

Next Generation Products

Science & Technology

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Important notice (continued)

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HARM REDUCTION SCIENCE

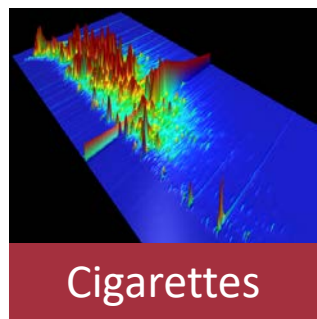
SCIENCE & TECHNOLOGY OF
OUR NGP PLATFORMS

R&D TRANSFORMATION

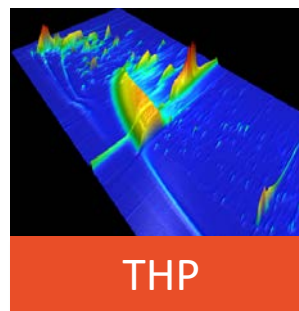
Harm reduction science



Increasing acknowledgement of the risk continuum model



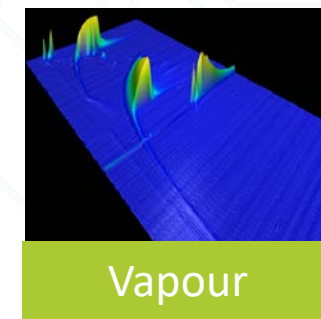
Position confirmed through epidemiology^a



Position to be confirmed*

Snus

Position confirmed through epidemiology^c



Position proposed By Public Health Authorities*

High

Low

- a. Doll & Hill (1954) *BMJ* 1954: 1451-1455
- b. Fearon *et al* 2017 Poster 113 GFN Conference <http://bit.ly/2xRPVvD>
- c. Lee (2013) *Harm Reduct J* **10**: 36, doi: 10.1186/1477-7517-10-36
- d. PHE Report 2015 bit.ly/1yp57N; RCP Report 2016 <http://bit.ly/244lizV>; CRUK 2016 <http://bit.ly/2yVZlq0>

*Clinical data suggests reduced exposure^b
 *UK public health suggests reduced risk^d

These modellings do not necessarily mean that our products are less harmful than cigarettes

Increasing acknowledgement of the risk continuum model

Our portfolio approach supports the risk continuum model



These modellings do not necessarily mean that our products are less harmful than cigarettes

A three-step scientific journey to assessing the risk profile of Next Generation Products^a

01 EMISSIONS

- › Science showing no combustion
- › Untargeted emissions
- › Targeted emissions
- › Environmental emissions

02 EXPOSURE

- › Puffing behaviour
- › Average daily consumption
- › Clinical PK
- › Clinical BoE

03 RISK

- › Clinical BoBE
- › Risk perception
- › Post-market surveillance

Reduced toxicity in lab models

in vitro reg tox

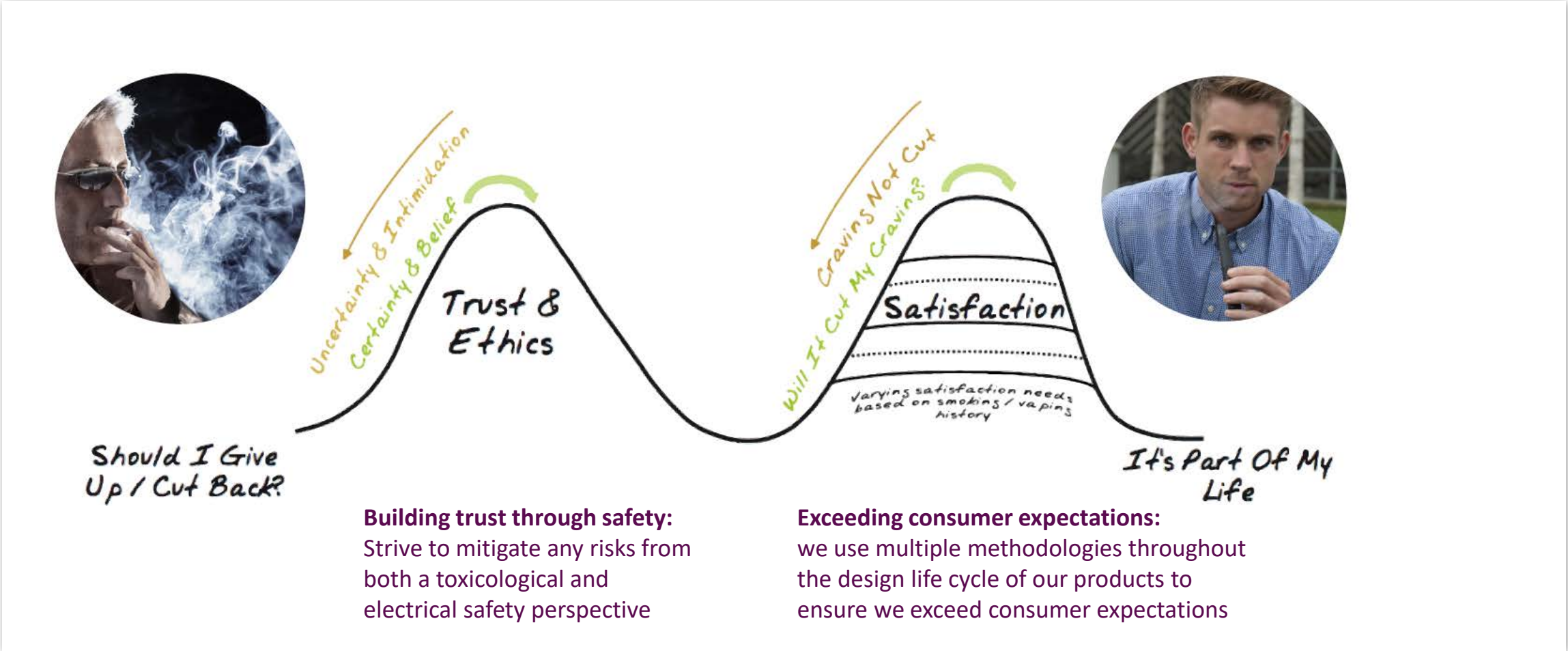
in vitro disease models

in vitro systems science

a. Murphy J et al (2017) Reg Tox Pharm doi.org/10.1016/j.yrtph.2017.09.008

Driving consumer conversion

Addressing safety, quality, potential reduced risk nature and consumer satisfaction



glo science and technology

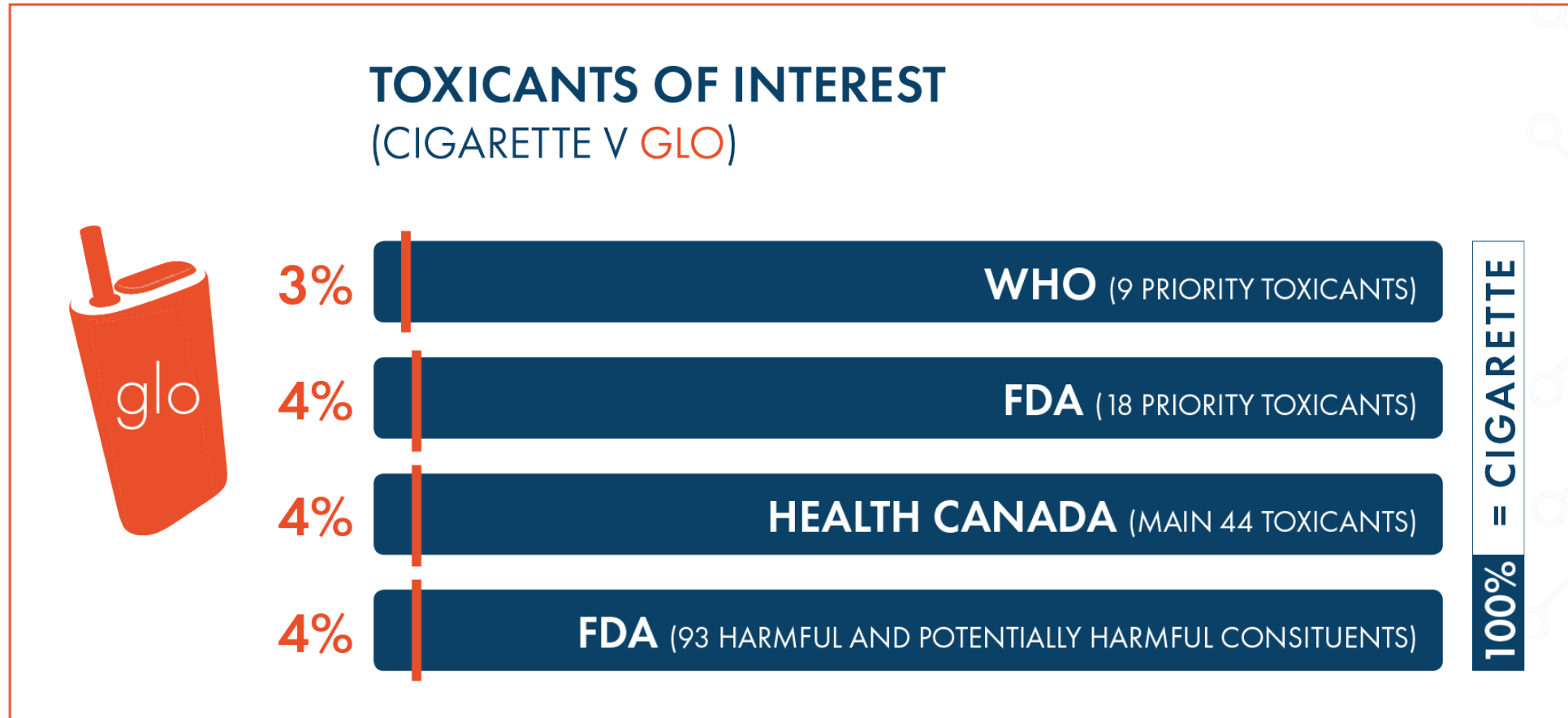


The glo development journey



Targeted emissions: glo

In laboratory tests, glo has substantially reduced levels of targeted toxicants in comparison to a scientific reference cigarette, 3R4F



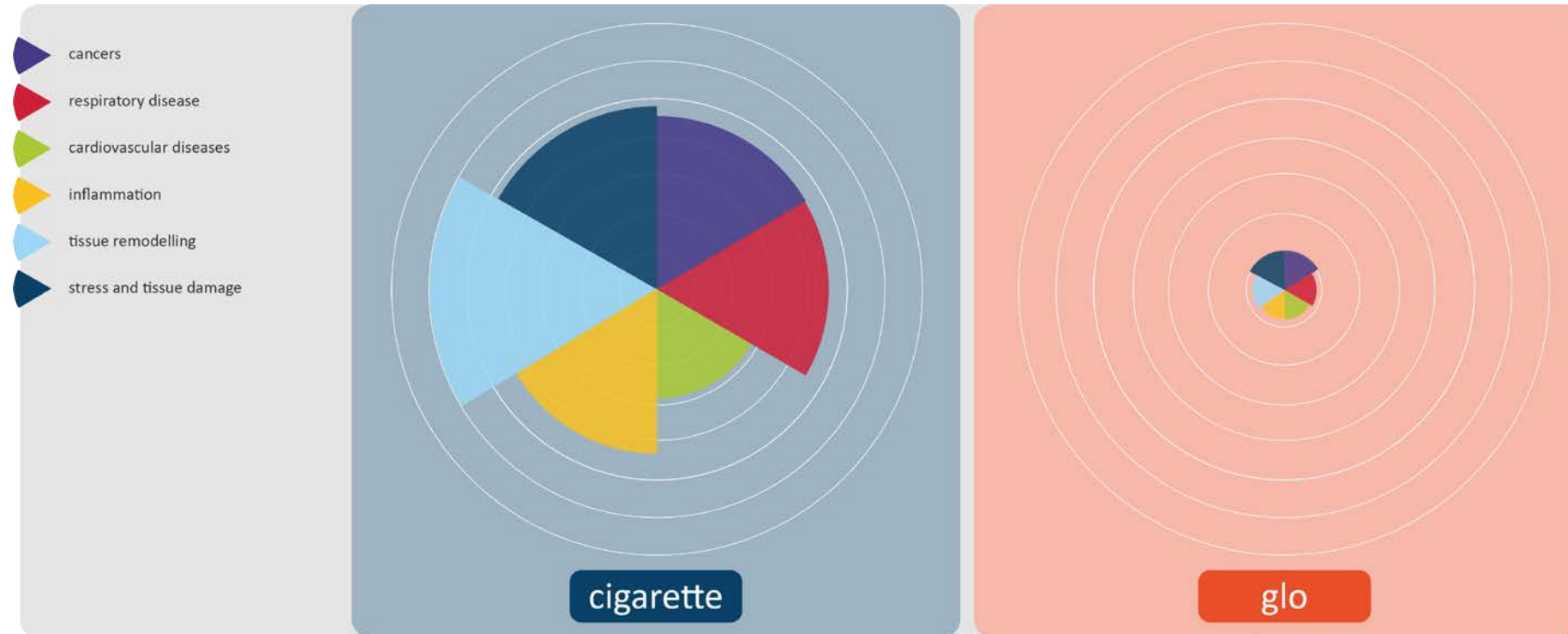
Comparison of smoke from a scientific reference cigarette (approx. 9 mg tar) and vapour from glo. This quality does not necessarily mean this product is less harmful than other tobacco products

Systems biology: glo

In laboratory tests, glo promotes substantially less disease relevant gene changes in comparison to a scientific reference cigarette, 3R4F

In lab based tests, glo™ promotes substantially less disease relevant gene responses in comparison to a cigarette^{a,b}

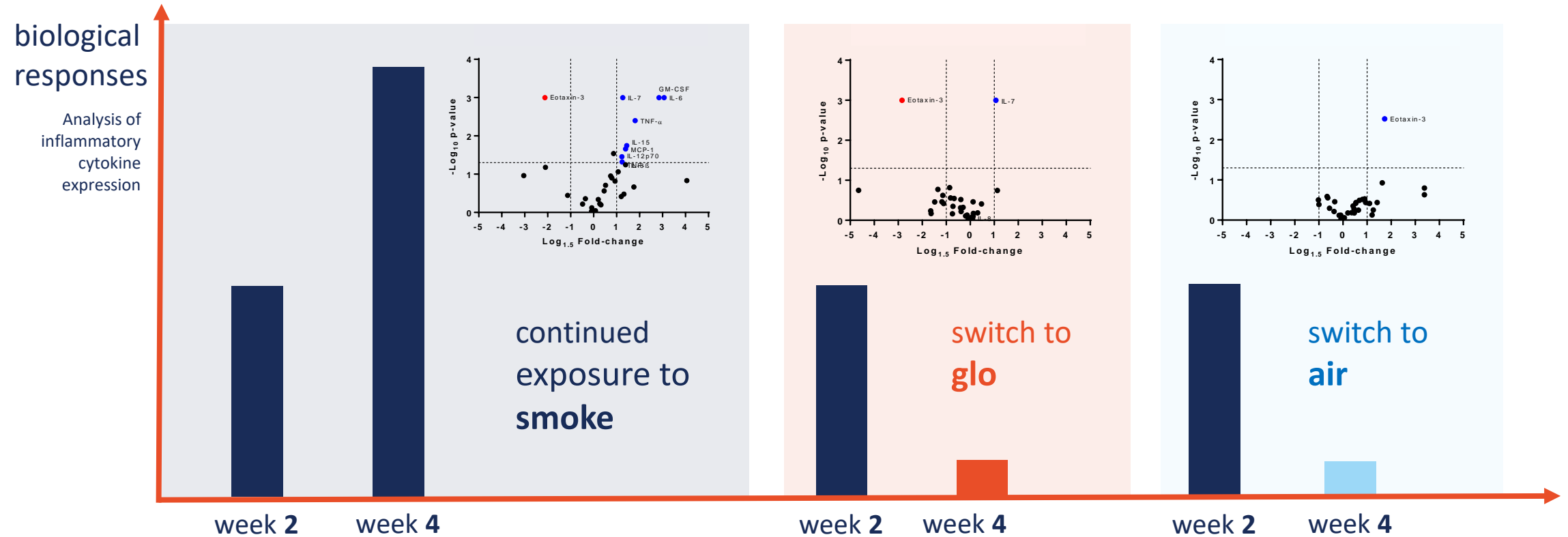
- › 3-D cellular system (Mucilair™) exposed to glo™ heated tobacco vapour and cigarette smoke
- › Ingenuity Pathway Analysis^c of >22,000 gene responses grouped into disease relevant categories



^aMethods adapted from Banerjee et al (2017) Appl in vitro Toxicol. 3(1) 84-98; doi:10.1089/aivt.2016.0024; ^bglo and a scientific reference cigarette (3R4F) puffed on machines using the Health Canada Intense (HCI) regime: The contents of glo vapour differ significantly from cigarette smoke, however, these qualities and the above responses do not necessarily mean this product produces less adverse health effects than other tobacco products; ^cIngenuity Pathway Analysis (IPA) has broadly been adopted by the life science research community and is widely cited for the analysis, integration, and interpretation of data derived from 'omics experiments

glo laboratory switching studies in support of Institute of Medicine 'gold standard'^a

Following two week exposure to smoke, there was no statistically significant difference in cells which were exposed to glo vapour or air^b



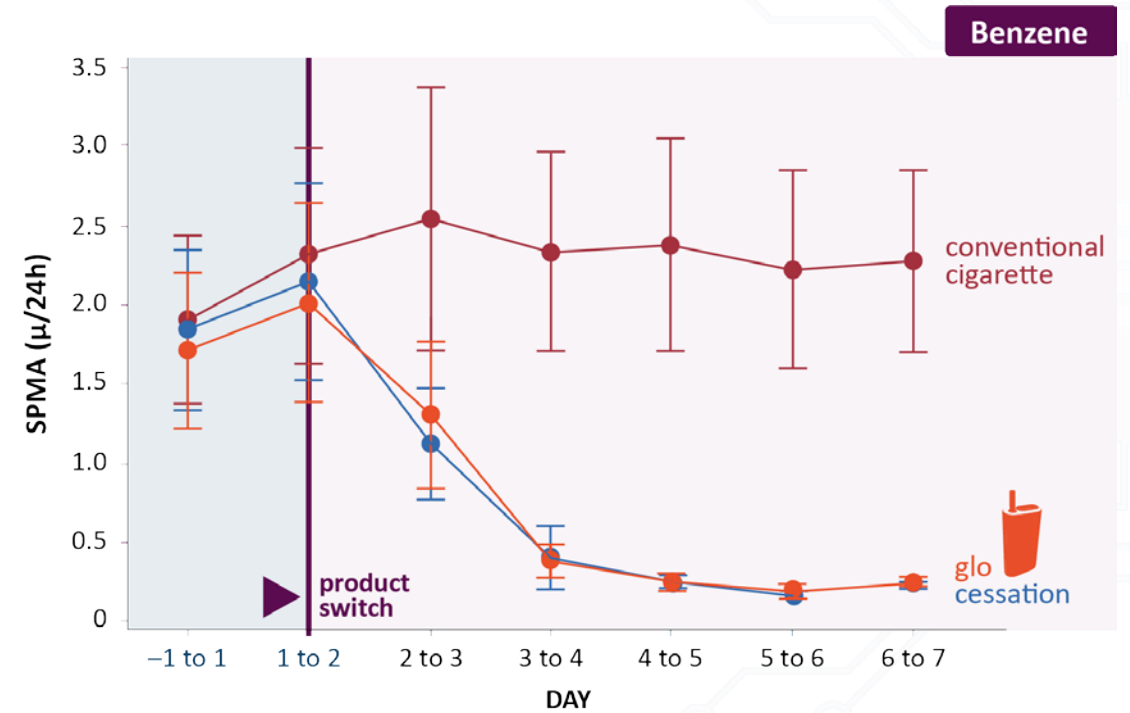
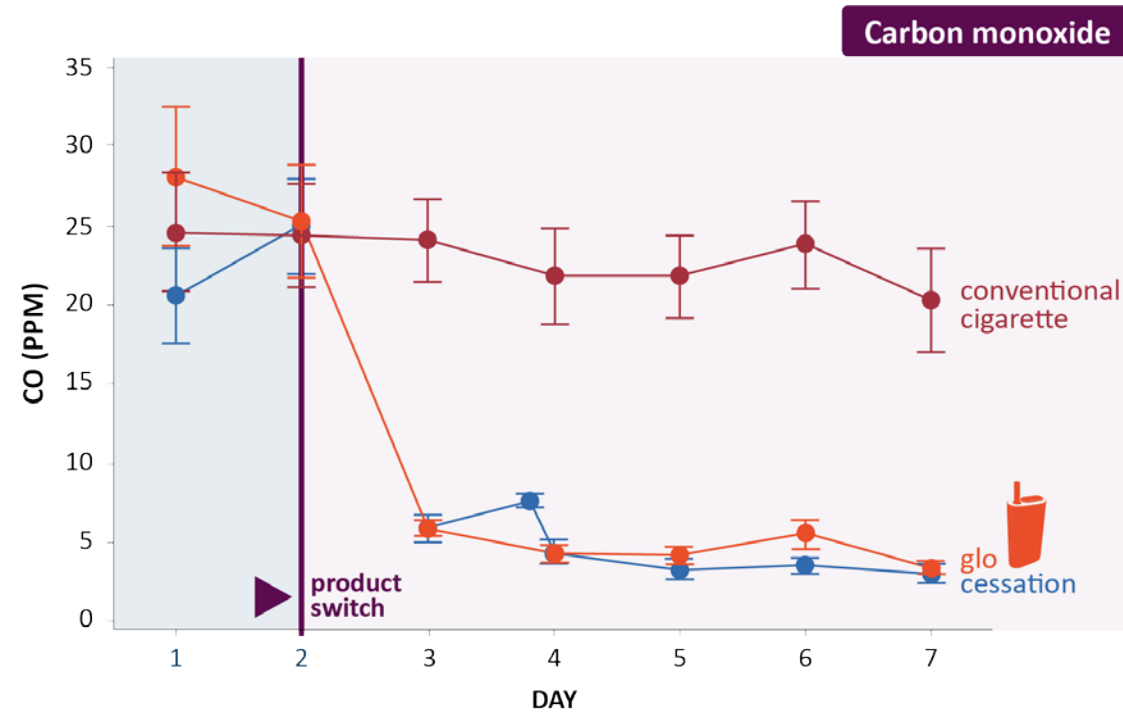
These results do not necessarily mean this product is less harmful than other tobacco products

^aInstitute of Medicine (2012) Scientific Standards for studies on modified risk tobacco products

^bThe 3-D cell construct MucilairTM was used in this study

glo clinical switching studies in support of Institute of Medicine 'gold standard'^a

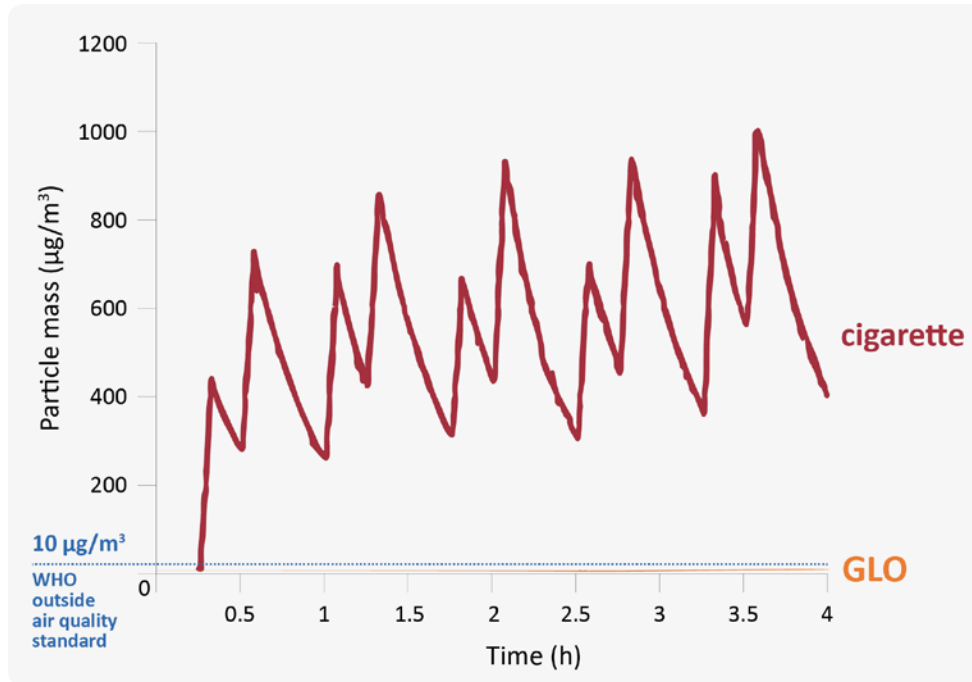
No statistically significant difference in BoEs between smokers who switch to glo and those who quit^{b,c,d}



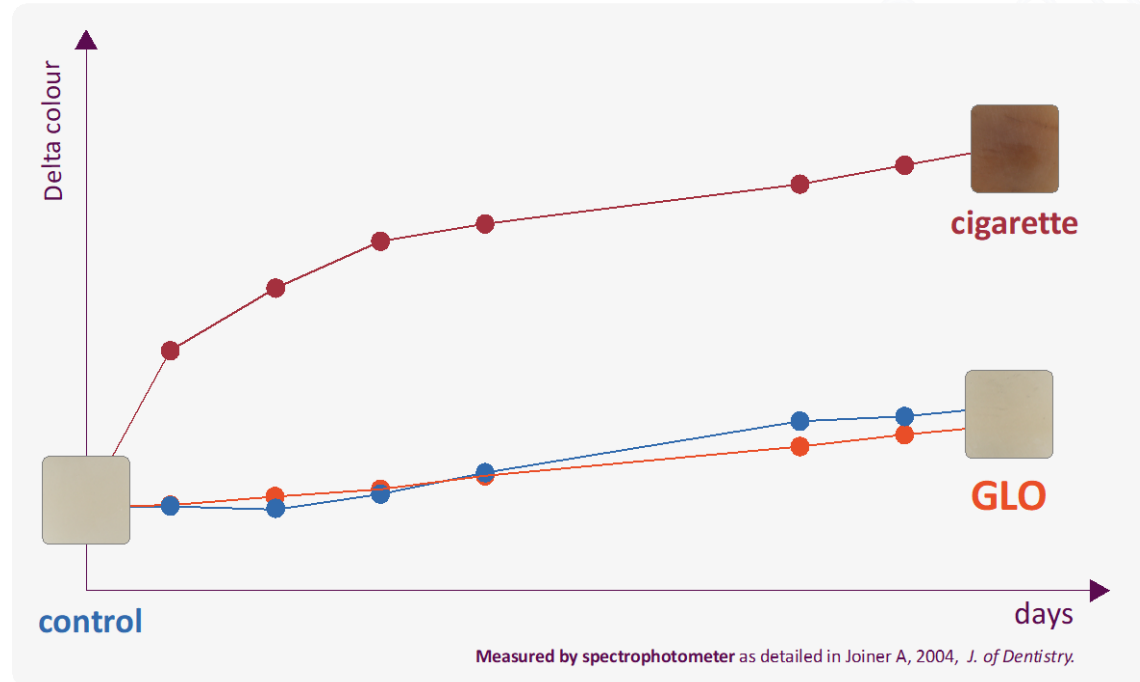
^aInstitute of Medicine (2012) Scientific Standards for studies on modified risk tobacco products
^bThese results do not necessarily mean this product is less harmful than other tobacco products
^cGale *et al* (2017) *BMC Public Health* doi.org/10.1186/s12889-017-4678-9
^dFearon *et al* (2017) Poster 113 GFN Conference <http://bit.ly/2xRPVVD>

Science update: glo

Science based studies to assess personal hygiene and social consideration of glo^a



Social consideration: 'cleaner air' when using glo relative to smoking^b



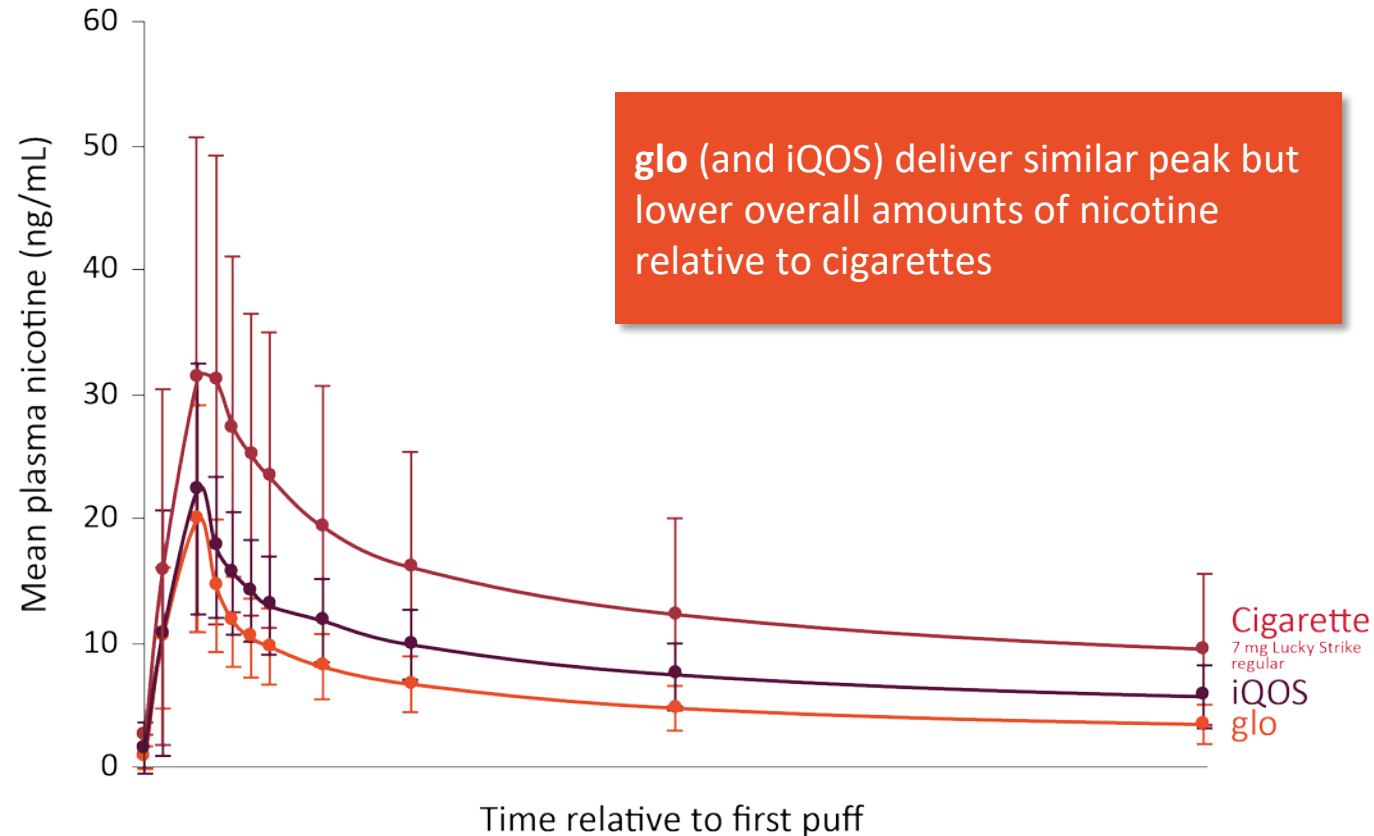
Personal hygiene: teeth staining is reduced when exposed to glo vapour in comparison to cigarette smoke and parity with untreated control

^aThese results do not necessarily mean this product is less harmful than other tobacco products

^bForster *et al* (2017) *Reg Tox Pharm*, in press

Pharmacokinetic data: glo

Uptake of nicotine amongst Japanese consumers

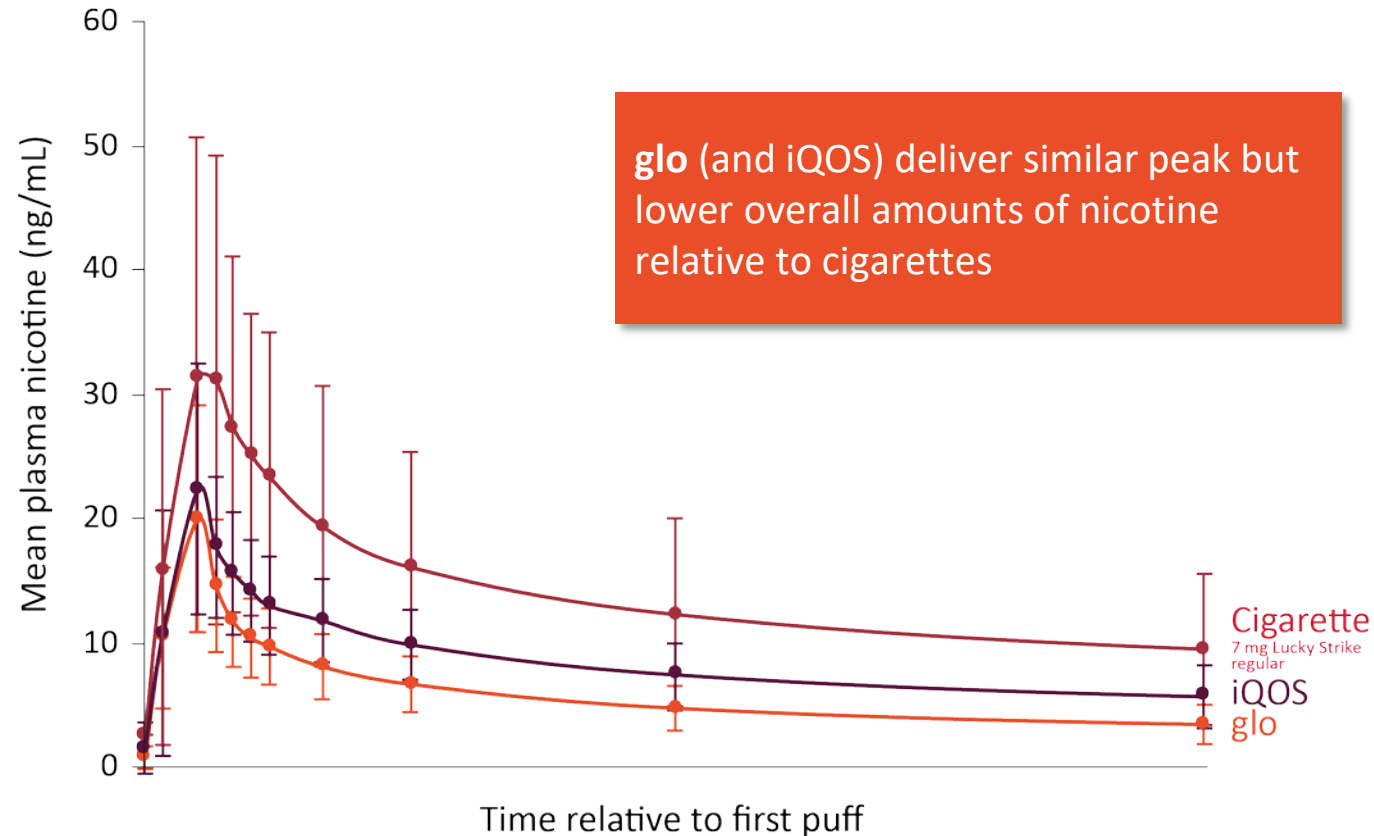


Gale et al (2017) BMC Public Health doi.org/10.1186/s12889-017-4678-9

These results do not necessarily mean this product is less harmful than other tobacco products

Pharmacokinetic data: glo

Uptake of nicotine amongst Japanese consumers



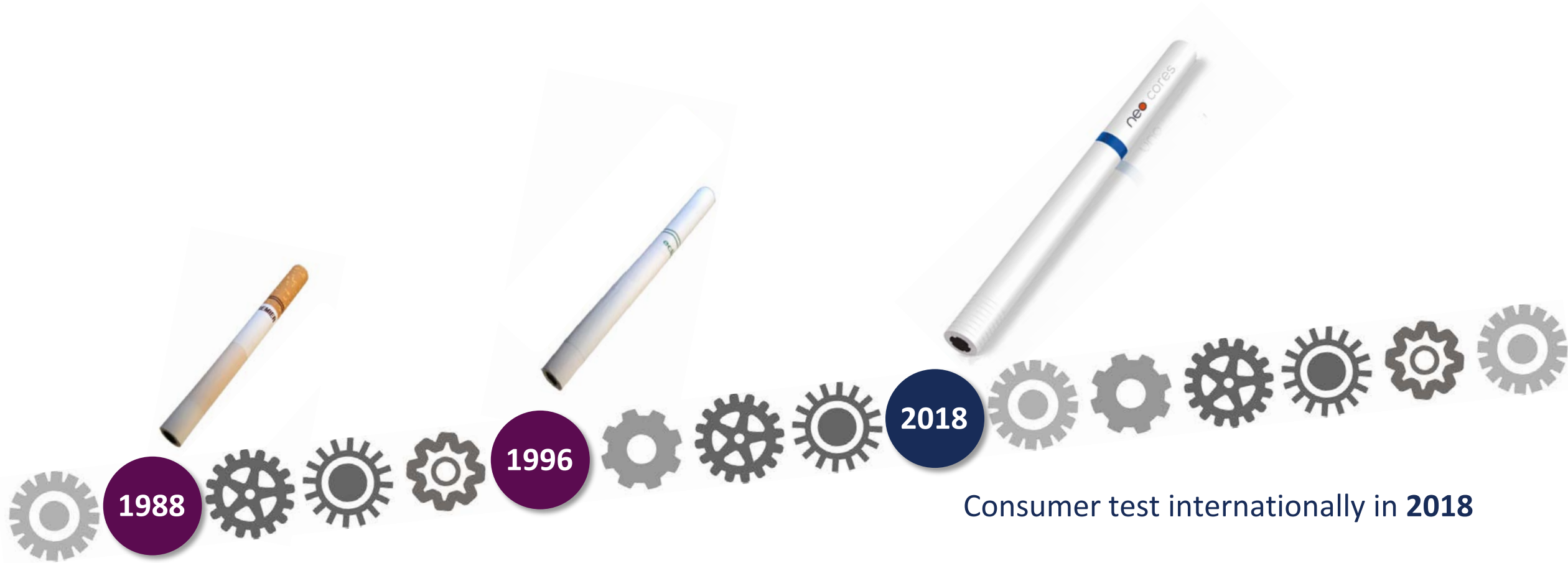
glo (and iQOS) deliver similar peak but lower overall amounts of nicotine relative to cigarettes



Gale et al (2017) BMC Public Health doi.org/10.1186/s12889-017-4678-9
These results do not necessarily mean this product is less harmful than other tobacco products

Carbon Tip science and technology





Strong performance in taste, satisfaction and usability

- › More impact
- › Improved taste of neocores vs. previous carbon tip heated products
- › Easier to light up

- › Reduced toxicants
- › Reduced odour *
- › Reduced ash

Comparison of smoke from an industry standard reference cigarette (approx. 9 mg tar) and vapour from Neocores CTHP, in terms of the 9 harmful components the World Health Organisation recommends to reduce in cigarette smoke

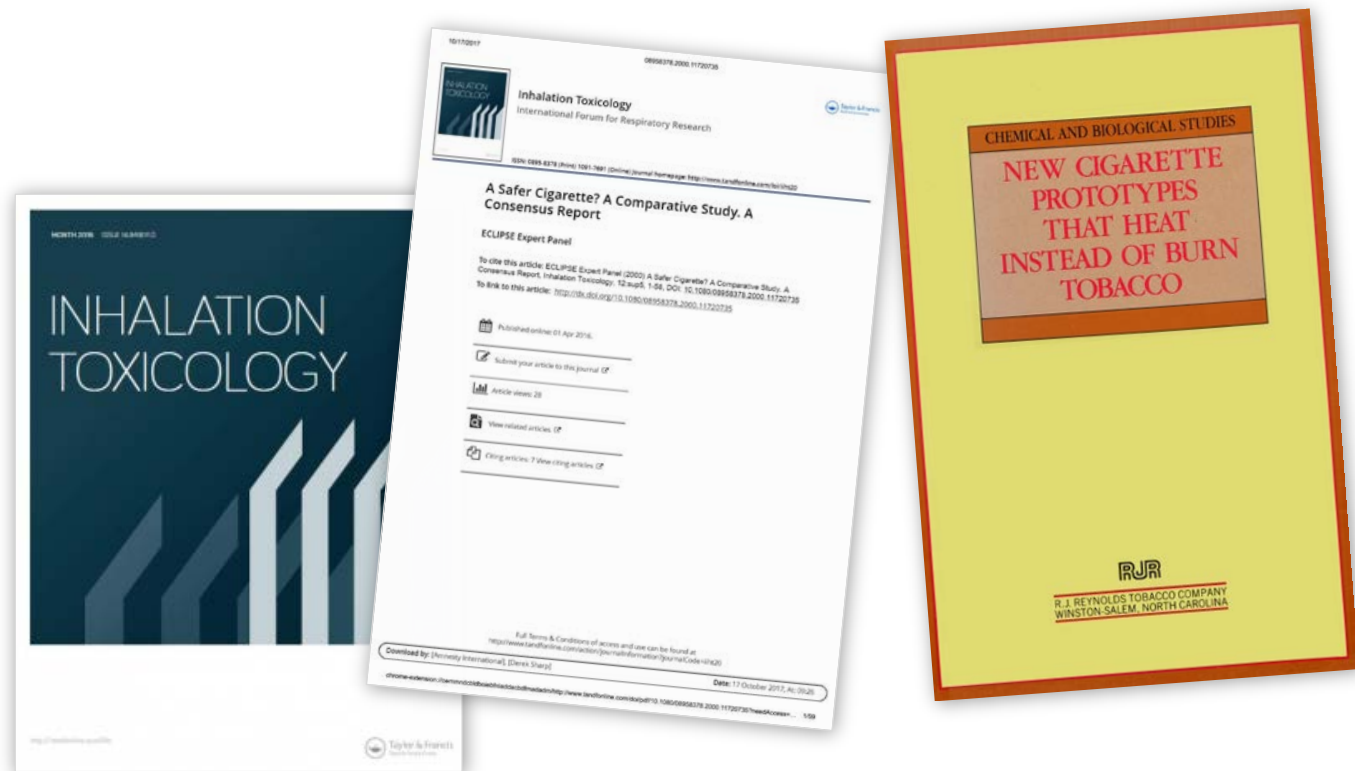
This quality does not necessarily mean this product is less harmful than other tobacco products

**Compared to a conventional cigarette when smoked*



Extensive scientific evaluation and publications on the carbon tip platform **over three decades**

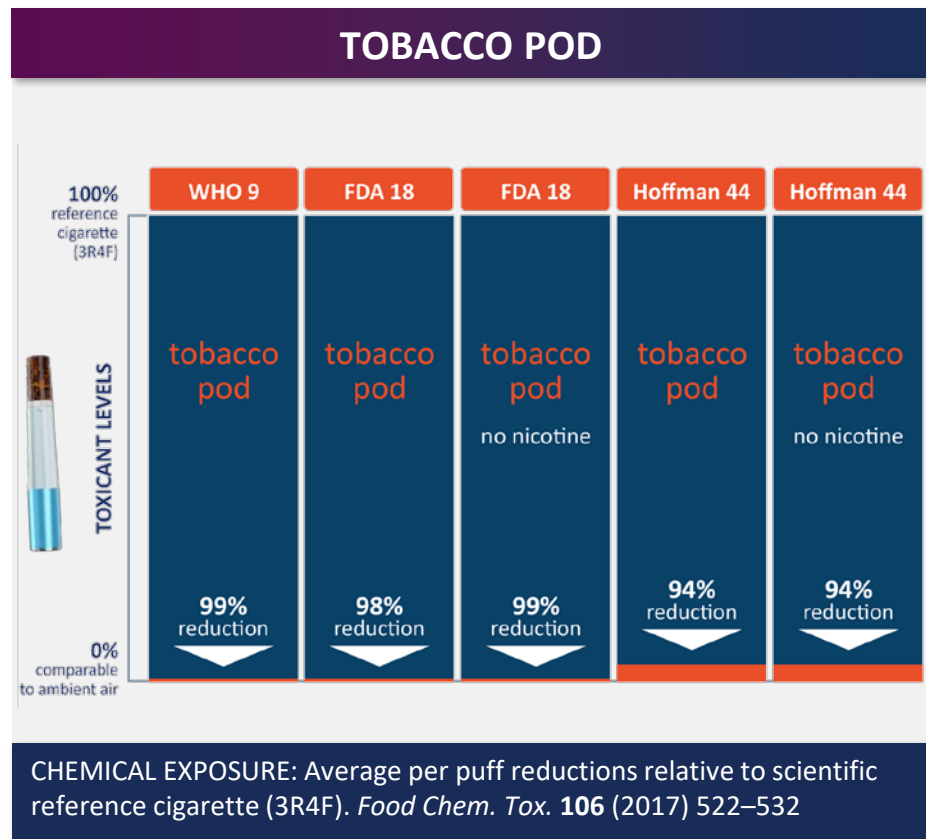
- Targeted emissions
- Side-stream emissions
- *In vitro* and *in vivo* regulatory toxicology
- Topography
- Urine mutagenicity
- Biomarker studies



Hybrid science and technology





Hybrid Gen 1 science and technology



TOBACCO EXTRACT

Successfully qualified

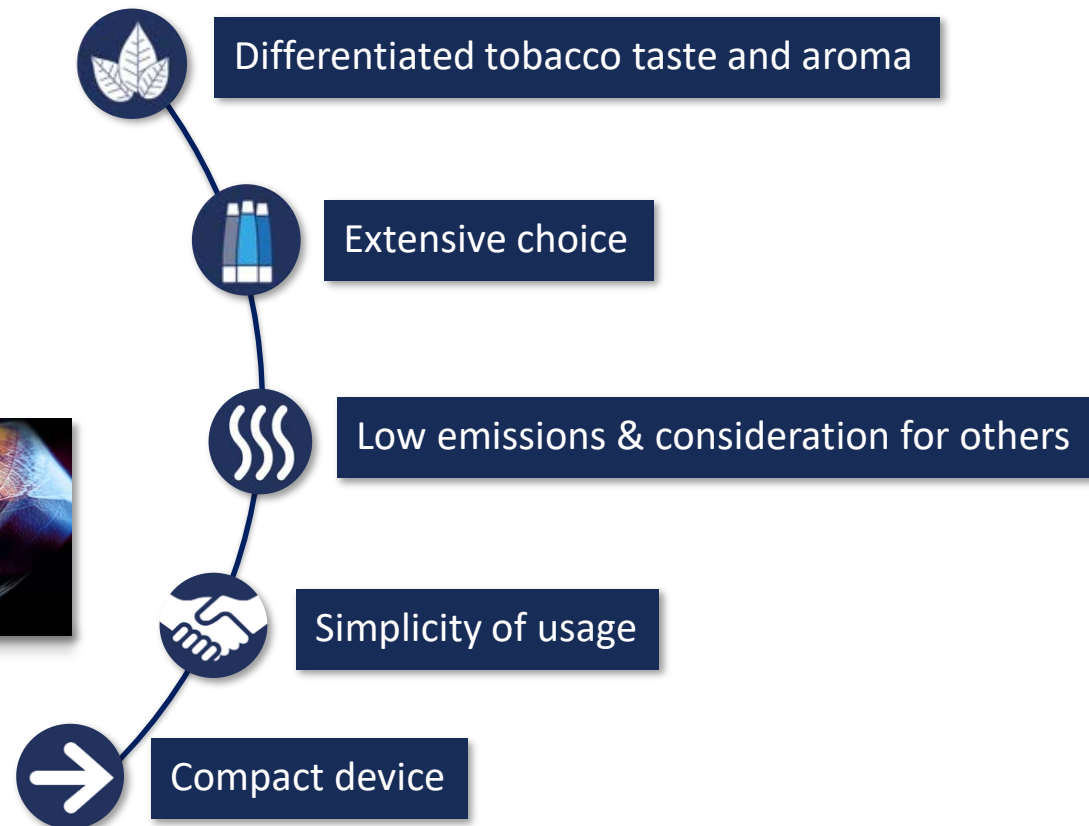
- ✓ Stability
- ✓ Flavour authenticity
- ✓ Sensory
- ✓ Toxicology

TOBACCO EXTRACT > 95% Toxicants Reduction (WHO 9. vs. 3R4F)*
Absence of *in vitro* mutagenic and genotox properties

*This is average reduction in toxicants as defined by WHO Tobreg in the iFuse aerosol relative to 3R4F scientific reference cigarette smoke

Hybrid Gen 2 science and technology



This quality does not necessarily mean this product is less harmful than other tobacco products

EPOK science and technology



A novel oral smokeless product addressing currently unmet consumer needs

An extended portfolio to incorporate new to world smokeless products

Snus: Leading portfolios of smokeless tobacco products in US and Northern Europe

EPOK: new to world oral smokeless product

- › Cellulose based low tobacco inclusion nicotine product containing flavours
- › Delivers same consumer satisfaction as Snus, with improved chemical profile
- › Less visible oral hygiene impact*

Introducing a tobacco free variant containing nicotine and flavours in the future

CONSTITUENT LEVELS (EPOK v SNUS)



*Compared to use of traditional snus products
This quality does not necessarily mean this product is less harmful than tobacco products

Raptor science and technology



Game changing technology: Dynamic Vapour Technology

Many advantages vs. coil/wire & wick systems

- › 46x larger surface area
- › 3x aerosol particle size
- › Advanced temperature control
- › Dynamic wicking
- › Improved sensory performance
- › Improved consumer satisfaction
- › Less e-liquid nicotine required



| | Competitor Coil/Wire & Wick Closed Systems* | Raptor |
|----------------------------|---|------------|
| Performance | | |
| Aerosol Particle Size (nm) | 450 to 550 | Up to 2000 |
| Purity | | |
| Formaldehyde (ug/puff) | 0.8 to 1.2 | 0.1 |

*Logic Pro and MESH

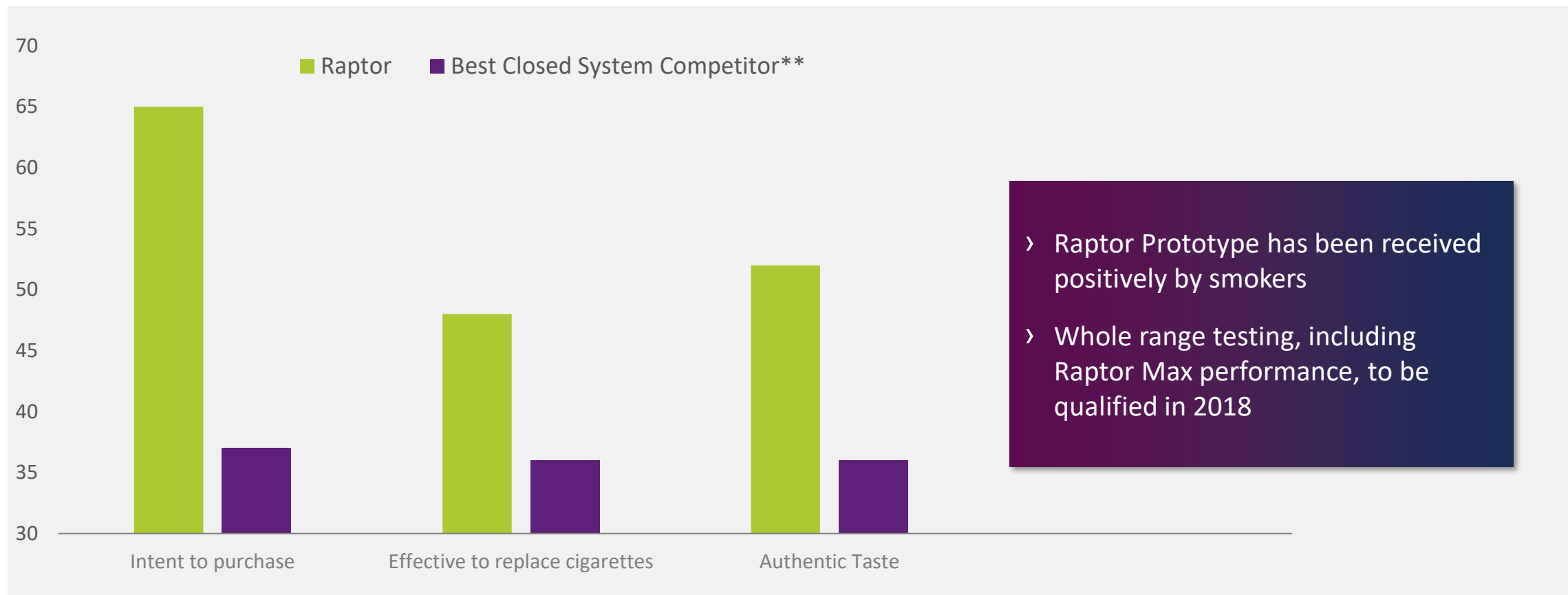
This quality does not necessarily mean this product is less harmful than other tobacco products

Developing and tuning a new to the world technology



Raptor: A new level of performance for smokers

Total Offer Evaluation with German smokers (Raptor 3mg/ml eLiquid)*



› Raptor Prototype has been received positively by smokers

› Whole range testing, including Raptor Max performance, to be qualified in 2018

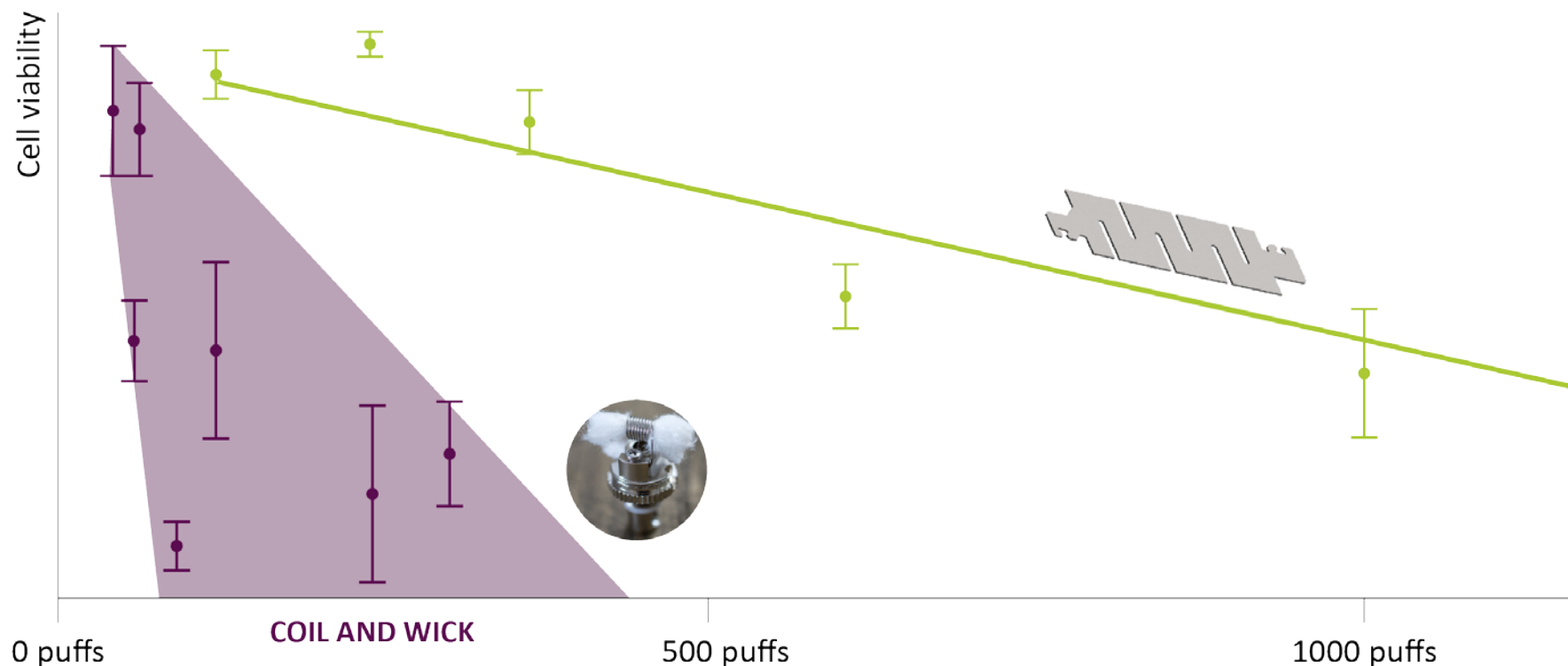
*40 to 50 smokers in each panel

**Logic Pro

This quality does not necessarily mean this product is less harmful than other tobacco products

Raptor: A new level of performance in toxicity testing

Pre-clinical toxicological assessment shows potential of DV Tech versus 'coil and wick' based e-cigarettes

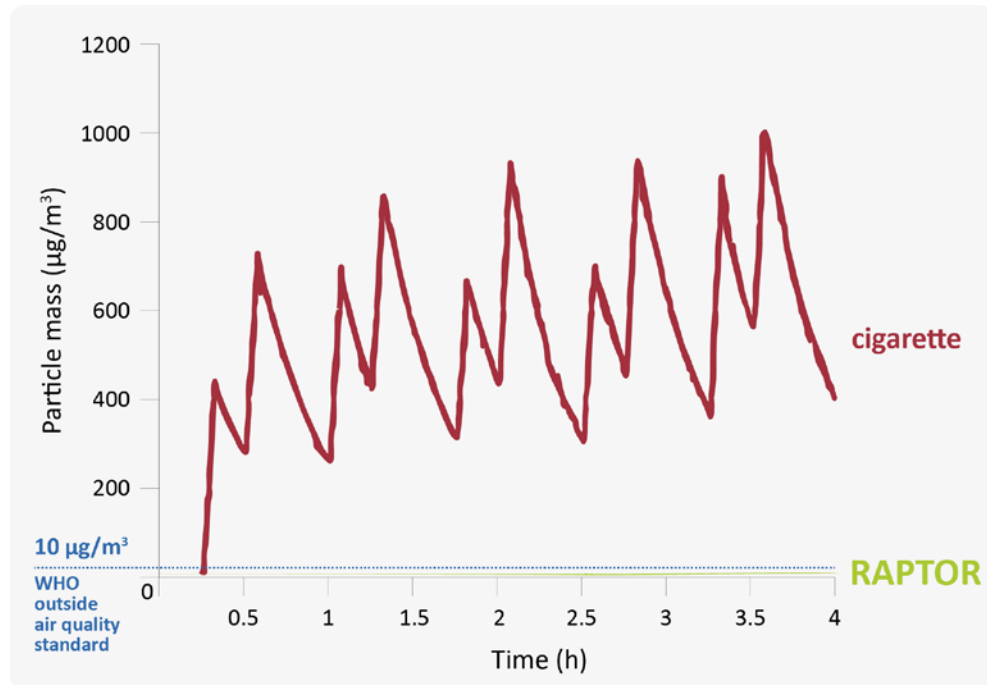


'Coil and wick' based vapour products have substantially reduced toxicological responses relative to cigarettes. However, Raptor, incorporating 'DV Tech' shows even greater reductions, even under extreme puffing conditions

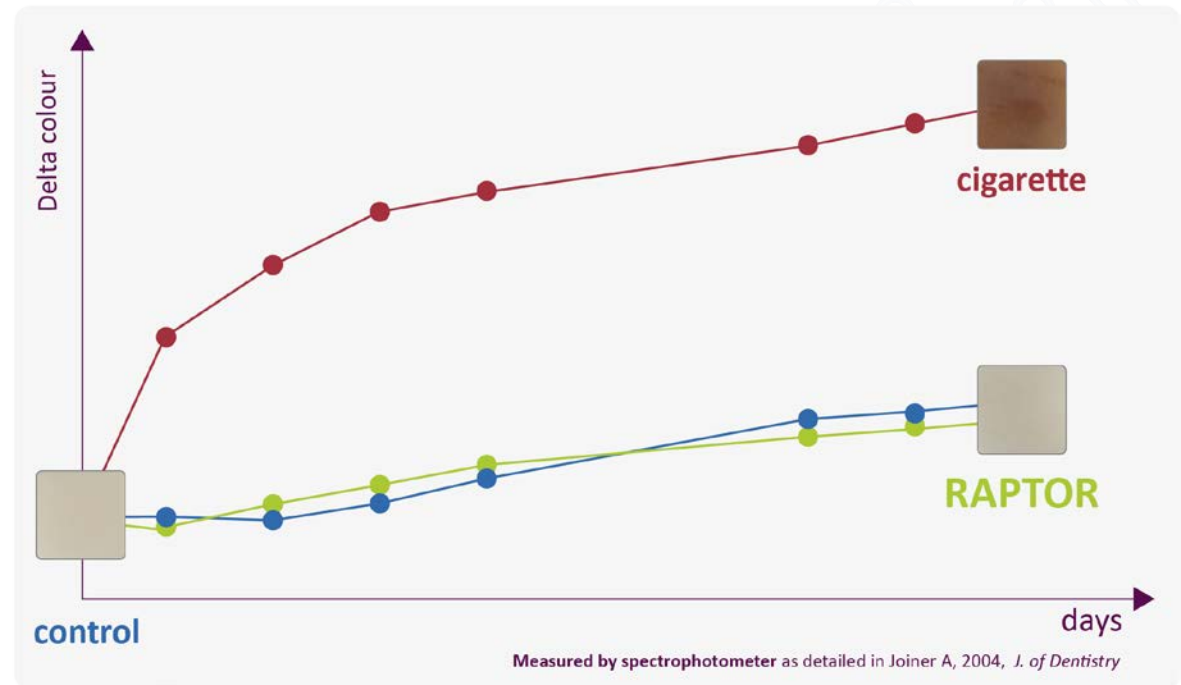
This quality does not necessarily mean this product is less harmful than other tobacco products

Science update: Raptor

Science based studies show improved personal hygiene and social consideration of **Raptor^a**



Social consideration: 'cleaner air' when using Raptor relative to smoking^b



Personal hygiene: teeth staining is reduced when exposed to Raptor vapour in comparison to cigarette smoke and parity with untreated control

a. These results do not necessarily mean this product is less harmful than other tobacco products

Transforming our R&D

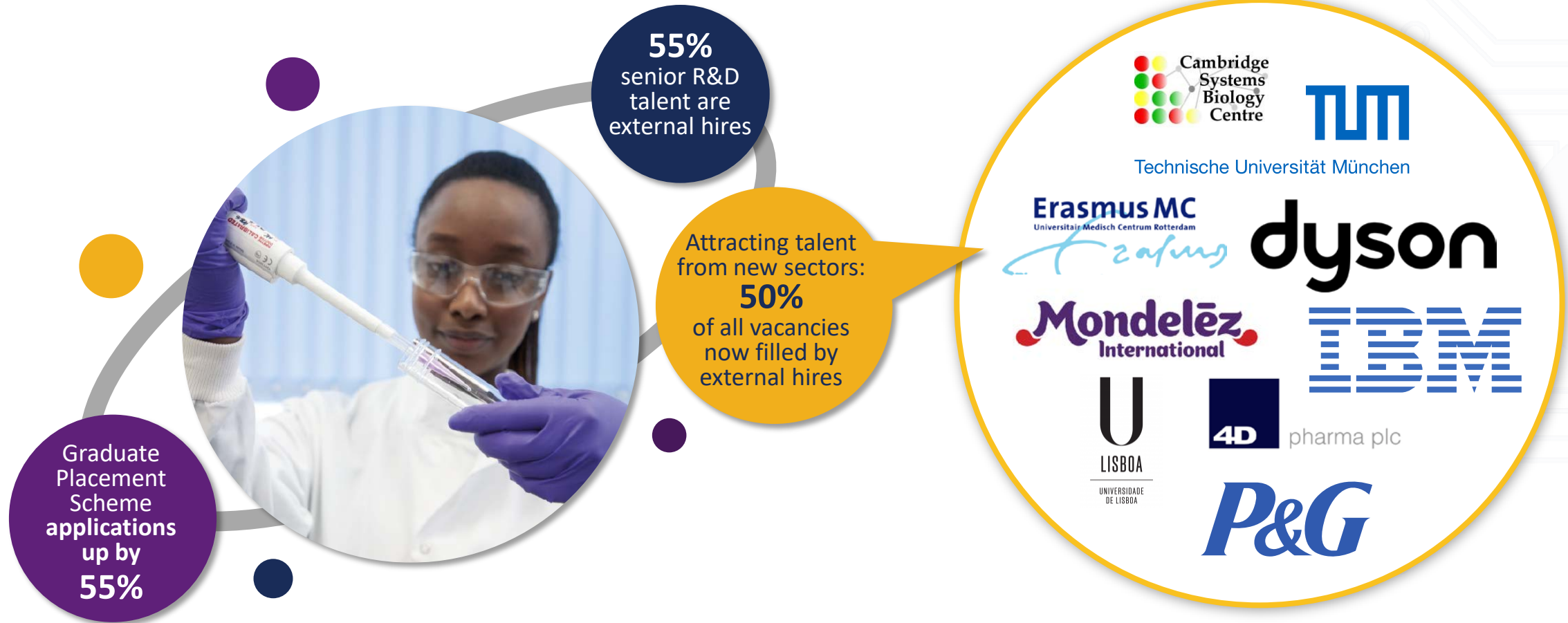


- optimisation of consumer experience
- superior flavour through novel selection of leaf
- ergonomic design with more uses/charges
- dynamic vapour technology delivering maximum satisfaction
- chip technology controlling aerosol output
- nano engineering for 'leak free' products

innovation @ BAT



Transformation of our R&D through talent acquisition



BAT/RAI: creation of the industry's leading R&D



- Combining the capabilities of both organisations enhances our global R&D strength
- Combined R&D by numbers:
 - › 1500 people across science, technology and innovation
 - › Total R&D investment over last six years: \$2bn
 - › Combined patent portfolio over last three years: more than 3300 filed; more than 1600 granted
 - › Combined publications in last three years: 109
 - › Innovation, product development and compliance expertise in all regions across the globe

R&D OF THE FUTURE NOW



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