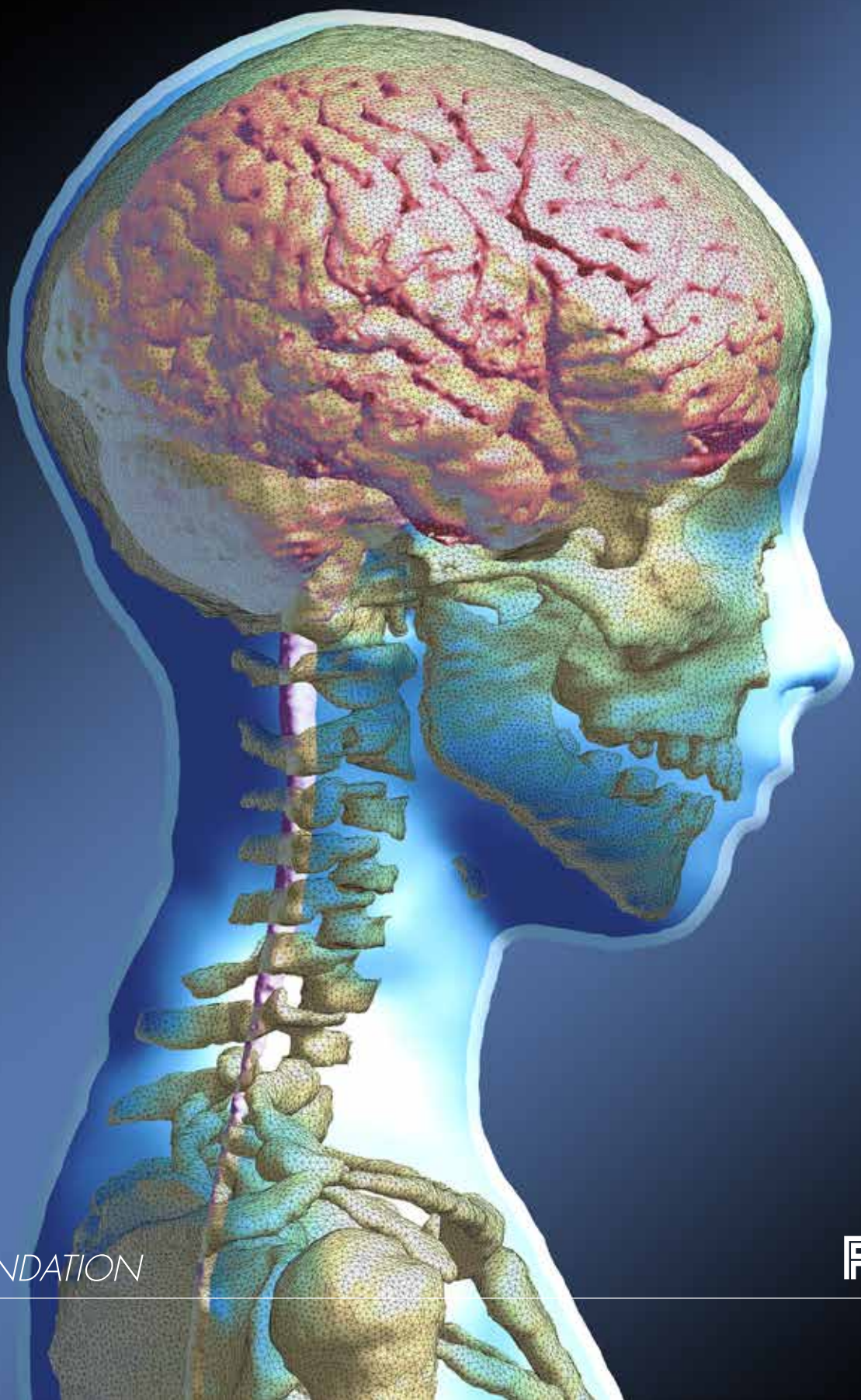
SWISS MADE

ViP

In Silico Clinical Tests and Trials The Future Today



IT'IS FOUNDATION

FDA

The Virtual Population from the IT'IS Foundation

The Virtual Population (ViP) developed by the IT'IS Foundation consists of 15 high-resolution, full-body anatomical human models and three pregnant woman models. The models were developed from high-resolution magnetic resonance imaging (MRI) data of healthy volunteers and reconstructed as three-dimensional computer-aided-design (CAD) objects. The CAD format allows the models to be meshed at arbitrary resolutions without any loss of detail or small features.

History of the Virtual Population

The ViP project first started in 2005 when the mobile phone industry launched the development of the Virtual Family, a joint project between the IT'IS Foundation and the US Food and Drug Administration. Additional models were gradually generated to broaden the population coverage, forming ViP v1.x. The v2.0 models, consisting of 22 simplified CAD files, were developed to support finite-element modeling in third-party commercially available platforms. The newest generation ViP3.0 models, available since mid-2015, elevate computational simulations in 3D anatomies to an unprecedented level of detail and accuracy, with more than 300 tissues and organs per model, a resolution of 0.5 mm^3 throughout the entire body, and specific physical, physiological, and biological properties for all segmented tissues*.

Verification, Validation, and Compatibility of ViP

Model quality and consistency is based on stringent quality assurance guidelines, quality control procedures performed by team members, a case-tracking system, and the generation of log files of changes. Quality guidelines were developed to ensure that differences between models are due to real interpersonal differences and not segmentation errors. All ViP3.0 models come with a validation certificate issued by a professional anatomist. Their compatibility with v1.x for EM applications has been validated by simulations. To provide permanent digital access to each released version of the models and to guarantee unambiguous traceability, each ViP model has also been assigned a unique digital object identifier (DOI) code.

How to Obtain the Virtual Population Models**

The v1.x models are available to the research community for unrestricted use related to non-commercial purposes and are subject to a licensing fee for commercial use. All fees collected are re-invested to support the continued development of the ViP. The Virtual Family v2.0 is free of charge, except for handling fees. The computable, functionalized, and posable ViP 3.0 models require a Sim4Life license from ZMT.

* For information about tissue properties, please visit www.itis.swiss/database

** For inquiries, please contact virtualpopulation@itis.swiss

Name	Gender	Age [years]	Height[1] [m]	Weight[1] [kg]	BMI[1] [kg/m²]	No. of tissues[1]	DOI code[1]
Glenn[a,2]	male	84	1.73	61.1	20.4	304	10.13099/VIP11015-03-0
FATS[b,2]	male	37	1.82	119.0	36.0	305	10.13099/VIP11014-03-0
DUKE[c,2]	male	34	1.77	70.3	22.4	305	10.13099/VIP11001-03-0
ELLA[c,2]	female	26	1.63	57.3	21.5	305	10.13099/VIP11002-03-0
JEDUK[a,h,2]	male	33	1.64	55	20.4	305	DOI: 10.13099/ViP11017-03-1
YOON-SUN[a,h,2]	female	26	1.52	55	33.6	305	DOI: 10.13099/ViP11016-03-1
LOUIS[d,2]	male	14	1.68	49.7	17.5	306	10.13099/VIP11006-03-0
BILLIE[c,2]	female	11	1.49	34.0	15.4	305	10.13099/VIP11003-03-0
EARTHA[d,2]	female	8	1.36	29.9	16.2	306	10.13099/VIP11007-03-0
DIZZY[d,2]	male	8	1.37	25.4	13.5	306	10.13099/VIP11005-03-0
THELONIOUS[c,2]	male	6	1.15	18.6	14.1	299	10.13099/VIP11004-03-0
ROBERTA[d,2]	female	5	1.09	17.8	14.9	302	10.13099/VIP11008-03-0
NINA[e]	female	3	0.92	13.9	16.4	97	10.13099/ViP-Nina-V1.1
CHARLIE[f]	female	8 weeks	N/A	4.3	N/A	60	10.13099/ViP-Charlie-V1.1
PREGNANT WOMAN[g] (3rd month)	N/A	3 months (months in utero)	N/A	0.015	N/A	15	10.13099/ViP-Pregnant3m-V1.1
PREGNANT WOMAN[g] (7th month)	N/A	7 months (months in utero)	N/A	1.4	N/A	20	10.13099/ViP-Pregnant7m-V1.1
PREGNANT WOMAN[g] (9th month)	female	9 months (months in utero)	N/A	2.7	N/A	26	10.13099/ViP-Pregnant9m-V1.1

All the models are in CAD format. The system requirements for using the CAD models are 64bit OS (Window 7, Vista, or XP) and at least 4GB RAM.
[a] Available in Version 3.0 only, [b] Available in Version 1.x and 3.0, [c] Virtual Family, available in Version 1.x, 2.0, and 3.0, [d] Virtual Classroom, available in Version 3.0
[e] Morphed version of Roberta, available in Version 1.x, [f] Adaptation from the voxel baby developed by the Helmoltz Zentrum München, available in Version 1.x
[g] Pregnant woman based on "Ella", specifications refer to the the fetus, [1] values refer to version 3.0, [2] posable, [h] Yoonsun and Jeduk are based on the Visible Korean cryosection datasets and will be released in 2018 (Yoonsun in Q3, Jeduk in Q4). Update releases with individual (separated) muscles, arteries and veins will follow the initial released version.

Acknowledgements

The models were developed in collaboration with the Center for Devices and Radiological Health (CDRH) of the U. S. Food and Drug Administration (FDA), Silver Spring, MD, USA; the Austrian Institute of Technology GmbH (AIT, formerly the Austrian Research Centers), Seibersdorf, Austria; the University of Houston, TX, USA; the Universitätsklinikum Erlangen, Friedrich-Alexander-University (FAU) Hospital, Erlangen-Nürnberg, Germany; Siemens Medical Solutions, Erlangen, Germany; Erasmus MC – Daniel den Hoed Cancer Center, Rotterdam, the Netherlands; and the University of Zurich and ETH Zurich, Zurich, Switzerland.

The Mobile Manufacturers Forum, the GSM Association, and SPEAG funded the development of the original Virtual Family. The German Federal Office for Radiation Protection (BfS) supported the development of four additional models of childre (Virtual Classroom). The Swiss National Research Program NFP57, the Netherlands Organization for Health Research & Development (ZonMw), and SPEAG funded the development of the pregnant women and infant models. The EUREKA project MRI+ supported the development of the obese male model, and SPEAG funded the model of the elderly male. Scientists at the FDA (USA) and other specialists have validated all models. The Korean male and female models are being developed with funding from the Swiss Innovation Agency (Innosuisse) and the Korean Institute for Advancement of Technology (KIAT).

IT'IS FOUNDATION

www.itis.swiss/vip

IT'IS Foundation · Zeughausstrasse 43 · 8004 Zurich · Switzerland
Phone +41 44 245 9696 · Fax +41 44 245 9699 · Email vip@itis.swiss

IT'IS Foundation is a member of