

Breakfast Symposium ARGX-113 Phase 2 Study in Pemphigus Vulgaris

John Stanley, MD, University of Pennsylvania Peter Verheesen, PhD, argenx Patrick Dupuy, MD, argenx Tim Van Hauwermeiren, CEO, argenx



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- 08:30 Welcome & Introduction Tim Van Hauwermeiren, CEO argenx
- 08:35 ARGX-113: Phase 2 Study in pemphigus vulgaris

Agenda

- Introduction on pemphigus vulgaris John Stanley, MD, Dermatology University of Pennsylvania School of Medicine
- **Preclinical and clinical rationale** Peter Verheesen, PhD, argenx
- Phase 2 clinical trial in pemphigus vulgaris Patrick Dupuy, MD, argenx
- 09:35 ARGX-113: Pipeline-in-product opportunity Tim Van Hauwermeiren, CEO argenx

09:45 **Q&A**

Prof. John Stanley





- Since 1995: Professor, Department of Dermatology, University of Pennsylvania, Philadelphia, PA
- Prof. Stanley's contributions to the Science (i.a.):
 - Pemphigus antigens: Molecularly cloned the pemphigus vulgaris antigen and showed it was a new member of the desmoglein gene family, desmoglein 3. These antigen characterizations led to the clinical use of ELISA assays to diagnose and evaluate severity of disease.
 - Pemphigus pathophysiology: Developed and validated the "Desmoglein Compensation Theory" in pemphigus. This concept explains the blister localization in pemphigus vulgaris.
 - Defining the antibody repertoire in pemphigus: Genetically and proteomically characterized the IgG-B cell antibody repertoire in pemphigus vulgaris and shown that the same non-tolerant (i.e. anti-desmoglein) B cells and antibodies persist over a decade in patients, and that patients rarely develop new non-tolerant anti-desmoglein B cells emerging from the marrow.



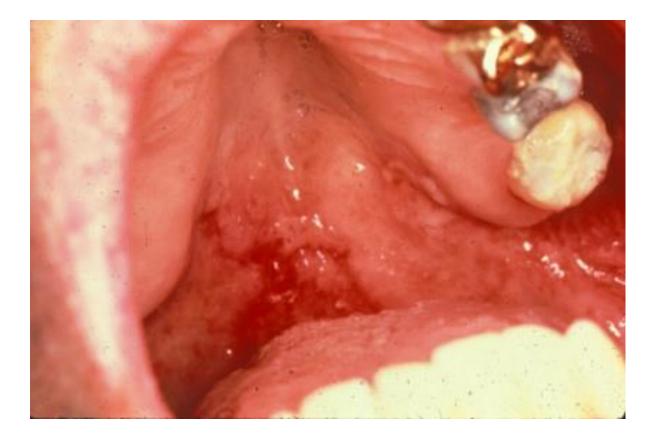
Pemphigus vulgaris: Introduction

Therapies for Pemphigus

Pemphigus vulgaris

- Acutely can be severe and life-threatening
- After therapy can remit and relapse
- May become chronic with low level disease
- With current therapy some patients have long term remissions off therapy (? Cures)

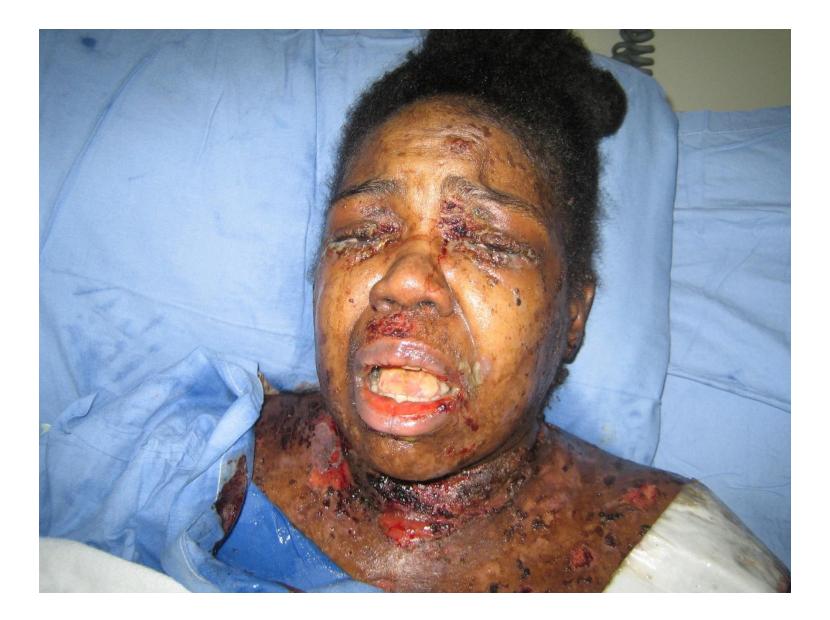
Pemphigus vulgaris (PV)











PV chronic and persistent





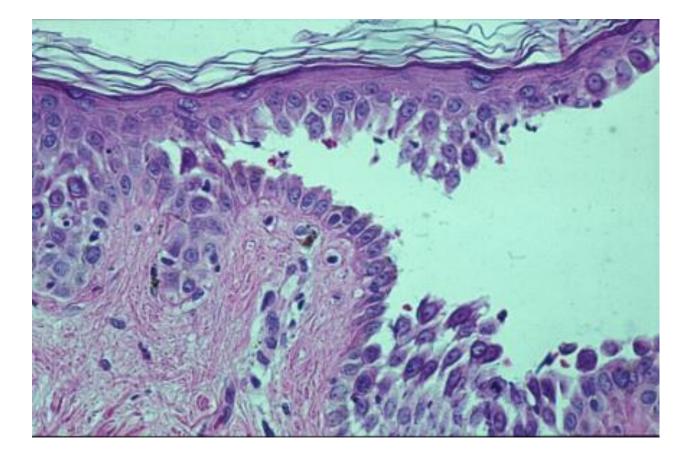








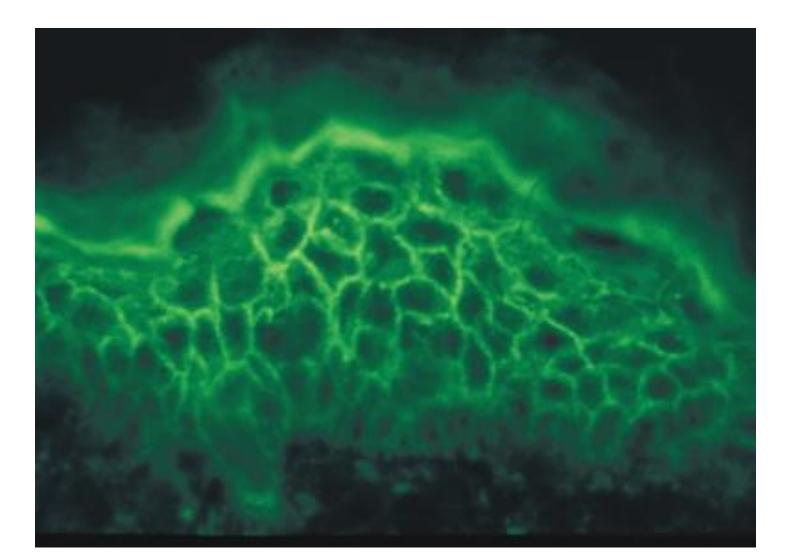
PV: histology



Epidemiology

- Age of onset: peak 50-70 years
- Incidence PV per 1M/year
 - Jerusalem: 16 (Ashkenazi Jews HLA-DRB1*0402)
 - UK: 7 (BMJ Langan SM et al, 2008)
 - France, Germany, Switzerland, Finland: 0.5-1
 - Connecticut: 4.2, Jewish pop 32 (Arch Derm Simon DG et al, 1980)
- Approx. 30-40,000 cases in US (IPPF Website)
- Deaths PV in US
 - 1979-2002: 1226
 - Mortality 2000-2002: 0.2 per 1M per year
- Hospitalization US (JAMA Derm Hsu D et al, 2016)
 - 8 per 1 million hospitalizations
 - Cost per pt: \$14-16,000 (cf. \$18,200 for MI)
 - Total hosp costs 2012: PV 1^o dx: \$7 mil; PV 2^o dx: \$40 mil

Pemphigus: IIF

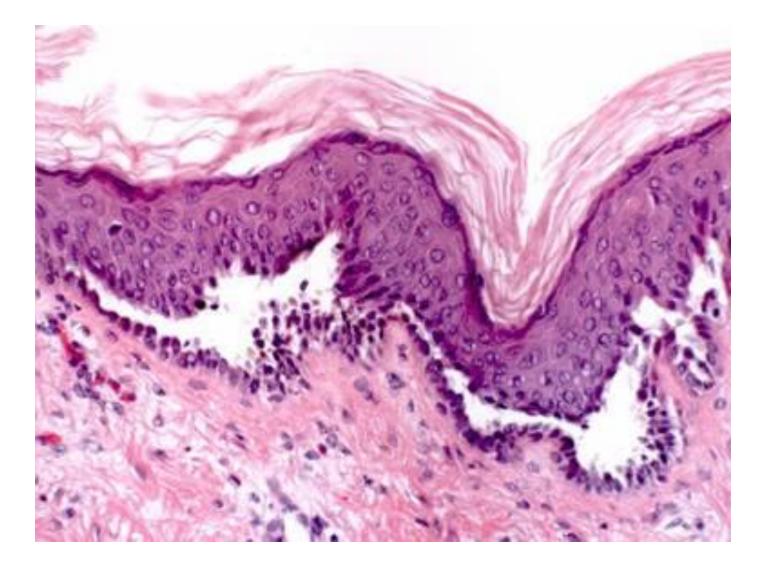


Pemphigus autoantibodies are pathogenic

- Clinical observations

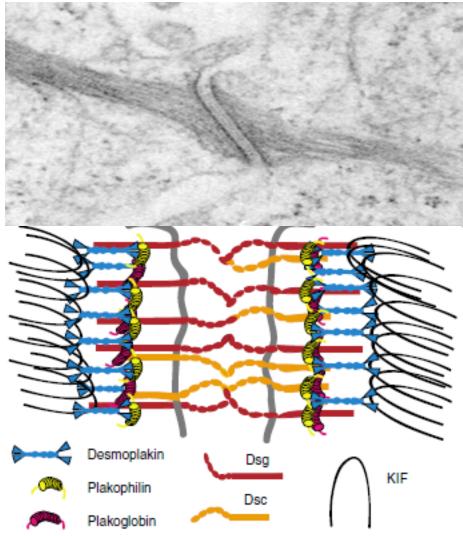
 –antibody titer and disease activity
 –neonatal pemphigus
- Experimental observation
 - -skin organ culture
 - -passive transfer to neonatal mice

PV antibody injected in normal skin



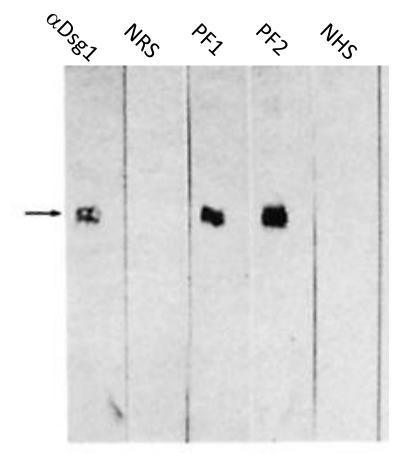
Discovery that pemphigus is an anti-desmosomal autoimmune disease

Desmosomes hold cells together; in pemphigus autoantibodies cause cells to fall apart



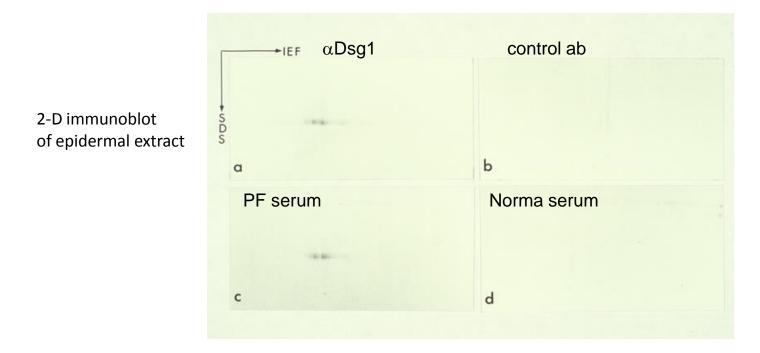
Kottke MD et al J Cell Sci 119:797, 2006

Immunoblot: desmoglein 1 (Dsg1) co-migrates with PF antigen



Koulu, Kusumi, Steinberg, Klaus-Kovtun, Stanley. J Exp Med 160:1509, 1984

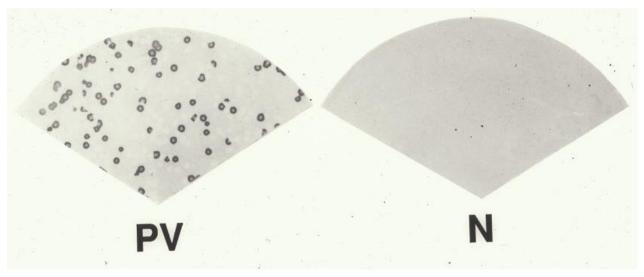
PFAg is desmoglein 1 (Dsg1): first autoimmune disease targeting desmosome



Koulu, Kusumi, Steinberg, Klaus-Kovtun, Stanley, **JExpMed** 1984 Stanley, Koulu, Klaus-Kovtun, Steinberg **J Immunol** 1986

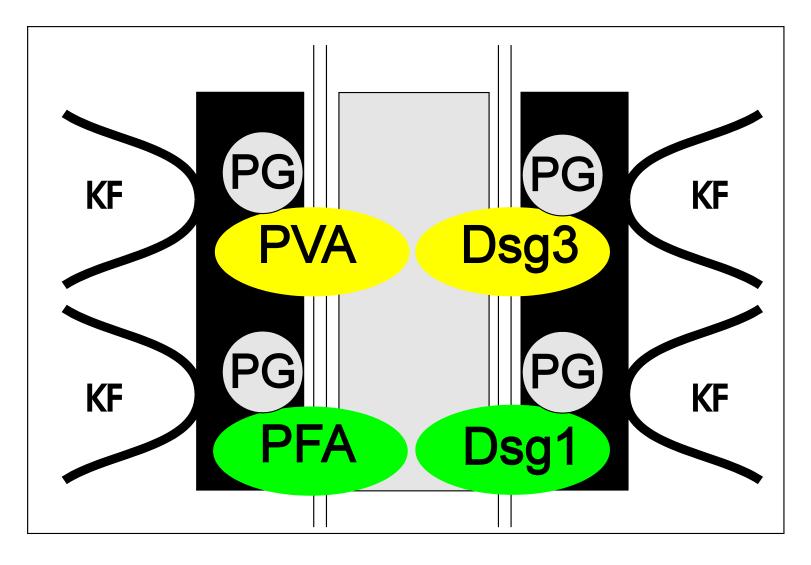
Molecular cloning indicates PV antigen is a previously unknown desmoglein, now called desmoglein 3

λ gt11 clone expressing pemphigus antigen



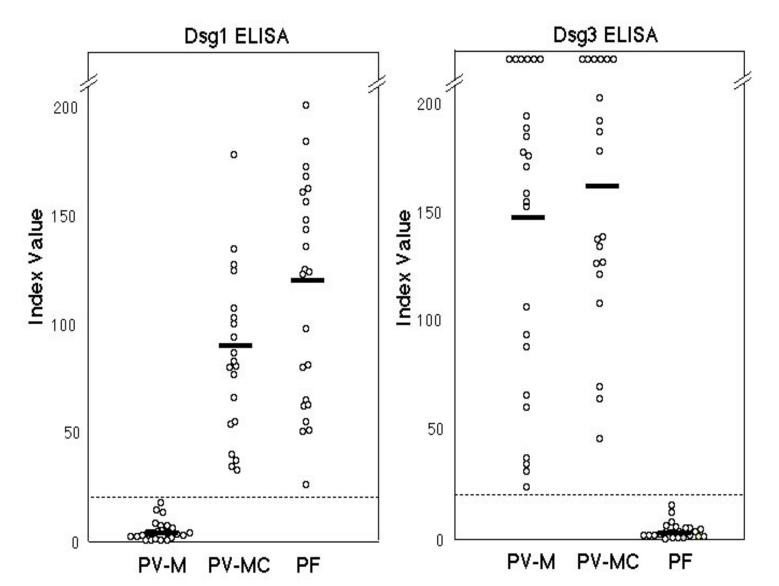
Amagai, Klaus-Kovtun, Stanley, Cell 1991

Pemphigus antibodies bind desmogleins, cell adhesion molecules in desmosomes



ELISA

anti-Dsg antibodies in PF and PV



Pemphigus disease activity correlates with antidesmoglein antibody level

- IIF titer
- ELISA titer (BJD, Cheng SW et al, 2002; JEADV Kwon EJ et al, 2008)
- Effective therapies decrease autoantibodies
- Patients in remission usually have low or undetectable antibodies

Basic principles of therapy of pemphigus

- Decreasing autoantibody levels will decrease disease activity
- Eliminating B cells that produce antibody will cure disease
- Possible: eliminate anti-Dsg3 T cells or T reg therapy

Major current therapies

- Non-targeted therapies induce general immunosuppression with many off target effects and adverse reactions
 - Prednisone
 - Azathioprine/mycophenolate
- Antibody and B-cell directed therapies
 - Plasmapheresis/adsorption
 - IVIg probably decreases autoantibodies by catabolism of all antibodies
 - Rituximab: targets B-cells that make pemphigus antibodies but not plasma cells that make antibodies induced by immunizations and infectious diseases

Rituximab

- Chimeric human-murine anti-CD20
- Binds all B-cells except B stem cells
 - B cells absent from blood for 6-12 mos.
- Does not bind plasma cells
- Pemphigus anti-Dsg3 and anti-Dsg1 antibodies decrease, often to undetectable
 - Anti-tetanus toxoid, V-Z do not
- Rituximab induces long term remission off therapy in about 50% of patients probably because it eliminates all non-tolerant anti-desmoglein B cells necessary to produce pemphigus antibodies

Rituximab as primary therapy

Joly et al Lancet 389:2031, 2017

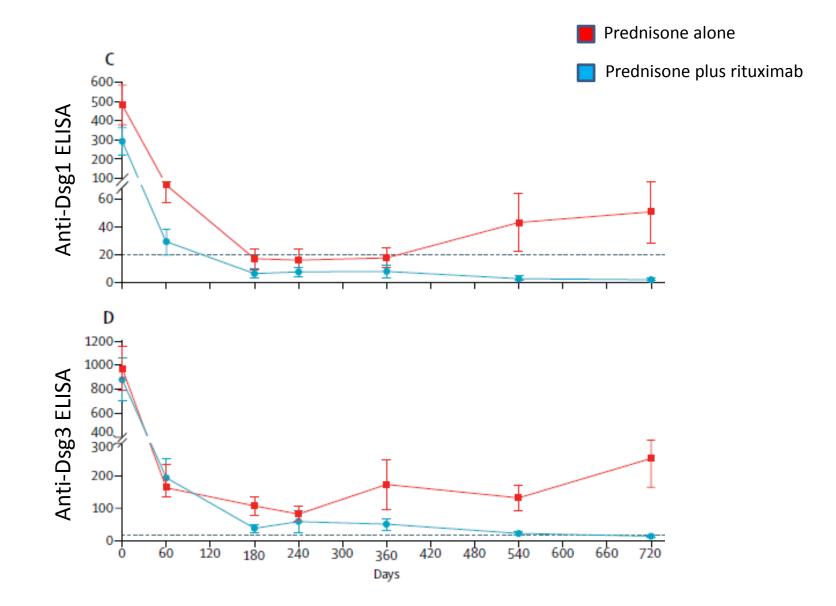
- 90 pemphigus patients (82% PV)
- Therapies
 - Rituximab plus prednisone taper from 0.5-1 mg/kg/day
 - Prednisone taper from 1-1.5 mg/kg/day
- Primary end point: CR of therapy (CROT) at month 24

Rituximab as primary therapy

Joly et al Lancet 389:2031, 2017

	Pred alone	Rituximab plus pred
CROT at 24 mos	34%	89%
Median time to CROT (d)	677	277
Median duration CROT (d)	62	446
Relapse	45%	24%
2 yr disease free	37%	75%
Severe adverse effects per pt *	1.2	0.59

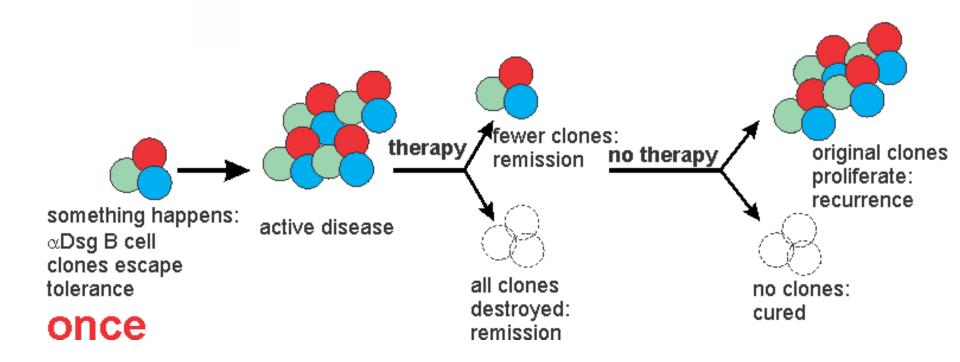
*diabetes, myopathy, bone disease most common; no deaths in either group



Rituximab adverse side effects

- 0-6.4% serious adverse effects
- Infection
 - reactivation HBV
 - other viral
 - bacterial
- Progressive multifocal leukoencephalopathy
 - JC virus (50% of population seropositive)
- TEN
- Neutropenia
 - one to several months after therapy
 - usually asymptomatic but if concomitant immunsuppression may have infectious complication
- Immediate hypersensitivity

Why pemphigus recurs after therapy



Potential cure in pemphigus

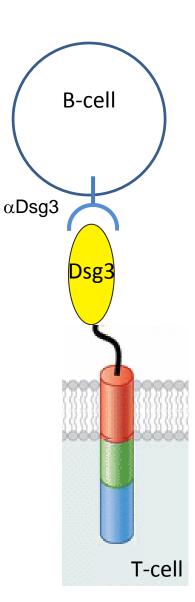
- Pemphigus patients do not have an ongoing defect in tolerance to desmoglein
- Pemphigus probably results in a one time "hit" with development of a few non-tolerant B cell clones
- If the oligoclonal B cells can be eliminated, disease can be cured

Therapeutic goals for pemphigus

- Decrease or eliminate autoantibodies with minimal off target effects on immune system
- To induce cure treatment aim is to eliminate all anti-Dsg B cells and/or T-cells
- Therapies that only decrease autoantibody titer (without eliminating anti-Dsg B and/or T cells) will be effective but probably not induce cure
 - Valuable in acute, severe disease

Future therapies

- argenx
- Chimeric autoantigen receptor cell based therapy
- Target anti-desmoglein T cell or use regulatory T cells

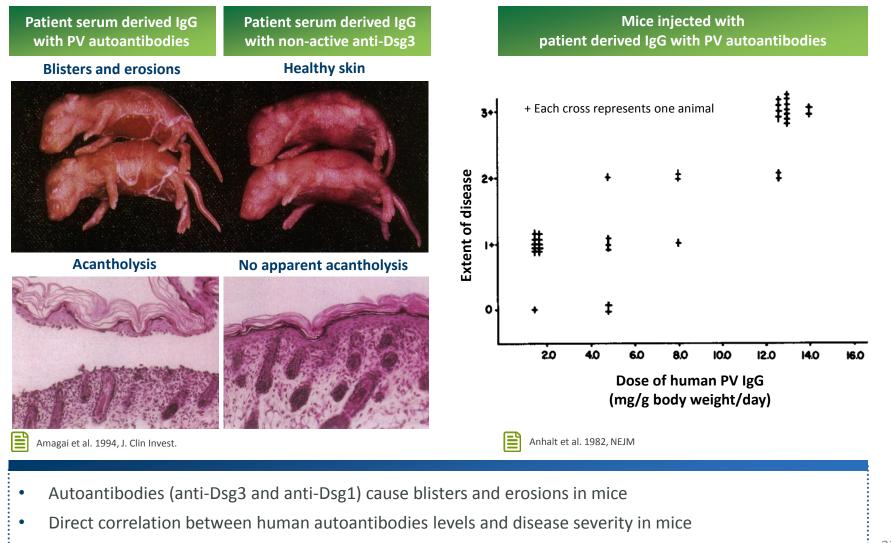




ARGX-113: Preclinical and clinical rationale for pemphigus vulgaris

Pemphigus vulgaris autoantibodies induce skin lesions

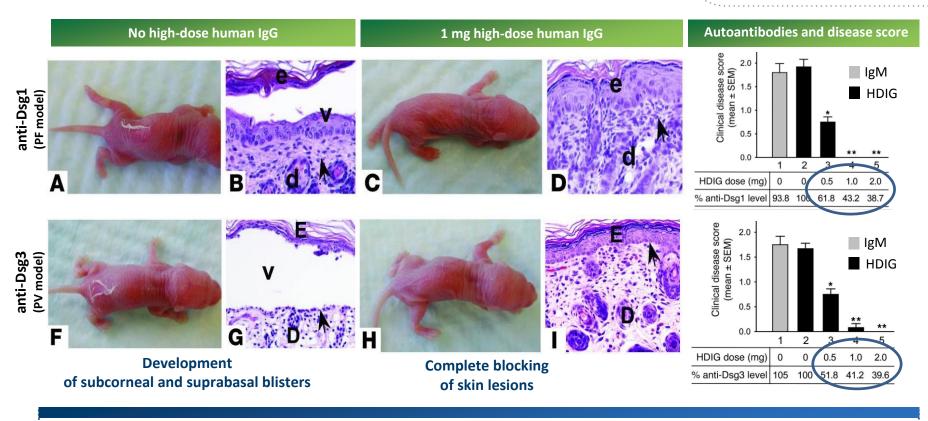
Autoantibody levels correlate with disease severity







High-dose human IgG prevents skin lesion formation in mice



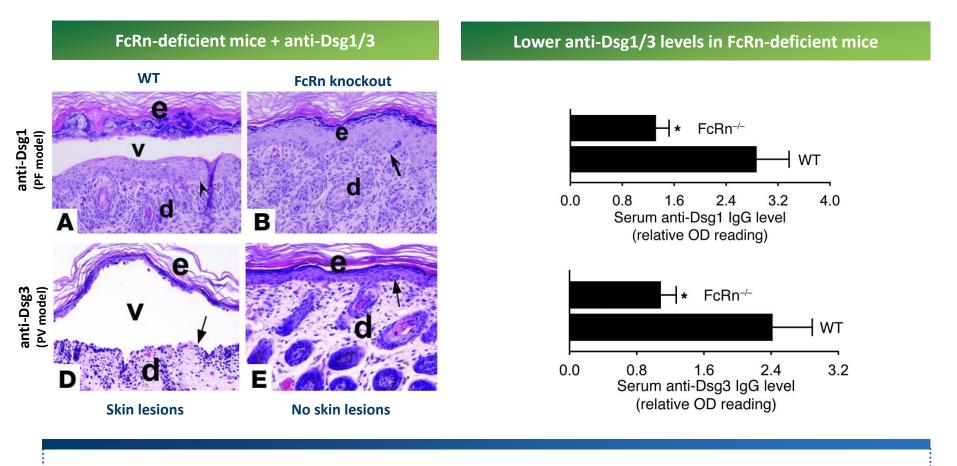
- Pre-treatment of mice with high-dose human IgG:
 - accelerates catabolism of pathogenic anti-Dsg1 and anti-Dsg3
 - prevents skin blisters
 - inhibits experimental pemphigus
- Lowering of autoantibodies levels correlates with reduction of clinical disease score

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FcRn-deficient mice resistant to experimental pemphigus

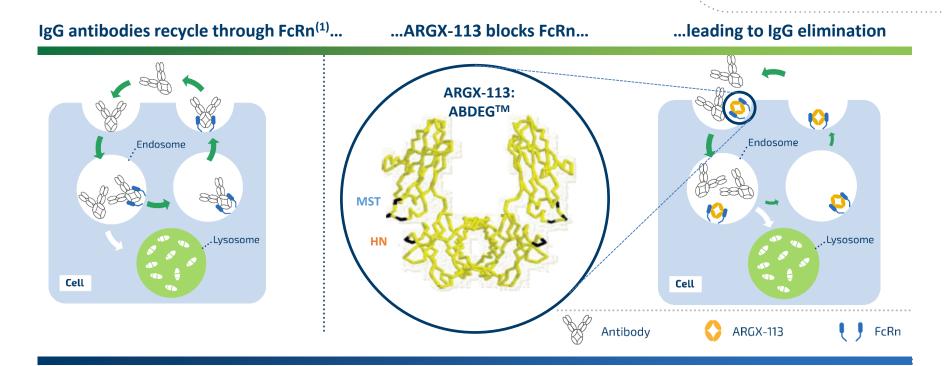


- FcRn-deficient mice resistant to anti-Dsg1/3 \rightarrow reduction in circulating pathogenic lgG
- Faster degradation prevents pathogenic IgG from reaching skin tissue targets \rightarrow skin blistering abolished

ARGX-113: Lead program based on novel target FcRn



An innovative approach to eliminate IgG autoantibodies

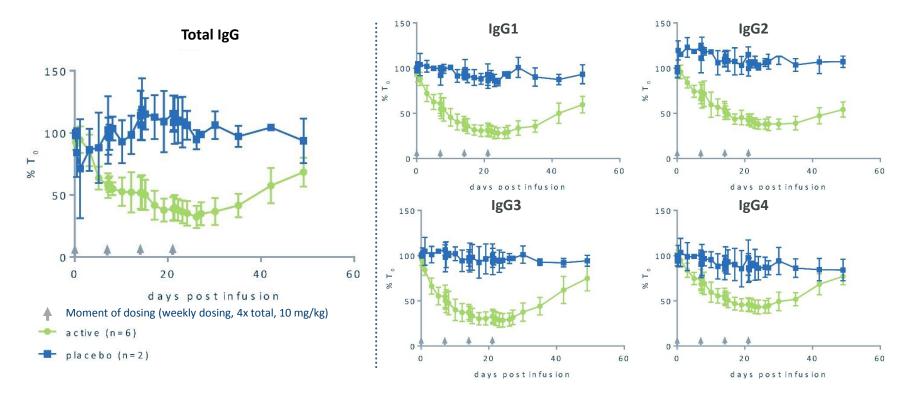


- ARGX-113 is a human IgG1 Fc-fragment that utilizes ABDEG[™] Fc engineering technology⁽²⁾⁽³⁾
- ARGX-113 targets and binds to FcRn blocking the recycling of IgG leading to an elimination of IgG antibodies
- Demonstrated 50% to 85% reduction of circulating IgG antibody levels in Phase 1 trial
- Pathogenic IgG antibodies mediate multiple autoimmune diseases
- There is a correlation between disease severity and autoantibody levels in pemphigus vulgaris

ARGX-113: IgG reduction seen in Phase 1

PD data multiple ascending dose (MAD) study in healthy volunteers

Dosing 10 mg/kg; every 7 days



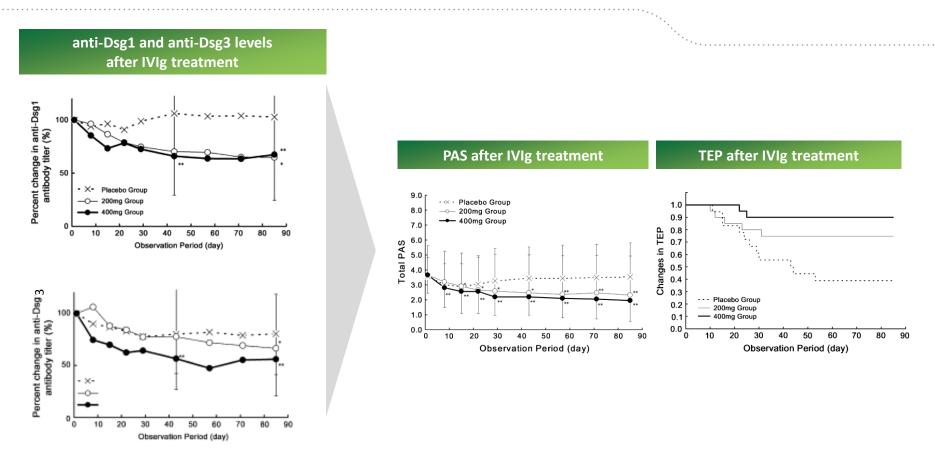
- IgG reduction across subclasses
- IgG reduction: 50% achieved in 1 week; up to 85% maximum reduction
- Selective IgG reduction, not affecting IgM/IgA and albumin levels (data not shown)
- Pathogenic anti-Dsg antibodies in PV are from IgG1 and IgG4 subclasses
- Total IgG reduction of 10 mg/kg dosing every 7 days for 4 weeks (median 69%; range: 55-83%)



Pemphigus vulgaris patients benefit from lowering autoantibodies



IVIg treatment

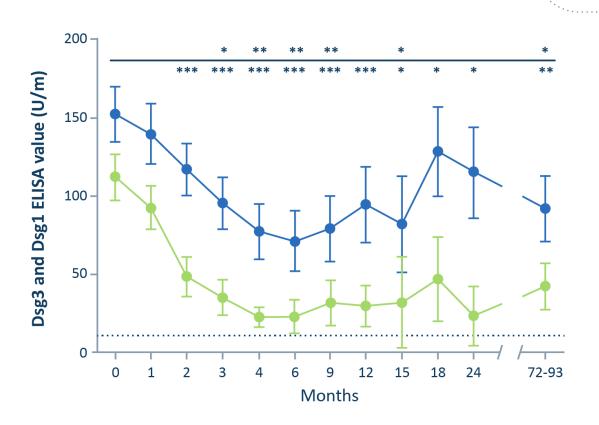


- IVIg treatment lowers anti-Dsg1 and anti-Dsg3 significantly
 - Correlates with lower total Pemphigus Activity Score (PAS)
 - Prolongs time to escape from the protocol (**TEP**) 10% and 25% after 90 days

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Pemphigus vulgaris patients benefit from lowering autoantibodies Rituximab treatment





- Rituximab treatment: B-cell depletion results in significant lower anti-Dsg1 and anti-Dsg3 levels ٠
- Autoantibodies levels reduced after several weeks to months ۲

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ARGX-113: favorable safety and tolerability profile



Phase 1 study in healthy volunteers

	Placebo	acebo		SAD						
				-				MAD		
ARGX-113 (mg/kg)		0.2	2	10	25	50	10 (q4d)	10 (q7d)	25 (q7d)	
N (total number of subjects)	18*	4	4	4	4	4	6	6	12**	•••••• <u>•</u>
INVESTIGATIONS										Moderate AE
Diff. WBC count abnormal					3	4		()		•
C-Reactive protein increased					2	4			1	Other= Mild AE
NERVOUS SYSTEM DISORDERS					4000000					
Headache	4				1 :	3	1		3	
Dizziness	1					2				
Somnolence									1	
MUSCULOSKELETAL AND CON	NECTIVE TISS		DERS							AEs that were
Back pain	2					1				considered possibly,
Myalgia						1				probably, or likely-
Pain in extremity						1				related to treatment
GASTROINTESTINAL DISORDER	S									(ARGX-113 vs. placebo)
Nausea						1				
Abnormal discomfort	1								1	
GENERAL DISORDERS AND ADM	VINISTRATIO	N SITE CO	NDITIONS							
Chills						1+ 1			2	
Fatigue	2								2	
Feeling cold	2								1	
Malaise									1	
Pyrexia									1	
EYE DISORDERS										
Photophobia						1				
Eye paresthesia								1		
SKIN AND SUBCUTANEOUS TIS	SUE DISORDI	ERS								
Hyperhidrosis	1					1				
Rash macular								1		
Rash maculo-papular									1	
BLOOD AND LYMPHATIC SYSTE	M DISORDE	RS								
Lymphadenopathy										44



ARGX-113: Phase 2 clinical trial in pemphigus vulgaris



ARGX-113: Proof-of-concept study in pemphigus vulgaris

Pemphigus vulgaris



- Antibody-driven disease
- Strong biomarkers (serum IgG, anti-Dsg 3 +/- 1) can be used to anticipate clinical activity
- High medical needs:
 - Early disease control
 - Keep patients under remission safely
 - Current treatments (e.g. high dose corticosteroids, immunosuppressant) = co-morbidity factors

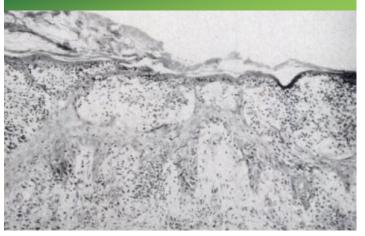
For updated review: Kasperkiewicz et al. 2017, Nature Reviews

Neonatal pemphigus vulgaris: Passive transfer of maternal IgG causing the disease

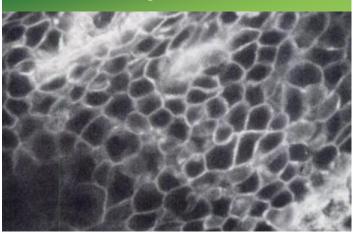




Acantholysis



Maternal IgG in newborn skin



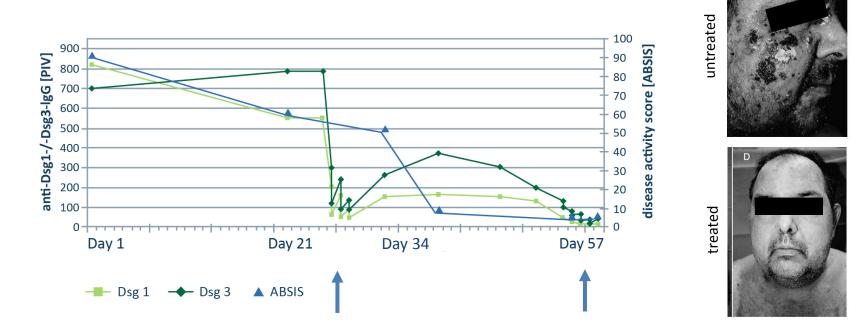


Pemphigus vulgaris patients benefit from lowering autoantibodies



Immunoadsorption treatment





• Immunoadsorption (2 cycles) reduces circulating autoantibodies (anti-Dsg1 and anti-Dsg3) rapidly

- 70-80 % reduction of total IgG
- 50-70% reduction of autoantibodies
- Disease control within 4-8 weeks

Current PV treatment can manage the disease, but carries significant health risks and damages quality of life





I just sat down for a snack and I realized I had a huge blood blister on my palate. Being a dentist I knew there could be a serious reason for this



My health deteriorated quickly, and in only five weeks I moved from being strong and healthy to being unable to eat and even walk around the city. I kept thinking, "This can't be true". I had no idea how living with a chronic disease would change my life



After several months of seeing doctors, three biopsies, and numerous hospital waiting rooms, I found out I had Pemphigus Vulgaris. I was started on high dose Prednisone

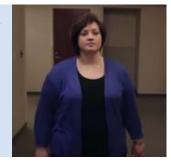
There's no cure, no smart drug to take it all away. It is nearly always controllable, but that control comes at a heavy cost.



The slightest change to my medication regimen could disturb the precarious balance, and instead of controlling the disease I'd be tumbling down into another crisis. Once I started Azathioprine, it did get a little easier though.



I found it very hard to accept that my health was badly damaged and I couldn't return to my old self. High dose corticosteroids and azathioprine had been necessary, and saved my life, but I was now disabled with problems walking, pain, and poor eye sight.





Two years after starting steroids, I'm finally off them. But, if I stop taking small doses of azathioprine, the blisters always come back.



At a conference, I heard about Rituximab. I didn't want to rock the boat and risk my health. But, I deserve to be symptom free. Few doctors have expertise with Rituximab, so it was difficult finding the right doctor to go through treatment with me.

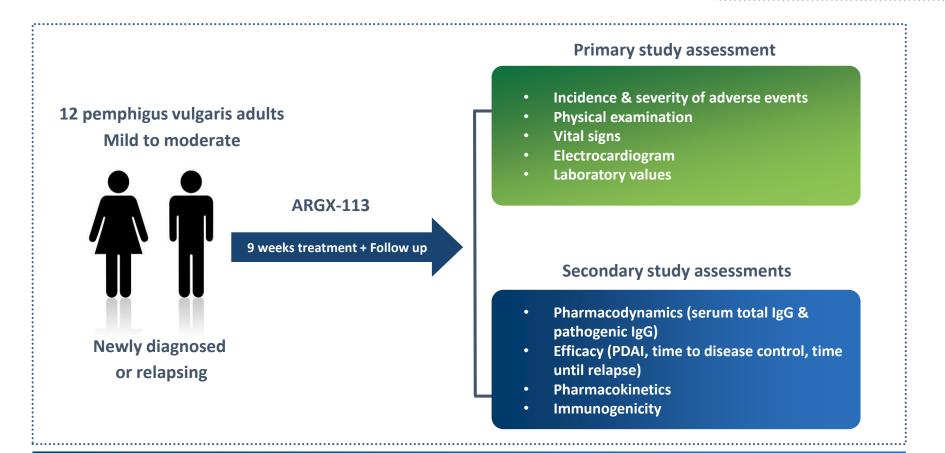




- Demonstrate pharmacologic effect of ARGX-113 in an IgG-driven disease
- Assess the safety and efficacy of ARGX-113 in pemphigus vulgaris (disease control, treatment consolidation)
- Prepare design of further trials in the indication



ARGX-113 Phase 2 study: Exploratory, open-label, non-controlled



- Newly diagnosed and relapsing patients off therapy: ARGX-113 used as monotherapy
- Relapsing patients under minimal prednisone: prednisone kept at stable dosage
- First line, long term treatment: effect of ARGX-113 at induction phase (3 weeks) and maintenance



PDAI: Pemphigus disease area index

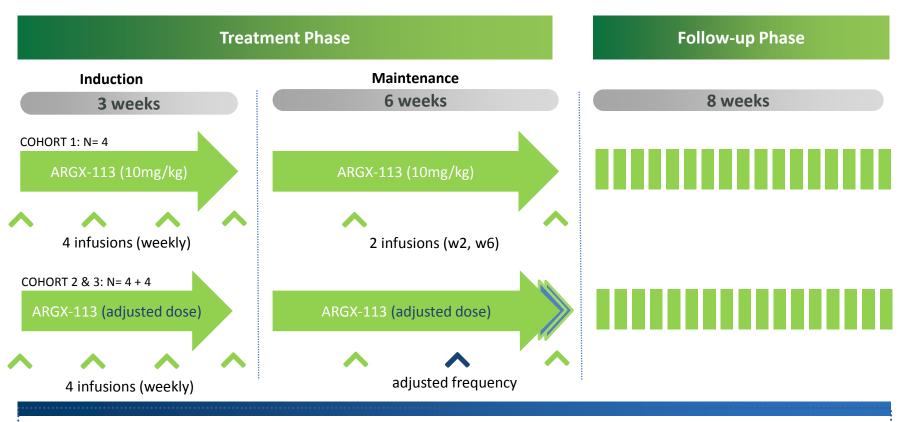
Skin	Skin Activity		Damage	Mucous membrane	•	
Anatomical Erosion/Blisters or new erythema		Post-inflammatory hyperpigmentation or erythema from resolving lesion	Anatomical Location	Erosion/Blisters		
	0 absent 1 1-3 lesions, up to one >2 cm in any diameter, none > 6 cm 2 2-3 lesions, at least two > 2 cm diameter, none > 6 cm 3 3 lesions, and/or at least one >6 cm	Number lesions if ≤ 3	0 absent 1 present		0 absent 1 1 lesion 2 2–3 lesions 5 >3 lesions or 2 lesions >2 cm 10 entire area	Number lesions if ≤ 3
	10 >3 lesions, and/or at least one lesion			Eyes		
Ears	>16 cm diameter or entire area			Nose		
Ears Nose				Buccal mucosa		
Rest of the face				Hard palate		
Neck				Soft palate		
Chest				· · ·		
Abdomen				Upper gingiva		
Back, buttocks				Lower gingiva		
Arms Hands				Tongue		
Legs				Floor of mouth		
Feet				Labia bucosa		
Genitals				Posterior pharynx		
Total skin	/120		/12	Anogenital		
Scalp		Number	Post-inflammatory	Total Mucosa	/120	
Scalp	Erosion/Blisters or new erythema	Number lesions if ≤ 3	hyperpigmentation or erythema from resolving lesion			
	0 absent 1 in one guadrant		0 absent 1 present	Severity	. PDAI ⁽²⁾⁽³⁾	
	2 two quadrants 3 three guadrants		r prosent	Mild	1-14	
	4 affects whole skull 10 at least one lesion > 6 cm			Moderate	15-44	
Total Scalp (0–10			/1	Severe	≥ 45	

- PDAI: international validated score (preferable as severity measure)
- High score denotes worse disease
- Score range: from 0 to 263 (250 points measuring disease activity & 13 points measuring post-inflammatory lesions)
- Disease control: absence of new lesion, and established lesions beginning to heal
- Relapse: appearance of 3 or more lesions within the month not healing spontaneously within one week, or extension of established lesions

(1) Rosenbach et al. 2009, J invest. Dermatol (2) Hanna et al. 2016, Int J Womens Dermatol (3) Boulard et al. 2016, Br J Dermatol (4) Murell et al. 2008, J Am Acad Dermatol



ARGX-113 Phase 2 study : IDMC-driven adaptive design



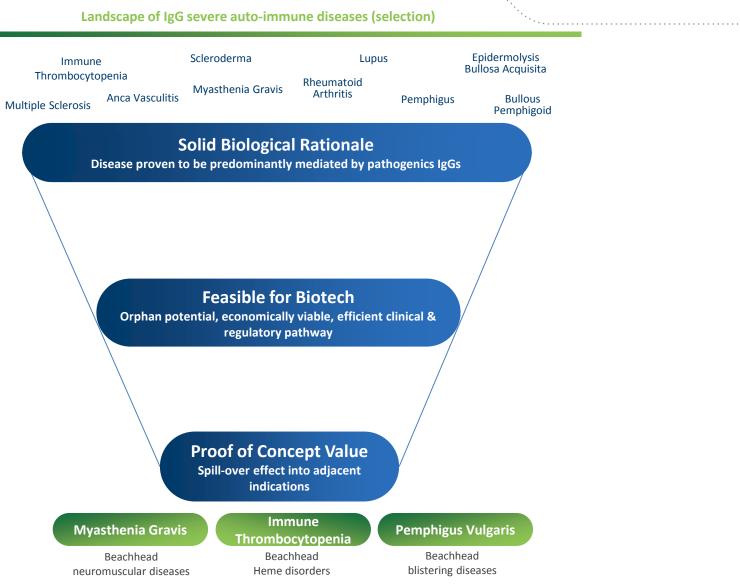
- Patients enrollment divided in 3 sequential cohorts
- IDMC recommendations for cohorts 2 & 3:
 - Change of dose (max dose of 25mg/kg)
 - Frequency of administration at maintenance (max 2 extra doses after each cohort)
 - Expansion of maintenance duration



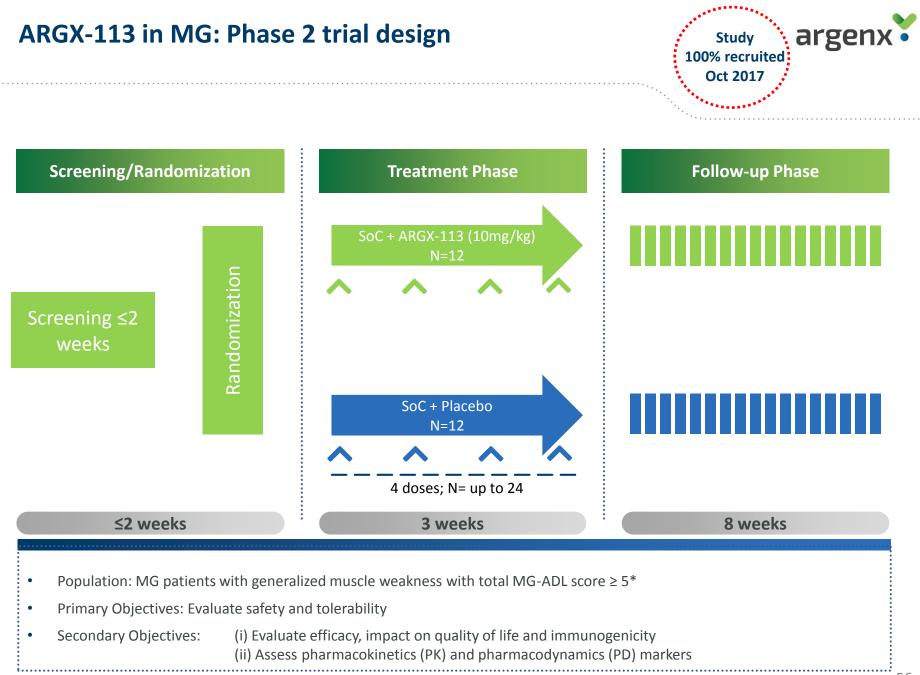
ARGX-113: A pipeline-in-aproduct opportunity

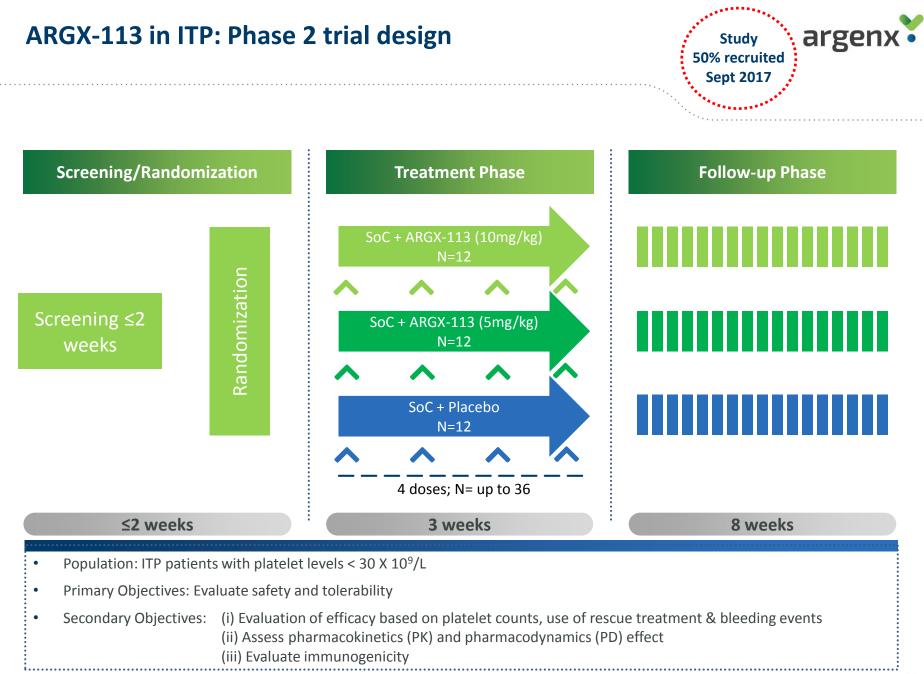
ARGX-113: A pipeline-in-product opportunity

Prioritizing IgG autoantibody mediated diseases



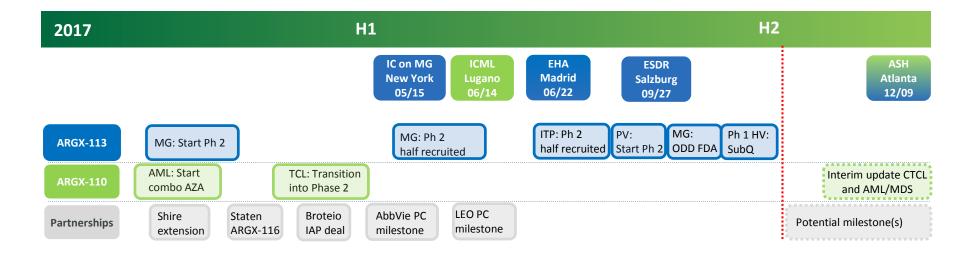






Key Upcoming Milestones & Communications





2018	H1	H2					
ARGX-113	Top-line results MG Ph 2 trial	Top-line results ITP Ph 2 trial					
ARGX-110		Top-line results CTCL Ph 2 trial					
Partnerships	Potential milestone(s)						



Please Join argenx for a Lunch and Discussion during the ASH Annual Meeting

Monday, December 11, 2017

12:00 PM - 1:30 PM

Omni Atlanta Hotel

South Tower Atrium Terrace Birch Room 100 CNN Center NVV Atlanta, GA 30303 Next to Convention Center

Please RSVP by Monday, December 4

Rachel Frank rachelf@sternir.com 212.362.1200 Advancing ARGX-110 to clinical proof-of-concept in acute myeloid leukemia (AML) & cutaneous t-cell lymphoma (CTCL)

Agenda

Overview of AML Gail Roboz, MD Weil Cornell Medicine, New York

CD7 0: Novel AML Target Hans de Haard, PhD, argenx

Phase 1/2 AML Trial: Proof-of-Biology Data Nicolas Leupin, MD, argenx

Phase 1/2 CTCL Trial: Data Update Nicolas Leupin, MD, argenx

Q&A

Guest Speaker

Gail Roboz, MD

Professor of Medicine and Director of Clinical and Translational Leukemia Program

Weill Medical College of Cornell University and New York Presbyterian Hospital

Following the presentation, please join us and our colleagues from the University of Bern for an informal mix and mingle.



Thank you!

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