

## Clinical Trial Protocol: DX-2930-03

**Study Title:** HELP Study™: A Multicenter, Randomized, Double-Blind, Placebo-Controlled Efficacy and Safety Study to Evaluate DX-2930 For Long-Term Prophylaxis Against Acute Attacks of Hereditary Angioedema (HAE)

**Study Number:** DX-2930-03

**Study Phase:** Phase 3

**Product Name:** DX-2930

**IND Number:** 116647

**EudraCT Number:** 2015-003943-20

**Indication:** Prevention of angioedema attacks in patients with HAE

**Investigators:** Multicenter

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**Date:**

**Original Protocol**

14 September 2015

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## PROTOCOL SIGNATURE PAGE

**Study Title:** HELP Study™: A Multicenter, Randomized, Double-Blind, Placebo-Controlled Efficacy and Safety Study to Evaluate DX-2930 For Long-Term Prophylaxis Against Acute Attacks of Hereditary Angioedema (HAE)  
**Study Number:** DX-2930-03  
**Final Date:** 14 September 2015

This clinical study protocol was subject to critical review and has been approved by the Sponsor. The signature of the Sponsor representative indicates that the Sponsor will comply with all Sponsor obligations detailed in applicable regulations and guidelines and will ensure the Investigator is informed of all relevant information that becomes available.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
Ryan Iarrobino  
PPD, Clinical Development  
55 Network Drive, Burlington, MA 01803

I have read the foregoing protocol and agree that it contains all necessary details for carrying out this study. I will conduct the study in compliance with the Declaration of Helsinki, GCP, and all applicable regulatory requirements and guidelines as outlined herein and will complete the study within the time designated.

I will provide copies of the protocol and all pertinent information to all individuals responsible to me who assist in the conduct of this study. I will discuss this material with them to ensure they are fully informed regarding the drug and the conduct of the study.

I will use only the informed consent form approved by Dyax Corp. and my Institutional Review Board (IRB), Research Ethics Board (REB) or Ethics Committee (EC) and will fulfill all responsibilities for submitting pertinent information to the IRB/REB/EC responsible for this study.

I further agree that Dyax Corp. or their designees shall have access to any source documents from which eCRF information may have been generated.

By signing this protocol, I agree to adhere to the instructions and procedures described in it and thereby to adhere to the principles of GCP to which it conforms.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
Investigator  
Address: \_\_\_\_\_  
\_\_\_\_\_

## SYNOPSIS

<b>Sponsor:</b> Dyax Corp.
<b>Name of Finished Product:</b> DX-2930 Drug Product (DP)
<b>Name of Active Ingredient:</b> DX-2930 is a recombinant, Chinese hamster ovary (CHO) cell-expressed, fully human immunoglobulin G subclass 1 (IgG1), kappa light chain, monoclonal antibody.
<b>Names of Inactive Ingredients:</b> Sodium phosphate, citric acid, histidine, sodium chloride, and Tween 80
<b>Study Title:</b> HELP Study <sup>TM</sup> : A Multicenter, Randomized, Double-Blind, Placebo-Controlled Efficacy and Safety Study to Evaluate DX-2930 For Long-Term Prophylaxis Against Acute Attacks of Hereditary Angioedema (HAE)
<b>Study Number:</b> DX-2930-03
<b>Study Phase:</b> Phase 3
<b>Study Location:</b> Approximately 60 study sites planned across the United States, Italy, United Kingdom, Germany, Canada and Jordan
<b>Primary Objective:</b> To evaluate the efficacy of DX-2930 in preventing HAE attacks
<b>Secondary Objective:</b> To evaluate the safety of repeated subcutaneous administrations of DX-2930
<b>Tertiary Objectives:</b> <ul style="list-style-type: none"><li>• To evaluate the pharmacodynamic (PD) effects of chronically administered DX-2930</li><li>• To assess the immunogenicity of chronically administered DX-2930</li><li>• To evaluate the pharmacokinetics (PK) of chronically administered DX-2930</li><li>• To evaluate the effect of DX-2930 upon quality of life assessments</li></ul>
<b>Study Design:</b> This study is a phase 3, multicenter, randomized, double-blind, placebo-controlled trial to evaluate the efficacy and safety of DX-2930 in preventing acute angioedema attacks in patients with Type I and Type II HAE.  <u>Long-Term Prophylactic (LTP) Therapy Washout:</u> Following informed consent, subjects will undergo screening assessments. Screened subjects who are on long-term prophylactic therapy for HAE are required to undergo a minimum 2 week washout period prior to the start of the run-in period. This LTP washout is permitted as

long as the Investigator determines that doing so would not place the subject at any undue safety risk and the subject is at least 18 years of age. The Investigator must confirm the subject has successfully completed the 2 week washout period before they can enter the run-in period.

Run-In Period:

Screened subjects who are either not on long-term prophylactic therapy for HAE, or have completed the required washout period, will enter a run-in period of 4 weeks to determine the baseline HAE attack rate. Only subjects meeting a minimum baseline rate of at least 1 Investigator-confirmed HAE attack per 4 weeks will be eligible for enrollment and randomization. Subjects who experience 3 or more Investigator-confirmed attacks before the end of the 4 weeks can exit the run-in period early and proceed to enrollment and randomization. Subjects without at least 1 Investigator-confirmed attack after 4 weeks of run-in will have their run-in period extended for another 4 weeks, during which time they need to have at least 2 Investigator-confirmed attacks to proceed to enrollment and randomization. Subjects who have their run-in extended may not exit the run-in period early. Subjects who do not meet the minimum attack rate during run-in or are otherwise determined to be ineligible due to screening assessments will be considered screen failures. Subjects who screen fail will not be allowed to rescreen into the study.

Treatment Period:

After verification of eligibility, subjects will be randomized 2:1 to receive repeated subcutaneous (SC) administrations of DX-2930 or placebo in a double-blind fashion. Subjects who are randomized to DX-2930 will be assigned in a 1:1:1 ratio to one of three dose regimens: 300 mg every 2 weeks, 300 mg every 4 weeks or 150 mg every 4 weeks. Randomization into all treatment groups will be blocked by naïve vs. non-naïve subjects (subjects receiving active study drug in protocol DX-2930-02) as well as the baseline attack rate observed during the run-in period into the following groups: 1 to < 2 attacks per 4 weeks, 2 to < 3 attacks per 4 weeks, and  $\geq 3$  attacks per 4 weeks.

Each subject will undergo a treatment period consisting of 13 doses of blinded Investigational Medicinal Product (IMP), for a period of 26 weeks from the date of first dose on Day 0 through two weeks after the final dose. Subjects randomized to one of the 4 treatment arms will either receive a DX-2930 or placebo dose according to the dosing schedule in Table 1.



**Table 1. Treatment Period Dosing Schedule**

Treatment Period		Treatment Arms: DX-2930 or Placebo			
Dose Number	Dose Day/ Week	300 mg every 2 weeks	300 mg every 4 weeks	150 mg every 4 weeks	Placebo
1	Day 0/ Week 0	DX-2930	DX-2930	DX-2930	Placebo
2	Day 14/ Week 2	DX-2930	Placebo	Placebo	Placebo
3	Day 28/ Week 4	DX-2930	DX-2930	DX-2930	Placebo
4	Day 42/ Week 6	DX-2930	Placebo	Placebo	Placebo
5	Day 56/ Week 8	DX-2930	DX-2930	DX-2930	Placebo
6	Day 70/ Week 10	DX-2930	Placebo	Placebo	Placebo
7	Day 84/ Week 12	DX-2930	DX-2930	DX-2930	Placebo
8	Day 98/ Week 14	DX-2930	Placebo	Placebo	Placebo
9	Day 112/ Week 16	DX-2930	DX-2930	DX-2930	Placebo
10	Day 126/ Week 18	DX-2930	Placebo	Placebo	Placebo
11	Day 140/ Week 20	DX-2930	DX-2930	DX-2930	Placebo
12	Day 154/ Week 22	DX-2930	Placebo	Placebo	Placebo
13	Day 168/ Week 24	DX-2930	DX-2930	DX-2930	Placebo
--	Day 182/ Week 26	No Dose	No Dose	No Dose	No Dose

**Open-Label Extension (OLE) Study:**

Subjects who complete the treatment period will be offered the option of enrolling in an open-label extension (OLE) study that will be described in a separate protocol (DX-2930-04).

**Follow-up Period:**

Subjects who do not participate in the OLE will undergo safety and additional evaluations (i.e., PK and PD) during an 8 week follow-up period. Subjects (or caregivers) will be instructed to inform the site of any HAE attack they experience after the final follow-up visit.

**Study Population:**

The study will enroll approximately 120 subjects to provide 108 completed. Subjects will be 12 years of age and older with a confirmed diagnosis of HAE (Type I or II) who experience at least 1 Investigator-confirmed attack per 4 weeks during the run-in period. HAE diagnosis will be confirmed through documented clinical history consistent with HAE and diagnostic testing conducted either during the screening visit or during participation in study DX-2930-02.

**Criteria for Inclusion:**

Subjects must meet the following criteria to be enrolled in this study:

1. Males and females 12 years of age or older at the time of screening.
2. Documented diagnosis of HAE (Type I or II) based upon all of the following:
  - Documented clinical history consistent with HAE (subcutaneous or mucosal, nonpruritic swelling episodes without accompanying urticaria).
  - Diagnostic testing results obtained during screening (or a prior DX-2930 study) that confirm HAE Type I or II: C1 inhibitor (C1-INH) functional level < 40% of the normal level. Subjects with functional C1-INH level 40-50% of the normal level may be enrolled if they also have a C4 level below the normal range. Subjects may begin participating in the run-in period before these diagnostic results are available. Subjects may be retested if results are incongruent with clinical history or believed by the Investigator to be confounded by recent LTP use.
  - At least one of the following: Age at reported onset of first angioedema symptoms ≤ 30 years, a family history consistent with HAE Type I or II, or C1q within normal range.
3. Experiencing a baseline rate of at least 1 Investigator-confirmed HAE attack per 4 weeks as confirmed during the run-in period.
4. Adult subjects and caregivers of subjects under the age of 18 are willing and able to read, understand, and sign an informed consent form. Subjects age 12 to 17, whose caregiver provides informed consent, are willing and able to read, understand and sign an assent form.
5. Males and females who are fertile and sexually active must adhere to contraception requirements for the duration of the study as follows:
  - Females of childbearing potential must agree to be abstinent or else use any two of the following medically acceptable forms of contraception from screening through 30 days after the final study visit: progestin-only oral contraceptive, condom with or without spermicidal jelly, diaphragm or cervical cap with spermicidal jelly, or intra-uterine device (IUD, all types). A female whose male partner has had a vasectomy must agree to use one additional form of medically acceptable contraception.
  - Females of non-childbearing potential, defined as surgically sterile (status post hysterectomy, bilateral oophorectomy, or bilateral tubal ligation) or post-menopausal for at least 12 months do not require contraception during the study.
  - Males, including males who are surgically sterile (post vasectomy), with female partners of childbearing potential must agree to be abstinent or else use a medically acceptable form of contraception from screening through 60 days after the final study visit.

**Criteria for Exclusion:**

Subjects who meet any of the following criteria will be excluded from the study:

1. Concomitant diagnosis of another form of chronic, recurrent angioedema, such as acquired angioedema (AAE), HAE with normal C1-INH (also known as HAE Type III), idiopathic angioedema, or recurrent angioedema associated with urticaria.
2. Dosing with an investigational drug or exposure to an investigational device within 4 weeks prior to screening.

3. Exposure to angiotensin-converting enzyme (ACE) inhibitors or any estrogen-containing medications with systemic absorption (such as oral contraceptives or hormonal replacement therapy) within 4 weeks prior to screening.
4. Exposure to androgens (e.g. stanozolol, danazol, oxandrolone, methyltestosterone, testosterone) within 2 weeks prior to entering the run-in period.
5. Use of long-term prophylactic therapy for HAE (C1-INH, attenuated androgens, or anti-fibrinolytics) within 2 weeks prior to entering the run-in period.
6. Use of short-term prophylaxis for HAE within 7 days prior to entering the run-in period. Short-term prophylaxis is defined as C1-INH, attenuated androgens, or anti-fibrinolytics used to avoid angioedema complications from medically indicated procedures.
7. Any of the following liver function test abnormalities: alanine aminotransferase (ALT) > 3x upper limit of normal, or aspartate aminotransferase (AST) > 3x upper limit of normal, or total bilirubin > 2x upper limit of normal (unless the bilirubin elevation is a result of Gilbert's syndrome).
8. Pregnancy or breastfeeding.
9. Subject has any condition that, in the opinion of the Investigator or Sponsor, may compromise their safety or compliance, preclude successful conduct of the study, or interfere with interpretation of the results (e.g., history of substance abuse or dependence, significant pre-existing illness or other major comorbidity that the Investigator considers may confound the interpretation of study results).

**Test Product; Dose; and Mode of Administration:**

DX-2930 is a sterile, preservative-free solution for injection, pH 6.0. The active ingredient, DX-2930, is formulated using the following compendial components: 30 mM sodium phosphate, 19 mM citric acid, 50 mM histidine, 90 mM sodium chloride, 0.01% Tween 80. Each vial contains a nominal concentration of 100 mg DX-2930 active ingredient in 1 mL solution. The test product will be administered subcutaneously into the upper arm in a blinded manner.

For each 300 mg dose of DX-2930, each subject will receive a total of 3 mL, divided into 2 separate 1.5 mL SC injections of DX-2930. The 2 injections will be given in the same upper arm, with at least 2 cm separation between each injection site.

For each 150 mg dose of DX-2930, each subject will receive a total of 3 mL, divided into 2 separate 1.5 mL SC injections, where one injection is DX-2930 and the other is placebo. The 2 injections will be given in the same upper arm, with at least 2 cm separation between each injection site.

**Placebo; Dose; and Mode of Administration:**

Placebo consists of the inactive formulation of the test product: 30 mM sodium phosphate, 19 mM citric acid, 50 mM histidine, 90 mM sodium chloride, pH 6.0 with 0.01% Tween 80.

Placebo doses will be administered to subjects randomized to the placebo treatment arm and in between doses of DX-2930 for subjects randomized to the 300 mg or 150 mg DX-2930 every 4 weeks treatment arms, according to the dosing schedule in Table 1.



For each placebo dose, each subject will receive a total of 3 mL, divided into 2 separate 1.5 mL SC injections of placebo. The 2 injections will be given in the same upper arm, with at least 2 cm separation between each injection site.

**Duration of Treatment:**

Subjects will receive a dose of blinded IMP every 2 weeks during the 26-week treatment period for a total of 13 doses. The first dose of IMP will be administered on Day 0 and the last dose of IMP will be administered on Day 168. There will be a  $\pm$  3-day window around each study visit, with a maximum of 17 days or a minimum of 11 days between any two doses. Subjects will be monitored at the study site through 2 hours post-dose for the first 4 doses with the ability to reduce this time to 1 hour for the remaining doses based on the discretion of the Investigator and the absence of safety signals. A follow-up visit will occur on Day 182.

**Duration of Study for Individual Subjects:**

Following informed consent, subjects will undergo screening assessments. Screened subjects who are on long-term prophylactic therapy for HAE are required to undergo a minimum 2 week washout period prior to the start of run-in. Subjects who are either not on long-term prophylactic therapy for HAE, or have completed the required washout period, will enter a run-in period of 4 weeks to determine the baseline HAE attack rate. The run-in period may last as long as 8 weeks in order to meet the minimum attack rate required for enrollment. Enrolled subjects will then undergo a 26-week treatment period. Subjects who do not participate in the OLE will be followed for an additional 8 weeks in the double-blind study.

**Prohibited Concomitant Treatments:**

Use of the following treatments will not be permitted during the study:

- Long-term prophylaxis for HAE (e.g., use of C1-INH for long-term prophylaxis, attenuated androgens, or anti-fibrinolytics).
- Angiotensin-converting enzyme (ACE) inhibitors.
- Estrogen-containing medications with systemic absorption (such as oral contraceptives or hormonal replacement therapy).
- Androgens (e.g., stanozolol, danazol, oxandrolone, methyltestosterone, testosterone).
- Any other investigational drug or device.

The use of short-term prophylactic treatment for HAE is permitted if medically indicated.

**Management of Acute Attacks:**

Acute HAE attacks during the study are to be managed in accord with the Investigator's usual care of their patients, including use of acute attack therapies that the Investigator deems as medically appropriate. Use of C1-INH will be permitted as an acute attack therapy but not as a long-term prophylaxis.

**Safety Assessments:**

The following assessments will be conducted according to the Study Activities Schedule:

- Adverse events (AEs), including serious adverse events (SAEs) and adverse events of



<p>special interest (AESI).</p> <ul style="list-style-type: none"><li>• Vital signs, including sitting or supine blood pressure (BP), heart rate (HR), body temperature, and respiratory rate (RR).</li><li>• Physical examination.</li><li>• Clinical laboratory testing (hematology, serum chemistry, coagulation, and urinalysis).</li><li>• 12-Lead electrocardiogram (ECG).</li></ul>
<p><b>Pharmacokinetic (PK) Assessments:</b></p> <p>Blood samples will be collected for the measurement of plasma DX-2930 concentrations prior to IMP administration on Day 0 and on Days <math>56 \pm 3</math>, <math>98 \pm 3</math>, <math>140 \pm 3</math>, and <math>182 \pm 3</math>. Additional samples will be collected on Days <math>210 \pm 3</math> and <math>238 \pm 3</math> during the follow-up period for any subjects not entering OLE.</p>
<p><b>Pharmacodynamic (PD) Assessments:</b></p> <p>Blood samples will be collected to evaluate the pharmacodynamic effects of DX-2930 through biomarker assays prior to IMP administration on Day 0 and on Days <math>56 \pm 3</math>, <math>98 \pm 3</math>, <math>140 \pm 3</math>, and <math>182 \pm 3</math>. Additional samples will be collected on Days <math>210 \pm 3</math> and <math>238 \pm 3</math> during the follow-up period for any subjects not entering OLE.</p>
<p><b>Immunogenicity Assessments:</b></p> <p>Blood samples will be collected to assay for the presence of anti-drug antibodies, including evaluation of neutralizing antibodies (if any confirmed positive anti-drug antibodies are detected) prior to IMP administration on Day 0 and on Days <math>56 \pm 3</math>, <math>98 \pm 3</math>, <math>140 \pm 3</math>, and <math>182 \pm 3</math>. Additional samples will be collected on Day <math>238 \pm 3</math> during the follow-up period for any subjects not entering OLE.</p>
<p><b>C1-INH, C4 and C1q Assessments:</b></p> <p>Samples for C1-INH, C4, and C1q assays will be obtained at screening for eligibility assessment unless already collected as part of protocol DX-2930-02.</p>
<p><b>Quality of Life Assessments:</b></p> <p>Quality of life (QOL) assessments will be conducted prior to IMP administration on Day 0 and on Days <math>98 \pm 3</math>, and <math>182 \pm 3</math>. An additional QOL assessment will be conducted on Day <math>238 \pm 3</math> for subjects not entering OLE.</p>
<p><b>Collection of HAE Attack Data:</b></p> <p>The collection, reporting and assessment of attacks in this study will be done in accordance with the HAE Attack Assessment and Reporting Procedures (HAARP). Site personnel will be trained on HAARP prior to screening subjects at their site.</p> <p>During screening, site personnel will train subjects and caregivers on identifying symptoms of an attack, the requirements for reporting attacks and the information they will be expected to provide. The subject (and caregiver) will confirm their understanding of what is required of them for reporting attacks to the site.</p> <p>At screening, subject HAE attack history will be collected. Information collected will include any prior history of laryngeal attacks, attack frequency, average severity, predominant attack</p>

location(s), average duration, acute attack therapy use, and history of long-term prophylaxis.

During the study, subjects (or caregivers) will be instructed to notify and report details to the study site within 72 hours of the onset of an HAE attack. In the situation that a subject is incapacitated following an attack, this information can be provided to the site by a family member or other individual with detailed knowledge of the event. If desired by the subject, memory aids may be provided to assist in tracking any HAE attacks subjects experience.

Subjects (or caregivers) will be asked to provide the following information when reporting an attack:

- Date and time symptoms of an attack were first experienced
- Description of symptoms experienced, including location(s)
- Impact on activity and whether any assistance or medical intervention was required, including hospitalizations or emergency department visits
- Any medications used to treat the attack
- If the attack resolved, date and time the subject was no longer experiencing symptoms

Site personnel will review the information provided and solicit additional information as necessary to document the attack, as described in the HAARP.

Site personnel will contact the subject or caregiver on a weekly basis or approximately 7 days after last contact with the subject throughout the run-in period. If the subject experiences 1 or more Investigator-confirmed HAE attacks by end of week 4, the subject will have fulfilled the run-in requirement and may proceed to enrollment and randomization. Subjects who experience 3 or more Investigator-confirmed attacks can exit the run-in period early and proceed to enrollment and randomization. If the subject experiences no Investigator-confirmed HAE attacks by the end of week 4, the subject will remain in the run-in period for an additional 4 weeks. The maximum duration of the run-in period is 8 weeks. If run-in has been extended and the subject has 2 or more Investigator-confirmed HAE attacks by the end of week 8, the subject will have fulfilled the run-in requirement and may proceed to the double-blind treatment period. Subjects who have their run-in extended may not exit the run-in period early. Subjects who do not meet the minimum attack rate during run-in will be considered a screen fail.

During the treatment period site personnel will contact the subject or caregiver once between scheduled study visits or approximately 7 days after last contact to solicit for any HAE attack information not already reported.

Throughout the duration of the double-blind study, during each study visit at the investigative site, site personnel will solicit for any new HAE attack information that was not already provided to the site.

In this study HAE attacks will be captured as AEs. All AEs, regardless of seriousness, severity, or causal relationship to IMP, will be recorded on the AE page of the eCRF. Any AE reported to the site meeting criteria for a serious adverse event must be reported to Dyax using the SAE Reporting Form in the EDC system within 24 hours of becoming aware of the event. For all serious adverse events that are reported as HAE attacks, the Principal Investigator or physician designee will review the event within 24 hours of initial notification and, in accordance with HAARP, evaluate if it represented a confirmed HAE attack. For all non-serious AEs that are reported as HAE attacks, the Principal Investigator or physician designee will review the event within 3 days of initial notification and, in accordance with HAARP, evaluate if it represented a confirmed HAE attack. If necessary for the evaluation, the Investigator or designee may contact the subject for additional information. Any subject-reported attack not confirmed by the Investigator must have an alternate AE diagnosis recorded. All subject-reported and Investigator-confirmed HAE attacks will be recorded in the eCRF.

Emergency department visits for HAE attacks and HAE attacks resulting in hospital admissions will be captured.

To be confirmed as an HAE attack, the event must have symptoms or signs consistent with an attack in at least one of the following locations:

- Peripheral angioedema: cutaneous swelling involving an extremity, the face, neck, torso, and/or genitourinary region
- Abdominal angioedema: abdominal pain, with or without abdominal distention, nausea, vomiting, or diarrhea
- Laryngeal angioedema: stridor, dyspnea, difficulty speaking, difficulty swallowing, throat tightening, or swelling of the tongue, palate, uvula, or larynx

Despite the presence of these symptoms, the Investigator may still clinically determine that the event did not represent an HAE attack if there are features that strongly refute such a diagnosis. For example, the reported event is accompanied by symptoms that are not consistent with an HAE attack (e.g., urticaria), the reported event persists well beyond the typical time course of an HAE attack (e.g., greater than 7 days), or there is a likely alternate etiology for the event (e.g., the subject's abdominal symptoms are attributable to a viral gastroenteritis outbreak in the household).

To be counted as a unique attack distinct from the previous attack, the new symptoms must occur at least 24 hours after resolution of the prior attack's symptoms.

**Study Stopping Rules:**

An Internal Study Safety Committee (SSC) will review blinded safety data at 50% of subjects completing Day 182, and *ad hoc* if needed. If necessary during a safety evaluation, the SSC may break the blind for individual subjects to determine if adverse events occurred in DX-2930 treated subjects.

Through the SSC review of safety data, the Sponsor may suspend dosing in the study at any



time for an important safety concern until the SSC can evaluate the potential signal and recommend an appropriate course of action.

If it is determined at any time that a dose group must be dropped due to an important safety signal, the sponsor may randomize the remaining unenrolled subjects into the remaining lower DX-2930 dosing arm(s) or placebo and continue enrollment for the remainder of the study in a double-blind fashion. If a dose is dropped due to an important safety signal, the highest remaining dose automatically becomes the primary dose comparison versus placebo. Subjects who had not yet completed the full treatment period in a dosing arm that has been dropped will rollover into a lower dosing arm in the Open-Label Extension Study, DX-2930-04, as determined by the SSC. Data for these subjects will be used up to the time at which it is decided to drop the dose in the efficacy analyses and in its entirety in the safety analyses.

**Individual Stopping Rules:**

Dosing for any individual subject will be discontinued if the subject experiences a DX-2930-related SAE (or a DX-2930-related, clinically significant non-serious AE) that, in the assessment of the Investigator and Medical Monitor, warrants discontinuation from further dosing for that subject's well-being. Subjects will continue to be followed through completion of all scheduled visits. Subjects who are discontinued from further dosing will not be eligible to participate in the OLE.

**Criteria for Evaluation:**

Primary and secondary efficacy endpoints will be based on an efficacy evaluation period spanning Day 14  $\pm$  3 through Day 182  $\pm$  3.

**Primary Endpoint**

- Number of HAE attacks per week

**Secondary Endpoints (rank ordered)**

1. Time to first attack, i.e. duration that a subject is attack-free until their first attack.
2. Number per week of HAE attacks requiring acute attack therapy use.
3. Number per week of moderate or severe HAE attacks.
4. Number per week of high-morbidity HAE attacks; a high-morbidity HAE attack is defined as any attack that has at least one of the following characteristics: severe, results in hospitalization (except hospitalization for observation < 24 hours), hemodynamically significant (systolic blood pressure < 90, requires IV hydration, or associated with syncope or near-syncope) or laryngeal.

**Safety Measures:**

- Adverse events (AEs) including serious adverse events (SAEs) and adverse events of special interest (AESI)
- Clinical laboratory testing (hematology, clinical chemistry, coagulation and urinalysis)
- Vitals signs including blood pressure, heart rate, body temperature and respiratory rate



- Physical examination
- 12-lead electrocardiogram (ECG)

**Additional Measures:**

- Pharmacodynamic effects
- Anti-drug antibody development
- Pharmacokinetic parameter determinations
- Quality of life assessments

**Analysis Populations:**

**Intent-to-treat (ITT) Population:** will include all randomized subjects who are administered at least 1 dose of active IMP or placebo. The primary efficacy analyses will be carried out with the ITT Population.

**Safety Population:** will include all subjects who are administered at least 1 dose of active IMP or placebo. All safety analyses will use the Safety Population.

**Sample Size Determination:**

The sample size needed to test the primary hypothesis ( $\alpha = 0.025$ , one-sided) in the Intent-to-treat (ITT) population to achieve a given power is calculated using the data and information from the DX-2930-02 study. Power analysis and sample size estimation was based on 1000 computer simulations using a mixed model repeated measures (MMRM) analysis of variance (ANOVA) for counts using the SAS generalized estimating equation (GEE) determination of statistical significance. Assumptions included that placebo subjects have an observed attack rate of 0.3 attacks per week during the treatment period, and are observed for 24 weeks of efficacy. Active treatment dose in each active treatment arm to placebo ratio was set at 1:1.5. A 10% missing data / dropout rate for both active treatment and placebo was also built into the empirical sample size simulations.

For a treatment effect of 60% reduction in attacks as compared to placebo, a sample size of 24 actively treated subjects for the primary active treatment arm and 36 placebo subjects would provide over 95% power (at  $\alpha=0.025$ , one-sided). A 60% reduction is well below the smallest expected reduction in attacks, for in the DX-2930-02 study, we observed reductions of attacks of near 100%. These sample sizes will also provide adequately sized safety population for evaluation. Up to 120 subjects may be enrolled to account for potential early drop-outs during the study.

**Statistical Methods:**

The primary analysis will be to compare the primary endpoint, which is the mean rate of Investigator-confirmed HAE attacks observed in each DX-2930 treatment arm to that in the placebo arm during the efficacy assessment period (Day 14 through Day 182). For the primary endpoint, an analysis of all randomized subjects who have received at least 1 dose of IMP will be conducted.

The HAE attack rates of the treated and placebo groups will be compared using MMRM ANOVA for counts using the GEE. The baseline attack rate for each subject as determined by the run-in period will be used as a continuous covariate in an analysis of covariance. For

each subject, the least squares mean will be calculated and adjusted for their baseline attack rate. A Poisson distribution will be assumed rather than a Gaussian distribution. Repeated measurement analysis will be employed, with a 7-day time period (i.e., 168 hours) serving as the discrete unit of measurement. There will be no Last Observation Carried Forward (LOCF), as the HAE attack rate will be computed as the total number of attacks divided by the total duration of observation during the specified time period. Subject weeks for which completed observation is less than the full 168 hours within a week will be handled according to an *a priori* plan to be described in the Statistical Analysis Plan.

There are three active treatment arms ordered by highest total monthly dose; 1) Primary Treatment Arm: 300 mg DX-2930 every 2 weeks, 2) Secondary Treatment Arm: 300 mg DX-2930 every 4 weeks, and 3) Tertiary Treatment Arm: 150 mg DX-2930 every 4 weeks. For the primary endpoint, each of the three active treatment arms will be compared against placebo using a closed sequential testing procedure in which first, the primary active treatment arm is compared to placebo at significance level alpha and then, if there is statistical significance found, then the secondary treatment arm is tested against placebo at level alpha. If statistical significance is found for both the primary and secondary treatment arms, then the tertiary treatment arm shall be compared to placebo at significance level alpha.

Further, all secondary hypotheses for each active treatment group versus placebo are to be tested in a closed sequential methodology. The *a priori* order of testing the secondary hypotheses has been pre-specified above. In order to preserve the overall level alpha, secondary endpoints are not tested unless the primary endpoint is found to be statistically significant.

The first secondary endpoint, time to first HAE attack, will be tested using the log-rank test comparing each active treatment group vs placebo. The descriptive analysis will use life table summaries based on Kaplan Meier (KM) estimates. Subjects without any HAE attacks during the 24-week period and subjects without 24 weeks of observation will be right censored.

The second secondary endpoint, mean rate of HAE acute therapy use, will be tested using the MMRM model as described for the primary endpoint.

The third secondary endpoint, mean rate of moderate or severe HAE attacks, will be tested using the MMRM model as described for the primary endpoint.

The fourth secondary endpoint, mean rate of high-morbidity HAE attacks will be tested using the MMRM model as described for the primary endpoint.

#### **Safety Analysis:**

Treatment-emergent AEs are defined as AEs with onset at the time of or following the start of treatment with study medication, or medical conditions present prior to the start of treatment but increasing in severity or relationship at the time of or following the start of treatment. The number and percentage of subjects with TEAEs will be displayed for each treatment group by body system and preferred term using the Medical Dictionary for Regulatory Activities (MedDRA®). Summaries in terms of severity and relationship to study medication will also be provided. Serious AEs will be summarized separately in a similar

fashion. Patient listings of AEs causing discontinuation of study medication, AEs leading to death, SAEs and AESI will be produced.

AESI will be analyzed according to primary system Organ Classes (SOCs) and Preferred Terms (PTs) determined by the search of relevant Standardized MedDRA Queries (SMQs). Summary tables with SOC and PTs, from the SMQ searches, will be generated presenting the number and percentage of subjects by AE, severity, seriousness, and relationship to study medication.

Usage of concomitant medications (other than rescue medications) will be summarized descriptively for each of the treatment groups and the combined active treatment group.

Actual values and change from baseline in vital signs and clinical laboratory tests will be summarized for each treatment group with descriptive statistics at each assessment obtained. For all laboratory tests, a shift table will be produced summarizing changes from normal to abnormal and vice-versa.

Abnormal physical examination findings will be listed.

The number and percentage of subjects with normal, abnormal-not clinically significant, and abnormal-clinically significant ECG findings will be displayed for each of the treatment groups.

Additional analyses of AEs, SAEs, severe AEs, AESI, and abnormal findings will be based on the timing (Study Day) and number of prior doses of study medication. The incidence of AEs by month from the start of study medication will be examined and the incidence among the four treatment arms will be compared. The rate of study discontinuation among the four treatment arms will also be compared.

**Date of Original Protocol:** 14 September 2015

## Study Activities Schedule

Study Activities Schedule																	
	Screening Visit	Run-in Period <sup>1</sup>	Treatment Period <sup>2</sup>													Follow-up Period <sup>3</sup>	
Tests and Assessments			Visit 1 Dose 1 Day 0	Site Check- in <sup>4</sup>	Visit 2 Dose 2 Day 14	Visit 3 Dose 3 Day 28	Visit 4 Dose 4 Day 42	Visit 5 Dose 5 Day 56	Visits 6 and 7 Doses 6 and 7 Days 70 and 84	Visit 8 Dose 8 Day 98	Visits 9 and 10 Doses 9 and 10 Days 112 and 126	Visit 11 Dose 11 Day 140	Day 144±1	Visits 12 and 13 Doses 12 and 13 Days 154 and 168	Visit 14 Day 182	Visit 15 Day 210	Visit 16 Day 238
Informed Consent	X																
Eligibility Review	X		X														
Long-term prophylactic therapy washout <sup>5</sup>	X																
Randomization			X														
Blinded IMP Treatment			X		X	X	X	X	X	X	X	X		X			
Demographic and Medical History	X																
C1-INH, C1q and C4 Testing <sup>6</sup>	X																
Pregnancy Test <sup>7</sup> (females)	X		X							X					X		X
Vital Signs <sup>8</sup>	X		X		X	X	X	X	X	X	X	X		X	X	X	X
Physical Examination <sup>9</sup>	X		X			X		X		X		X			X		X
12-Lead ECG <sup>10</sup>	X		X					X					X		X		
Clinical Laboratory Testing <sup>11</sup>	X		X			X		X		X		X			X		X
Serologies: HBsAg, HCV, and HIV	X																
Concomitant Therapy	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Adverse Events	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X



Study Activities Schedule																	
	Screening Visit	Run-in Period <sup>1</sup>	Treatment Period <sup>2</sup>													Follow-up Period <sup>3</sup>	
Tests and Assessments			Visit 1 Dose 1 Day 0	Site Check- in <sup>4</sup>	Visit 2 Dose 2 Day 14	Visit 3 Dose 3 Day 28	Visit 4 Dose 4 Day 42	Visit 5 Dose 5 Day 56	Visits 6 and 7 Doses 6 and 7 Days 70 and 84	Visit 8 Dose 8 Day 98	Visits 9 and 10 Doses 9 and 10 Days 112 and 126	Visit 11 Dose 11 Day 140	Day 144±1	Visits 12 and 13 Doses 12 and 13 Days 154 and 168	Visit 14 Day 182	Visit 15 Day 210	Visit 16 Day 238
HAE Attack Data <sup>12</sup>	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Quality of Life Assessments <sup>13</sup>			X							X					X		X
PK Blood Sampling			X					X		X		X			X	X	X
PD Sample Collection			X					X		X		X			X	X	X
Plasma Anti-Drug Antibody Testing			X					X		X		X			X		X
Discharge from Study <sup>14,15</sup>															X		X

ECG = Electrocardiogram; PK = Pharmacokinetic; PD = Pharmacodynamic; IMP = Investigational Medicinal Product

- Subjects will undergo a run-in period to determine their baseline HAE attack rate. Only subjects with a baseline rate of at least 1 Investigator-confirmed HAE attack per 4 weeks will be eligible for enrollment and randomization. Subjects who experience 3 or more Investigator-confirmed attacks before the end of the 4 weeks can exit the run-in period early and proceed to enrollment and randomization. Subjects without at least 1 Investigator-confirmed attack after 4 weeks of run-in will have their run-in period extended for another 4 weeks, during which time they need to have at least 2 Investigator-confirmed attacks to proceed to enrollment and randomization. Subjects who have their run-in extended may not exit run-in early. Subjects who do not meet the minimum attack rate during run-in or are otherwise determined to be ineligible due to screening assessments will be considered a screen fail.
- Treatment Period visits have a ±3 day window, with a maximum of 17 days or a minimum of 11 days between any two doses, starting with Dose 2, Day 14 through Day 182.
- For subjects who do not rollover into OLE (DX-2930-04). Follow-up visits have a ±3 day window.
- Site personnel contact the subject to solicit for any attacks not already reported by the subject once between scheduled site visits or approximately 7 days after last contact with subject.
- Subjects who are on long-term prophylactic (LTP) therapy for HAE are required to undergo a minimum 2 week washout period prior to the start of the run-in period. This LTP washout is permitted as long as the investigator determines that doing so would not place the subject at any undue safety risk and the subject is at least 18 years of age. The Investigator must confirm that the subject has successfully completed the 2 week washout period before they can enter the run-in period.
- Samples for C1-INH, C4, and C1q assays will be obtained at screening for eligibility assessment unless already collected as part of protocol DX-2930-02.
- The pregnancy test will only be conducted in females of childbearing potential. Tests performed on Day 0 and Day 182 must be urine-based. Tests performed at screening, Day 98, and Day 238 can be serum or urine-based.
- There is a ± 15 minute window for all vital signs. At study visits in which IMP is administered, vital signs including sitting or supine BP, HR, body temperature, and RR, will be obtained prior to dosing, 1 hour after dosing, and 2 hours after dosing for the first 4 doses with the ability to eliminate the 2 hour vitals for the remaining doses based on the discretion of the Investigator and the absence of safety signals.

- <sup>9</sup>. Height and weight will be collected at the Screening visit only.
- <sup>10</sup>. ECGs (single recordings) are collected at screening, baseline prior to Dose 1, Day 56, Day 144±1 day to capture the estimated C<sub>max</sub> and Day 182. The ECG assessment at C<sub>max</sub> on Day 144±1 day may be performed via at-home nurse or technician in lieu of a subject visit to the study site.
- <sup>11</sup>. Clinical laboratory testing will include Hematology, Coagulation, Serum Chemistry, and Urinalysis.
- <sup>12</sup>. Historical attack information will be collected at screening. During the study subjects (or caregivers, in the event the subject is < 18 years old or is incapacitated) are instructed to report details of the attack to the study site within 72 hours of the onset of the attack. Site personnel will also contact the subject once a week or at approximately 7 days after last contact with the subject during the run-in period and once between study visits or approximately 7 days after last contact with the subject during the treatment period in order to solicit for any attack that may have occurred. In addition, during study visits, site personnel will solicit for any new HAE attack information that was not given through prior subject contact with the site.
- <sup>13</sup>. Quality of life data will be obtained using the EQ5D and Angioedema Quality of Life Questionnaire (AE-QoL).
- <sup>14</sup>. Subjects who rollover into the Open-Label Extension protocol (DX-2930-04) will provide consent by Day 182 and receive their first open-label dose following the completion of all DX-2930-03 assessments scheduled on Day 182. At the completion of these assessments, the subject will be discharged from DX-2930-03 and roll into the DX-2930-04 study.
- <sup>15</sup>. Subjects who terminate from the study early will undergo (if possible) all of the assessments and procedures as Day 182 at their final study visit.

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## LIST OF ABBREVIATIONS AND DEFINITIONS OF TERMS

AAE	Acquired angioedema
ACE	Angiotensin converting enzyme
AE	Adverse event
AESI	Adverse Event of Special Interest
ALT	Alanine aminotransferase
ANOVA	Analysis of variance
aPTT	Activated partial thromboplastin time
AST	Aspartate aminotransferase
AUC	Area under the plasma concentration-time curve
AUC <sub>0-t</sub>	AUC from time zero to the last quantifiable concentration in plasma at time t
AUC <sub>0-∞</sub>	AUC from time 0 to infinity
AUC <sub>last</sub>	AUC from time 0 to the last measurable concentration
BLA	Biologics License Application
BMI	Body mass index
BP	Blood pressure
BUN	Blood urea nitrogen
C1-INH	C1 inhibitor
CFR	Code of Federal Regulations
CHO	Chinese hamster ovary
CL/F	apparent total plasma clearance after extravascular administration
C <sub>max</sub>	Maximum plasma drug concentration
CO <sub>2</sub>	Carbon dioxide
CPK	Creatine phosphokinase
CRF	Case report form
CRO	Clinical Research Organization
CSR	Clinical Study Report
DLT	Dose Limiting Toxicity



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DMID	Division of Microbiology and Infectious Diseases
DP	Drug product
ECG	Electrocardiogram
eCRF	Electronic case report form
EDC	Electronic data capture
ET	Early termination
FDA	Food and Drug Administration
FXI(a)	Factor XI (activated)
FXII(a)	Factor XII (activated)
GCP	Good Clinical Practice
GEE	Generalized estimating equation
GGT	Gamma-glutamyl transferase
HAE	Hereditary angioedema
HBsAg	Hepatitis B surface antigen
HCV	Hepatitis C virus
HIPAA	Health Information Portability and Accountability Act
HIV	Human immunodeficiency virus
HMWK	High molecular weight kininogen
HR	Heart rate
ICH	International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use
IEC	Independent Ethics Committee
IgG	Immunoglobulin G
IgG1	Immunoglobulin G subclass 1
IMP	Investigational medicinal product
IND	Investigational New Drug
INR	International normalized ratio
IRB	Institutional Review Board
IUD	Intrauterine device
IV	Intravenous

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IWRS	Interactive Web-based Randomization System
$K_i$	inhibition constant
LDH	Lactate dehydrogenase
LOCF	Last observation carried forward
MCH	Mean corpuscular hemoglobin
MCHC	Mean corpuscular hemoglobin concentration
MCV	Mean corpuscular volume
MedDRA	Medical Dictionary for Regulatory Activities
MMRM	Mixed model repeated measures
OLE	Open-label extension
PD	Pharmacodynamic(s)
PK	Pharmacokinetic(s)
pKal	Plasma kallikrein
PT	Prothrombin time
REB	Research Ethics Board
RBC	Red blood cell (count)
RR	Respiratory rate
SAE	Serious adverse event
SAP	Statistical Analysis Plan
SC	Subcutaneous
SD	Standard deviation
SGOT	Serum glutamic oxaloacetic transaminase (AST)
SGPT	Serum glutamic pyruvic transaminase (ALT)
SM	Safety Management
SMQ	Standard MedDRA query
SOC	System Organ Class
SOP	Standard operating procedure
SSC	Study Safety Committee
$t_{1/2}$	Terminal elimination half-life

$t_{\max}$	Time to maximum plasma concentration
TEAE	Treatment-Emergent Adverse Event
TT	Thrombin time
US	United States
$V_d/F$	Apparent volume of distribution during terminal phase after extravascular administration
WBC	White blood cell (count)
WHO	World Health Organization

## 1 INTRODUCTION

### 1.1 DX-2930

DX-2930 is a fully human IgG1 recombinant monoclonal antibody that binds specifically to active plasma kallikrein. DX-2930 is being developed for prophylactic treatment of angioedema attacks in patients with hereditary angioedema (HAE), a serious and life-threatening disease.

### 1.2 Hereditary Angioedema

HAE is a long-term, debilitating, and life-threatening disease caused by mutations in the C1-inhibitor (C1-INH) gene, resulting in deficiency or dysfunction of C1-INH protein. HAE manifests clinically as unpredictable, intermittent attacks of subcutaneous or submucosal edema of the face, larynx, gastrointestinal tract, limbs and/or genitalia (Zuraw, 2008). Swelling may last up to five or more days; most patients suffer multiple attacks per year. HAE is an orphan disorder. The exact prevalence of HAE is unknown, but current estimates range from 1 per 10,000 to 1 per 150,000 persons, with many authors agreeing that 1 per 50,000 is likely the closest estimate (Bygum, 2009; Goring et al., 1998; Lei et al., 2011; Nordenfelt et al., 2014; Roche et al., 2005).

Swelling in the larynx can obstruct the airways and cause death from asphyxiation (Bork et al., 2012; Bork et al., 2000). Approximately 50% of all HAE patients will experience a laryngeal attack in their lifetime, and there is no way to predict which patients are at risk of a laryngeal attack (Bork et al., 2003; Bork et al., 2006).

Abdominal attacks are often associated with nausea, vomiting, and severe pain; intestinal symptoms resembling abdominal emergencies may lead to unnecessary surgery (Zuraw, 2008).

Approximately 85% of patients have Type I HAE, characterized by very low production of functionally normal C1-INH protein, while the remaining approximately 15% of patients have Type II HAE and produce normal or elevated levels of a functionally impaired C1-INH (Zuraw, 2008). In patients with Types I and II HAE, uncontrolled plasma kallikrein generation results in excess bradykinin release from high-molecular weight kininogen (HMWK) and vascular leak mediated by bradykinin binding to the B2 receptor (B2-R) on the surface of endothelial cells (Zuraw, 2008). Clinical suspicion of Types I and II HAE can be confirmed by available blood tests. In addition to abnormalities in C1-INH level and function, plasma C4 levels are markedly reduced at all times in blood from most patients.

### 1.3 Therapeutic Rationale for DX-2930

Plasma kallikrein plays a critical role in the pathogenesis of HAE attacks (Davis, 2006; Kaplan and Joseph, 2010). In normal physiology, C1-INH regulates the activity of plasma kallikrein as well as a variety of other proteases, such as C1r, C1s, factor XIa, and factor XIIa. Plasma kallikrein regulates the release of bradykinin from high molecular weight



kininogen (HMWK). Due to a deficiency of C1-INH in HAE, uncontrolled plasma kallikrein activity occurs and leads to the excessive generation of bradykinin. Bradykinin is a vasodilator which is thought to be responsible for the characteristic HAE symptoms of localized swelling, inflammation, and pain ([Craig et al., 2012](#); [Zuraw et al., 2013](#)). Intervening at the level of bradykinin production with a plasma kallikrein inhibitor therefore represents an attractive and rational therapeutic strategy for HAE. Indeed, the importance of plasma kallikrein as a drug target in HAE has been validated through the observed effectiveness of Kalbitor® (ecallantide), a peptide that specifically targets plasma kallikrein, which was approved by the FDA for the treatment of acute HAE attacks ([Kalbitor® package insert, 2015](#)).

DX-2930 is a highly potent and specific inhibitor of plasma kallikrein ( $K_i = 125$  pM). X-ray crystallography of DX-2930 combined with plasma kallikrein demonstrates DX-2930 binding to the active site of kallikrein ([Kenniston et al., 2014](#)).

## 1.4 Safety Rationale for DX-2930

Safety data from the Phase 1a clinical study, a first-in-human study with DX-2930 in healthy subjects did not identify any safety concerns. Single doses up to 3 mg/kg of DX-2930 were well-tolerated. There were no dose-limiting toxicities, serious adverse events, or any other safety concerns identified.

Pharmacokinetic (PK) data from the Phase 1a clinical study in conjunction with data from the nonclinical toxicity studies support a wide safety margin. The mean  $C_{max}$  for human subjects treated at the highest dose of 3 mg/kg was approximately 14.5 µg/mL. As comparison, a mean  $C_{max}$  of 1310 µg /mL was observed following dosing of monkeys with 50 mg/kg DX-2930 SC weekly for 28 days. No toxicologically significant findings were observed in these treated animals or in any other nonclinical toxicity study to date for systemically administered DX-2930.

Safety data is also available from the Phase 1b study, a multiple-ascending dose study in HAE patients. In this study, two doses of DX-2930 up to 400 mg administered 14 days apart were well-tolerated. There were no dose-limiting toxicities, serious adverse events in any DX-2930 treated subjects, or any other safety concerns identified in this study of HAE patients. Pharmacokinetic data from the 1b study found that the drug exposure following two administrations of DX-2930 (up to a maximum of 400 mg) was substantially less than that attained and evaluated in the nonclinical toxicity studies.

For additional detail regarding the safety rationale for DX-2930, please refer to the [DX-2930 Investigator's Brochure](#).

## 1.5 DX-2930 Non-Clinical Pharmacology and Toxicology

For detail regarding the nonclinical findings, please refer to the [DX-2930 Investigator's Brochure](#).

## 1.6 DX-2930 Clinical Data

The clinical development program to date for DX-2930 consists of 2 studies to evaluate the safety, tolerability, and PK of DX-2930, including a Phase 1a single-ascending dose study in healthy subjects and a Phase 1b multiple-ascending dose study in HAE patients. These studies are summarized in the following sections.

### 1.6.1 Single-Ascending Dose Study in Healthy Subjects (DX-2930-01)

DX-2930-01 was a Phase 1a randomized, double-blind, placebo-controlled study in healthy subjects to evaluate the safety, tolerability, and PK following a single, SC dose of DX-2930. Participating subjects were randomized to receive placebo or active study drug within one of the following sequential, ascending dose cohorts: 0.1, 0.3, 1.0, or 3.0 mg/kg. For each dosing cohort, 6 subjects were randomized to receive active drug and 2 subjects to receive placebo.

A total of 32 subjects enrolled in the study and were randomized. The treatment groups were well balanced for demographic characteristics. The actual dose of DX-2930 administered to subjects ranged from 6.2 mg (in the 0.1 mg/kg group) to 300 mg (in the 3.0 mg/kg group) across all cohorts.

Based on the safety analysis, a single administration of DX-2930 was well tolerated up to doses of 3.0 mg/kg without evidence of dose-limiting toxicity. There were no deaths, SAEs, or subject discontinuations due to adverse events (AEs) during the study. Furthermore, there was no significant imbalance between placebo and DX-2930 for any particular treatment-emergent adverse event (TEAE). The most commonly reported TEAE was headache, which occurred at a rate of 25% for both DX-2930 and placebo.

The PK profile demonstrated linear, dose-dependent drug exposure with a mean half-life of approximately 17 to 21 days across dose groups. Results from two exploratory biomarker assays provide evidence for an important pharmacodynamic effect of DX-2930 in humans.

For additional detail regarding the single dose, clinical study in healthy subjects, please refer to the [DX-2930 Investigator's Brochure](#).

### 1.6.2 Multiple-Ascending Dose Study in HAE Patients (DX-2930-02)

DX-2930-02 was a Phase 1b randomized, double-blind, placebo-controlled, multiple ascending-dose study in patients with HAE to evaluate safety, tolerability, and PK of SC DX-2930. Participating subjects were randomized 2:1 to receive either active study drug or placebo within one of the following sequential, ascending dose cohorts: 30, 100, 300, or 400 mg (nominal 6 subjects per cohort). Each subject received 2 doses of study drug separated by 14 days and were followed for 15 weeks after the second dose.

A total of 37 subjects were randomized and treated with DX-2930 or placebo. One subject in the 400 mg dose group received a single dose of DX-2930 and, following several unsuccessful attempts to schedule their second dose, was replaced. This subject returned for a single follow-up visit before being lost to follow-up for reasons not related to the study.

Routine C1-INH testing revealed that one other subject did not have HAE Type I or II, despite a historical lab test indicating otherwise.

Subject demographics were balanced in terms of age, race, ethnicity and BMI. There were slightly more females in the DX-2930 group than in the placebo group (66.7% versus 53.8%).

The most common AEs reported were HAE attacks, injection site pain, and headache. The rates were not appreciably higher in the DX-2930 subjects compared to placebo. Two subjects were reported to have 3 related severe TEAEs. One of these was a DX-2930 subject (30 mg) with injection site pain lasting 1 minute and one was a DX-2930 subject (400 mg) with worsening headache lasting 1 minute and night sweats.

No safety signals were identified for vital signs, physical examinations, clinical laboratory tests, or electrocardiograms (ECG). Results suggest DX-2930 was well tolerated in this study with no evidence of dose-limiting toxicity at doses up to 400 mg.

A total of 3 out of 92 post-dose samples (3.3%), obtained from 2 out of 23 subjects (8.7%), were confirmed to be anti-drug antibody-positive.

The pharmacokinetic analysis for all subjects in the 30, 100, 300, and 400 mg doses showed drug levels in HAE subjects were dose-dependent and exhibited a prolonged half-life of approximately 2 weeks, typical of a human monoclonal antibody.  $C_{max}$  drug levels increased with increasing dose, as expected. These parameters are consistent with values obtained in healthy subjects in study DX-2930-01.

A Western blot assay showed pre-dose baseline levels of mean 2-chain high-molecular-weight kininogen (HMWK) in unactivated plasma collected from HAE patients was approximately 50%. A statistically significant reduction in 2-chain HMWK levels was observed on study days 8 and 22 in the 300 and 400 mg dose groups compared to pre-dose levels, levels similar to that observed in healthy subjects. This outcome demonstrates the pharmacodynamic activity of DX-2930 and its ability to effectively normalize the instability of HAE plasma in this assay.

Primary efficacy analyses were based on subjects in the 300 mg, 400 mg, and placebo dose groups who reported having at least 2 attacks in the 3 months prior to study entry (0.15 attacks/week). Of those subjects treated with 300 or 400 mg DX-2930, 15 of 16 subjects met these criteria. Of the placebo treated subjects, 11 of 13 subjects met these criteria.

The baseline HAE attack rates (attacks/week) were 0.39 attacks per week in the placebo group, 0.33 attacks per week in the 300 mg group, 0.55 attacks per week in the 400 mg group and 0.49 attacks per week in the 300 and 400 mg combined group. During the pre-specified, primary efficacy interval of 6 weeks (from days 8 to 50; corresponding to a period of notable drug exposure), the HAE attack rate, adjusted for baseline attack rate, was 0 in the 300 mg group and 0.045 attacks per week in the 400 mg group, compared to 0.37 attacks per week in the placebo group. This resulted in a 100% reduction vs placebo for the 300 mg DX-2930



group ( $P < 0.0001$ ) and an 88% reduction vs placebo for 400 mg DX-2930 ( $P = 0.005$ ). During this primary efficacy interval, 100% of subjects in the 300 mg group ( $P = 0.026$ ) and 82% of subjects in the 400 mg group ( $P = 0.03$ ) were attack-free compared with 27% of subjects in the placebo group.

The data from this study demonstrate proof of concept of the ability of DX-2930 to prevent acute attacks of HAE. A statistically significant finding of HAE attack prevention by DX-2930 was observed. DX-2930 was well tolerated in HAE subjects up to 400 mg. Drug exposure appears to be dose-proportional and consistent with the results obtained in healthy subjects in study DX-2930-01. Pharmacodynamic effect assays provide evidence that DX-2930 has a direct effect on plasma kallikrein activity in patient plasma.

For additional detail regarding the multiple dose, clinical study in HAE subjects, please refer to the [DX-2930 Investigator's Brochure](#).



## **2 STUDY OBJECTIVES**

### **2.1 Primary Objective**

To evaluate the efficacy of DX-2930 in preventing HAE attacks.

### **2.2 Secondary Objective**

To evaluate the safety of repeated subcutaneous administrations of DX-2930.

### **2.3 Tertiary Objectives**

- To evaluate the pharmacodynamic (PD) effects of chronically administered DX-2930
- To assess the immunogenicity of chronically administered DX-2930
- To evaluate the pharmacokinetics (PK) of chronically administered DX-2930
- To evaluate the effect of DX-2930 upon quality of life assessments

### 3 INVESTIGATIONAL PLAN

#### 3.1 Overall Study Design and Plan

##### 3.1.1 Overview

This study is a phase 3, multicenter, randomized, double-blind, placebo-controlled trial to evaluate the efficacy and safety of DX-2930 in preventing acute attacks in patients with Type I and Type II HAE. This double-blind study is planned to be followed by an open-label extension (OLE) that is described in a separate protocol (DX-2930-04).

Subjects aged 12 and over with a documented diagnosis of Type I or Type II HAE who experience at least 1 attack per 4 weeks during the run-in period will be eligible. Approximately 120 subjects may be enrolled to provide 108 that complete. Subjects will be enrolled from sites in the United States, Canada, Italy, Germany, United Kingdom and Jordan.

##### Long-Term Prophylactic (LTP) Therapy Washout:

Following informed consent, subjects will undergo screening assessments. Screened subjects who are on long-term prophylactic therapy for HAE are required to undergo a minimum 2 week washout period prior to the start of the run-in period. This LTP washout is permitted as long as the investigator determines that doing so would not place the subject at any undue safety risk and the subject is at least 18 years of age. These criteria ensure that patients who should remain on LTP do not washout for this study, but do allow the enrollment of appropriate patients with severe disease while minimizing their time off LTP. Current treatment guidelines recognize two different standard of care approaches to treating HAE, which include LTP and on-demand therapy (Cicardi et al., 2012; Craig et al., 2012; Zuraw et al., 2013). Throughout the study, subjects will be permitted to treat acute HAE attacks in accord with the Investigator's usual care of their patients. Thus, those subjects who stop their LTP to enter the study and are subsequently randomized to the placebo group will still be managed with no reduction in their standard of care. The Investigator must confirm that the subject has successfully completed the 2 week washout period before they can enter the run-in period.

##### Run-In Period:

Screened subjects who are either not on long-term prophylactic therapy for HAE, or have completed the required washout period will enter a run-in period of 4 weeks to determine the baseline HAE attack rate. Only subjects meeting a minimum baseline rate of at least 1 Investigator-confirmed HAE attack per 4 weeks will be eligible for enrollment and randomization. Subjects who experience 3 or more Investigator-confirmed attacks before the end of the 4 weeks can exit the run-in period early and proceed to enrollment and randomization. Subjects without at least 1 Investigator-confirmed attack after 4 weeks of run-in will have their run-in period extended for another 4 weeks, during which time they need to have at least 2 Investigator-confirmed attacks to proceed to enrollment and randomization. Subjects who have their run-in extended may not exit the run-in period early. Subjects who

do not meet the minimum attack rate during run-in or are otherwise determined to be ineligible due to screening assessments will be considered a screen fail. Subjects who screen fail will not be allowed to rescreen into the study.

**Treatment Period:**

After verification of eligibility, subjects will be randomized 2:1 to receive repeated subcutaneous (SC) administrations of DX-2930 or placebo in a double-blind fashion. Subjects who are randomized to DX-2930 will be assigned in a 1:1:1 ratio to one of three dose regimens: 300 mg every 2 weeks, 300 mg every 4 weeks or 150 mg every 4 weeks. Randomization into all treatment groups will be blocked by naïve vs. non-naïve subjects (subjects receiving active study drug in protocol DX-2930-02) as well as the baseline attack rate observed during the run-in period into the following groups: 1 to < 2 attacks per 4 weeks, 2 to < 3 attacks per 4 weeks, and  $\geq 3$  attacks per 4 weeks.

Each subject will undergo a treatment period consisting of 13 doses of blinded Investigational Medicinal Product (IMP), for a period of 26 weeks from the date of first dose on Day 0 through two weeks after the final dose. Subjects randomized to one of the 4 treatment arms will either receive a DX-2930 or placebo dose according to the dosing schedule in Table 1.

**Table 1. Treatment Period Dosing Schedule**

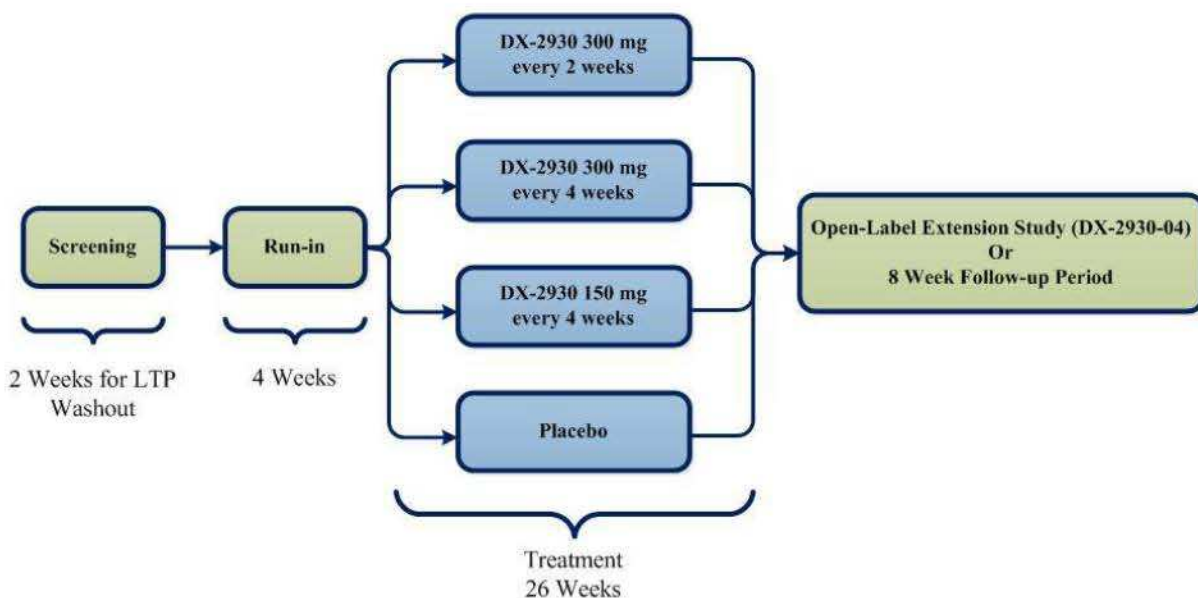
Treatment Period		Treatment Arms: DX-2930 or Placebo			
Dose Number	Dose Day/ Week	300 mg every 2 weeks	300 mg every 4 weeks	150 mg every 4 weeks	Placebo
1	Day 0/ Week 0	DX-2930	DX-2930	DX-2930	Placebo
2	Day 14/ Week 2	DX-2930	Placebo	Placebo	Placebo
3	Day 28/ Week 4	DX-2930	DX-2930	DX-2930	Placebo
4	Day 42/ Week 6	DX-2930	Placebo	Placebo	Placebo
5	Day 56/ Week 8	DX-2930	DX-2930	DX-2930	Placebo
6	Day 70/ Week 10	DX-2930	Placebo	Placebo	Placebo
7	Day 84/ Week 12	DX-2930	DX-2930	DX-2930	Placebo
8	Day 98/ Week 14	DX-2930	Placebo	Placebo	Placebo
9	Day 112/ Week 16	DX-2930	DX-2930	DX-2930	Placebo
10	Day 126/ Week 18	DX-2930	Placebo	Placebo	Placebo
11	Day 140/ Week 20	DX-2930	DX-2930	DX-2930	Placebo
12	Day 154/ Week 22	DX-2930	Placebo	Placebo	Placebo
13	Day 168/ Week 24	DX-2930	DX-2930	DX-2930	Placebo
--	Day 182/ Week 26	No Dose	No Dose	No Dose	No Dose

### Open-Label Extension (OLE):

Subjects who complete the treatment period will be offered the option of enrolling in an open-label extension (OLE) study that will be described in a separate protocol (DX-2930-04).

Figure 1 shows a schematic of the study design

**Figure 1. Overview of the Study Design**



### Follow-up Period:

Subjects who do not participate in the OLE will undergo safety and additional evaluations (i.e., PK and PD) during an 8 week follow-up period. Subjects (or caregivers) will be instructed to inform the site of any HAE attack they experience after the final follow-up visit.

## 3.1.2 Safety Oversight and Stopping Rules

### 3.1.2.1 Study Safety Committee (SSC)

This study will be conducted under the oversight of an internal Study Safety Committee (SSC) that will review blinded safety data at 50% of subjects completing Day 182, and ad hoc if needed. The SSC may recommend actions to be taken by the Sponsor including but not limited to the following:

- Suspension of dosing in the study
- Suspension of dosing in a specific dosing arm
- Increase in subject post-dose monitoring period at the study site



Any action taken by the Sponsor as a result of an SSC recommendation may be temporary until the SSC can evaluate the potential signal and recommend an appropriate course of action.

### 3.1.2.2 Study Level Stopping Rules

If it is determined at any time that a dose group must be dropped due to an important safety signal, the Sponsor may randomize the remaining unenrolled subjects into the remaining lower DX-2930 dosing arm(s) or placebo and continue enrollment for the remainder of the study in a double-blind fashion. Subjects who had not yet completed the full treatment period in a dosing arm that has been dropped will rollover into a lower dosing arm in the Open-Label Extension Study, DX-2930-04, as determined by the SSC. Data for these subjects will be used up to the time at which it is decided to drop the dose in the efficacy analyses and in its entirety in the safety analyses.

### 3.1.2.3 Individual Stopping Rules

Dosing for any individual subject will be discontinued if the subject experiences a DX-2930-related SAE (or a DX-2930-related, clinically significant non-serious AE) that, in the assessment of the Investigator and Medical Monitor, warrants discontinuation from further dosing for that subject's well-being. The subject will continue to be followed for the duration of the 26 week treatment period. Subjects who are discontinued from further dosing will not be eligible to participate in the OLE.

### 3.1.3 Follow-up for Subjects Meeting Stopping Criteria

Subjects that develop either an SAE or other toxicity considered clinically relevant (AE, laboratory, physical examination, vital sign, or ECG finding) will be carefully monitored until resolution, which may include the following:

- Additional clinical laboratory tests and/or other clinical investigations
- Additional visits or extended duration of follow-up
- Obtaining a specialist consultation

## 3.2 Rationale for Pivotal Dose Selection

The dose rationale is based on the pharmacodynamic bioactivity, PK, safety, and efficacy of DX-2930 from the Phase 1 clinical studies and nonclinical studies. Together, these attributes provide the rationale for the selected doses and regimens to achieve drug levels likely to prevent a majority of HAE attacks. Based on these considerations, 300 mg every 2 weeks, 300 mg every 4 weeks, and 150 mg every 4 weeks were identified as the dosing regimens for evaluation,

In study DX-2930-02, two DX-2930 doses of 300 mg or greater administered 2 weeks apart resulted in a normalization of plasma 2-chain HMWK levels and a maximal 91% reduction in HAE attacks (DX-2930 Investigators Brochure). Steady-state trough concentrations following DX-2930 administration every 2 weeks would be approximately 27,000 ng/mL.

The maximum plasma concentration ( $C_{\max}$ ) obtained following ecallantide administration to treat an acute attack is similar to this trough concentration of DX-2930.

It is possible that lower drug levels would prevent attacks following prophylactic treatment than those required for acute attack treatment, since systemic drug exposure could attenuate contact system activation through the inhibition of plasma kallikrein-mediated FXII activation. As such, 2 dosing regimens of DX-2930 administered monthly are being evaluated. Doses of 300 mg or 150 mg DX-2930 administered every 4 weeks would result in a steady-state trough concentration of approximately 9,500 and 4,750 ng/mL, respectively. These trough levels bracket the  $C_{\max}$  observed in the 100 mg dose group in study DX-2930-02, which demonstrated a slight, but not statistically significant, reduction in 2-chain HMWK levels.

The 3 proposed dose-regimen combinations provide a 6-fold range of steady-state trough concentrations and leverage both the biomarker and efficacy data generated in study DX-2930-02. Evaluation of the DX-2930 plasma concentrations at the time of attacks reported by DX-2930 treated subjects in DX-2930-02 suggests that the 3 planned dosing regimens will provide a meaningful range of clinical response.

### **3.3 Individual Subject Dosing and Follow-Up**

Subjects will receive a dose of blinded IMP every 2 weeks during the 26 week Treatment Period for a total of 13 doses. The first dose of IMP will be administered on Day 0 and the last dose of IMP will be administered on Day 168. There will be a  $\pm 3$  day window around each study visit, with a maximum of 17 days or a minimum of 11 days between any two doses. After each dose, subjects will be monitored at the study site through 2 hours post-dose for the first 4 doses with the ability to reduce this time to 1 hour for the remaining doses based on the discretion of the Investigator and the absence of safety signals. A follow-up visit will occur on Day 182.

### **3.4 Study Duration for Individual Subjects**

Following informed consent, subjects will undergo screening assessments. Screened subjects who are on long-term prophylactic therapy for HAE are required to undergo a minimum 2 week wash-out period prior to the start of run-in. Subjects who are either not on long-term prophylactic therapy for HAE, or have completed the required washout period will enter a run-in period of 4 weeks to determine the baseline HAE attack rate. The run-in period may last as long as 8 weeks in order to meet the minimum attack rate required for enrollment. Enrolled subjects will then undergo a 26-week treatment period. Subjects who do not participate in the OLE will be followed for an additional 8 weeks.

## 4 STUDY POPULATION SELECTION

### 4.1 Study Population

The study will enroll approximately 120 subjects to provide 108 completed. Subjects will be 12 years of age and older with a confirmed diagnosis of HAE (Type I or II) who experience at least 1 Investigator-confirmed attack per 4 weeks during the run-in period. HAE diagnosis will be confirmed through documented clinical history consistent with HAE and diagnostic testing conducted either during the screening visit or during participation in study DX-2930-02.

The subject population includes subjects who are 12 to 17 years old. Like adults, children with HAE can suffer from recurrent and debilitating attacks. Symptoms may present very early in childhood, and upper airway angioedema has been reported in HAE patients as young as the age of 3 (Bork et al., 2003). In one case series of 49 pediatric HAE patients, 23 had suffered at least one episode of airway angioedema by the age of 18 (Farkas, 2010). An important unmet medical need exists among children with HAE, especially adolescents, since the disease commonly worsens after puberty (Bennett and Craig, 2015; Zuraw, 2008).

### 4.2 Inclusion Criteria

Each subject must meet the following criteria to be enrolled in this study:

1. Males and females 12 years of age or older at the time of screening.
2. Documented diagnosis of HAE (Type I or II) based upon all of the following:
  - Documented clinical history consistent with HAE (subcutaneous or mucosal, nonpruritic swelling episodes without accompanying urticaria).
  - Diagnostic testing results obtained during screening (or a prior DX-2930 study) that confirm HAE Type I or II: C1 inhibitor (C1-INH) functional level < 40% of the normal level. Subjects with functional C1-INH level 40-50% of the normal level may be enrolled if they also have a C4 level below the normal range. Subjects may begin participating in the run-in period before these diagnostic results are available. Subjects may be retested if results are incongruent with clinical history or believed by the Investigator to be confounded by recent LTP use.
  - At least one of the following: age at reported onset of first angioedema symptoms ≤ 30 years, a family history consistent with HAE Type I or II, or C1q within normal range.
3. Experiencing a baseline rate of at least 1 Investigator-confirmed HAE attack per 4 weeks as confirmed during the run-in period.
4. Adult subjects and caregivers of subjects under the age of 18 are willing and able to read, understand, and sign an informed consent form. Subjects age 12 to 17, whose caregiver provides informed consent, are willing and able to read, understand and sign an assent form.
5. Males and females who are fertile and sexually active must adhere to contraception requirements for the duration of the study as follows:



- Females of childbearing potential must agree to be abstinent or else use any two of the following medically acceptable forms of contraception from screening through 30 days after the final study visit: progestin-only oral contraceptive, condom with or without spermicidal jelly, diaphragm or cervical cap with spermicidal jelly, or intra-uterine device (IUD, all types). A female whose male partner has had a vasectomy must agree to use one additional form of medically acceptable contraception.
- Females of non-childbearing potential, defined as surgically sterile (status post hysterectomy, bilateral oophorectomy, or bilateral tubal ligation) or post-menopausal for at least 12 months do not require contraception during the study.
- Males, including males who are surgically sterile (post vasectomy), with female partners of childbearing potential must agree to be abstinent or else use a medically acceptable form of contraception from screening through 60 days after the final study visit.

### 4.3 Exclusion Criteria

Subjects who meet any of the following criteria will be excluded from the study:

1. Concomitant diagnosis of another form of chronic, recurrent angioedema, such as acquired angioedema (AAE), HAE with normal C1-INH (also known as HAE Type III), idiopathic angioedema, or recurrent angioedema associated with urticaria.
2. Dosing with an investigational drug or exposure to an investigational device within 4 weeks prior screening.
3. Exposure to angiotensin-converting enzyme (ACE) inhibitors or any estrogen-containing medications with systemic absorption (such as oral contraceptives or hormonal replacement therapy) within 4 weeks prior to screening.
4. Exposure to androgens (e.g. stanozolol, danazol, oxandrolone, methyltestosterone, testosterone) within 2 weeks prior to entering the run-in period.
5. Use of long-term prophylactic therapy for HAE (C1-INH, attenuated androgens, or anti-fibrinolytics) within 2 weeks prior to entering the run-in period.
6. Use of short-term prophylaxis for HAE within 7 days prior to entering the run-in period. Short-term prophylaxis is defined as C1-INH, attenuated androgens, or anti-fibrinolytics used to avoid angioedema complications from medically indicated procedures.
7. Any of the following liver function test abnormalities: alanine aminotransferase (ALT) > 3x upper limit of normal, or aspartate aminotransferase (AST) > 3x upper limit of normal, or total bilirubin > 2x upper limit of normal (unless the bilirubin elevation is a result of Gilbert's syndrome).
8. Pregnancy or breastfeeding.
9. Subject has any condition that, in the opinion of the Investigator or Sponsor, may compromise their safety or compliance, preclude successful conduct of the study, or interfere with interpretation of the results (e.g., history of substance abuse or dependence, significant pre-existing illness or other major comorbidity that the Investigator considers may confound the interpretation of study results).



## **5 STUDY TREATMENT(S)**

### **5.1 Description of Treatment(s)**

For detailed information regarding IMP administration, refer to the Pharmacy Manual.

#### **5.1.1 DX-2930**

DX-2930 is a sterile, preservative-free solution for injection, pH 6.0. The active ingredient, DX-2930, is formulated using the following compendial components: 30 mM sodium phosphate, 19 mM citric acid, 50 mM histidine, 90 mM sodium chloride, 0.01% Tween 80. Each vial contains a nominal concentration of 100 mg DX-2930 active ingredient in 1 mL solution. The test product will be administered by subcutaneous injection into the upper arm in a blinded manner.

For each 300 mg dose of DX-2930, each subject will receive a total of 3 mL, divided into 2 separate 1.5 mL SC injections of DX-2930. The 2 injections will be given in the same upper arm, with at least 2 cm separation between each injection site.

For each 150 mg dose of DX-2930, each subject will receive a total of 3 mL, divided into 2 separate 1.5 mL SC injections, where one injection is DX-2930 and the other is placebo. The 2 injections will be given in the same upper arm, with at least 2 cm separation between each injection site.

#### **5.1.2 Placebo**

Placebo consists of the inactive formulation of the test product: 30 mM sodium phosphate, 19 mM citric acid, 50 mM histidine, 90 mM sodium chloride, pH 6.0 with 0.01% Tween 80.

Placebo doses will be administered to subjects randomized to the placebo treatment arm and in between doses of DX-2930 for subjects randomized to the 300 mg or 150 mg DX-2930 every 4 weeks treatment arms, according to the dosing schedule in Table 1.

For each placebo dose, each subject will receive a total of 3 mL, divided into 2 separate 1.5 mL SC injections of placebo. The 2 injections will be given in the same upper arm, with at least 2 cm separation between each injection site.

### **5.2 Dosing and Follow-Up Schedule**

Details of subject dosing and follow-up are included in the Study Activities Schedule, [Appendix 1](#).

### **5.3 Method of Assigning Subjects to Treatment Groups**

Subjects meeting all eligibility criteria will be enrolled in the study and sequentially assigned an identification number. Subjects will be assigned to one of the DX-2930 or placebo

treatment groups via an Interactive Web-based Randomization System (IWRS). Use of the IWRS will be outlined in the Operations Manual.

## 5.4 Blinding and Unblinding

Subjects will be randomized to receive 300 mg DX-2930 every 2 weeks, 300 mg DX-2930 every 4 weeks, 150 mg DX-2930 every 4 weeks or placebo every 2 weeks in a double-blind fashion. Subjects, caregivers for subjects under 18 years of age, Investigators and site personnel will be blinded to the treatment administered until the study is complete. The Sponsor will be blinded to the treatment administered until all subject involvement in the treatment period is complete and primary statistical analyses have been conducted.

If necessary for the SSC to conduct a safety evaluation, the Sponsor may break the blind for individual subjects to determine if adverse events occurred in DX-2930 treated subjects.

In the event of a drug-related SAE, the Investigator will contact and consult with the Medical Monitor regarding emergency unblinding of treatment assignment for the subject. The Investigator or the Medical Monitor can obtain the treatment assignment for the subject through the IWRS. In the event of a drug-related, serious, unexpected AE, the Dyax Pharmacovigilance Department may be provided with the treatment assignment for the subject for the purpose of regulatory reporting.

## 5.5 Prior and Concomitant Therapy

Reasonable efforts will be made to determine all relevant treatments received by the subject from the time of screening up to administration of the first dose of IMP.

All information on concomitant therapy from the time of first dose of IMP through the final study visit (including all prescription/non-prescription medications, herbal medications and vitamin supplements) must be recorded on the subject's electronic Case Report Form (eCRF) and should include the name of the procedure or drug and duration of the treatment (start and stop dates). Concomitant treatments (non-pharmacological treatments) include any surgical or diagnostic procedures.

### 5.5.1 Allowed Therapies

The following therapies are allowed during the study:

- Therapies for co-existing conditions, including those for acute attacks of HAE, are permitted if not excluded in [Section 5.5.2](#).
- The use of short-term prophylactic treatment for HAE will be permitted if medically indicated.
- Therapies to treat any AEs the subject experiences during the study are permitted.

### 5.5.2 Excluded Concomitant Therapies

Use of the following treatments will not be permitted during the study:

- Long-term prophylaxis for HAE (e.g., use of C1-INH for long-term prophylaxis, attenuated androgens, or anti-fibrinolytics).
- Angiotensin-converting enzyme (ACE) inhibitors.
- Estrogen-containing medications with systemic absorption (such as oral contraceptives or hormonal replacement therapy).
- Androgens (e.g., stanozolol, danazol, oxandrolone, methyltestosterone, testosterone).
- Any other investigational drug or device.

## 5.6 Restrictions

### 5.6.1 Medical Interventions

Medical interventions deemed necessary by the Investigator for the health and well-being of the subject will not be excluded during this study.

### 5.6.2 Fluid and Food Intake

There are no restrictions on fluid and food intake. Subjects may continue their usual dietary regimens.

### 5.6.3 Activity

There are no activity restrictions. Subjects may continue their usual activity regimens.

## 5.7 Treatment Compliance

All doses of the IMP will be administered during clinic visits under the direct supervision of the Investigator or qualified site personnel designated by the Investigator.

## 5.8 Packaging and Labeling

The test products (DX-2930 and placebo) will be supplied by Dyax Corp. and packaged and labeled according to applicable local and regulatory requirements for investigational studies.

## 5.9 Storage and Accountability

All supplies of the investigational products (DX-2930 and placebo) must be stored refrigerated (2°C to 8°C/36°F to 46°F) in the original carton and protected from light, in a securely locked area, accessible to authorized persons only, until needed for dose preparation. Qualified site personnel will inventory the investigational product received and will maintain records of disposition of the drug, including dates, quantity and use.

## **5.10 Investigational Medicinal Product Retention at Study Site**

The Investigator (or designee) is responsible for maintaining accurate accountability records of the IMP throughout the clinical study. All IMP received at the site must be inventoried and accounted for in an accountability log provided by the Sponsor. All dispensing and accountability records will be available for Sponsor review. IMP accountability will be verified during on-site monitoring visits.

Upon the completion or termination of the study, and upon written authorization from the Sponsor, or its representative, all unused and/or partially used IMP should be returned or destroyed at the investigational site, as specified by Sponsor. It is the Investigator's responsibility to ensure that the Sponsor, or its representative, has provided written authorization that procedures for proper disposal of the IMP have been established, and that appropriate records of the disposal are documented and maintained. No unused IMP may be disposed until fully accounted for by the Sponsor monitor (or designee).



## **6 STUDY PROCEDURES**

Please refer to the Study Activities Schedule, [Appendix 1](#).

### **6.1 Informed Consent**

Informed Consent and Assent forms must be approved for use by the reviewing institutional review board (IRB), research ethics board (REB) or independent ethics committee (IEC). Informed consent, and assent when applicable, must be obtained for all subjects participating in the study prior to performing any study related activities. Subjects may withdraw consent at any time. Participation in the study may be terminated at any time without the subject's consent as determined by the Investigator.

### **6.2 Eligibility Review**

The Investigator or qualified site personnel will confirm that all Inclusion and Exclusion criteria have been met.

### **6.3 Demographics and Medical History**

Demographics: date of birth (alternatively age or year of birth, if full date of birth is not allowed to be collected for legal reasons), sex, race and ethnicity (where locally permitted) and medical history will be obtained from the subject and recorded in source documents and the eCRF. Medical history will capture the subject's current relevant medical status (current disease processes), past relevant medical status (past disease processes), history of surgery, allergies and concomitant medications.

### **6.4 Efficacy Assessments**

#### **6.4.1 Primary and Secondary Endpoints**

Primary and secondary efficacy endpoints will be based on an efficacy evaluation period spanning Day 14  $\pm$  3 through Day 182  $\pm$  3.

#### **Primary Endpoint**

- Number of HAE attacks per week

#### **Secondary Endpoints (in rank order)**

1. Time to first attack, i.e., duration that a subject is attack-free until their first attack.
2. Number per week of HAE attacks requiring acute attack therapy use.
3. Number per week of moderate or severe HAE attacks.
4. Number per week of high-morbidity HAE attacks; a high-morbidity HAE attack is defined as any attack that has at least one of the following characteristics: severe, results in hospitalization (except hospitalization for observation <24 hours) , hemodynamically

significant (systolic blood pressure < 90, requires IV hydration, or associated with syncope or near-syncope) or laryngeal.

#### 6.4.2 HAE Attack Information Collection

The collection, reporting and assessment of attacks in this study will be done in accordance with the HAE Attack Assessment and Reporting Procedures (HAARP) ([Appendix 4](#)). Site personnel will be trained on HAARP prior to screening subjects at their site.

During screening, site personnel will train subjects and caregivers on identifying symptoms of an attack, the requirements for reporting attacks and the information they will be expected to provide. The subject (and caregiver) will confirm their understanding of what is required of them for reporting attacks to the site.

At screening, subject HAE attack history will be collected. Information collected will include any prior history of laryngeal attacks, attack frequency, average severity, predominant attack location(s), average duration, acute attack therapy use, and history of long-term prophylaxis.

During the study subjects (or caregivers, in the event the subject is < 18 years old) will be instructed to notify and report details to the study site within 72 hours of the onset of an HAE attack. In the event that a subject is incapacitated following an attack, this information can be provided to the site by a family member or other individual with detailed knowledge of the event. If desired by the subject, memory aids may be provided to assist in tracking any HAE attacks subjects experience.

Subjects (or caregivers) will be asked to provide the following information when reporting an attack:

- Date and time symptoms of an attack were first experienced
- Description of symptoms experienced, including location(s)
- Impact on activity and whether any assistance or medical intervention was required, including hospitalizations or emergency department visits
- Any medications used to treat the attack
- If the attack resolved, date and time the subject was no longer experiencing symptoms

Site personnel will review the information provided and solicit additional information as necessary to document the attack, as described in HAARP.

Subjects washing out of LTP will be contacted by the site at the end of the 2 week washout period. The Investigator must confirm the subject has successfully completed the 2 week washout period before they can enter the run-in period. Confirmation of washout will be captured in the eCRF.

Site personnel will contact the subject or caregiver weekly, or approximately 7 days after their last contact with the subject, throughout the run-in period. If the subject experiences 1 or more Investigator confirmed HAE attacks by the end of week 4, the subject will have fulfilled the run-in requirement and may proceed to enrollment and randomization. Subjects who experience 3 or more Investigator-confirmed attacks can exit the run-in period early and proceed to enrollment and randomization. If the subject experiences no Investigator-confirmed HAE attacks the end of the subject will remain in the run-in period for an additional 4 weeks. The maximum duration of the run-in period is 8 weeks. If run-in has been extended and the subject has 2 or more Investigator-confirmed HAE attacks by the end of week 8, the subject will have fulfilled the run-in requirement and may proceed to the double-blind treatment period. Subjects who have their run-in extended may not exit the run-in period early. Subjects who do not meet the minimum attack rate during run-in will be considered a screen fail.

During the treatment period site personnel will contact the subject or caregiver once between scheduled study visits or approximately 7 days after their last contact to solicit for any HAE attack information not already reported.

Throughout the duration of the double-blind study, during each study visit at the investigative site, site personnel will solicit for any new HAE attack information that was not already provided to the site.

In this study HAE attacks will be captured as AEs. All AEs, regardless of seriousness, severity, or causal relationship to study drug, will be recorded on the AE page of the eCRF. Any AE reported to the site meeting criteria for a serious adverse event must be reported to Dyax using the SAE Reporting Form in the EDC system within 24 hours of becoming aware of the event. For all serious adverse events that are reported as HAE attacks, the Principal Investigator or physician designee will review the event within 24 hours of initial notification and, in accordance with HAARP, evaluate if it represented a confirmed HAE attack. For all non-serious AEs that are reported as HAE attacks, the Principal Investigator or physician designee will review the event within 3 days of initial notification and, in accordance with HAARP, evaluate if it represented a confirmed HAE attack. If necessary for the evaluation, the Investigator or designee may contact the subject for additional information. Any subject-reported attack not confirmed by the Investigator must have an alternate AE diagnosis recorded. All subject-reported and Investigator-confirmed HAE attacks will be recorded in the eCRF.

Emergency department visits for HAE attacks and HAE attacks resulting in hospital admissions will be captured.

To be confirmed as an HAE attack, the event must have symptoms or signs consistent with an attack in at least one of the following locations:

- Peripheral angioedema: cutaneous swelling involving an extremity, the face, neck, torso, and/or genitourinary region.

- Abdominal angioedema: abdominal pain, with or without abdominal distention, nausea, vomiting, or diarrhea.
- Laryngeal angioedema: stridor, dyspnea, difficulty speaking, difficulty swallowing, throat tightening, or swelling of the tongue, palate, uvula, or larynx.

Despite the presence of these symptoms, the Investigator may still clinically determine that the event did not represent an HAE attack if there are features that strongly refute such a diagnosis. For example, the reported event is accompanied by symptoms that are not consistent with an HAE attack (e.g., urticaria), the reported event persists well beyond the typical time course of an HAE attack (e.g., greater than 7 days), or there is a likely alternate etiology for the event (e.g., the subject's abdominal symptoms are attributable to a viral gastroenteritis outbreak in the household).

To be counted as a unique attack distinct from the previous attack, the new symptoms must occur at least 24 hours after resolution of the prior attack's symptoms.

## 6.5 Vital Signs

Vital signs will be assessed by the Investigator or his/her qualified designee according to the Study Activities Schedule ([Appendix 1](#)). Routine vital sign assessments will be taken with the subject in the sitting or supine position after 5 minutes at rest and will include body temperature, heart rate (HR), blood pressure (BP) and respiratory rate (RR). BP should be determined using the same arm and the same equipment for each assessment. There is a  $\pm 15$  minute window for all vital signs.

## 6.6 Physical Examination

A physical examination including height, weight and calculation of Body Mass Index (BMI) will be performed by the Investigator or his/her qualified designee according to the Study Activities Schedule ([Appendix 1](#)). The findings of each examination will be recorded on the source documents and eCRF. The physical examination will include the body systems listed below:

- Height and weight (at Screening visit only)
- General appearance
- Ears, nose, and throat
- Head and Neck
- Ophthalmological
- Respiratory
- Cardiovascular
- Abdomen
- Neurological
- Extremities



- Dermatological
- Lymphatic

## 6.7 Electrocardiography (ECG)

A standard 12-lead ECG (single recording) will be performed according to the Study Activities Schedule ([Appendix 1](#)). The date and time of each ECG and its results will be documented in the source documents and eCRF. Electrocardiograms will be sent to a central reading vendor for assessment.

## 6.8 Clinical Laboratory Tests

### 6.8.1 Laboratory Parameters

Laboratory testing will be performed according to the Study Activities Schedule ([Appendix 1](#)).

Laboratory testing includes general safety parameters (hematology, coagulation, urinalysis, and serum chemistry), serology, pregnancy tests, C1-INH functional assay, C4 assay, C1q assay, PK samples, PD samples, and plasma anti-drug antibody testing. All laboratory tests will be performed using established and validated methods.

When multiple sample collection types are performed at the same assessment time point, the samples will be drawn in the following order (depending on what sample types are to be collected at that time point): laboratory safety samples (hematology, coagulation, serum chemistry), C1-INH, C4, C1q, PK, PD, anti-drug antibodies. Aliquots from the PK, PD and anti-drug antibody samples may be retained as back-up for additional parameter testing if necessary. Subjects will be in a seated or supine position during blood collection. The total blood draw for each subject who does not rollover into the OLE will be approximately 271 mL. The total blood draw for each subject that does rollover into the OLE will be approximately 208 mL. Please refer to the Laboratory Manual for more information.

Laboratory testing will include the following as specified in the Study Activities Schedule ([Appendix 1](#)).

#### 6.8.1.1 Hematology

- Hemoglobin
- Hematocrit
- Red blood cell (RBC) count
- White blood cell (WBC) count with differential
- Mean corpuscular volume (MCV)
- Mean corpuscular hemoglobin (MCH)
- Mean corpuscular hemoglobin concentration (MCHC)

- Absolute platelet count

#### 6.8.1.2 Coagulation

- Prothrombin time (PT)
- Activated partial thromboplastin time (aPTT)
- International Normalized Ratio (INR)

#### 6.8.1.3 Chemistry

- Albumin
- Alkaline phosphatase
- Alanine aminotransferase (ALT; SGPT)
- Aspartate aminotransferase (AST; SGOT)
- Bilirubin (total and direct)
- Blood urea nitrogen (BUN)
- Calcium
- Carbon dioxide (CO<sub>2</sub>)
- Chloride
- Creatinine
- Creatine phosphokinase (CPK)
- Glucose
- Phosphate
- Magnesium
- Potassium
- Sodium
- Total protein
- Uric acid

#### 6.8.1.4 Urinalysis

- Bilirubin
- Glucose
- Ketones
- Blood
- Nitrite
- pH
- Protein

- Specific gravity
- Microscopy (if indicated by macroscopic findings)

#### 6.8.1.5 Serology

HBsAg, HCV, and HIV tests

#### 6.8.1.6 Pregnancy Test

Serum or urine pregnancy test

#### 6.8.1.7 C1-INH Functional Assay

Results of a C1-INH functional assay are required for eligibility assessment. Samples will be drawn at the screening visit unless they were previously drawn and used for diagnostic confirmation in DX-2930-02. Subjects may be retested if results are incongruent with clinical history or believed by the Investigator to be confounded by recent LTP use.

#### 6.8.1.8 C4 Assay

Results of a C4 assay may be required for eligibility assessment. Samples will be drawn at the screening visit unless they were previously drawn and used for diagnostic confirmation in DX-2930-02. Subjects may be retested if results are incongruent with clinical history or believed by the Investigator to be confounded by recent LTP use.

#### 6.8.1.9 C1q Assay

Results of a C1q assay may be required for eligibility assessment. Samples will be drawn at the screening visit if C1-INH and C4 samples are also being drawn. Subjects may be retested if results are incongruent with clinical history or believed by the Investigator to be confounded by recent LTP use.

#### 6.8.1.10 PK Sample Collection

As outlined in [Section 6.9](#).

#### 6.8.1.11 PD Sample Collection

As outlined in [Section 6.10](#).

#### 6.8.1.12 Plasma Anti-Drug Antibody Testing

As outlined in [Section 6.11](#).

### 6.8.2 Sample Collection, Storage, and Shipping

Blood samples for laboratory assessments will be collected at the site by a trained phlebotomist designated and/or approved by the study Investigator. Details for the collection,

processing, storage and shipment of samples for all laboratory determinations will be provided in the Laboratory Manual.

Biological material will be stored and secured in a manner that assures that unauthorized access is prohibited and the samples are not lost, allowed to deteriorate, or accidentally or illegally destroyed.

## **6.9 Pharmacokinetic Assessments**

Blood samples for the measurement of plasma DX-2930 concentration will be obtained at pre-dose on Days 0,  $56 \pm 3$ ,  $98 \pm 3$ ,  $140 \pm 3$ , and  $182 \pm 3$ . Additional samples will be collected on Days  $210 \pm 3$  and  $238 \pm 3$  during the follow-up period for any subjects not entering OLE.

## **6.10 Pharmacodynamic Assessments**

To evaluate the PD effects of DX-2930 upon plasma kallikrein activity, blood samples will be obtained at pre-dose on Days 0,  $56 \pm 3$ ,  $98 \pm 3$ ,  $140 \pm 3$ , and  $182 \pm 3$ . Additional samples will be collected on Days  $210 \pm 3$  and  $238 \pm 3$  during the follow-up period for any subjects not entering OLE.

## **6.11 Plasma Anti-Drug Antibody Testing**

Plasma samples for testing for formation of antibodies to DX-2930 will be obtained at pre-dose on Days 0,  $56 \pm 3$ ,  $98 \pm 3$ ,  $140 \pm 3$ , and  $182 \pm 3$ . Additional samples will be collected on Days  $238 \pm 3$  during the follow-up period for any subjects not entering OLE.

## **6.12 Prior and Concomitant Therapy**

The Sponsor representatives and Investigator at the site conducting the trial will review and evaluate prior and concomitant medication usage on an ongoing basis. All prescription, over-the-counter medications, herbals, and supplements that are being taken or have been taken by subjects from the time of screening through the duration of the study will be regarded as concomitant medications and must be documented in the source documents and eCRF.

## **6.13 Randomization**

Subjects will be randomized 2:1 to receive repeated subcutaneous (SC) administrations of DX-2930 or placebo in a double-blind fashion. Subjects who are randomized to DX-2930 will be assigned in a 1:1:1 ratio to one of three dose regimens: 300 mg every 2 weeks, 300 mg every 4 weeks or 150 mg every 4 weeks. Randomization into all treatment groups will be blocked by naïve vs. non-naïve subjects (subjects receiving active study drug in protocol DX-2930-02) as well as the baseline attack rate into the following groups: 1 to < 2 attacks per 4 weeks, 2 to < 3 attacks per 4 weeks, and  $\geq 3$  attacks per 4 weeks.



## 6.14 Investigational Medicinal Product Treatment

Instructions for safe handling of IMP, preparation of each subcutaneous dose, and administration of IMP are provided in the Pharmacy Manual. Preparation and dispensing of the IMP will be handled by qualified site personnel as directed by the Principal Investigator at the study site. The Principal Investigator or qualified site personnel will administer the assigned IMP. The requirements for maintaining IMP accountability are provided in [Section 5.9](#) of this protocol.

## 6.15 Quality of Life Assessments

Quality of life data will be obtained using the EQ5D and Angioedema Quality of Life Questionnaire (AE-QoL) at pre-dose on Days 0,  $98 \pm 3$ , and  $182 \pm 3$ . An additional quality of life assessment will be conducted on Day  $238 \pm 3$  for subjects not entering OLE.

## 6.16 Adverse Event Reporting

Adverse events will be collected from signing of the informed consent through the last study visit.

### 6.16.1 Definitions

#### 6.16.1.1 Adverse Event

An AE is any untoward medical occurrence in a clinical trial subject whether or not it appears to have a causal relationship with the treatment administered.

An AE can therefore be any unfavorable and unintended sign (including an abnormal laboratory finding), symptom, or disease temporally associated with the use of a medicinal product or participation in a clinical study, whether or not directly related to the medicinal product or study participation.

- AEs may be new events or may be pre-existing conditions that have become aggravated or have worsened in severity or frequency during the course of the study.
- AEs may be clinically significant changes from baseline in physical examination, laboratory tests, or other diagnostic investigation (e.g., laboratory results, x-ray findings).

Laboratory abnormalities generally are not considered AEs unless they are associated with clinical signs or symptoms, or require medical intervention. A clinically significant laboratory abnormality that is independent from a known underlying medical condition and that requires medical or surgical intervention, or leads to IMP interruption or discontinuation, will, in itself, be considered an AE. Laboratory or diagnostic testing abnormalities that reflect or are part of a known underlying medical condition are not, in themselves, AEs; rather, the underlying medical condition leading to the abnormalities would be reported as the AE.

Pregnancy is not an AE; however, if a female subject becomes pregnant during the conduct of the study, the Investigator must notify the Sponsor according to the procedures provided in [Section 6.16.5.2](#).

#### 6.16.1.2 Serious Adverse Event

A SAE is any adverse experience occurring at any dose that results in any of the following outcomes:

- Death
- Life-threatening experience; Note: “Life-threatening” refers to a situation in which the subject was at substantial risk of death at the time of the event; it does not refer to an event that might have caused death if it were more severe.
- Requires inpatient hospitalization or prolongation of existing hospitalization; Note: Does not include hospitalization for observation with release within 24 hours. A scheduled hospitalization for a pre-existing condition that has not worsened during participation in the study does not meet this criterion. Pre-planned hospitalizations for an elective medical/surgical procedure or routine check-ups do not meet this criterion.
- Results in persistent or significant disability or incapacity.
- Is a congenital anomaly or birth defect.
- Is considered to be an important medical event defined as those that may not be immediately life-threatening or result in death or hospitalization, but may jeopardize the subject or may require intervention to prevent one of the outcomes listed in the definition above.

#### 6.16.1.3 Overdose

An overdose is defined as a significant variation from the recommended/scheduled dosage for a product. The dosing for this study will be conducted in a controlled clinical setting and an overdose is not anticipated. However, in the event of an accident, for this study, an overdose of DX-2930 is considered a dose that is two-fold higher than the intended dose for the subject.

#### 6.16.1.4 Planned Hospitalization

A hospitalization planned by the subject prior to the first dose of IMP is considered a therapeutic intervention and not the result of a new SAE and should be recorded as medical history. If the planned hospitalization or procedure is executed as planned, the record in the subject’s medical history is considered complete. However, if the event/condition worsens during the trial, it must be reported as an AE.

#### 6.16.1.5 Treatment-Emergent Adverse Events (TEAE)

An AE is treatment-emergent if the onset time is after first administration of IMP through the Day 182±3 final follow-up visit or, in the event that onset time precedes first IMP administration, the AE increases in severity during the 182±3 day follow-up period.

#### 6.16.1.6 Adverse Events of Special Interest (AESI)

Adverse events of special interest (AESI) will be captured and monitored during this study. **Investigators will report all AESI to Dyax, regardless of causality, using the same timelines as described for SAE reporting.** The following describe the AESI and the criteria for reporting AESI.

##### HYPERSENSITIVITY REACTIONS

As hypersensitivity reactions have been observed for monoclonal antibodies as a class, these events are considered AESI for this study. Investigators will report all diagnoses, or signs and symptoms when diagnoses cannot be determined, that are consistent with hypersensitivity reactions, regardless of causality, within 24 hours from the time of study drug administration. Investigators will report hypersensitivity reactions that occur after 24 hours, only if the reactions are suspected to be related to study drug.

##### EVENTS OF DISORDERED COAGULATION

###### *Bleeding AESI*

Although aPTT prolongation due to plasma kallikrein inhibition is an artifactual *in vitro* phenomenon, as a precautionary measure in evaluating the safety of DX-2930, bleeding events will be reported as AESI for this study. Investigators will report all diagnoses, or signs and symptoms when diagnoses cannot be determined, that are consistent with a clinical event of bleeding. Coagulation testing (aPTT, PT, INR) should be performed when possible, and when temporally reasonable, with any reports of bleeding or for clinical conditions possibly indicative of bleeding.

###### *Hypercoagulable AESI*

Investigators will report all diagnoses, or signs and symptoms when diagnoses cannot be determined, that are consistent with a thrombotic or embolic etiology.

#### 6.16.2 Monitoring

##### 6.16.2.1 Monitoring of Adverse Events

Each subject will be monitored for the occurrence of AEs, including SAEs, from signing of the ICF through final follow-up on Day 182 ± 3.

- Subjects will be questioned and/or examined by the Investigator or a qualified designee for evidence of AEs. The questioning of subjects with regard to the possible occurrence of AEs will be generalized such as, "How have you been feeling since your last visit?" The presence or absence of specific AEs should not be elicited from subjects.
- Subjects having TEAEs will be monitored until resolution with relevant clinical assessments and laboratory tests, as determined by the Investigator.



- AEs, actions taken as a result of AEs, and follow-up results must be recorded in the eCRF as well as in the subject's source documentation. Follow-up laboratory results should be filed with the subject's source documentation.

For any SAEs or AEs that require the subject to be discontinued from dosing, relevant clinical assessments and laboratory tests will be repeated as clinically appropriate, until final resolution or stabilization of the event(s). Subjects will continue to be followed through completion of all scheduled visits.

#### 6.16.2.2 Monitoring of Safety Laboratory Assessments

All safety laboratory assessments will be performed at a central laboratory. The clinical laboratory values will be reported to the Investigator who will review them for clinical significance and consideration of abnormal values as potential AEs.

### 6.16.3 Assessment of Adverse Events

#### 6.16.3.1 Assessment of Severity

The term “severe” is often used to describe the intensity (severity) of a specific event (as in mild, moderate, or severe myocardial infarction); the event itself, however, may be of relatively minor medical significance (such as severe nausea). This is not the same as “serious,” which is based on subject/event outcome or action criteria usually associated with events that pose a threat to a subject’s life or functioning.

In this study, the severity of AEs will be assessed according to Division of Microbiology and Infectious Diseases (DMID) Adult Toxicity Table, Draft, November 2007 (US National Institutes of Health: National Institute of Allergy and Infectious Diseases) ([Appendix 2](#)) and the Division of Microbiology and Infectious Diseases (DMID) Pediatric Toxicity Table, Draft, November 2007 (US National Institutes of Health: National Institute of Allergy and Infectious Diseases) ([Appendix 3](#)). For abnormalities not specifically found in the Toxicity Tables, the following general scale will be used to estimate grade of severity:

- GRADE 1 (Mild): Transient or mild discomfort; no medical intervention/therapy required
- GRADE 2 (Moderate): Mild to moderate limitation in activity - some assistance may be needed; no or minimal medical intervention/therapy required
- GRADE 3 (Severe): Marked limitation in activity, some assistance usually required; medical intervention/therapy required, hospitalizations possible
- GRADE 4 (Life-threatening): Extreme limitation in activity, significant assistance required; significant medical intervention/therapy required, hospitalization or hospice care probable

Any treatment-emergent ECG abnormality that is considered by the Investigator as clinically significant and requiring intervention/therapy will be assessed as a severe AE.



#### 6.16.3.2 Assessment of Causality

A medically qualified Investigator must assess the relationship of any AE (including SAEs) to the use of the IMP, as related or not related, based on clinical judgment and using all available information, and may include consideration of the following factors:

- Possible alternative causes of the AE, including the disease under treatment, pre-existing conditions, concomitant use of other drugs, and presence of environmental or genetic factors.
- The temporal association between IMP exposure and onset of the AE.
- Whether the manifestations of the AE are consistent with known actions or toxicity of the IMP.
- The AE resolved or improved with decreasing the dose or stopping use of the IMP (dechallenge). Judgment should be used if multiple products are discontinued at the same time.

The causal relationship between the study IMP and the AE will be assessed using one of the following categories:

**Not Related:** Factors consistent with an assessment of Not Related include:

- Temporal relationship is lacking (e.g., the event did not occur within a reasonable time frame following administration of the IMP); or
- Other causative factors more likely explain the event (e.g., a pre-existing condition, other concomitant treatments).

**Related:** Factors consistent with an assessment of Related include:

- There is a positive temporal relationship (e.g., the event occurred within a reasonable time frame following administration of IMP); or
- The AE is more likely explained by the investigational product than by another cause (i.e., the AE shows a pattern consistent with previous knowledge of the investigational product or the class of the IMP).

#### 6.16.3.3 Assessment of Clinical Significance

Clinical significance of individual AEs will be determined by the Investigator, with discussion with the Medical Monitor as appropriate, or by the SSC for overall study AE review.

#### 6.16.4 Clinical Laboratory Adverse Events

Laboratory abnormalities generally are not considered AEs unless they are associated with clinical signs or symptoms, or require medical intervention. A clinically significant laboratory abnormality that is independent from a known underlying medical condition and

that requires medical or surgical intervention, or leads to IMP interruption or discontinuation, will be considered an AE.

When laboratory abnormalities are considered to be AEs, the DMID Adult Toxicity Table ([Appendix 2](#)) or DMID Pediatric Toxicity Tables ([Appendix 3](#)) will be used to assess severity. Where discrepancies in the upper limit of normal (ULN) and lower limit of normal (LLN) of laboratory ranges occur between those included in the DMID tables and those of the laboratory that performs the assays, the values provided by the laboratory will be used for assignment of severity grade. Clinical significance of individual laboratory AEs will be determined by the Investigator with input from the Medical Monitor as needed.

Following is an exception to defining clinically significant, abnormal laboratory values as AEs:

- APTT prolongation in the absence of any associated bleeding or other evidence of clinical relevance will not be considered a clinically significant laboratory abnormality or AE. In the appropriate physiologic setting, such as IV heparin therapy, aPTT can be used to monitor bleeding risk. However, as noted in the Investigators Brochure, aPTT prolongation due to plasma kallikrein inhibition is an artifactual *in vitro* phenomenon. Although plasma kallikrein drives fibrin formation in the aPTT assay, plasma kallikrein-driven coagulation does not appear to have hemostatic or other physiologically important functions *in vivo*. It is well documented that, in humans, deficiency of factor XII or prekallikrein (and thus plasma kallikrein) is not associated with abnormal bleeding, either spontaneous or during surgical procedures ([Renne and Gruber, 2012](#)). Despite the lack of clinical effect, deficiency of either protein is associated with marked prolongation of the aPTT.

## 6.16.5 Reporting Investigator Safety Observations to the Sponsor

### 6.16.5.1 Reporting Non-serious Adverse Events

All AEs, regardless of seriousness, severity, or causal relationship to IMP, will be recorded on the AE page of the eCRF. In this study all HAE attacks reported by the subject, regardless of whether or not they are confirmed by the Investigator, will be captured as AEs.

### 6.16.5.2 Reporting Pregnancies

If a female subject or the female partner of a male subject becomes pregnant during the course of the study, the Investigator must report the pregnancy to the Dyax Pharmacovigilance Department using the **Pregnancy Reporting Form** within **24 hours** of becoming aware of the event. The Investigator must obtain consent to collect pregnancy information (including the status of the newborn, if applicable).

If some of the information required for completion of the Pregnancy Reporting Form is unavailable at the time of the initial report, follow-up reports will be completed and submitted within 24 hours of becoming aware of the new information. The Investigator is required to follow the pregnancy through delivery. The outcome of the pregnancy and the

status of the newborn (if applicable) will be reported on the Pregnancy Reporting Form within 24 hours of becoming aware.

#### 6.16.5.3 Safety Observations Requiring Expedited Reporting by the Investigator to Dyax

Any occurrence of the following events or outcomes in a subject in the trial must be reported expeditiously by the Investigator or qualified designee to the Dyax Pharmacovigilance Department:

- SAE
- AESI
- Overdose
- Cancer

The Investigator is to report any expedited safety observations from the list above to Dyax using the **SAE Reporting Form in the EDC system** within 24 hours of becoming aware of the event.

Any SAE reported to the Dyax Pharmacovigilance Department using the SAE Reporting Form in the EDC system is to be recorded in the eCRF, as well as in the subject's source documentation along with any actions taken. If all required information on the form is not available at the time of the initial report, follow-up information will be completed in the EDC system.

The Investigator is required to follow SAEs until resolution regardless of whether the subjects are still participating in the study. SAE resolution is defined as:

- Resolved with or without residual effects.
- A return to baseline for a pre-existing condition.
- Laboratory values have returned to baseline or stabilized.
- The Investigator does not expect any further improvement or worsening of the event.
- Fatal outcome—if an autopsy is performed, the autopsy report is requested to be provided to the sponsor as soon as it is available.

#### 6.16.5.4 Expedited Reporting by the Sponsor to a Regulatory Health Authority

The Sponsor or designee will report relevant safety information to concerned health authorities in accordance with local laws and regulations.

#### 6.16.5.5 Safety Contact Information

##### **Medical Safety Contact for US and Canada**

PPD [REDACTED], M.D.  
PPD [REDACTED]  
Phone (US): PPD [REDACTED]  
Email: PPD [REDACTED]

Calls or emails received weekends, holidays, or weekdays between 8:00 pm and 8:00 am Eastern (US) time will be responded to the morning of the following business day

##### **24-Hour Medical Safety Contact for Europe and Middle East**

PPD [REDACTED], M.D.  
PPD [REDACTED]  
Phone: PPD [REDACTED]  
Email: PPD [REDACTED]

##### **Dyax Pharmacovigilance Department**

**Contacts:** PPD [REDACTED]  
Email: PPD [REDACTED]  
Phone (US): PPD [REDACTED]

#### 6.16.5.6 Safety Notifications by the Sponsor to the Investigator

Investigators will receive prompt notification of any adverse experience related to IMP that is both serious and unexpected, or any finding that suggests a significant risk for subjects. The Investigator will promptly inform his / her IRB/REB/IEC of the notification and insert the notification in the Investigator's Regulatory Binder in accordance with local regulations.

#### 6.16.5.7 Unblinding a Subject's Treatment during the Trial

Requirements for emergency unblinding by the Investigator are detailed in [Section 5.4](#). To assess an occurrence of a safety observation, the Dyax Pharmacovigilance Department may unblind the treatment of any subject.

### **6.17 Subject Withdrawal**

The Investigator may withdraw a subject from the trial for any of the reasons listed below. Any reason should be discussed with the Medical Monitor prior to withdrawing a subject.

- In the opinion of the Investigator, the subject is unable to comply with the requirements of the protocol for satisfactory completion or interpretation of study results,
- A serious or intolerable AE occurs,
- A clinically significant change in a laboratory parameter occurs,
- The Sponsor or Investigator terminates the study, or
- The subject requests to be discontinued from the study.



Subjects will continue to be followed through completion of all scheduled visits. The criteria used by the SSC regarding dose administration suspension and/or study discontinuation are provided in [Section 3.1.2](#).

## **6.18 Appropriateness of Measurements**

This is a Phase 3 multi-center, randomized, double-blind, placebo-controlled study that is designed to evaluate the efficacy and safety of DX-2930 in prevention of HAE attacks in subjects with HAE. DX-2930 is a recombinant, fully human IgG1, kappa light chain, monoclonal antibody. The randomized, placebo controlled study design is a standard approach for differentiation between the efficacy and safety profiles of an active and placebo treatment when administered to subjects. All of the measures employed in this protocol are standard measures routinely used for the evaluation of the efficacy, safety and tolerability of an investigational product.

## 7 STUDY ACTIVITIES

Study activities are summarized by study visit in [Appendix 1](#) (Study Activities Schedule).

### 7.1 Screening

**The following procedures and assessments are to be performed during Screening:**

- Informed consent ([Section 6.1](#))
- Eligibility review ([Section 6.2](#))
- Demographics and medical history ([Section 6.3](#))
- C1-INH functional assay, C4 and C1q sample collection ([Section 6.8](#))
- Pregnancy test, serum or urine (females) ([Section 6.8](#))
- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Complete physical examination ([Section 6.6](#)); documentation of height and weight
- 12-Lead ECG ([Section 6.7](#))
- Laboratory testing including, serology, hematology, coagulation, serum chemistry and urinalysis ([Section 6.8](#))
- Prior and concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#)); pre-existing signs and symptoms
- Subjects who are on LTP for HAE must complete a 2 week washout period, as confirmed by the Investigator, before entering the run-in period.

### 7.2 Run-in Period

Subjects who were on LTP may enter run-in after successfully completing a 2 week washout of their LTP. All subjects will undergo a run-in period of 4 weeks to determine the baseline HAE attack rate ([Section 6.4](#)). The run-in period may be shortened to less than 4 weeks for any subject who experiences 3 Investigator-confirmed attacks before the 4 weeks have ended. The run-in period may be expanded by an additional 4 weeks if the subject does not meet the minimum attack requirement during the first 4 weeks.

The following will be collected on an ongoing basis during the run-in period by subjects (or caregivers) reporting symptoms of an HAE attack to the site or through regular site contact with the subject (or caregiver):

- Prior and concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))

### 7.3 Start of Treatment Period: Visit 1, Dose 1 (Day 0)

The following procedures and assessments are to be performed on Day 0 prior to the first dose of IMP administration:

- Eligibility review ([Section 6.2](#))
- Randomization to treatment ([Section 6.13](#))
- Urine pregnancy test (females) ([Section 6.8](#))
- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Complete physical examination ([Section 6.6](#))
- 12-Lead ECG ([Section 6.7](#))
- Laboratory testing including hematology, coagulation, serum chemistry and urinalysis ([Section 6.8](#))
- PK baseline sample collection ([Section 6.9](#))
- PD baseline sample collection ([Section 6.10](#))
- Baseline anti-drug antibody sample collection ([Section 6.11](#))
- Prior and concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))
- Quality of life assessments ([Section 6.15](#))

After the preceding procedures and assessments are completed:

- Administer IMP ([Section 6.14](#))

After administration of IMP, the following post treatment procedures and assessments will be performed:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#)) at 1 and 2 hours post-dose
- Concomitant therapy ([Section 6.12](#))
- AE collection ([Section 6.16](#))

### 7.4 Site Contact with the Subject

Site personnel contact the subject once between scheduled study visits or approximately 7 days after their last contact with the subject to solicit for any HAE attack information not already reported by the subject.

- Concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))

- AE collection ([Section 6.16](#))

## **7.5 Continuation of Treatment Period: Visit 2, Dose 2 (Day 14 ± 3 days)**

On Day 14 the following procedures and assessments will be performed prior to IMP administration:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))

After the preceding procedures and assessments are completed:

- Administer IMP ([Section 6.14](#))

After administration of IMP, the following post treatment procedures and assessments will be performed:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#)) at 1 and 2 hours post-dose
- Concomitant therapy ([Section 6.12](#))
- AE collection ([Section 6.16](#))

## **7.6 Continuation of Treatment Period: Visit 3, Dose 3 (Day 28 ± 3 days)**

On Day 28, the following procedures and assessments will be performed prior to IMP administration:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Complete physical examination ([Section 6.6](#))
- Laboratory testing including hematology, coagulation, serum chemistry and urinalysis ([Section 6.8](#))
- Concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))

After the preceding procedures and assessments are completed:

- Administer IMP ([Section 6.14](#))



After administration of IMP, the following post treatment procedures and assessments will be performed:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#)) at 1 and 2 hours post-dose
- Concomitant therapy ([Section 6.12](#))
- AE collection ([Section 6.16](#))

## **7.7 Continuation of Treatment Period: Visit 4, Dose 4 (Day 42 ± 3 days)**

On Day 42, the following procedures and assessments will be performed prior to IMP administration:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))

After the preceding procedures and assessments are completed:

- Administer IMP ([Section 6.14](#))

After administration of IMP, the following post treatment procedures and assessments will be performed:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#)) at 1 and 2 hours post-dose
- Concomitant therapy ([Section 6.12](#))
- AE collection ([Section 6.16](#))

## **7.8 Continuation of Treatment Period: Visit 5, Dose 5 (Day 56 ± 3 days)**

On Day 56, the following procedures and assessments will be performed prior to IMP administration:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Complete physical examination ([Section 6.6](#))
- 12-Lead ECG ([Section 6.7](#))
- Laboratory testing including hematology, coagulation, serum chemistry and urinalysis ([Section 6.8](#))
- PK sample collection ([Section 6.9](#))
- PD sample collection ([Section 6.10](#))

- Anti-drug antibody sample collection ([Section 6.11](#))
- Concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))

After the preceding procedures and assessments are completed:

- Administer IMP ([Section 6.14](#))

After administration of IMP, the following post treatment procedures and assessments will be performed:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#)) at 1 and 2 hours post-dose. This 2 hour assessment of vitals may be dismissed if, based on the discretion of the Investigator and the absence of safety signals, the Investigator determines that the subject only needs to be monitored for 1 hour post dose. The post-dose monitoring period may be lengthened back to 2 hours at any time by the Sponsor based on SSC recommendation.
- Concomitant therapy ([Section 6.12](#))
- AE collection ([Section 6.16](#))

## **7.9 Continuation of Treatment Period: Visits 6 and 7, Doses 6 and 7 (Days 70 and 84, all $\pm$ 3 days)**

On Days 70 and 84, the following procedures and assessments will be performed prior to IMP administration:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))

After the preceding procedures and assessments are completed:

- Administer IMP ([Section 6.14](#))

After administration of IMP, the following post treatment procedures and assessments will be performed:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#)) at 1 and 2 hours post-dose. This 2 hour assessment of vitals may be dismissed if, based on the discretion of the Investigator and the absence of safety signals, the Investigator determines that the subject only needs to be monitored for 1 hour post dose. The post-dose monitoring

period may be lengthened back to 2 hours at any time by the Sponsor based on SSC recommendation.

- Concomitant therapy ([Section 6.12](#))
- AE collection ([Section 6.16](#))

## **7.10 Continuation of Treatment Period: Visit 8, Dose 8 (Day 98 ± 3 days)**

On Day 98, the following procedures and assessments will be performed prior to IMP administration:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Complete physical examination ([Section 6.6](#))
- Laboratory testing including hematology, coagulation, serum chemistry and urinalysis ([Section 6.8](#))
- Pregnancy test, serum or urine (females) ([Section 6.8](#))
- PK sample collection ([Section 6.9](#))
- PD sample collection ([Section 6.10](#))
- Anti-drug antibody sample collection ([Section 6.11](#))
- Concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))
- Quality of life assessments ([Section 6.15](#))

After the preceding procedures and assessments are completed:

- Administer IMP ([Section 6.14](#))

After administration of IMP, the following post treatment procedures and assessments will be performed:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#)) at 1 and 2 hours post-dose. This 2 hour assessment of vitals may be dismissed if, based on the discretion of the Investigator and the absence of safety signals, the Investigator determines that the subject only needs to be monitored for 1 hour post dose. The post-dose monitoring period may be lengthened back to 2 hours at any time by the Sponsor based on SSC recommendation.
- Concomitant therapy ([Section 6.12](#))
- AE collection ([Section 6.16](#))

### **7.11 Continuation of Treatment Period: Visits 9 and 10, Doses 9 and 10 (Days 112 and 126, all $\pm$ 3 days)**

On Days 112 and 126, the following procedures and assessments will be performed prior to IMP administration:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))

After the preceding procedures and assessments are completed:

- Administer IMP ([Section 6.14](#))

After administration of IMP, the following post treatment procedures and assessments will be performed:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#)) at 1 and 2 hours post-dose. This 2 hour assessment of vitals may be dismissed if, based on the discretion of the Investigator and the absence of safety signals, the Investigator determines that the subject only needs to be monitored for 1 hour post dose. The post-dose monitoring period may be lengthened back to 2 hours at any time by the Sponsor based on SSC recommendation.
- Concomitant therapy ([Section 6.12](#))
- AE collection ([Section 6.16](#))

### **7.12 Continuation of Treatment Period: Visit 11, Dose 11 (Day 140 $\pm$ 3 days)**

On Day 140, the following procedures and assessments will be performed prior to IMP administration:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Complete physical examination ([Section 6.6](#))
- Laboratory testing including hematology, coagulation, serum chemistry and urinalysis ([Section 6.8](#))
- PK sample collection ([Section 6.9](#))
- PD sample collection ([Section 6.10](#))
- Anti-drug antibody sample collection ([Section 6.11](#))
- Concomitant therapy ([Section 6.12](#))



- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))

After the preceding procedures and assessments are completed:

- Administer IMP ([Section 6.14](#))

After administration of IMP, the following post treatment procedures and assessments will be performed:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#)) at 1 and 2 hours post-dose. This 2 hour assessment of vitals may be dismissed if, based on the discretion of the Investigator and the absence of safety signals, the Investigator determines that the subject only needs to be monitored for 1 hour post dose. The post-dose monitoring period may be lengthened back to 2 hours at any time by the Sponsor based on SSC recommendation.
- Concomitant therapy ([Section 6.12](#))
- AE collection ([Section 6.16](#))

### **7.13 Continuation of Treatment Period (Day 144 ± 1 day)**

This ECG assessment may be conducted through an at-home visit by a nurse or technician or at the study site. The date, time and collection location of this ECG and its results will be documented in the source documents and eCRF.

- 12-Lead ECG ([Section 6.7](#))

### **7.14 Continuation of Treatment Period: Visits 12 and 13, Doses 12 and 13 (Days 154 and 168, all ± 3 days)**

On Days 154 and 168, the following procedures and assessments will be performed prior to IMP administration:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))

After the preceding procedures and assessments are completed:

- Administer IMP ([Section 6.14](#))

After administration of IMP, the following post treatment procedures and assessments will be performed:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#)) at 1 and 2 hours post-dose. This 2 hour assessment of vitals may be dismissed if, based on the discretion of the Investigator and the absence of safety signals, the Investigator determines that the subject only needs to be monitored for 1 hour post dose. The post-dose monitoring period may be lengthened back to 2 hours at any time by the Sponsor based on SSC recommendation.
- Concomitant therapy ([Section 6.12](#))
- AE collection ([Section 6.16](#))

### **7.15 Completion of Treatment Period: Visit 14, Day 182 ± 3 days**

On Day 182, the following procedures and assessments will be performed:

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Complete physical examination ([Section 6.6](#))
- 12-Lead ECG ([Section 6.7](#))
- Laboratory testing including hematology, coagulation, serum chemistry and urinalysis ([Section 6.8](#))
- Urine pregnancy test (females) ([Section 6.8](#))
- PK sample collection ([Section 6.9](#))
- PD sample collection ([Section 6.10](#))
- Anti-drug antibody sample collection ([Section 6.11](#))
- Concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))
- Quality of life assessments ([Section 6.15](#))
- Discharge from study:
  - Subjects will be offered the option of enrolling in the DX-2930-04 Open Label Extension (OLE) study for continued treatment and safety follow-up.
  - Informed Consent obtained for study DX-2930-04
  - Subjects who consent to participate in DX-2930-04 will receive their first OLE dose following the completion of all double-blind assessments scheduled on Day 182.

### **7.16 Follow-up Period (Subjects Not Continuing in Open-Label Extension Study): Visit 15, Day 210 ± 3 days**

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- PK sample collection ([Section 6.9](#))
- PD sample collection ([Section 6.10](#))
- Concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))

### **7.17 Final Follow-up Visit (Subjects Not Continuing in Open-Label Extension Study): Visit 16, Day 238 ± 3 days**

- Vital signs including body temperature, HR, BP and RR ([Section 6.5](#))
- Complete physical examination ([Section 6.6](#))
- 12-Lead ECG ([Section 6.7](#))
- Laboratory testing including hematology, coagulation, serum chemistry and urinalysis ([Section 6.8](#))
- Urine pregnancy test (females) ([Section 6.8](#))
- PK sample collection ([Section 6.9](#))
- PD sample collection ([Section 6.10](#))
- Anti-drug antibody sample collection ([Section 6.11](#))
- Concomitant therapy ([Section 6.12](#))
- HAE attack information ([Section 6.4](#))
- AE collection ([Section 6.16](#))
- Quality of life assessments ([Section 6.15](#))

### **7.18 Early Termination (ET)**

Subjects that terminate early from the study will undergo (if possible) all of the assessments and procedures scheduled for Day 182.

## **8 QUALITY CONTROL AND ASSURANCE**

The Sponsor (Dyax) and the Contract Research Organization (CRO) conducting trial management services, Rho, Inc. will implement a system of quality assurance that includes all elements described in this protocol. Within this system, SOPs from the Sponsor and CRO will be implemented to ensure that the clinical trial is conducted in compliance with regulatory requirements and Good Clinical Practices (GCP). Quality control will be applied to each stage of data handling to ensure that data are accurate, reliable and processed correctly.

The site staff should assist in all aspects of audit/inspection.



## 9 DATA ANALYSIS / STATISTICAL METHODS

### 9.1 Sample Size Determination

The sample size needed to test the primary hypothesis ( $\alpha = 0.025$ , one-sided) in the Intent-to-treat (ITT) population to achieve a given power is calculated using the data and information from the DX-2930-02 study. Power analysis and sample size estimation was based on 1000 computer simulations using a mixed model repeated measures (MMRM) analysis of variance (ANOVA) for counts using the SAS generalized estimating equation (GEE) determination of statistical significance. Assumptions included that placebo subjects have an observed attack rate of 0.3 attacks per week during the treatment period, and are observed for 24 weeks of efficacy. Active treatment dose in each active treatment arm to placebo ratio was set at 1:1.5. A 10% missing data / dropout rate for both active treatment and placebo was also built into the empirical sample size simulations.

For a treatment effect of 60% reduction in attacks as compared to placebo, a sample size of 24 actively treated subjects for the primary active treatment arm and 36 placebo subjects would provide over 95% power (at  $\alpha=0.025$ , one-sided). A 60% reduction is well below the smallest expected reduction in attacks, for in the DX-2930-02 study, we observed reductions of attacks of near 100%. These sample sizes will also provide adequately sized safety population for evaluation. Up to 120 subjects may be enrolled to account for potential early drop-outs during the study.

### 9.2 Analysis Populations

The analysis populations will be defined as follows:

**Intent-to-treat (ITT) Population:** will include all randomized subjects who are administered at least 1 dose of active IMP or placebo. The primary efficacy analyses will be carried out with the ITT Population.

**Safety Population:** will include all subjects who are administered at least 1 dose of active IMP or placebo. All safety analyses will use the Safety Population.

### 9.3 Analysis of Disposition

The numbers of subjects randomized, completing, or withdrawing, along with reasons for withdrawal, will be tabulated by treatment group.

### 9.4 Demographics and Baseline Characteristics Analyses

Baseline and demographic variables will be descriptively summarized by treatment group.

## **9.5 Analysis of Pharmacokinetic and Pharmacodynamic Endpoints**

### **9.5.1 Pharmacokinetic Assessments:**

Blood samples will be collected for the measurement of plasma DX-2930 concentrations prior to IMP administration on Day 0 and on Days  $56 \pm 3$ ,  $98 \pm 3$ ,  $140 \pm 3$  and  $182 \pm 3$ . Additional samples will be collected on Days  $210 \pm 3$ , and  $238 \pm 3$  during the follow-up period for any subjects not entering OLE.

Plasma concentrations of DX-2930 will be summarized with descriptive statistics by nominal PK sampling time using the PK Population.

Any concentrations reported below the lower limit of quantitation (LLOQ) will be assigned zero for summarizing concentration data, however, the PK parameter calculation of AUC will use either missing or zero for samples below LLOQ. Sample concentrations below the LLOQ will be assigned zero when they precede the first concentration not below the LLOQ. Sample concentrations following the last concentration not below the LLOQ will be assigned missing when below the LLOQ. If a sample concentration is below the LLOQ and between the first and last concentrations not below the LLOQ, then the assignment of missing or zero will be at the discretion of the PK specialists using physiological rationale.

Full details of the planned PK parameters will be included in the statistical analysis plan (SAP).

### **9.5.2 Pharmacodynamic Assessments:**

Blood samples will be collected to evaluate the pharmacodynamic effects of DX-2930 through biomarker assays prior to IMP administration on Day 0 and on Days  $56 \pm 3$ ,  $98 \pm 3$ ,  $140 \pm 3$ , and  $182 \pm 3$ . Additional samples will be collected on Days  $210 \pm 3$ , and  $238 \pm 3$  during the follow-up period for any subjects not entering OLE.

### **9.5.3 Immunogenicity Assessments:**

Blood samples will be collected to assay for the presence of anti-drug antibodies, including evaluation of neutralizing antibodies (if any confirmed positive anti-drug antibodies are detected) prior to IMP administration on Day 0 and on Days  $56 \pm 3$ ,  $98 \pm 3$ ,  $140 \pm 3$ , and  $182 \pm 3$ . Additional samples will be collected on Day  $238 \pm 3$  during the follow-up period for any subjects not entering OLE.

### **9.5.4 C1-INH and C4 Assessments:**

Samples will be obtained for C1-INH, C4 and C1q assays at screening for eligibility assessment.

## 9.6 Analysis of Primary and Secondary Efficacy Endpoints

The primary analysis will be to compare the primary endpoint, which is mean rate of Investigator-confirmed HAE attacks observed in each DX-2930 treatment arm to that in the placebo arm during the efficacy assessment period (Day 14 through Day 182). For the primary endpoint, an analysis of all randomized subjects who have received at least 1 dose of IMP will be conducted.

The HAE attack rates of the treated and placebo groups will be compared using MMRM ANOVA for counts using the GEE. The baseline attack rate for each subject as determined by the run-in period will be used as a continuous covariate in an analysis of covariance. The model will be based on two fixed effects (treatment group and prior use of DX-2930), the random effect will be the subject and the baseline attack rate will be a continuous covariate. For each subject, the least squares mean will be calculated and adjusted for their baseline attack rate. A Poisson distribution will be assumed rather than a Gaussian distribution. Repeated measurement analysis will be employed, with a 7-day time period (i.e., 168 hours) serving as the discrete unit of measurement. There will be no Last Observation Carried Forward (LOCF), as the HAE attack rate will be computed as the total number of attacks divided by the total duration of observation during the specified time period. Subject weeks for which completed observation is less than the full 168 hours within a week will be handled according to an *a priori* plan to be described in the SAP.

The lsmean difference of the natural logarithms of attack rates between each dose level and placebo, which is also the regression coefficient for each treatment group effect, and its 95% confidence interval can also be directly estimated from the GEE model. The rate of the mean event rate per week, for each dose level vs placebo and its 95% Confidence interval can also be estimated by transforming the above lsmean difference and its 95% CI confidence interval by the exponential function,

The percentage change in mean attack rate of each active rate of each active treatment group from the attack rate of placebo defined as  $100\% * (\text{treatment attack rate} - \text{placebo attack rate}) / \text{placebo attack rate}$  will also be displayed.

Sample code for the above analysis is:

```
PROC GENMOD DATA = XXXX ;  
WHERE x<=visitm<=y;  
    CLASS Trta (REF = 'Placebo') usubjid;  
    MODEL attack=trta priordx base/ DIST=poisson;  
    REPEATED SUBJECT=usubjid / CORR=ind;  
    LSMEANS trta/DIFF CL ILINK;  
    ODS OUTPUT diffs – meandiff lsmeans = means;  
RUN;
```

There are three active treatment arms ordered by highest total monthly dose; 1) Primary Treatment Arm: 300 mg DX-2930 every 2 weeks, 2) Secondary Treatment Arm: 300 mg DX-2930 every 4 weeks, and 3) Tertiary Treatment Arm: 150 mg DX-2930 every 4 weeks.



For the primary endpoint, each of the three active treatment arms will be compared against placebo using a closed sequential testing procedure in which first, the primary active treatment arm is compared to placebo at significance level alpha and then, if there is statistical significance found, then the secondary treatment arm is tested against placebo at level alpha. If statistical significance is found for both the primary and secondary treatment arms, then the tertiary treatment arm shall be compared to placebo at significance level alpha.

If a dose is dropped due to an important safety signal, the highest remaining dose automatically becomes the primary dose comparison versus placebo.

All secondary hypotheses for each active treatment group versus placebo are also to be tested in a closed sequential methodology. The *a priori* order of testing the secondary hypotheses has been pre-specified in Section 6.4.1. In order to preserve the overall alpha level, secondary endpoints are not tested unless the primary endpoint is found to be statistically significant.

The first secondary endpoint, time to first HAE attack, will be tested using the log-rank test comparing each active treatment group vs placebo. The descriptive summaries will use life table summaries based on Kaplan Meier (KM) estimates. Subjects without any HAE attacks during the 24-week period and subjects without 24 weeks of observation will be right censored.

The second secondary endpoint, reduction in HAE acute therapy use, will be tested using the MMRM model as described for the primary endpoint. The same SAS code used for the primary endpoint will be used but with a different endpoint.

The third secondary endpoint, reduction in moderate or severe HAE attacks, will be tested using the MMRM model as described for the primary endpoint. The same SAS code used for the primary endpoint will be used but with a different endpoint.

The fourth secondary endpoint, reduction in high-morbidity HAE attacks, will be tested using the MMRM model as described for the primary endpoint. The same SAS code used for the primary endpoint will be used but with a different endpoint.

## 9.7 Safety Analysis

Treatment-emergent AEs are defined as AEs with onset at the time of or following the start of treatment with study medication, or medical conditions present prior to the start of treatment but increasing in severity or relationship at the time of or following the start of treatment. The number and percentage of subjects with TEAEs will be displayed for each treatment group by body system and preferred term using the Medical Dictionary for Regulatory Activities (MedDRA®). Summaries in terms of severity and relationship to study medication will also be provided. Serious AEs will be summarized separately in a similar fashion. Patient listings of AEs causing discontinuation of study medication, AEs leading to death, SAEs and AESI will be produced.

AESI will be analyzed according to primary system Organ Classes (SOCs) and Preferred Terms (PTs) determined by the search of relevant Standardized MedDRA Queries (SMQs).



Summary tables with SOC's and PTs, from the SMQ searches, will be generated presenting the number and percentage of subjects by AE, severity, seriousness, and relationship to study medication.

Usage of concomitant medications (other than rescue medications) will be summarized descriptively for each of the treatment groups and the combined active treatment group.

Actual values and change from screening in vital signs and clinical laboratory tests will be summarized for each treatment group with descriptive statistics at each assessment obtained. For all laboratory tests, a shift table will be produced summarizing changes from normal to abnormal and vice-versa.

Abnormal physical examination findings will be listed.

The number and percentage of subjects with normal, abnormal-not clinically significant, and abnormal-clinically significant ECG findings will be displayed for each of the treatment groups.

Additional analyses of AEs, SAEs, severe AEs, AESI, and abnormal findings will be based on the timing (Study Day) and number of prior doses of study medication. The incidence of AEs by month from the start of study medication will be examined and the incidence among the four treatment arms will be compared. The rate of study discontinuation among the four treatment arms will also be compared.

## **9.8 Analysis of Quality of Life Assessments**

Quality of life data will be obtained using the EQ5D and Angioedema Quality of Life Questionnaire at pre-dose on Days 0,  $98 \pm 3$ , and  $182 \pm 3$ . An additional QOL assessment will be conducted on Day  $238 \pm 3$  for subjects not entering OLE.

## 10 STUDY ADMINISTRATIVE STRUCTURE

The study administration structure is provided in [Table 2](#).

**Table 2. Study Administrative Structure**

<b>Sponsor Contact:</b>	Ryan Iarrobino PPD [REDACTED], Clinical Development 55 Network Drive, Burlington, MA 01803 Phone: PPD [REDACTED] Email: PPD [REDACTED]
<b>Sponsor Medical Director:</b>	PPD [REDACTED], MD PPD [REDACTED], Medical Research 55 Network Drive, Burlington, MA 01803 Phone: PPD [REDACTED] Email: PPD [REDACTED]
<b>Medical Monitor (US, Canada):</b>	PPD [REDACTED], MD Rho, Inc. PPD [REDACTED], PPD [REDACTED], PPD [REDACTED] Phone: PPD [REDACTED] Email: PPD [REDACTED]
<b>Medical Monitor (Jordan, Europe)</b>	PPD [REDACTED], M.D. Voisin Consulting PPD [REDACTED] PPD [REDACTED], France Phone: PPD [REDACTED] Email: PPD [REDACTED]
<b>Study Monitoring (US):</b>	Rho, Inc. PPD [REDACTED], PPD [REDACTED], PPD [REDACTED] Phone: PPD [REDACTED]
<b>Study Monitoring (Jordan)</b>	Triumpharma PPD [REDACTED], PPD [REDACTED] PPD [REDACTED], PPD [REDACTED] PPD [REDACTED], Jordan Phone: PPD [REDACTED]
<b>Study Monitoring (Canada)</b>	Red Maple Trials Incorporated PPD [REDACTED], PPD [REDACTED] PPD [REDACTED], PPD [REDACTED], Canada, PPD [REDACTED] Phone: PPD [REDACTED]
<b>Study Monitoring (Europe)</b>	Dyax Corp 55 Network Drive, Burlington, MA 01803 Phone: PPD [REDACTED]

## **10.1 Institutional Review Board/Research Ethics Board/Independent Ethics Committee**

The protocol and all protocol amendments must be signed and dated by the Investigator and approved in writing by the IRB/REB/IEC in accordance with GCP prior to implementation. In addition, the IRB/REB/IEC must approve the written informed consent and assent forms, any consent or assent form updates, subject recruitment procedures (e.g., advertisements), and any written information to be provided to subjects prior to implementation. The Investigator must provide an annual report to the IRB/REB/IEC on the progress of the study including number of subjects enrolled, discontinued, and SAEs. It is required that a yearly review of the protocol by the IRB/REB/IEC be documented in a letter from the IRB/REB/IEC. The Investigator must provide notification to the IRB/REB/IEC of the completion, termination or discontinuation of the study.

## **10.2 Ethical Conduct of the Study**

The procedures set out in this clinical study protocol are designed to ensure that the Sponsor and the Investigator abide by the principles of the International Conference on Harmonisation (ICH) guidelines on GCP, applicable local regulatory requirements, and the Declaration of Helsinki (Version 2008). The clinical study also will be carried out in keeping with national and local legal requirements [in accordance with United States Investigational New Drug (IND) regulations (21 CFR 56)].

## **10.3 Subject Information and Consent**

Before each subject is enrolled in the clinical study, written informed consent will be obtained according to the regulatory and legal requirements of the participating country. As part of this procedure, the Investigator must explain orally and in writing the nature, duration, and purpose of the study, and the action of the drug in such a manner that the study subject is aware of the potential risks, inconveniences, or AEs that may occur. The study subject should be informed that he/she is free to withdraw from the study at any time. He/she will receive all information that is required by federal regulations and ICH guidelines. Subjects who are under the age of 18 (or lower if age of consent is less than 18 in a specific country) and whose legal guardian or caretaker has provided written informed consent will provide their assent to participate. The Investigator or designee will provide the Sponsor with a copy of the IRB/REB/IEC-approved informed consent and assent forms prior to the start of the study.

## **10.4 Subject Confidentiality**

The anonymity of participating subjects must be maintained. Subjects will be specified on study documents by their subject number and birth date (if allowed based on local data protection regulations), not by name. Documents that identify the subject (e.g., the signed informed consent document) must be maintained in confidence by the Investigator.

The Investigator agrees not to use or disclose protected health information other than as permitted or required by the subject authorization or as required by law.

## **10.5 Study Monitoring**

The Sponsor (or designee) will conduct a study initiation visit to verify the qualifications of the Investigator, inspect the facilities, and inform the Investigator of responsibilities and procedures for ensuring adequate and correct documentation.

The Investigator must prepare and maintain adequate and accurate records of all observations and other data pertinent to the clinical study for each study participant. Frequent communication between the clinical site and the Sponsor is essential to ensure that the safety of the study is monitored adequately. The Investigator will make all appropriate safety assessments on an ongoing basis. The Medical Monitor may review safety information as it becomes available throughout the study.

All aspects of the study will be carefully monitored with respect to GCP and SOPs for compliance with applicable government regulations. The Study Monitor will be an authorized individual designated by the Sponsor. The Study Monitor will have access to all records necessary to ensure integrity of the data and will periodically review the progress of the study with the Investigator.

## **10.6 Case Report Forms and Study Records**

The Investigator will ensure the accuracy, completeness, and timeliness of the data reported to the Sponsor. Data collection processes and procedures will be reviewed and validated to ensure completeness, accuracy, reliability, and consistency. A complete audit trail will be maintained of all data changes. The Investigator or designee will cooperate with the Sponsor's representative(s) for the periodic review of study documents to ensure the accuracy and completeness of the data capture system at each scheduled monitoring visit.

Electronic consistency checks and manual review will be used to identify any errors or inconsistencies in the data. This information will be provided to the clinical sites by means of electronic or manual queries.

The Investigator or designee will prepare and maintain adequate and accurate study documents (medical records, ECGs, AE and concomitant medication reporting, source data collection forms, etc.) designed to record all observations and other pertinent data for each subject receiving randomized study drug.

The Investigator will allow Sponsor representatives, contract designees, authorized regulatory authority inspectors, and the IRB/REB/IEC to have direct access to all documents pertaining to the study.

A Trial Master File will be maintained by the Sponsor (or designee). All documents and other materials that pertain to the conduct of the trial, quality of the data, and compliance with GCPs will be collected in the Trial Master File.



## **10.7 Study Safety Committee**

This study will be conducted under the oversight of an internal Study Safety Committee (SSC) that will review safety data at regular intervals throughout the course of the study.

## **10.8 Protocol Violations/Deviations**

The Investigator will be instructed not to deviate from the protocol, except where necessary to eliminate an immediate hazard to study participants. Should other unexpected circumstances arise that will require deviation from protocol-specific procedures, the Investigator should contact their Sponsor representative to discuss the appropriate course of action.

The Investigator should document all protocol deviations/violations in the subject's eCRF and source documents or the Investigator Site File if appropriate. In the event of a significant deviation/violation, the Investigator should notify the Sponsor representative. Significant deviations/violations include, but are not limited to those that increase the health risk to the subject, or confound interpretation of primary study assessments. The Investigator will promptly report all changes in research activity and all unanticipated problems involving risks to human subjects or others to his or her IRB/REB/IEC.

## **10.9 Access to Source Documentation and On-Site Audits**

Regulatory agencies may request access to all study records, including source documents, for inspection and copying, in keeping with country regulations. The Investigator should immediately notify the Sponsor representative of any announced or unannounced regulatory agency inspections. An auditing inspection may also be conducted by the Sponsor representative or designee. Any aspect of the trial may be subject to audit by the Sponsor and/or inspection by regulatory authorities or the IRB/REB/IEC. Such audits/inspections may take place at the Sponsor's site(s), the CRO, or at the clinical sites, including laboratories, pharmacies and any other facilities used for the study.

The Investigator will be responsible for the accuracy of the data entered in the eCRF. The Investigator will permit the designated Sponsor representatives and regulatory bodies to have direct access to the source documents to verify data represented in the eCRF.

## **10.10 Data Generation and Analysis**

This study will be performed in accordance with regulatory requirements outlined in Food and Drug Administration (FDA) 21 CFR Part 50, 21 CFR Part 54, 21 CFR Part 56, 21 CFR Part 312 and 21 CFR Part 11 as well as the ICH GCP E6 Guidelines. The study monitors will meet with the Investigators and staff shortly before the start of the trial to review the procedures for study conduct and documentation. During the study, the monitors will visit the sites to verify record keeping and adherence to the protocol. For this study, eCRFs will be used. The monitors will conduct 100% source document verification by comparing the eCRFs with the source documents to ensure accuracy and consistency. Edit check programs, other forms of electronic validation, manual listings and a query process

will be executed to verify the accuracy of the database. The EDC system will maintain a full audit trail of electronic data changes. Access to all source documentation will be made available for monitoring and audit purposes.

### **10.11 Retention of Data**

All source documents (e.g., informed consent forms, laboratory reports, progress notes, medical histories, physical and diagnostic findings, diagnosis and pharmacy records, and IMP dispensing/disposition records) that support data in the eCRFs of each study subject must be retained in the files of the responsible Investigator.

According to ICH guidelines, essential documents should be retained for a minimum of 2 years after the last approval of a marketing application in an ICH region and until there are no pending or contemplated marketing applications in an ICH region or at least 2 years have elapsed since the formal discontinuation of clinical development of the IMP. However, these documents should be retained for a longer period if required by the applicable legal requirements.

If the responsible Investigator retires, relocates or for any other reason withdraws from the responsibility of keeping the study records, custody must be transferred to a person who will accept the responsibility. The Sponsor representative must be notified in writing of the name and address of the new custodian, prior to the transfer.

### **10.12 Financial Disclosure**

Study personnel on the Form FDA 1572 will complete a financial disclosure form (Form FDA 3455) at the beginning of the study and up to one year post completion of the study. New study personnel added to the Form 1572 must also meet these requirements.

### **10.13 Publication and Disclosure Policy**

All information concerning DX-2930, Sponsor operations, patent applications, formulas, manufacturing processes, basic scientific data, and formulation information, supplied to the Investigator by a Sponsor representative and not previously published, is considered confidential and remains the sole property of the Sponsor. The Investigator must agree to use this information only to accomplish this study, and must not use it for other purposes without the Sponsor's advanced written consent.

The information developed in this study will be used by the Sponsor in connection with the continued development of DX-2930 and thus may be disclosed as required to other clinical Investigators or government regulatory agencies. To permit the information derived from the clinical studies to be used, the Investigator is obligated to provide the Sponsor with all data obtained in the study.

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## 11 REFERENCE LIST

Bennett G, Craig T. Hereditary angioedema with a focus on the child. *Allergy Asthma Proc.* 2015;36(1):70-3.

Bork K, Hardt J, Schicketanz K-H, Ressel N. Clinical studies of sudden upper airway obstruction in patients with hereditary angioedema due to C1 esterase inhibitor deficiency. *Arch Int Med.* 2003;163:1229-1235.

Bork K, Hardt J, Witzke G. Fatal laryngeal attacks and mortality in hereditary angioedema due to C1-INH deficiency. *J Allergy Clin Immunol.* 2012;130(3):692-7.

Bork K, Meng G, Staubach P, Hardt J. Hereditary angioedema: New findings concerning symptoms, affected organs, and course. *Am J Med.* 2006;119(3):267-274.

Bork K, Siedlecki K, Bosch S, Schopf RE, Kreuz W. Asphyxiation by laryngeal edema in patients with hereditary angioedema. *Mayo Clin Proc.* 2000;75(4):349-54.

Bygum A. Hereditary angio-oedema in Denmark: a nationwide survey. *Br J Dermatol.* 2009;161(5):1153-8.

Cicardi M, Bork K, Caballero T, Craig T, Li HH, Longhurst H, et al. Evidence-based recommendations for the therapeutic management of angioedema owing to hereditary C1 inhibitor deficiency: consensus report of an International Working Group. *Allergy.* 2012;67(2):147-57.

Craig T, Pursun EA, Bork K, Bowen T, Boysen H, Farkas H, et al. WAO Guideline for the Management of Hereditary Angioedema. *World Allergy Organ J.* 2012;5(12):182-199.

Davis AE, 3rd. Mechanism of angioedema in first complement component inhibitor deficiency. *Immunol Allergy Clin North Am.* 2006;26(4):633-51.

Farkas H. Pediatric hereditary angioedema due to C1-inhibitor deficiency. *Allergy Asthma Clin Immunol.* 2010;6(1):18.

Goring HD, Bork K, Spath PJ, Bauer R, Ziemer A, Hintner H, et al. [Hereditary angioedema in the German-speaking region]. *Hautarzt.* 1998;49(2):114-22.

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KALBITOR® (ecallantide) [package insert] Burlington, MA: Dyax Corp.; 2015.

Kaplan AP, Joseph K. The bradykinin-forming cascade and its role in hereditary angioedema. *Ann Allergy Asthma Immunol.* 2010;104(3):193-204.

Kenniston JA, Faucette RR, Martik D, Comeau SR, Lindberg AP, Kopacz KJ, et al. Inhibition of plasma kallikrein by a highly specific active site blocking antibody. *J Biol Chem.* 2014;289(34):23596-608.

Lei WT, Shyur SD, Huang LH, Kao YH, Lo CY. Type I hereditary angioedema in Taiwan -- clinical, biological features and genetic study. *Asian Pac J Allergy Immunol.* 2011;29(4):327-31.

Nordenfelt P, Dawson S, Wahlgren CF, Lindfors A, Mallbris L, Bjorkander J. Quantifying the burden of disease and perceived health state in patients with hereditary angioedema in Sweden. *Allergy Asthma Proc.* 2014;35(2):185-90.

Renne T, Gruber A. Plasma kallikrein: novel functions for an old protease. *Thromb Haemost.* 2012;107(6):1012-3.

Roche O, Blanch A, Caballero T, Sastre N, Callejo D, Lopez-Trascasa M. Hereditary angioedema due to C1 inhibitor deficiency: patient registry and approach to the prevalence in Spain. *Ann Allergy Asthma Immunol.* 2005;94(4):498-503.

Zuraw BL. Clinical practice. Hereditary angioedema. *N Engl J Med.* 2008;359(10):1027-36.

Zuraw BL, Banerji A, Bernstein JA, Busse PJ, Christiansen SC, Davis-Lorton M, et al. US Hereditary Angioedema Association Medical Advisory Board 2013 Recommendations for the Management of Hereditary Angioedema Due to C1 Inhibitor Deficiency. *J Allergy Clin Immunol Pract.* 2013;1(5):458-67.

Zuraw BL, Bernstein JA, Lang DM, Craig T, Dreyfus D, Hsieh F, et al. A focused parameter update: Hereditary angioedema, acquired C1 inhibitor deficiency, and angiotensin-converting enzyme inhibitor-associated angioedema. *J Allergy Clin Immunol.* 2013;131(6):1491-1493 e25.



## **12 APPENDICES**

Appendix 1 Study Activities Schedule

Appendix 2 National Institute of Allergy and Infectious Diseases, Division of Microbiology and Infectious Diseases (DMID) Adult Toxicity Table (Modified) (US National Institutes of Health; National Institute of Allergy and Infectious Diseases)

Appendix 3 National Institute of Allergy and Infectious Diseases, Division of Microbiology and Infectious Diseases (DMID) Pediatric Toxicity Tables (Modified) (US National Institutes of Health; National Institute of Allergy and Infectious Diseases)

Appendix 4 HAE Attack Assessment and Reporting Procedures (HAARP)

## Appendix 1 Study Activities Schedule

Study Activities Schedule																	
	Screening Visit	Run-in Period <sup>1</sup>	Treatment Period <sup>2</sup>													Follow-up Period <sup>3</sup>	
Tests and Assessments			Visit 1 Dose 1 Day 0	Site Check- in <sup>4</sup>	Visit 2 Dose 2 Day 14	Visit 3 Dose 3 Day 28	Visit 4 Dose 4 Day 42	Visit 5 Dose 5 Day 56	Visits 6 and 7 Doses 6 and 7 Days 70 and 84	Visit 8 Dose 8 Day 98	Visits 9 and 10 Doses 9 and 10 Days 112 and 126	Visit 11 Dose 11 Day 140	Day 144±1	Visits 12 and 13 Doses 12 and 13 Days 154 and 168	Visit 14 Day 182	Visit 15 Day 210	Visit 16 Day 238
Informed Consent	X																
Eligibility Review	X		X														
Long-term prophylactic therapy washout <sup>5</sup>	X																
Randomization			X														
Blinded IMP Treatment			X		X	X	X	X	X	X	X	X		X			
Demographic and Medical History	X																
C1-INH, C1q and C4 Testing <sup>6</sup>	X																
Pregnancy Test <sup>7</sup> (females)	X		X							X					X		X
Vital Signs <sup>8</sup>	X		X		X	X	X	X	X	X	X	X		X	X	X	X
Physical Examination <sup>9</sup>	X		X			X		X		X		X			X		X
12-Lead ECG <sup>10</sup>	X		X					X					X		X		
Clinical Laboratory Testing <sup>11</sup>	X		X			X		X		X		X			X		X
Serologies: HBsAg, HCV, and HIV	X																
Concomitant Therapy	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X

Study Activities Schedule																	
	Screening Visit	Run-in Period <sup>1</sup>	Treatment Period <sup>2</sup>													Follow-up Period <sup>3</sup>	
Tests and Assessments			Visit 1 Dose 1 Day 0	Site Check- in <sup>4</sup>	Visit 2 Dose 2 Day 14	Visit 3 Dose 3 Day 28	Visit 4 Dose 4 Day 42	Visit 5 Dose 5 Day 56	Visits 6 and 7 Doses 6 and 7 Days 70 and 84	Visit 8 Dose 8 Day 98	Visits 9 and 10 Doses 9 and 10 Days 112 and 126	Visit 11 Dose 11 Day 140	Day 144±1	Visits 12 and 13 Doses 12 and 13 Days 154 and 168	Visit 14 Day 182	Visit 15 Day 210	Visit 16 Day 238
Adverse Events	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
HAE Attack Data <sup>12</sup>	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Quality of Life Assessments <sup>13</sup>			X							X					X		X
PK Blood Sampling			X					X		X		X			X	X	X
PD Sample Collection			X					X		X		X			X	X	X
Plasma Anti-Drug Antibody Testing			X					X		X		X			X		X
Discharge from Study <sup>14,15</sup>															X		X

ECG = Electrocardiogram; PK = Pharmacokinetic; PD = Pharmacodynamic; IMP = Investigational Medicinal Product

- Subjects will undergo a run-in period to determine their baseline HAE attack rate. Only subjects with a baseline rate of at least 1 Investigator-confirmed HAE attack per 4 weeks will be eligible for enrollment and randomization. Subjects who experience 3 or more Investigator-confirmed attacks before the end of the 4 weeks can exit the run-in period early and proceed to enrollment and randomization. Subjects without at least 1 Investigator-confirmed attack after 4 weeks of run-in will have their run-in period extended for another 4 weeks, during which time they need to have at least 2 Investigator-confirmed attacks to proceed to enrollment and randomization. Subjects who have their run-in extended may not exit run-in early. Subjects who do not meet the minimum attack rate during run-in or are otherwise determined to be ineligible due to screening assessments will be considered a screen fail.
- Treatment Period visits have a ±3 day window, with a maximum of 17 days or a minimum of 11 days between any two doses, starting with Dose 2, Day 14 through Day 182.
- For subjects who do not rollover into OLE (DX-2930-04). Follow-up visits have a ±3 day window
- Site personnel contact the subject to solicit for any attacks not already reported by the subject once between scheduled site visits or approximately 7 days after last contact with subject.
- Subjects who are on long-term prophylactic (LTP) therapy for HAE are required to undergo a minimum 2 week washout period prior to the start of the run-in period. This LTP washout is permitted as long as the investigator determines that doing so would not place the subject at any undue safety risk and the subject is at least 18 years of age. The Investigator must confirm that the subject has successfully completed the 2 week washout period before they can enter the run-in period.
- Samples for C1-INH, C4, and C1q assays will be obtained at screening for eligibility assessment unless already collected as part of protocol DX-2930-02.
- The pregnancy test will only be conducted in females of childbearing potential. Tests performed on Day 0 and Day 182 must be urine-based. Tests performed at screening, Day 98, and Day 238 can be serum or urine-based.

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8. There is a  $\pm 15$  minute window for all vital signs. At study visits in which IMP is administered, vital signs including sitting or supine BP, HR, body temperature, and RR, will be obtained prior to dosing, 1 hour after dosing, and 2 hours after dosing for the first 4 doses with the ability to eliminate the 2 hour vitals for the remaining doses based on the discretion of the Investigator and the absence of safety signals.
  9. Height and weight will be collected at the Screening visit only.
  10. ECGs (single recordings) are collected at screening, baseline prior to Dose 1, Day 56, Day 144 $\pm$ 1 day to capture the estimated  $C_{max}$  and Day 182. The ECG assessment at  $C_{max}$  on Day 144 $\pm$ 1 day may be performed via at-home nurse or technician in lieu of a subject visit to the study site.
  11. Clinical laboratory testing will include Hematology, Coagulation, Serum Chemistry, and Urinalysis.
  12. Historical attack information will be collected at screening. During the study subjects (or caregivers, in the event the subject is < 18 years old or is incapacitated) are instructed to report details of the attack to the study site within 72 hours of the onset of the attack. Site personnel will also contact the subject once a week or at approximately 7 days after last contact with the subject during the run-in period and once between study visits or approximately 7 days after last contact with the subject during the treatment period in order to solicit for any attack that may have occurred. In addition, during study visits, site personnel will solicit for any new HAE attack information that was not given through prior subject contact with the site.
  13. Quality of life data will be obtained using the EQ5D and Angioedema Quality of Life Questionnaire (AE-QoL).
  14. Subjects who rollover into the Open-Label Extension protocol (DX-2930-04) will provide consent by Day 182 and receive their first open-label dose following the completion of all DX-2930-03 assessments scheduled on Day 182. At the completion of these assessments, the subject will be discharged from DX-2930-03 and roll into the DX-2930-04 study.
  15. Subjects who terminate from the study early will undergo (if possible) all of the assessments and procedures as Day 182 at their final study visit.



**Appendix 2      National Institute of Allergy and Infectious Diseases,  
Division of Microbiology and Infectious Diseases  
(DMID) Adult Toxicity Table (Modified) (US National  
Institutes of Health; National Institute of Allergy and  
Infectious Diseases)**

**Appendix 3      National Institute of Allergy and Infectious Diseases,  
Division of Microbiology and Infectious Diseases  
(DMID) Pediatric Toxicity Tables (Modified) (US  
National Institutes of Health; National Institute of  
Allergy and Infectious Diseases)**

## **Appendix 4      HAE Attack Assessment and Reporting Procedures (HAARP)**