

Botulinum Toxin treatment of dystonia

Rezzak Yilmaz

05 September 2025

Dystonia: Bridging Theory and Hands-On Expertise

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Company/ Institution	Honoraria/ expenses	Consulting	Funded research	Patent	Other
Gen Pharma	X	X			
ARIS Pharma	X		X		
Abbvie	X	X			
Ilko Pharma	X		X		
Abdi Ibrahim Pharma	X				
Nobel Pharma					
Ankara University			X		
TÜBİTAK			X		

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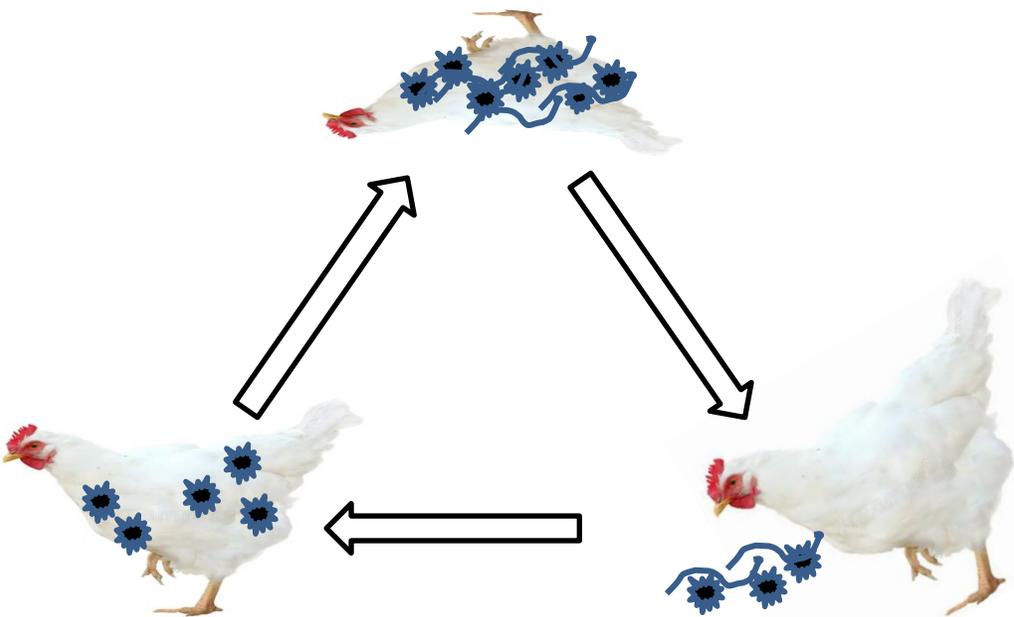
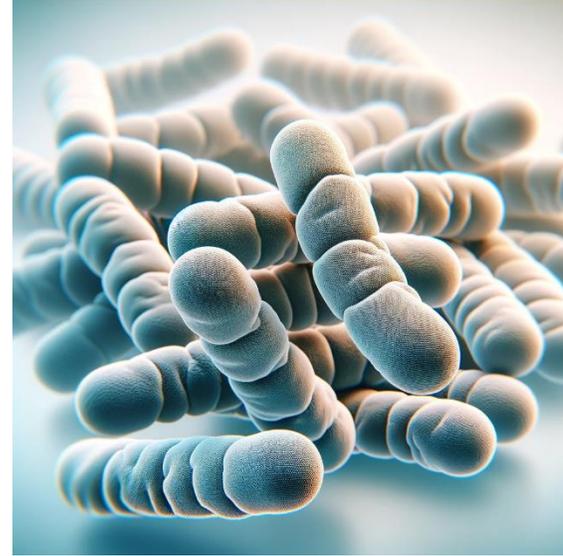
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Clostridium botulinum, *baratii*, *butyricum*, *argentinense*

Clostridium tetani

Toxin types: A, B, C1, D, EE, F, G ve H



Wildl Dis. 2010 Jul;46(3):912-7. doi: 10.7589/0090-3558-46.3.912.

An outbreak of type C botulism in waterbirds: Incheon, Korea

Na-Ri Shin ¹, Seong Hwan Byun, Jeong Hoon Chun, Jeong Hwa Shin, Yun Jeong Kim, Jeong-Hee Kim,
Gi-Eun Rhie, Hyen Mi Chung, In-Pil Mo, Cheon-Kwon Yoo

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REVIEW

Biological warfare in a historical perspective

R. Roffey¹, A. Tegnell² and F. Elgh^{1,2,3}

¹Swedish Defense Research Agency, Division of NBC-Defense, Umeå, ²Center for Microbiological Preparedness, Swedish Institute for Infectious Disease Control (SMI), Solna and ³Department of Virology, Umeå University, Umeå, Sweden

- 1930-1940 Red Army Institute of Bacteriology, Vlasikha, Russia
- 1974, 1979 Iraq, Al Hazen
- WWII investigations in Japan and USA

United States Army Chemical Corps



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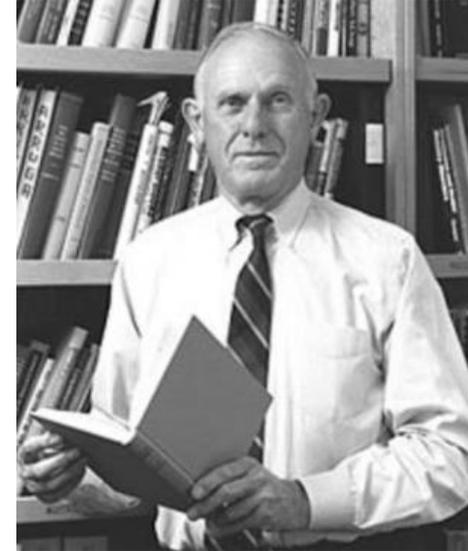
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Justinus Kerner
(18.09.1786 – 21.02.1862)



Émile van Ermengem
(1851–1932)



Alan Brown Scott
(13.07.1932 – 16.12.2021)

> Invest Ophthalmol. 1973 Dec;12(12):924-7.

Pharmacologic weakening of extraocular muscles

A B Scott, A Rosenbaum, C C Collins



Botulus

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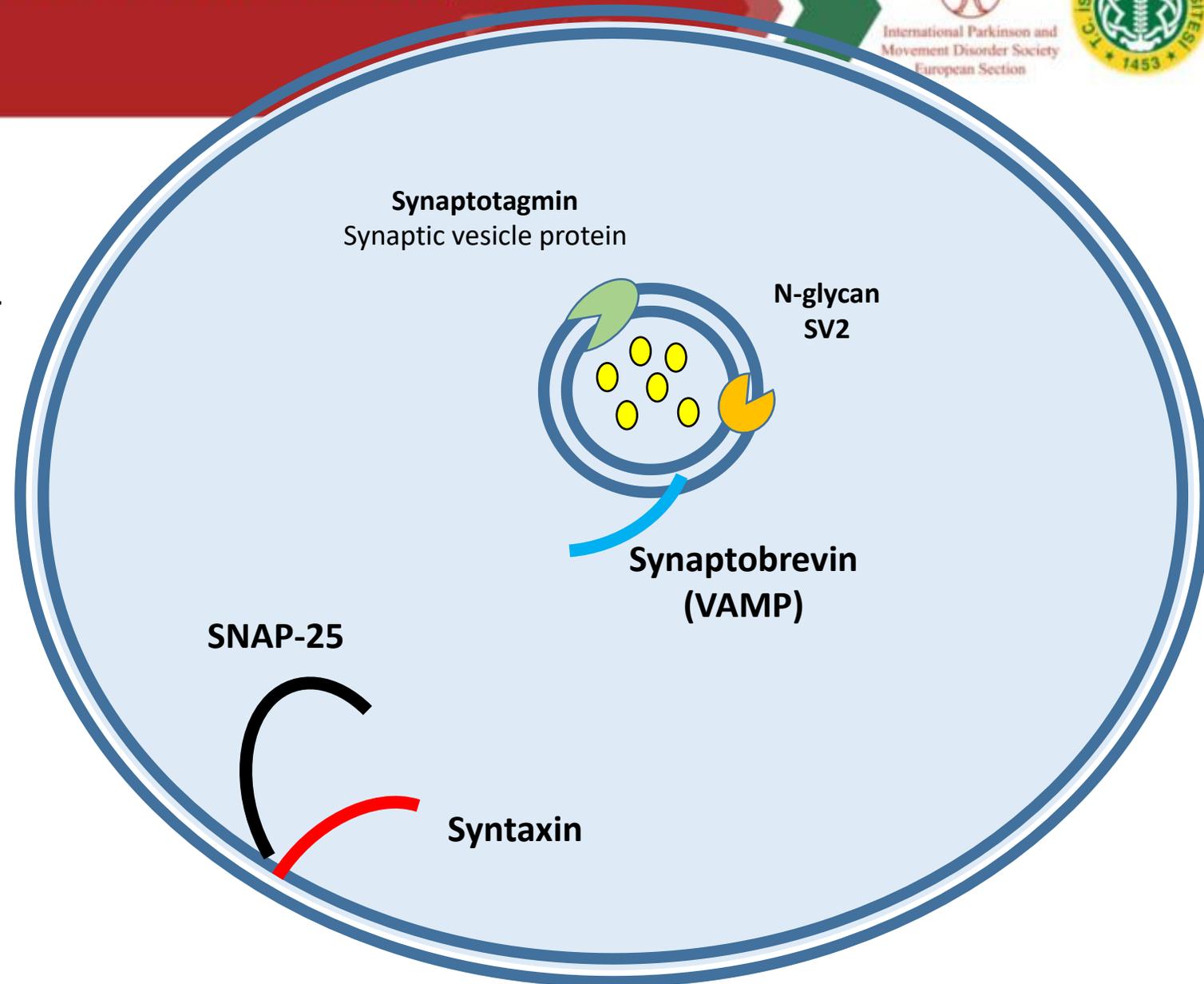
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SNARE proteins:

Soluble **N**SF **A**ttachment **P**rotein **R**Eceptor
(**N**-ethylmaleimide-**S**ensitive **F**actor)

1. **Synaptobrevin** (vesicle- associated membrane protein - VAMP)
2. **Syntaxin**
3. **SNAP-25** (Synaptosomal-Associated Protein of 25 kDa)

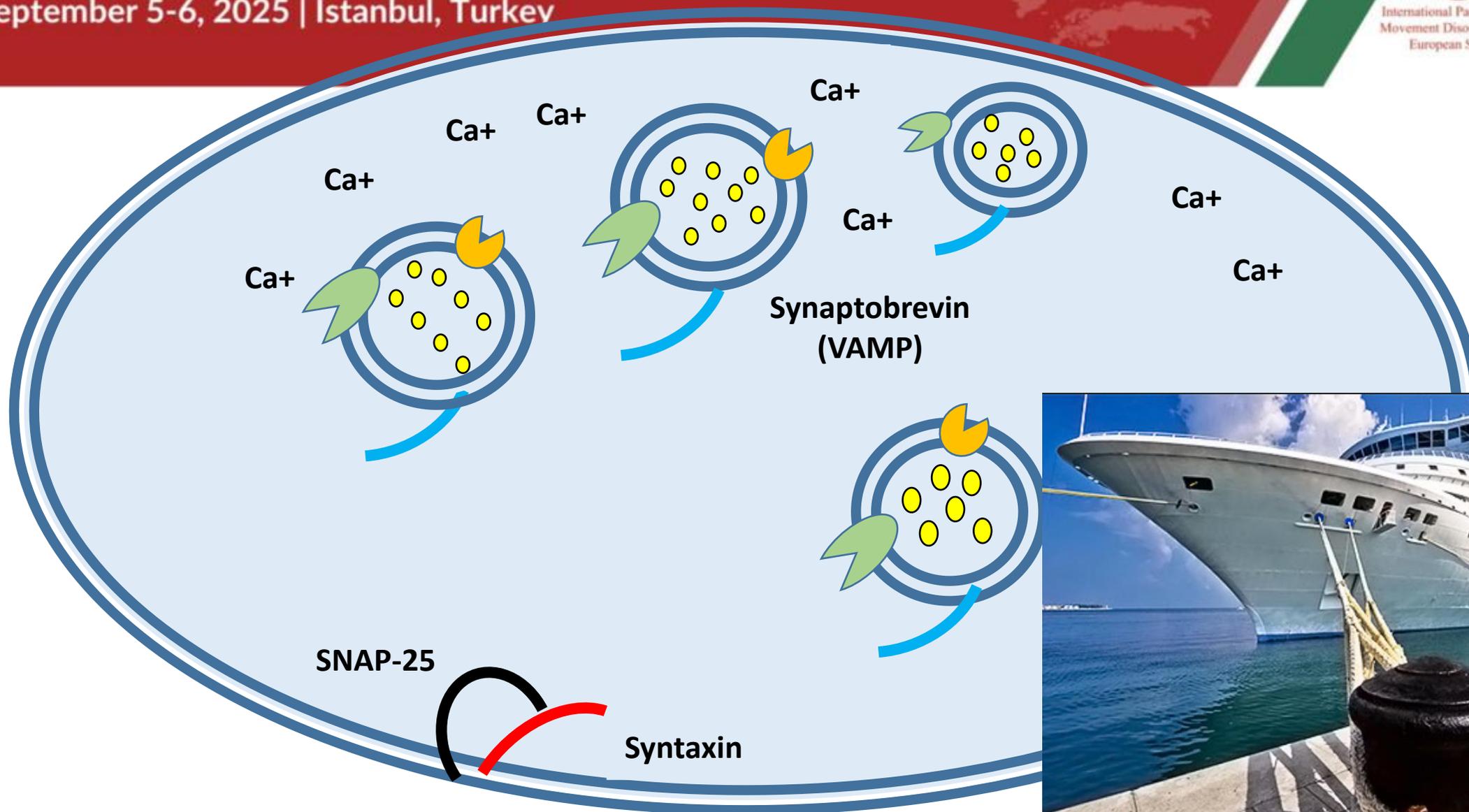


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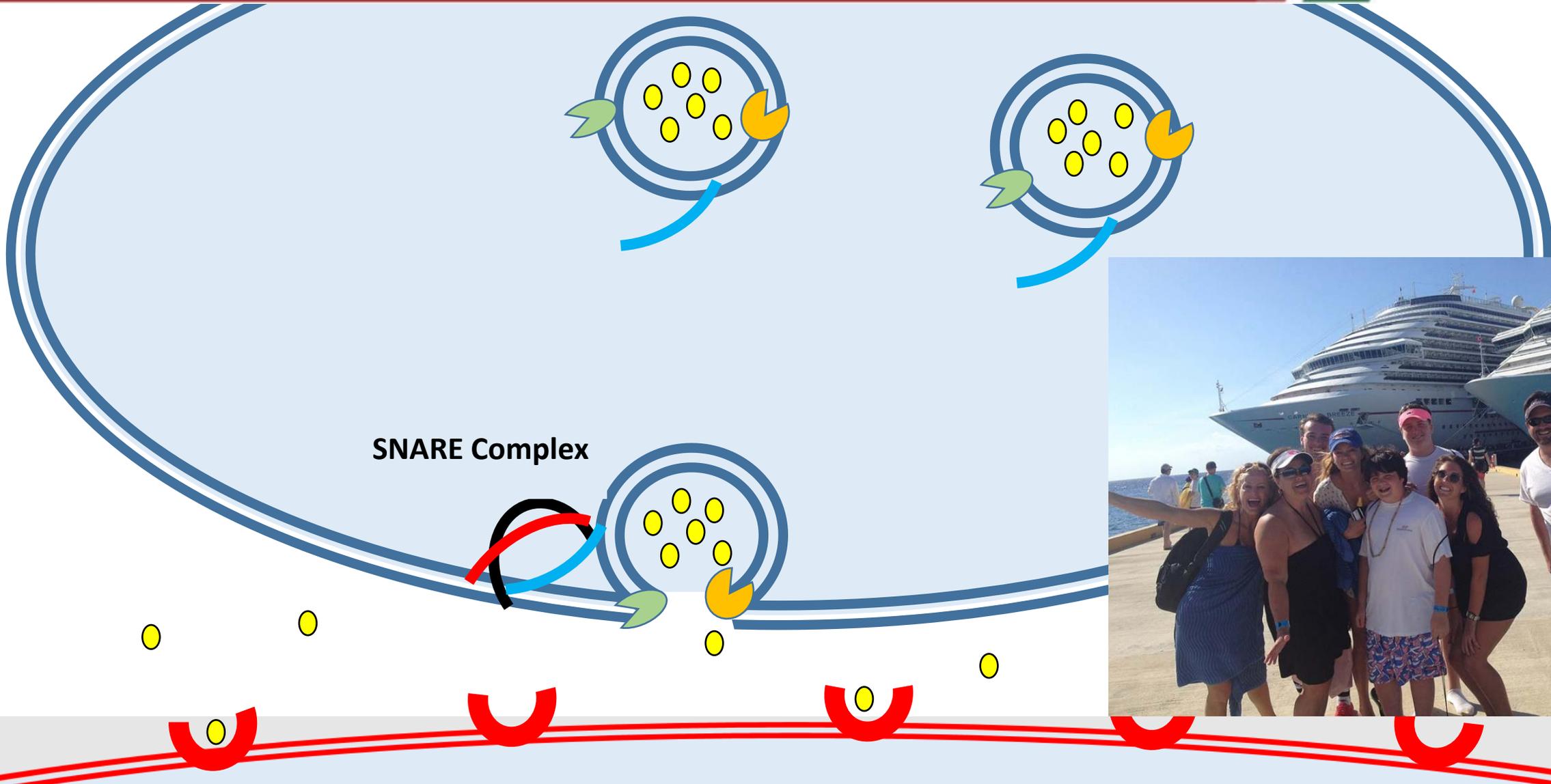


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Brand	Year	Indications
Botox® (OnabotulinumtoxinA)	1989	Strabismus & Blepharospasm (1989), Cervical Dystonia (2000), Hyperhidrosis (2004), Chronic Migraine (2010), Upper Limb Spasticity (2010), Overactive Bladder (2013), Pediatric Spasticity (2016)
Dysport® (AbobotulinumtoxinA)	2009 1991 (UK)	Cervical Dystonia (2009), Adult Upper Limb Spasticity (2015), Pediatric Lower Limb Spasticity (2016), Pediatric Upper Limb Spasticity (2019)
Xeomin® (IncobotulinumtoxinA)	2010 2005 (EU)	Cervical Dystonia (2010), Blepharospasm (2010), Upper Limb Spasticity (2015), Pediatric Spasticity (2020)
Jeuveau® / Nabota® (PrabotulinumtoxinA)	-	no therapeutic FDA approvals in U.S.
Daxxify® (DaxibotulinumtoxinA-lanm)	2022	Cervical Dystonia (2023)
Myobloc® / Neurobloc® (RimabotulinumtoxinB)	2000	Cervical Dystonia (Europe 1998) / Cervical Dystonia (USA 2000)

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OnabotulinumtoxinA	Botox [®] Cosmetics [®] Vistabel [®]	Allergan-AbbVie	USA/
AbobotulinumtoxinA	Dysport [®] Azzalure [®] Reloxin [®]	Ipsen/Medicis	UK/France/ USA
IncobotulinumtoxinA	Xeomin [®] Cosmetics [®] Bocouture [®]	Merz Pharmaceuticals	Germany
RimabotulinumtoxinB	NeuroBloc [®] Myobloc [®] NerBloc [®]	US WorldMeds/Eisai/ Sloan/Elan/Solstice	USA
PrabotulinumtoxinA	Nabota [®] Jeveau [®] Evosyal [®]	Daewoong/Evolus- Alphaeon	R. Korea/ USA
DaxibotulinumtoxinA	RTT150	Revance	USA
	Relatox [®]	Microgen	Russia
	Botulax [®]	Hugel	R. Korea
	Masport [®]	Masoundarou	I.R. Iran
	CosmeTox [®]	Transdermal	USA
	BTXA [®]	Intas	India
	Botogenie	BioMed	India
	EB-001	Bonti/Allergan	USA
MCL005	Malvern Cosmeceuticals	UK	
ANT-1207	Anterios/Allergan	USA	

LanbotulinumtoxinA	Hengli [®] Lantox [®] Lanzox [®] CBTX-A [®] Prosigne [®] Redux [®] Liftox [®] Dituroxal [®]	Lanzhou Institute of Biological Products/Hugh Source	P.R. China
	Neuronox [®] Meditoxin [®] Botulift [®] Cunox [®]	Medytox	R. Korea
	Coretox [®] Innotox [®] Botulax [®] Zentox [®] Regenox [®]	Medytox Medytox/Allergan Hugel	R. Korea R. Korea/ R. Korea

- 42 brands

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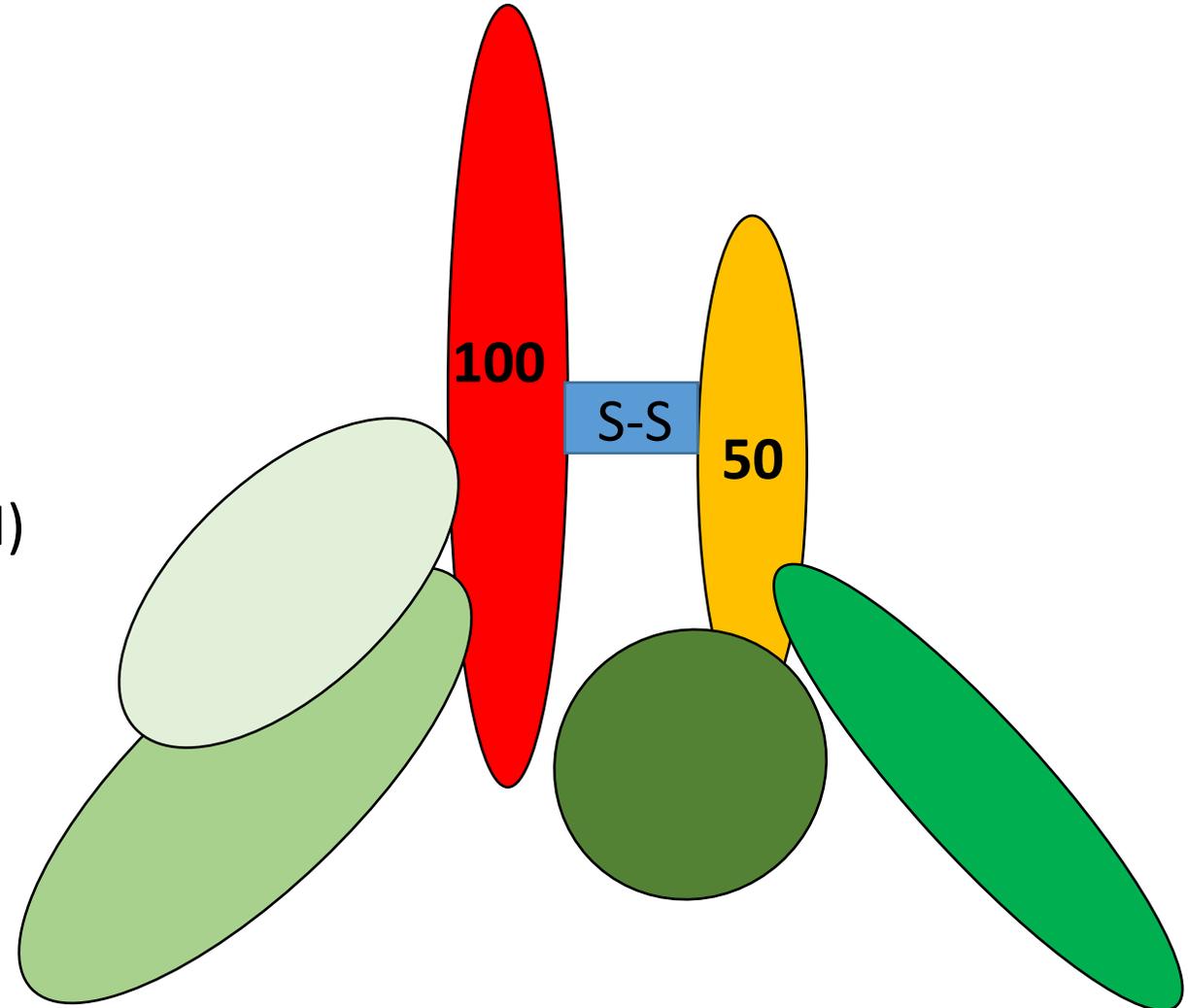
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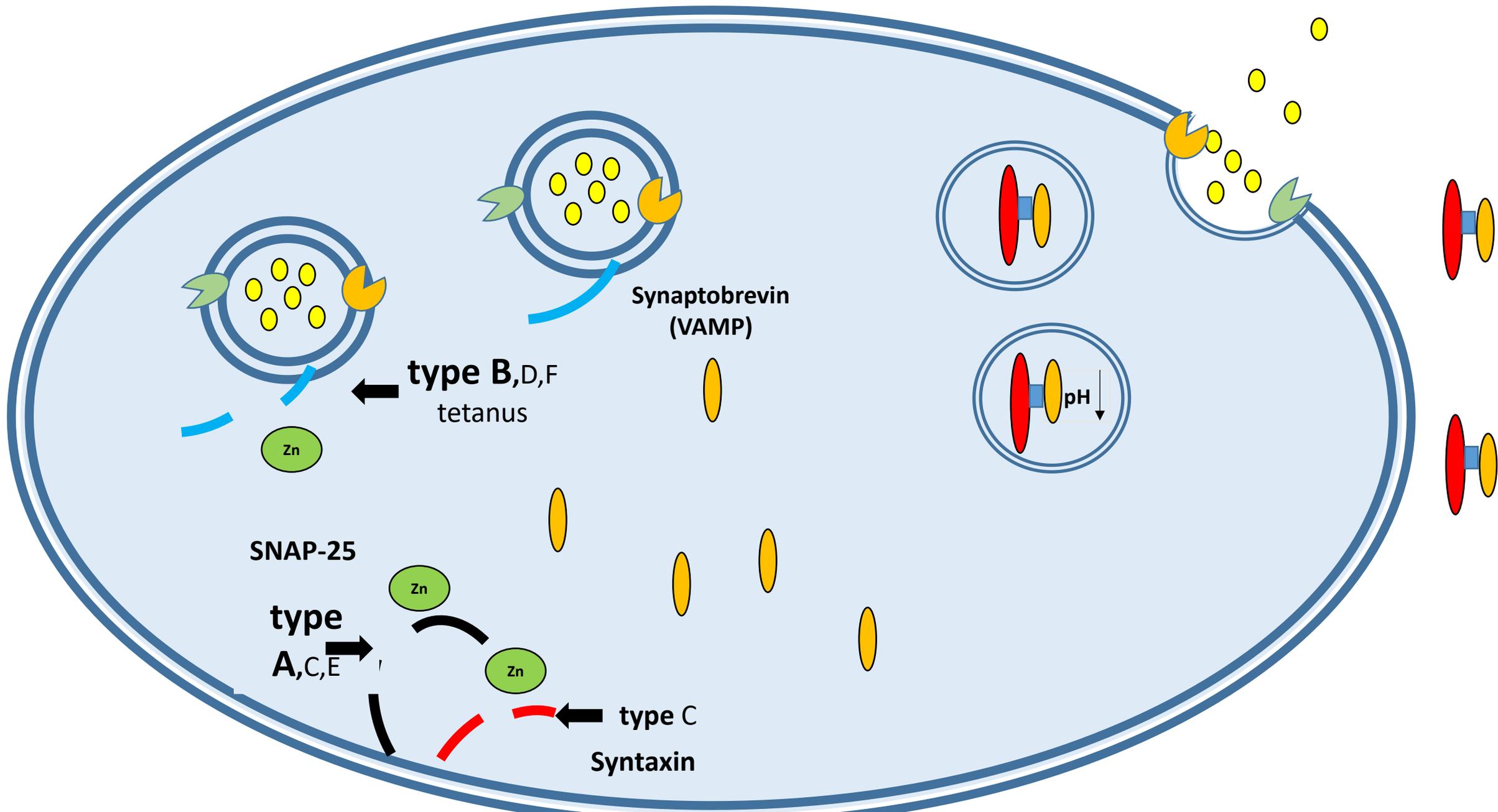


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- 1296 aminoacids
- Heavy chain: 100 kDa
- Light chain: 50 kDa
- Accessory proteins
 - Hemagglutinin proteins
 - Non-toxic non-hemagglutinin (NTNH)
 - Albumin
 - Sugars
- Total: 900 Kda (onaBONT)



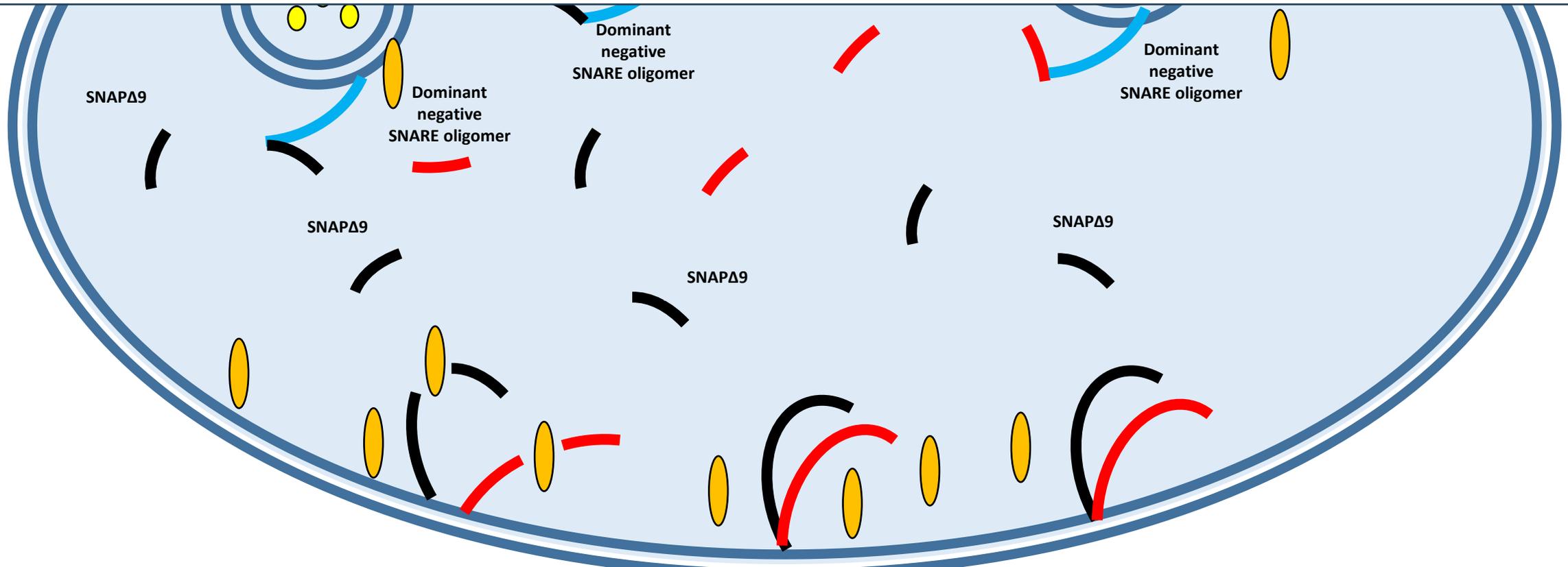


Why Does the Effect Last So Long?

1: Truncated SNARE protein fragments continue to form inactive complexes

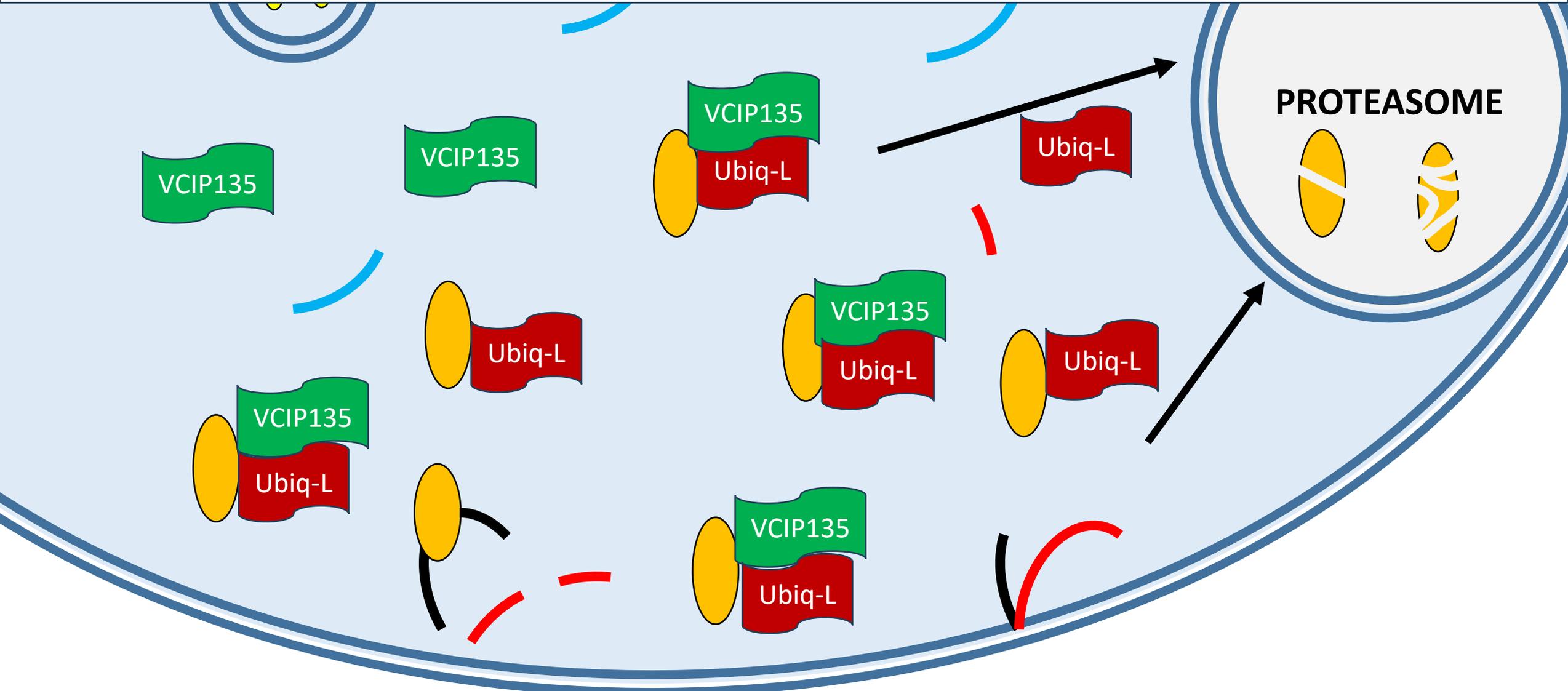
Why Does the Effect Last So Long?

2: The light chain is located in close proximity to the target SNARE proteins



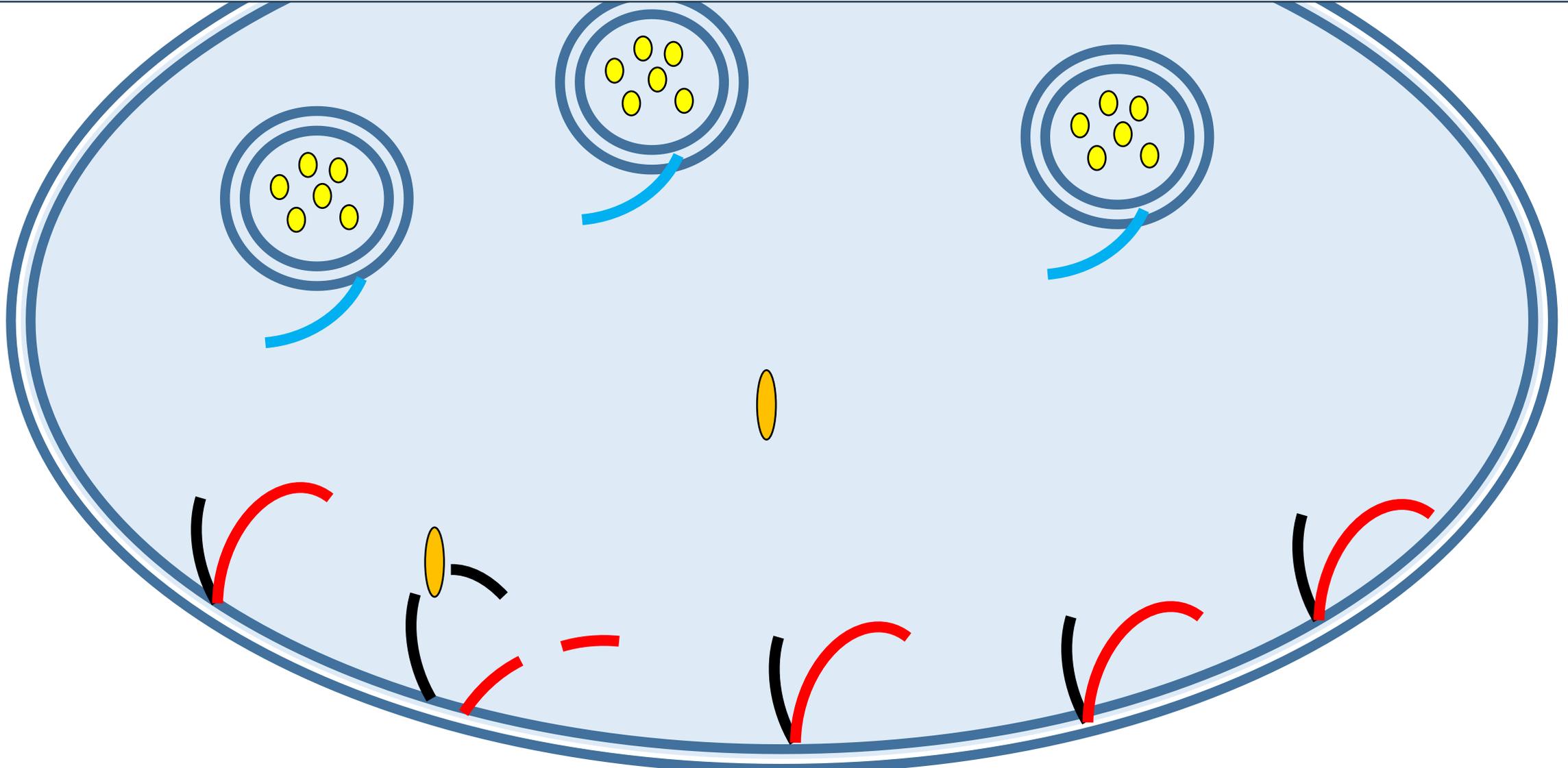
Why Does the Effect Last So Long?

3: Light chain-VCIP135 interaction shields the light chain from ubiquitination.



Why Does the Effect Last So Long?

4: Even if very few light chains remain, paralytic activity continues



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- First period: (one month): Forming new NM junctions – axonal sprouting
- Second period: Refunctioning of the NM junction, decline in sprouting (2 months)

Alderson et al., 1991; Paiva et al. 1999; Filippi et al., 1993; Rosales et al., 1996, Ishikawa et al., 2000



Efficacy and Safety of DaxibotulinumtoxinA for Injection in Cervical Dystonia

ASPEN-1 Phase 3 Randomized Controlled Trial

Cynthia L. Comella, MD, Joseph Jankovic, MD, Robert A. Hauser, MD, Atul T. Patel, MD, Marta D. Banach, MD, PhD, Edvard Ehler, MD, Domenico Vitarella, PhD, Roman G. Rubio, PhD, and Todd M. Gross, PhD, on behalf of the ASPEN-1 Study Group

Correspondence

Dr. Comella
cynthia_comella@rush.edu

Neurology® 2024;102:e208091. doi:10.1212/WNL.0000000000208091

Results

Of 444 individuals screened, 301 were randomized to DAXI 125U (n = 125) or 250U (n = 130) or placebo (n = 46). DAXI 125U and 250U significantly improved the mean TWSTRS total score vs placebo (least squares mean [standard error] difference vs placebo: DAXI 125U, -8.5 [1.93], $p < 0.0001$; DAXI 250U, -6.6 [1.92], $p = 0.0006$). The median duration of effect (time from treatment until loss of $\geq 80\%$ of the peak improvement in average TWSTRS total score achieved at weeks 4 and 6) was 24.0 (95% confidence interval 20.3–29.1) weeks with DAXI 125U and 20.3 (16.7–24.0) weeks with DAXI 250U. Significant improvements were also observed with DAXI in CGIC and PGIC responder rates and TWSTRS subscales. Treatment-related treatment-emergent adverse events (TEAEs) were reported by 29.6% of participants with DAXI 125U, 23.8% with DAXI 250U, and 17.4% with placebo, with injection site pain being the most common overall. The most frequently reported treatment-related TEAEs of interest in DAXI 125U, DAXI 250U, and placebo, respectively, were muscular weakness (4.8%, 2.3%, 0%), musculoskeletal pain (2.4%, 3.1%, 0%), and dysphagia (1.6%, 3.8%, 0%).



Clinical Trial > [Plast Reconstr Surg. 2018 Dec;142\(6\):847e-855e.](#)

Safety and Efficacy of EB-001, a Novel Type E Botulinum Toxin, in Subjects with Glabellar Frown Lines: Results of a Phase 2, Randomized, Placebo-Controlled, Ascending-Dose Study

Steve G Yoelin¹, Sunil S Dhawan¹, Domenico Vitarella¹, Wajdie Ahmad¹, Fauad Hasan¹, Susan Abushakra¹

Results: A two-grade investigator-rated response was observed starting in the third cohort (EB-001), with increased rates observed at higher doses. Onset of clinical effect was within 24 hours, with a duration ranging between 14 and 30 days for the highest doses. Adverse event incidence was low, with the most common being mild to moderate headache. There were no serious adverse events or ptosis, and there were no clinically significant changes in other safety assessments.

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April 24, 2025

AbbVie Submits Biologics License Application to U.S. FDA for TrenibotulinumtoxinE (TrenibotE) for the Treatment of Glabellar Lines



–TrenibotE is a first-in-class botulinum neurotoxin serotype E characterized by a rapid onset of action as early as 8 hours after administration (earliest assessment time) and shorter duration of effect of 2-3 weeks.

–If approved, TrenibotE will be the first neurotoxin of its kind available to patients.

–Submission is supported by data from over 2,100 patients treated with TrenibotE throughout the clinical program.

NORTH CHICAGO, Ill., April 24, 2025 /PRNewswire/ -- AbbVie (NYSE: ABBV) today announced submission of a Biologics License Application (BLA) to the U.S. Food and Drug Administration (FDA) for trenibotulinumtoxinE (TrenibotE) for the treatment of moderate to severe glabellar lines.

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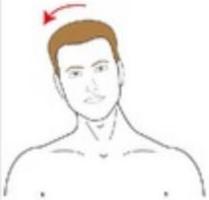
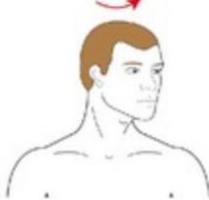
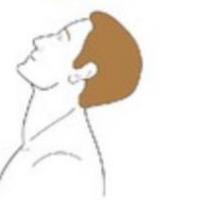
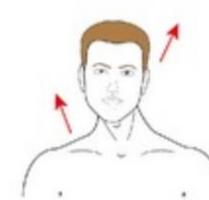
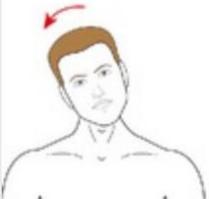
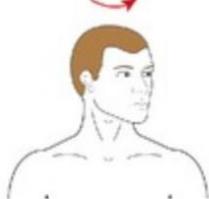
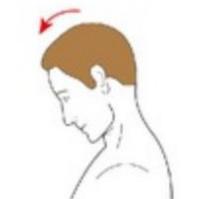
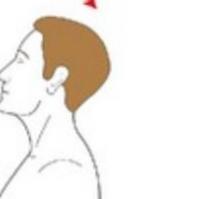
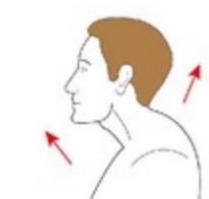
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> Mov Disord Clin Pract. 2015 May 7;2(3):224-226

Selection of Muscles for Botulinum Toxin Injections in Cervical Dystonia

Wolfgang H Jost¹, Laurent Tatu²

<p>Laterocollis: <i>ipsilateral</i> M. levator scapulae (M) M. semispinalis cervicis (M) M. scalenus medius (S) M. longissimus cervicis (S)</p>  <p>Laterocollis</p>	<p>Torticollis: <i>ipsilateral</i> M. semispinalis cervicis (M) M. levator scapulae (M) M. splenius cervicis (S) M. longissimus cervicis (S)</p>  <p>Torticollis</p>	<p>Anterocollis: <i>bilateral</i> M. scalenus medius (M) M. levator scapulae (M) M. longus colli (S)</p>  <p>Anterocollis</p>	<p>Retrocollis: <i>bilateral</i> M. semispinalis cervicis (M)</p>  <p>Retrocollis</p>	<p>Lateral shift: Combination of laterocollis to one side and laterocaput to the opposite site Correspondent muscles</p>  <p>Lateral shift</p>
<p>Laterocaput: <i>ipsilateral</i> M. sternocleidomastoideus (M) M. trapezius pars descendens (M) M. splenius capitis (M) M. semispinalis capitis (S) M. longissimus capitis (S) M. levator scapulae (S)</p>  <p>Laterocaput</p>	<p>Torticaput: <i>contralateral</i> M. trapezius pars descendens (M) M. sternocleidomastoideus (M) M. semispinalis capitis pars med. (S) <i>ipsilateral</i> M. obliquus capitis inferior (M) M. longissimus capitis (S) M. splenius capitis (S)</p>  <p>Torticaput</p>	<p>Anterocaput: <i>bilateral</i> M. longus capitis (M) M. levator scapulae (M) M. sternocleidomastoideus (S)</p>  <p>Anterocaput</p>	<p>Retrocaput: <i>bilateral</i> M. obliquus capitis inferior (M) M. semispinalis capitis (M) M. trapezius pars descendens (M) M. splenius capitis (S)</p>  <p>Retrocaput</p>	<p>Sagittal shift: Combination of anterocollis and retrocaput Correspondent muscles</p>  <p>Sagittal shift</p>

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Muscle	BOTOX® (units)	XEOMIN® (units)	DYSPORE® (units)	NeuroBloc® (units)
Sternocleidomastoid ^a	20–50	20–50	80–200	1000–2500
Infrahyoid muscles ^a	10–15	10–15	40–60	500–750
Anterior scalene	10–20	10–20	40–80	500–1000
Middle scalene	10–20	10–20	40–80	500–1000
Posterior scalene	10–20	10–20	40–80	500–1000
Levator scapulae	10–25	10–25	40–100	500–1250
Trapezius (upper portion)	20–50	20–50	80–200	1000–2500
Splenius capitis ^a	50–100	50–100	200–400	2500–5000
Semispinalis capitis ^a	15–30	15–30	60–120	750–1500

Kamm & Reiner 2010

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Toxin	Upper lid (U)		Lower lid (U)		Other
	Medial	Lateral	Medial	Lateral	
Botox [®]	1.25–5	1.25–5	1.25–5	1.25–5	1.25–5
Dysport [®]	20	40	20	40	
Xeomin [®]	5	5	5	5	
Myobloc [®]	150	150	150	150	

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Clinical Trial > [J Neurol Neurosurg Psychiatry](#). 1991 Sep;54(9):813-6. doi: 10.1136/jnnp.54.9.813.

A double blind trial of botulinum toxin "A" in torticollis, with one year follow up

A P Moore ¹, L D Blumhardt

Clinical Trial > [Mov Disord](#). 1991;6(2):145-50. doi: 10.1002/mds.870060210.

Treatment of idiopathic spasmodic torticollis with botulinum toxin A: a double-blind study on twenty-three patients

I T Lorentz ¹, S S Subramaniam, C Yiannikas

Clinical Trial > [Lancet](#). 1986 Aug 2;2(8501):245-7. doi: 10.1016/s0140-6736(86)92070-2.

Double-blind study of botulinum toxin in spasmodic torticollis

J K Tsui, A Eisen, A J Stoessl, S Calne, D B Calne

Clinical Trial > [Neurology](#). 1997 Sep;49(3):701-7. doi: 10.1212/wnl.49.3.701.

Botulinum toxin type B: a double-blind, placebo-controlled, safety and efficacy study in cervical dystonia

M F Lew ¹, B T Adornato, D D Duane, D D Dykstra, S A Factor, J M Massey, M F Brin, J Jankovic, R L Rodnitzky, C Singer, M R Swenson, D Tarsy, J J Murray, M Koller, J D Wallace

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Review > [Front Neurol.](#) 2017 Feb 24;8:35. doi: 10.3389/fneur.2017.00035. eCollection 2017.

Clinical Practice: Evidence-Based Recommendations for the Treatment of Cervical Dystonia with Botulinum Toxin

Maria Fiorella Contarino ¹, Joost Van Den Dool ², Yacov Balash ³, Kailash Bhatia ⁴, Nir Giladi ³, Johannes H Koelman ⁵, Annemette Lokkegaard ⁶, Maria J Marti ⁷, Miranda Postma ⁵, Maja Relja ⁸, Matej Skorvanek ⁹, Johannes D Speelman ⁵, Evelien Zoons ⁵, Joaquim J Ferreira ¹⁰, Marie Vidailhet ¹¹, Alberto Albanese ¹², Marina A J Tijssen ¹³

Question	Answer	Level of recommendation
Is abobotulinumtoxinA effective in improving CD?	Yes	A
Is incobotulinumtoxinA effective in improving CD?	Yes	B
Is onabotulinumtoxinA effective in improving CD?	Yes	A
Is rimabotulinumtoxinA effective in improving CD?	Yes	A
Does BoNT-A treatment improve quality of life?	Yes	B
Does BoNT-A reduce pain associated with CD?	Yes	A

Question	Answer	Level of recommendation
Do BoNT-A and BoNT-B have a comparable effect and duration of effect on dystonia?	Yes	A
Do BoNT-A and BoNT-B have the same rate of side effects?	No (side effects are more frequent with BoNT-B)	B
What is the conversion ratio of onabotulinumtoxinA to abobotulinumtoxinA?	1 IU to 3 IU 1 IU to 2.5 IU	A B
What is the conversion ratio of onabotulinumtoxinA to incobotulinumtoxinA?	1 IU to 1 IU	B

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> [Clin Neurol Neurosurg](#). 2021 Oct;209:106889. doi: 10.1016/j.clineuro.2021.106889.

Epub 2021 Aug 13.

Dose conversion ratio, comparative efficacy, and adverse events after switching from onabotulinum toxin A to abobotulinum toxin A for neurological conditions

Inci Sule Ozer¹, Muge Kuzu Kumcu², Sabiha Tezcan Aydemir³, Muhittin Cenk Akbostanci⁴

Methods: There were 64 patients with cervical dystonia (39), hemifacial spasm (16), oromandibular dystonia (5), blepharospasm (3), and extremity dystonia (1) who switched from ONA to ABO. The

Conclusion: Although the mean dose conversion ratio was 4.70, the range was very wide (approximately 2-9). Therefore, we conclude that after the switch from Botox to Dysport, the doses should be tailored to the patients' clinical situation at treatment initiation, without using a dose

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Observational Study > J Neurol. 2019 Dec;266(12):3038-3046. doi: 10.1007/s00415-019-09527-2.

Epub 2019 Sep 9.

How satisfied are cervical dystonia patients after 3 years of botulinum toxin type A treatment? Results from a prospective, long-term observational study

Carlo Colosimo¹, David Charles², Vijay P Misra³, Pascal Maisonobe⁴, Savary Om⁴;
INTEREST IN CD2 study group





Multicenter Study > [Brain Behav. 2025 Mar;15\(3\):e70325. doi: 10.1002/brb3.70325.](#)

Patient Burden in Dystonia Diagnosis and Botulinum Toxin Treatment: A Nationwide Survey in Turkey

Rezzak Yilmaz^{1 2}, Nevra Öksüz³, Mustafa Ceylan⁴, Bedia Samanci⁵, Ahmet Acarer⁶,
Nazlı Durmaz Çelik⁷, Hacer Erdem Tilki⁸, Serhat Özkan⁷, Haşmet Hanağası⁵, Okan Dogu³,
M Cenk Akbostanci^{1 2}

	BPS/HFS (n=347)	CD (n=339)	OMD (n=46)	SegD (n=43)	TSD (n=12)
Satisfied with BoNT treatment, % (n)					
Very satisfied	55.9 (195)	45.4 (154)	47.8 (22)	37.2 (16)	50 (6)
Satisfied	39.8 (139)	48.4 (164)	41.3 (19)	51.2 (22)	33.3 (4)
Not satisfied	4.0 (14)	4.1 (14)	10.9 (5)	11.6 (5)	8.3 (1)
Not satisfied at all	0	1.8 (6)	0	0	8.3 (1)

Botulinum toxin injections for the treatment of hemifacial spasm over 16 years

Mine Hayriye Sorgun¹, Rezzak Yilmaz², Yusuf Alper Akin³, Fatma Nazli Mercan³,
Muhittin Cenk Akbostanci³

Patients with HFS, n = 68

Total sessions, n = 470

	Botox ^a	Dysport ^b	<i>p</i> value
Age, year, mean ± SD	63 ± 14.4	64 ± 7.2	0.13
Sex, n (%)			0.45
Female	36 (55.4)	1(33.3)	
Male	29 (44.6)	2 (66.7)	
Total sessions, n (%)	460 (97.9)	10 (2.1)	NC
Doses as units, mean ± SD	33.8 ± 13.5	49.7 ± 21.9	0.19
First improvement (days), mean ± SD	8.1 ± 7.0	1.0 ± 0.0	NC
Improvement on VAS, %	74.3	76.3	0.86
Adverse effects, %	18.7	20	0.92

Dystonia: Bridging Theory and Hands-On Expertise

September 5-6, 2025 | Istanbul, Turkey



> [Neurotox Res. 2016 Jan;29\(1\):105-17.](#)

Neutralizing Antibody and Botulinum Toxin Therapy: A Systematic Review and Meta-analysis

[Margherita Fabbri](#), [Giorgio Leodori](#), [Ricardo M Fernandes](#), [Roongroj Bhidayasiri](#), [Maria Jose Marti](#),

[Carlo Colosimo](#), [Joaquim J Ferreira](#)

Categories	Sub-categories	All patients	Responders	SnR patients	
Clinical indications	Dystonia	Laboratory functional assay	20.0 %	7.3 %	47.6 %
	Dystonia	Laboratory screening tests/clinical assay	27.6 %		
	Dystonia	MDA	16.5 %		
	Spasticity	Laboratory functional assay	5.9 %	0.7 %	75.9 %
	Urology	Laboratory functional assay	2.7 %	3.8 %	
	Hyperhidrosis	Laboratory functional assay	1.1 %	1.4 %	
	Glabellar line			0.4 %	
BoNT formulation	ABO Dysport [®]	All indications	1.7 %	56.7%	
	ONA Botox [®]	All indications	1.5 %	32.5 %	
	INCO Xeomin [®]	All indications	0.5 %		
	BoNT-B NeuroBloc [®]	All indications	42.4 %		



BoNT – Antibody

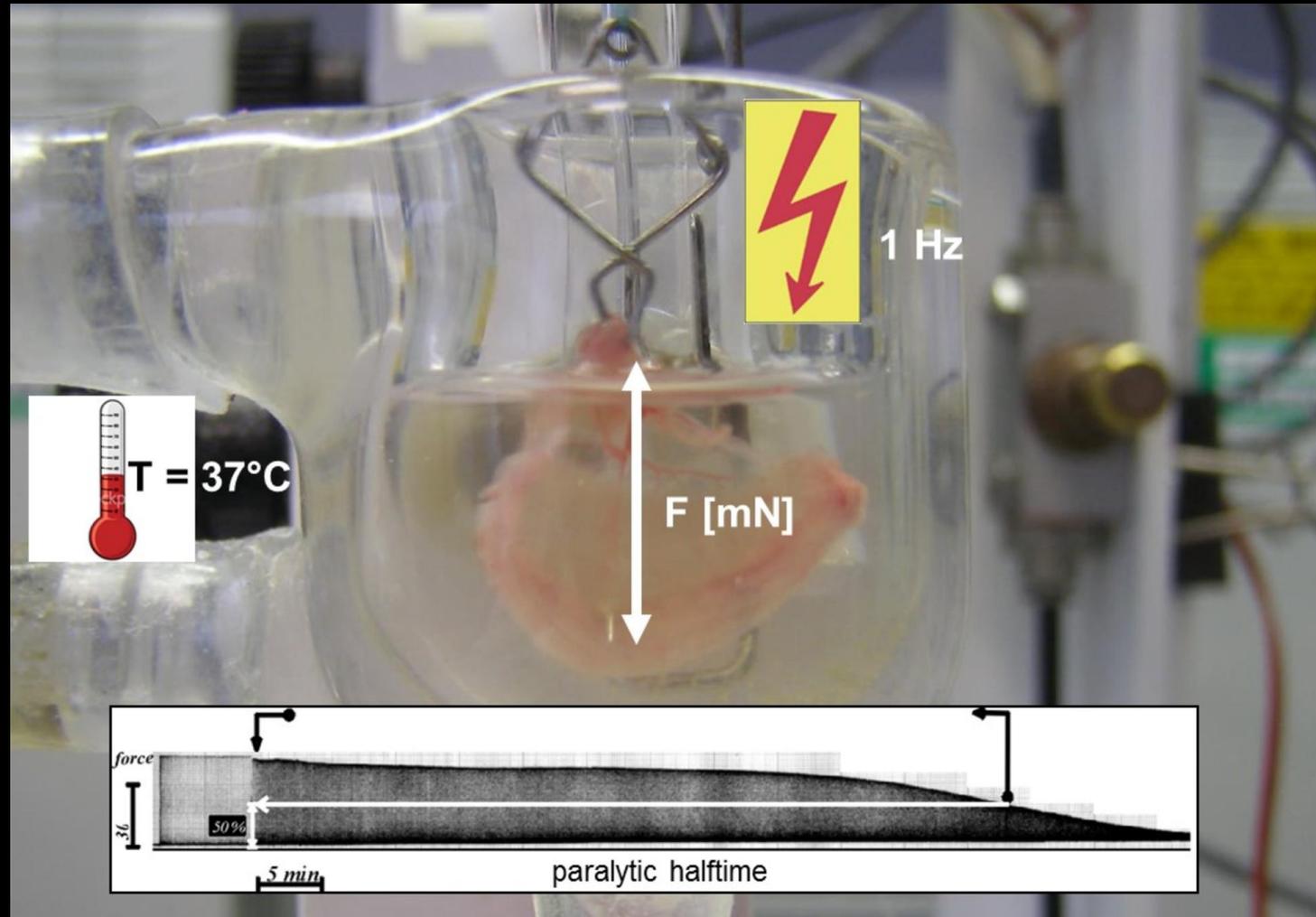
Method	Neutralizing antibody detection	Sensitivity	Ethical problem
ELISA	No	High	No
Western blot/IPA	No	Moderate	No
Mouse Protection Assay (GS)	Yes	High	High
MPNHD	Yes	High	Low
Cell-Based Assay	Yes	High	No
Surface Plasmon Resonance	No	High	No
Luminex	No	High	No

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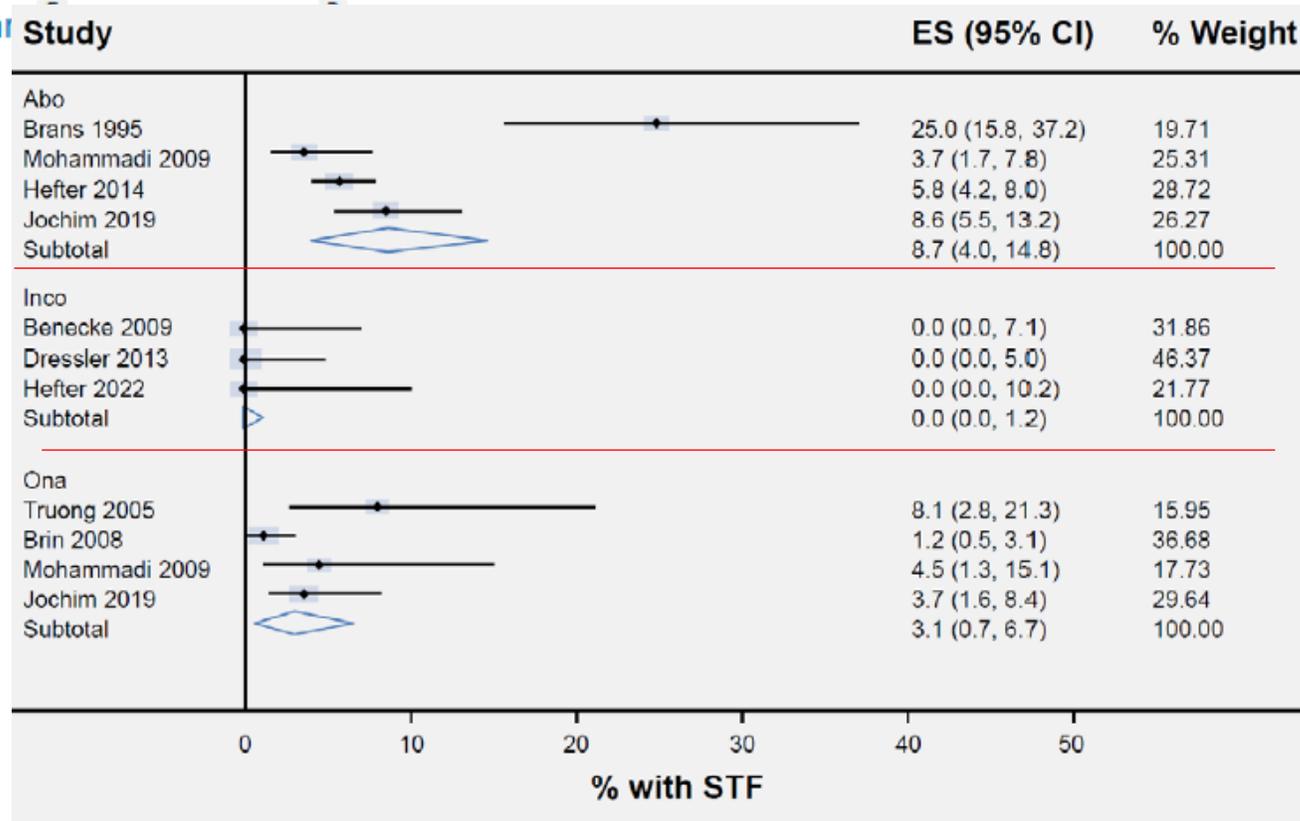


International Parkinson and
Movement Disorder Society
European Section



Systematic Review and Meta-Analysis of Secondary Treatment Failure and Immunogenicity With Botulinum Neurotoxin A in Multiple Indications

Uwe Walter^{1 2}, Phillipp Albrecht^{3 4}, Warner Car



- **Cervical dystonia:**
- **Abo: 9%**
- **Ona: 3%**
- **Inco: 0%**

Abo vs. Inco

Abo vs. Ona

Inco vs. Ona

P-value

<0.001

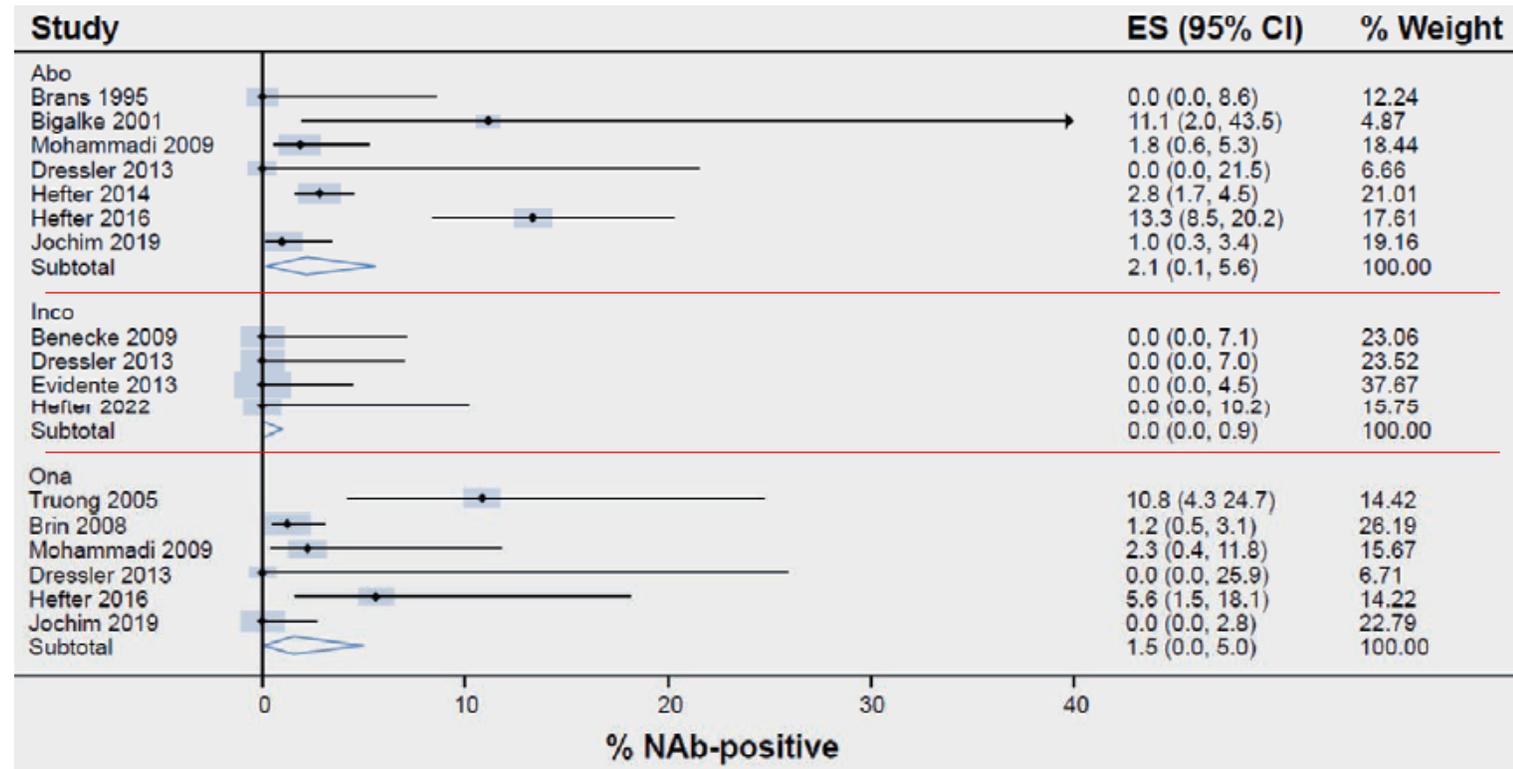
0.08

0.03

Systematic Review and Meta-Analysis of Secondary Treatment Failure and Immunogenicity With Botulinum Neurotoxin A in Multiple Indications

Uwe Walter ^{1 2}, Phillipp Albrecht ^{3 4}, Warner Carr ⁵, Harald Hefter ³

- **Cervical dystonia:**
- **Abo:** 2.8% (MHDA only)
- **Ona:** 2.1% (MHDA only)
- **Inco:** 0%



Abo vs. Inco

Abo vs. Ona

Inco vs. Ona

P-value

0.02

0.72

0.07

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- Antibody testing – is it clinically important?
 - Antibody: low / high titer
 - Antibody: neutralizing / non-neutralizing
 - Sensitivity (false positive / negative results)
 - Cost
 - EDB - eyebrow

Important	Not important
Dose	Injection area??
Injection intervals	Treatment duration??
BoNT type	Age
Switching BoNT types	Sex
Neuroleptic use	



Guidance for BoNT Injections

Method	Advantage	Disadvantage
Topography	Simple, quick, no equipment	Knowledge on topographic anatomy, mistargeting risk in smaller muscles
EMG	Detects functionally overactive muscles, real-time feedback	Needs equipment and expertise, equipment
Electrical stimulation	Stimulation of target muscle	Discomfort, requires cooperation; less effective in atrophic muscles
USG	Visualizes muscles/structures; precise, safe, allows the needle to be seen during injection.	Expensive, training required, no functional info alone, handling problems



BoNT injections with EMG

Review > [Parkinsonism Relat Disord.](#) 2012 Jul;18(6):731-6.

Muscle selection for treatment of cervical dystonia with botulinum toxin--a systematic review

S W R Nijmeijer ¹, J H T M Koelman, D J Kamphuis, M A J Tijssen

> [Mov Disord.](#) 2006 Oct;21(10):1737-41. doi: 10.1002/mds.21051.

Secondary nonresponsiveness to botulinum toxin A in cervical dystonia: the role of electromyogram-guided injections, botulinum toxin A antibody assay, and the extensor digitorum brevis test

> [Electromyogr Clin Neurophysiol.](#) 1996 Apr-May;36(3):179-85.

Quantitative EMG in cervical dystonia

L Ostergaard ¹, A Fuglsang-Frederiksen, O Sjö, L Werdelin, H Winkel

Carla Cordivari ¹, Vijay Peter Misra, Angela Vincent, Santiago Catania, Kailash P Bhatia, Andrew John Lees

combinations were seen less often. The distribution of muscles with abnormal activity was not always obvious from the clinical examination. CPN and IS, i.e., apparently unaffected muscles, showed



BoNT injections with EMG

Clinical Trial > Neurology. 1992 Apr;42(4):878-82. doi: 10.1212/wnl.42.4.878.

Botulinum toxin injection for spasmodic torticollis: increased magnitude of benefit with electromyographic assistance

C L Comella¹, A S Buchman, C M Tanner, N C Brown-Toms, C G Goetz

	(E+C)	(C)	<i>p</i> value
Objective measures (% reduction from baseline)			
Total TWSTRS score	14%	5%	0.004
Tilt	60%	32%	
Retrocollis	26%	3%	
Shoulder elevation	28%	6%	
Rotation	24%	17%	
Anterocollis	50%	36%	
Tremor	13%	32%	
Duration	6%	2%	
Subjective measures (% increase from baseline)			
Global ST score	45%	20%	0.010
Head position	55%	32%	
Mobility	51%	27%	
Pain	65%	40%	



BoNT injections with EMG

Utility of an EMG mapping study in treating cervical dystonia

J A Van Gerpen¹, J Y Matsumoto, J E Ahlskog, D M Maraganore, P G McManis

examination of four movement disorder specialists to an electromyographic (EMG) mapping study.

Clinical predictions of individual muscle involvement were only 59% sensitive and 75% specific.

ticollis. Our data indicate that, without the aid of an EMG mapping study, 41% of dystonic muscles would not be recognized and 25% of inactive muscles would be judged dystonic. This error rate was similar between examiners, including electromyographers



BoNT injections with USG

Accuracy of Ultrasound-Guided and Non-guided Botulinum Toxin Injection Into Neck Muscles Involved in Cervical Dystonia: A Cadaveric Study

Yun Dam Ko, MD¹, Soo In Yun, MD¹, Dahye Ryoo, MD¹, Myung Eun Chung, MD, PhD², Jihye Park, MD¹

- USG deep m: 95.8% vs. 54.2%,
- USG superficial m: 100% vs. 79.2%,

Muscles	Non-guided Accuracy (%)	Ultrasound-guided Accuracy (%)	p-value
Sternocleidomastoid			
Physician_1	83.3	100	
Physician_2	83.3	100	
Total	83.3	100	0.478
Upper trapezius			
Physician_1	83.3	100	
Physician_2	66.7	100	
Total	75.0	100	0.217
Levator scapulae			
Physician_1	66.7	100	
Physician_2	33.3	83.3	
Total	50.0	91.7	0.069

Muscles	Non-guided Accuracy (%)	Ultrasound-guided Accuracy (%)	p-value
Splenius capitis			
Physician_1	66.7	100	
Physician_2	50.0	100	
Total	58.3	100	0.037
Scalenus anterior			
Physician_1	50.0	100	
Physician_2	66.7	83.3	
Total	58.3	91.7	0.155
Scalenus medius			
Physician_1	66.7	100	
Physician_2	33.3	100	
Total	50.0	100	0.014
Overall accuracy	62.5	97.2	<0.001



BoNT injections with EMG/USG

Autor	Year	Patient, n	Design	Method	Outcome
Hong et al.	2012	5	Retrospective	USG & EMG	Dysphagia 35% with EMG, 0% with EMG + USG
Fujimoto et al.	2012	1	Case	US	USG better for longus colli
Huang et al.	2015	105	RCT	USG	USG better than no guidance
Schramm et al.	2017	35	Prospective	USG & EMG	USG suggested for OCI injections
Walter et al.	2018	5	Retrospective	USG	OCI injections are better with USG
Tyslerowicz et al.	2019	1	Case	USG & EMG	EMG + USG better for longus colli
Kutschenko et al.	2020	117	Retrospective	USG	Dysphagia with USG

BoNT injections with guidance

Systematic Review

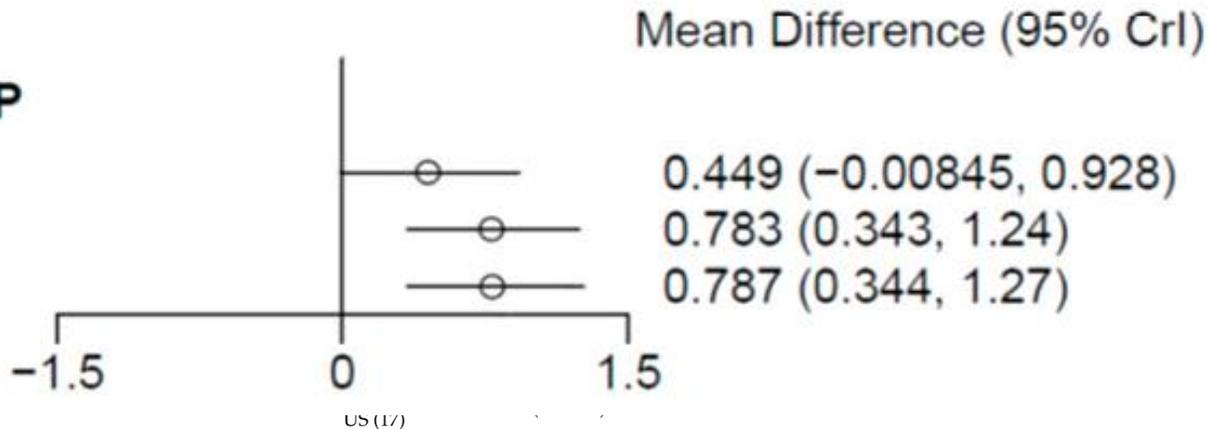
A Bayesian Network Meta-Analysis and Systematic Review of Guidance Techniques in Botulinum Toxin Injections and Their Hierarchy in the Treatment of Limb Spasticity

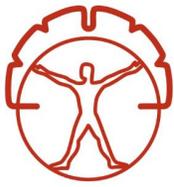
Evridiki Asimakidou¹ and Christos Sidiropoulos^{2,*}

Authors (Year)	Type of Study	No of Patients (m/f)	Cause of Spasticity	Assessment Scales	Post-Injection Clinical Evaluation	Guidance Technique (n)	Type of Toxin (Brand Name)	Dilution	Injection Sites/Muscle (n)
Turna et al. (2018) [52]	Prospective						Abobotulinum toxin A	1000 U in 2.5 mL NaCl	
Zeuner et al. (2016) [53]	Crossover								
Picelli et al. (2014) [54]	Parallel-gr								
Ploumis et al. (2013) [55]	Parallel-gr								
Picelli et al. (2012) [56]	Parallel-gr								
Mayer et al. (2008) [57]	Parallel-group RT	36 (18/18) (elbows)	Stroke, traumatic brain injury, hypoxic encephalopathy	AS *, RMS-EMG, TCA **	3 w	EMG (18) ES (18)	Onabotulinum toxin A (Botox®)	60 U in 2.4 mL NaCl and 30 U in 1.2 mL NaCl	1 site in motor point injections 4 (biceps) and 2 (brachioradialis)

Compared with MNP

EMG
ES
US





[Funct Neurol](#). 2018 Jan-Mar; 33(1): 7–18.



Pharmacological differences and clinical implications of various botulinum toxin preparations: a critical appraisal

[Adriano Ferrari](#), MD,^a [Mario Manca](#), MD,^b [Valeria Tugnoli](#), MD,^c and [Luigi Alberto Pini](#), MD^d

	OnabotulinumtoxinA	AbobotulinumtoxinA	IncobotulinumtoxinA
First approval	1989 (US)	1991 (UK)	2005 (Germany)
Production process	Crystallization	Chromatography	Chromatography
Stabilization process	Vacuum dried	Lyophilization	Lyophilization
Molecular weight	~900 kDa	~400 kDa	~150 kDa
Quantity of neurotoxin (ng protein/100 U)	~0.73ng/100 U	~0.65 ng/100 U	~0.44 ng/100 U
Excipient	NaCl	Lactose	Sucrose
Units/vial	100 U	500 U	100 U
Storage	36 months at 2-8°C	24 months at 2-8°C	48 months at <25°C
Storage after reconstitution	Up to 24 h at 2-8°C	Up to 8 h at 2-8°C	Up to 24 h at 2-8°C



**World Health
Organization**

Disease Outbreak News

Iatrogenic Botulism- European Region

Description of the situation

On 7 March 2023, the National IHR Focal Point (NFP) for Germany notified WHO of five cases of iatrogenic botulism in individuals who underwent medical procedures with the injection of botulinum neurotoxin type A (BoNT/A) in health institutions in Türkiye. As of 17 March 2023, a total of 71 clinical botulism cases were reported from Türkiye (53 cases), Germany (16 cases), Austria (one case) and Switzerland (one case) linked to the aforementioned medical interventions performed in Türkiye between 22 February and 1 March 2023.

All cases are adults; most cases are middle-aged women. Among the 69 cases for which treatment location information is known, two private hospitals in two locations in Türkiye were identified, with 66 cases linked to one hospital and three cases to another hospital.

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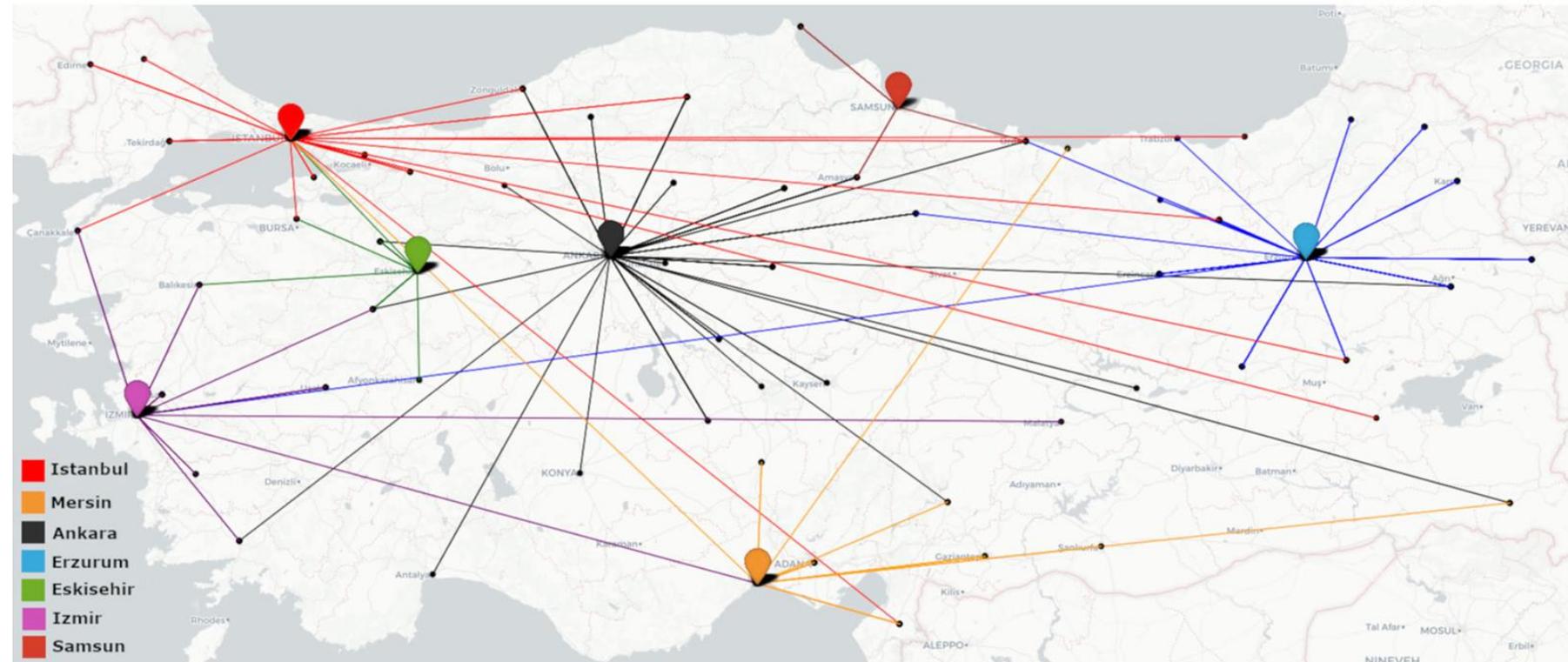
T.C. İSTANBUL ÜNİVERSİTESİ
1453

Multicenter Study > Brain Behav. 2025 Mar;15(3):e70325. doi: 10.1002/brb3.70325.

Patient Burden in Dystonia Diagnosis and Botulinum Toxin Treatment: A Nationwide Survey in Turkey

Rezzak Yilmaz^{1 2}, Nevra Öksüz³, Mustafa Ceylan⁴, Bedia Samanci⁵, Ahmet Acarer⁶,
Nazlı Durmaz Çelik⁷, Hacer Erdem Tilki⁸, Serhat Özkan⁷, Haşmet Hanağası⁵, Okan Dogu³,
M Cenk Akbostanci^{1 2}

- 25% com from another city
- 200km travel in average
- Spend 1/3 of household income



THANK YOU

