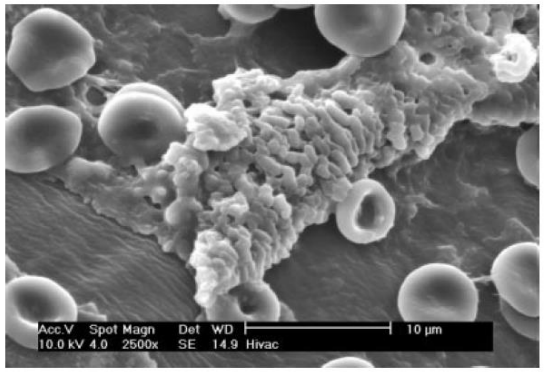


Figure 6. The same area as shown in Figure 5, after dehydration *in situ*. After collapse and condensation of the exopolymer, more red blood cells have become visible. The *P. acnes* biofilm is now revealed, showing masses of bacilli embedded in an exopolymer matrix. Original magnification ×2500.

- ✓ **Quel que soit le support, présence de biofilm**
- ✓ **Adhérence silicone, acier et titane**

Journal of Antimicrobial Chemotherapy (2007) **60**, 1298–1301
doi:10.1093/jac/dkm408
Advance Access publication 24 October 2007

JAC

Antibiotics for the eradication of *Propionibacterium acnes* biofilms in surgical infection

Roger Bayston[1]*, Bryar Nuradeen[1], Waheed Ashraf[1] and Brian J. C. Freeman[2]

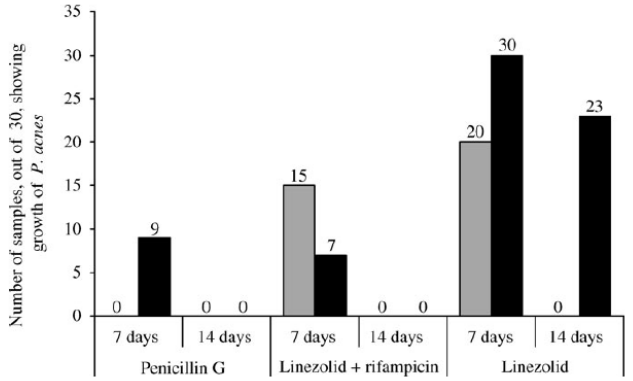


Figure 1. Eradication of *P. acnes* (grey columns) and subsequent relapse (black columns) following 7 and 14 days of 'treatment' with penicillin G, a combination of linezolid plus rifampicin, and linezolid alone. Thirty samples were used for each set of assays and each was assayed in triplicate. Penicillin reduced the counts to zero after 7 and 14 days, whereas linezolid, with or without rifampicin, failed to reduce the counts on more than half the samples to zero after 7 days. After 14 days, all were reduced to zero. No 'relapse' was seen after 14 days of penicillin alone or linezolid plus rifampicin, but after linezolid alone, 23 of 30 samples showed 'relapse'.

Modèle animal à *C. acnes*

Role of Rifampin against *Propionibacterium acnes* Biofilm *In Vitro* and in an Experimental Foreign-Body Infection Model

Ulrika Furustrand Tafin,[a] Stéphane Corvec,[a,b] Bertrand Betrisey,[a] Werner Zimmerli,[c] and Andrej Trampuz[a]

Infectious Diseases Service, Department of Medicine, University Hospital and University of Lausanne, Lausanne, Switzerland[a]; Institut de Biologie des Hôpitaux de Nantes, Service de Bactériologie-Hygiène, CHU de Nantes, Nantes, France[b]; and University Medical Clinic, Kantonsspital, Liestal, Switzerland[c]

AAC Journals.ASM.org

TABLE 1 Antimicrobial susceptibility of planktonic and biofilm *P. acnes*

	Value (μg/ml)[a]		
Parameter	Rifampin	Daptomycin	Levofloxacin
MIC	0.007	1	1
MBC	4	4	2
MBC/MIC ratio	571	4	2
MBEC	16	64	512

Bactéries sessiles

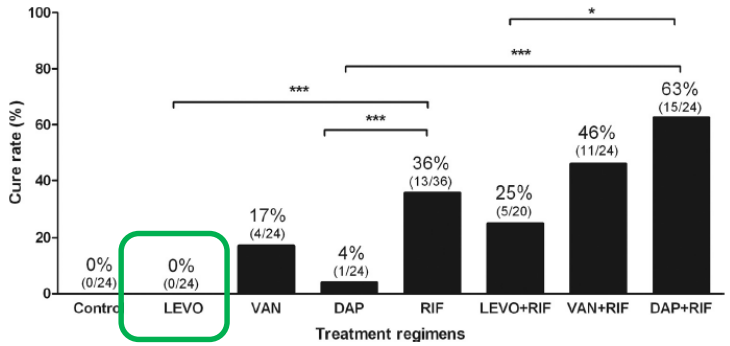


FIG 5 Treatment activity against biofilm *P. acnes*. Shown are the cure rates of adherent bacteria from explanted cages. The percentages above the columns indicate the cure rates. *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.005$.

Bactéries planctoniques

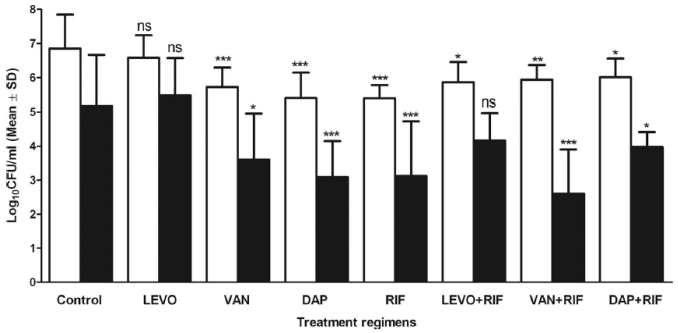


FIG 4 Treatment efficacy against planktonic *P. acnes*. Shown are the bacterial loads in cage fluid aspirated during treatment (white bars) and 5 days after treatment (black bars). The values are means and standard deviations (SD). DAP, daptomycin; VAN, vancomycin; LEVO, levofloxacin; RIF, rifampin. The treatment groups are compared to the control during treatment and after treatment. *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.005$; ns, not significant.

- ✓ **Rôle de la rifampicine**
- ✓ **Intérêt Péni G et CRO**
- ✓ **Traitement de référence ?**

Contents lists available at ScienceDirect

Anaerobe

journal homepage: www.elsevier.com/locate/anaerobe

Clinical microbiology

Antibiotic susceptibility of *Propionibacterium acnes* isolated from orthopaedic implant-associated infections

Jasmine Khassebaf [a, b], Bengt Hellmark [b], Sabina Davidsson [a, c], Magnus Unemo [b], Åsa Nilsdotter-Augustinsson [d, e], Bo Söderquist [a, *]

[a] Faculty of Medicine and Health, Örebro University, Örebro, Sweden
[b] Department of Laboratory Medicine, Clinical Microbiology, Örebro University Hospital, Örebro, Sweden
[c] Department of Urology, Örebro University Hospital, Örebro, Sweden
[d] Division of Infectious Diseases, Department of Clinical and Experimental Medicine, Faculty of Health Sciences, Linköping University, Linköping, Sweden
[e] Department of Infectious Diseases, County Council of Östergötland, Linköping, Sweden

Contents lists available at ScienceDirect

Anaerobe

journal homepage: www.elsevier.com/locate/anaerobe

Technical note

Occurrence and new mutations involved in rifampicin-resistant *Propionibacterium acnes* strains isolated from biofilm or device-related infections☆

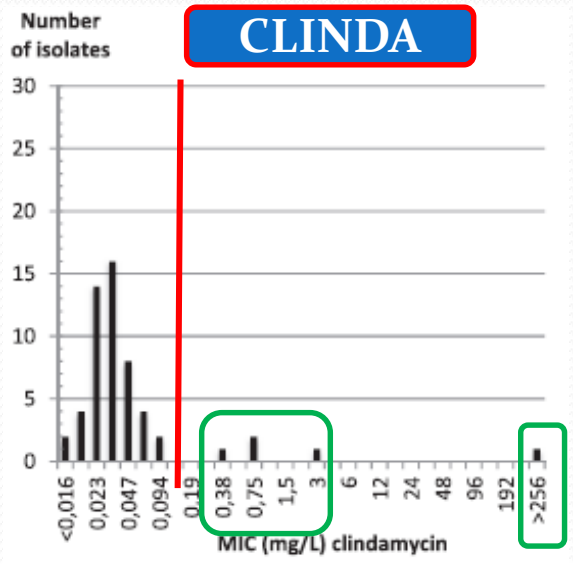
Ulrika Furustrand Tafin [a, 1], Guillaume Ghislain Aubin [b, c, 1], Gerhard Eich [d], Andrej Trampuz [e], Stéphane Corvec [b, c, *]

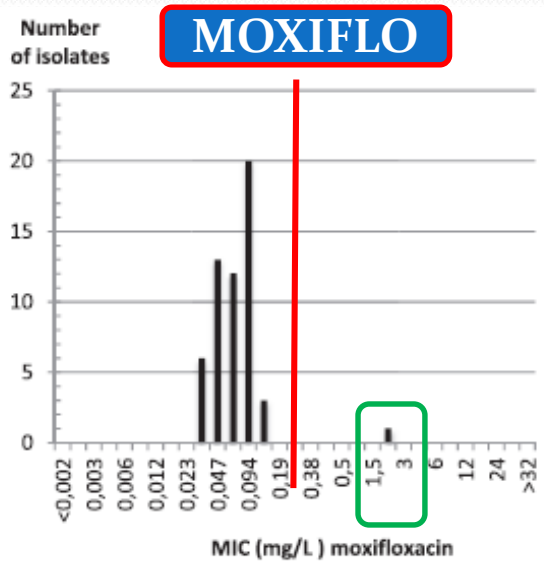
Observations cliniques

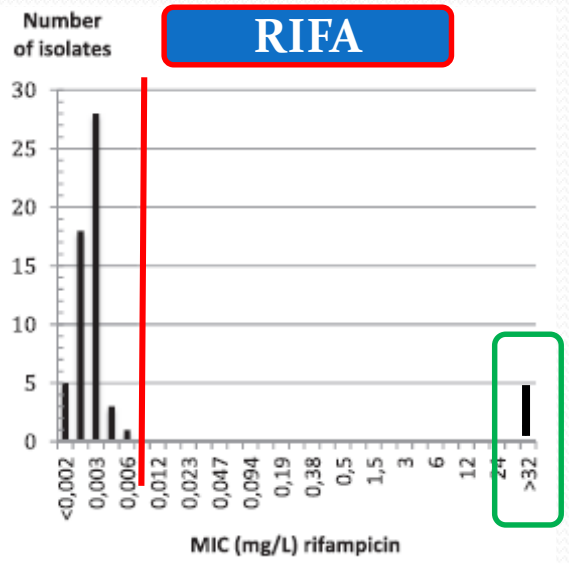
Antimicrobial Susceptibility of *Propionibacterium acnes* Isolates from Shoulder Surgery

John K. Crane,[a,c] Donald W. Hohman,[b,c] Scott R. Nodzo,[b,c] Thomas R. Duquin[b,c]

Department of Medicine, Division of Infectious Diseases, University at Buffalo, Buffalo, New York, USA[a]; Department of Orthopaedic Surgery, University at Buffalo, Buffalo, New York, USA[b]; Erie County Medical Center, Buffalo, New York, USA[c]







Des résistances de bas et haut niveau ont été rapportées !

AAC
Journals.ASM.org

Antimicrobial Susceptibility of *Propionibacterium acnes* Isolates from Shoulder Surgery

John K. Crane,[a,c] Donald W. Hohman,[b,c] Scott R. Nodzo,[b,c] Thomas R. Duquin[b,c]
Department of Medicine, Division of Infectious Diseases, University at Buffalo, Buffalo, New York, USA[a]; Department of Orthopaedic Surgery, University at Buffalo, Buffalo, New York, USA[b]; Erie County Medical Center, Buffalo, New York, USA[c]

TABLE 1 MICs of *P. acnes* strains

Antibiotic	MIC (mg/liter) for orthopedic isolates from the shoulder (n = 28) MIC_{50}	MIC_{90}	CLSI breakpoint (mg/liter)	% of strains resistant
Amoxicillin	0.028	0.117	–[a]	–
Penicillin G	0.006	0.125	≤0.5	4
Cephalothin	0.047	0.094	–	–
Ceftriaxone	0.016	0.045	–	–
Clindamycin	0.032	8.5	≤2	7
Ciprofloxacin	0.25	0.5	–	–
Moxifloxacin	0.125	0.38	≤2	0
Ertapenem	0.032	0.141	≤4	0
Vancomycin	0.38	0.5	–	–
Linezolid	0.25	0.93	–	–

[a] –, no interpretive standards from the Clinical and Laboratory Standards Institute (CLSI), and therefore, the percentage of resistant strains cannot be determined.

✓ **CMI basses aux β-lactamines**

Curr Rev Musculoskelet Med (2015) 8:67–74
DOI 10.1007/s12178-014-9256-5

SHOULDER SURGERY: COMPLICATIONS (X LI, SECTION EDITOR)

Management of *Propionibacterium acnes* infection after shoulder surgery

David Saper · Nina Capiro · Richard Ma · Xinning Li

✓ **Association :**

Cephalexine + rifampicine,
Clindamycine + ofloxacine,
Amoxicilline + rifampicine

Ten questions on prosthetic shoulder infection

Shoulder & Elbow
Shoulder & Elbow
2016, Vol. 8(3) 151–157

Elizabeth M Pinder, Joshua CY Ong, R Stephen Bale and Ian A Trail

✓ **Vanco + β-lactamines**
✓ **β-lactamines, Rif et FQ**
✓ **Dapto + rifampicine**

Achermann *et al*, CMR 2014, Saper *et al*, CMRR 2015

Alors quel traitement pour *C. acnes* ?

Which is the best treatment for prosthetic joint infections due to *Propioni-bacterium acnes*: need for further biofilm in vitro and experimental foreign-body in vivo studies?

Acta Orthopaedica 2016; 87 (3): 318–319

Stéphane Corvec and Guillaume G Aubin Roger Bayston and Waheed Ashraf

- ✓ **Rôle de la rifampicine**
- ✓ **Intérêt d'une association**
- ✓ **Traitement de référence ?**

Et vous ?

- ✓ **Mono ou bithérapie ?**
- ✓ **IV ou per os ? IV puis per os ?**
- ✓ **Traitement de 6, 8 ou 12 semaines ?**

Propionibacterium: We Found It, Now We Have to Deal with It

Philipp Moroder, MD, Andrej Trampuz, MD, and Markus Scheibel, MD

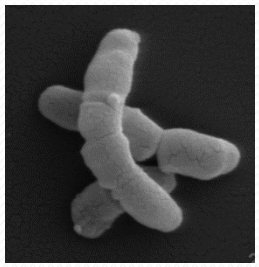
JB&JS THE JOURNAL OF BONE & JOINT SURGERY

Chirurgie optimale

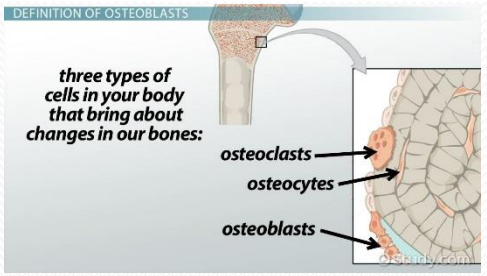
Identification & phylotype de *C. acnes*

Cultures prolongées Délai de positivité

Nouvelles modalités de préparation cutanée

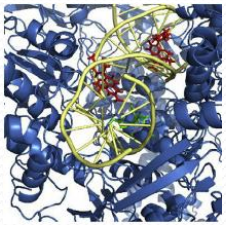


Interactions avec Ostéo-blastes et clastes



Antibio prophylaxie adaptée

Emergence résistance



Aubin *et al*, MMI 2012, Corvec *et al*, JSES 2017, Aubin *et al*, SR 2017, Furustrand *et al*, AAC 2012, Takoudju *et al*, Anaerobe 2017

Merci pour votre attention !

stephane.corvec@chu-nantes.fr